Master's thesis

A preliminary vulnerability assessment for Ísafjörður, Iceland

Coastal management options to reduce impacts of sea-level rise and storm surges

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A preliminary vulnerability assessment for Ísafjörður, Iceland – Coastal management options to reduce impacts of sea-level rise and storm surges

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Declaration

I hereby confirm that I am the sole author of this thesis and it is a product of my own academic research.

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Abstract

Climate change science argues that by the end of the 21st century, the global mean sea-level rise may easily exceed 1 metre, possibly accompanied by an increase in storm intensity. Although climate change is a global phenomenon, its impacts vary greatly according to scale and geographic region. This study took into account the United Nations' recommendations and the research objectives stated by the Icelandic Ministry of the Environment, and conducted a preliminary coastal vulnerability assessment for Ísafjörður, located in the Westfjords of Iceland.

A digital elevation model was created from 1 metre contour lines and used for GIS analysis. Due to uncertainty on future projections of sea-level rise, three equally probable normative scenarios (temperature and sea-level worlds) were constructed. Two scenarios explore the variation in regional sea-level at the case study area under fixed global temperature targets (2 degree world, 3 degree world). The third scenario assumes an increase in mean global seal-level of 1 metre by the end of the current century (1 metre sea-level rise world). In this work, the potential economic damages and expected loss of life from local storm surges were assessed. Assuming that rising sea-levels will add to the height of current storm dynamics, coastal options to deal with the threat of sea-level rise were proposed. This addresses the need to move beyond the identification of hot spots of vulnerability to propose measurable costal adaptation strategies to sea-level rise and storm surge impacts in Ísafjörður.

Results reveal that socio-economic impacts from sea-level rise and storm surges are expected to increase in Ísafjörður, more notably towards the end of the 21st century. Nevertheless, Ísafjörður possesses the time and a range of costal adaptation options to prepare for the impacts. In the case of potential loss of life, the coastal system thresholds were calculated and maximum allowed population growth rates were provided. Mitigation

of monetary impact costs by prioritizing interventions on historical buildings were assessed in combination with land elevation needs for the construction of new developments. The overall management suggestion to reduce Ísafjörður's economic costs due to impacts of sea-level rise and storm surge related risks is to steer future, and constrain current, developments in flood prone areas.

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1 Introduction

Future projections regarding the magnitude and extent of anthropogenic climate change and consequent accelerated sea-level rise (Michael, 2007) are increasing global concerns and posing a serious threat to low-lying coastal communities (Dasgupta, Laplante, & Meisner, 2008). Climate change science argues that by the end of the 21st century, the global mean sea-level rise may exceed 100 cm (Rahmstorf, 2007), possibly accompanied by an increase in storm intensity (IPCC, 2001). The issue of rising sea-levels has become important to a broad variety of stakeholders, as they need to ensure safe environmental conditions for coastal zones. Although climate change is a global phenomenon, its impacts are expected to vary greatly according to scale and geographic region. National and regional governments are now turning their attention to what these climate change induced alterations may mean for coastal communities. On one hand, there is the need to investigate and work towards the mitigation of climate change. On the other, there is a recognised need to prepare for unavoidable future sea-level changes via adaptation (*Table 1*).

Table 1

Examples of Mitigation and Adaptation Measures (adopted from Manuel and Herring, 2010)

Examples of mitigation measures		Examples of adaptation measures
Reduce CO_2 emissions: • by individual lifestyle changes (e.g., driving your car less) or, • switching to cleaner and more efficient energy sources (e.g. tidal and ocean energy)		Protect against rising sea-levels: • through better flood defences (e.g., construction of dikes) or, • change of land-use pattern (e.g., avoiding more vulnerable areas for housing)

In order to counter the impacts of ongoing global climatic change, both short-term adaptations and long-term adjustments are required (Burton et al., 2002).

Vulnerability assessments explore both impacts and adaptation options to counteract the negative effects of climate change. As such, they have become an attractive tool for policy makers and are currently being applied to several domains of interest, such as sea-level change impacts on the coastal sector. Despite the emergence of a substantial number of vulnerability assessements in climate change, the concept of vulnerability struggles to provide detailed information on the dynamics of vulnerability factors; therefore, vulnerability assessements are primarily used to acknowledge hot spot areas of intervention. The results/outcomes of these assessments can vary greatly regarding scale (from local to global), main input variables (from biophysical to socio-economic) and studied stimuli or hazard. To a certain extent, data constraints, uncertainty in climate change projections and lack of incorporation of local knowledge in vulnerability assessments hinder the formulation of more meaningful vulnerability assessments as exemplified further on in the thesis. From a coastal perspective, assessing vulnerability implies a detailed analysis of the full characteristics of the hazard (coastal floods) and the capabilities of a system (social, structural) to cope with the impacts. Since the capabilities of the system to counteract the negative effects of coastal flooding are often disregarded, coastal vulnerability assessments can rarely be differentiated from usual impact assessments.

The following sections introduce the reader to the broad context of global and national initiatives investigating climate change, accelerated sea-level rise and storm surge impacts. Subsequently, the purpose and objectives of this thesis are presented.

1.1 International Climate Change Actions

The increasing global concern about impacts associated with climate change has led to the formation of several international agencies, organisations and institutions that aim to better understand and mitigate these impacts. Among the most prominent is the Intergovernmental Panel on Climate Change[1] (IPCC) established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP). It can be regarded as the leading actor in terms of climate change research and brings together the current climate change expertise. The mandate of the IPCC is to:

> "Assess…the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate changes, its potential impacts and options for adaptation and mitigation (IPCC, 2007:14)".

The IPCC is divided into three different working groups. Working group I (WGI) deals with climate change science, working group II (WGII) focuses on the assessment of climate change related impacts, vulnerabilities and adaptation strategies, and working group III (WGIII) focuses on climate change mitigation. In combination these three working groups assess the current state of knowledge on climate change and produce technical papers and special reports that include science and social concerns (IPCC, 2001). To date, the IPCC has published four comprehensive assessment reports (1990, 1995, 2001 and 2007). A fifth assessment report will be released in 2014. Within each report the three working groups provide an update relating to their research area. This thesis fits within the area of WGII, as it is concerned with climate change impacts, adaptation and vulnerability. The IPCC takes the role of an advisory board and assesses and reports on the current state of knowledge on climate change research. Then, the UNFCCC uses the data produced by the IPCC and sets the intergovernmental framework for addressing global climate change issues (e.g., the Kyoto Protocol) (UNFCCC, 2006). Because of its global focus, the IPCC frames the up-to-date research on climate change science, and can be thus regarded as a valuable starting point for a climate vulnerability analysis. Nevertheless, the IPCC cannot (nor intends to)

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[1] Access to IPCC webpage through http://www.ipcc.ch/

tackle all the specificities of the world countries that influence the magnitude of all possible impacts under a changing climate. In this respect, a more specific level of knowledge is required.

For example, regarding Arctic countries it is worth mentioning that the Arctic Council was created in 1996 to address issues faced by the Arctic governments. The Arctic Council published the first comprehensively researched and independently reviewed evaluation of Arctic climate change and its regional and global impacts and published the first Arctic Climate Impact Assessment[2] (ACIA) in 2004. The ACIA was co-guided by the International Arctic Science Committee (IASC), a non-governmental organisation composed of international science groups participating in arctic science research.

1.2 Iceland's Climate Change Strategy

Despite the unquestionable role of both the IPCC and the Artic Council in gathering and producing knowledge on climate change dynamics and impacts, the implementation of mitigation and adaptation options, as well as detailed studies of climate change vulnerability and impact assessments, is reserved to the individual countries. In light of this thesis Iceland's efforts regarding climate change policies and the state of climate research are summarised.

Iceland has been a member of the UNFCC since 1993 and ratified the Kyoto Protocol in 2002. Within the same year the Icelandic government adopted a new climate change policy. This was done in close cooperation with several Icelandic ministries. The main goal is to reduce greenhouse gas emissions so that they will not exceed Iceland's obligations under the Kyoto Protocol[3]. A further objective is to increase the level of carbon sequestration. This is currently being done through several reforestation programs (NC4,

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[2] Arctic Climate Impact Assessment available at http://www.acia.uaf.edu/

[3] Iceland committed itself to limiting the growth in its greenhouse gas emissions to 10 percent above the base year level during the first commitment period from 2008 to 2012. The base year for Iceland is 1990 for all greenhouse gases. (NC4, 2006)

2006). Iceland's Fourth Communication on Climate Change[4] (NC4), published in 2006, states that it is uncertain how climate change will impact Iceland. It is argued that the natural fluctuations in temperature are greater in the North Atlantic than in most other oceanic areas. Therefore, the impact of increasing temperatures due to greenhouse gas emissions will differ depending on the direction of short-term natural fluctuations.

Specifically, the Icelandic Meteorological Office (IMO) is involved in climate system studies and does some work on modeling and prediction. The University of Iceland largely covers the area of paleoclimate-related research. The Marine Research Institute (MRI) observes climate change. Icelandic scientists and research institutions are involved in several projects that study the impacts of future global climate change (e.g., ACIA) (NC4, 2006).

In a UNFCCC review report of the NC4 from 2007 the expert review team noted that the NC4 does not contain a section on vulnerability assessments. It recommends that Iceland, as an island country with a coastline that is vulnerable to sea-level rise, include such a section in its next national communication (UNFCCC, 2007). According to the Icelandic Ministry for the Environment (2010) the research on climate change impacts on infrastructure are subject to ongoing studies.

1.3 Motivation and Objectives

This project addresses both the recommendations made by the United Nations and the research objectives stated by the Icelandic Ministry of the Environment (2010), and conducts a preliminary coastal vulnerability assessment of sea-level rise and storm surges for the town of Ísafjörður, located in the Westfjords region of Iceland.

In the past 20 years there have been numerous policy-oriented studies regarding the vulnerability to climate-induced impacts (Downing et al., 1999), such as an increase in

[4] Iceland's Fourth Communication on Climate Change (NC4) can be found on the following website: http://eng.umhverfisraduneyti.is/publications/

temperature and sea-level rise. However, their usefulness in producing clear-cut and practically usable results remains highly questionable (Patt et al., 2005). Similar to the assumptions made by Patt et al. (2005) this thesis argues that three factors contribute to this:

- The uncertainty of long-term projections regarding social and physical processes such as demographic projections and sea-level rise estimates.
- The challenge of narrowing vulnerability assessments to specific questions instead of aggregated measures of vulnerability of a system.
- The lack of a policy-option space for specific system components and stresses.

This work intends to contribute to an improved knowledge of climate change impacts in Iceland, the Ísafjarðarbær municipality and the general public, especially concerning the general lack of information regarding the physical and socio-economic threats associated with storm surges under an accelerating rise of sea-level. Collecting relevant information regarding the impacts of accelerated sea-level rise can allow for a more sustainable planning and management of the coastal zones of the Ísafjarðarbær municipality towards climate change and associated rising sea-levels (Antonijevic and Lucas, n.d.). In addition this project engages the recommendations made by the United Nations (see Chapter 1.2). This preliminary coastal vulnerability assessment is expected to go beyond the identification of vulnerability hot spots within the municipality by further proposing mitigation and adaptation strategies (in the form of management-options) to reduce future sea-level rise impacts. It is expected that a reduction of economical costs can be achieved in the long-run when useful mitigation and adaptation measures are applied within the Ísafjarðarbær municipality. Furthermore, efforts are made to guarantee the transferability of the proposed methodology to other coastal regions of Iceland. The main outcomes expected are summarised as follows:

- Areas vulnerable to coastal flooding associated with regional sea-level rise and storm surge innundation for Ísafjörður and Skutulsfjörður will be identified based on three different sea-level rise scenarios calculated from year 2010 to 2100.
- An integrated assessment of vulnerable areas will be conducted. In detail this reflects the identification of infrastructure vulnerability (economic damages to buildings and extent and damage factors of flooded roads) and social vulnerability (loss of life due to flooding) for each of the three sea-level rise scenarios.
- Development of coastal managment options targeted at reducing sea-level rise and storm surge impacts.
- A mapped coastal vulnerability assessment will be a map-based visualisation of the three main coastal flood scenarios for Ísafjörður and Skutulsfjörður in year 2100.

In this work only the consequences of storm surges under accelerating sea-level rise are investigated. Although progressive sea-level rise will very likely impact Ísafjörður in the future, damages are more related with increased erosion rates or inundated land that becomes unavailable for longer periods of time. Due to the long time scales of the phenomenon, researchers assume that in case of progressive sea-level rise markets have the time to adjust to the impacts. It is expected that impacts resulting exclusively from increasing sea-levels are relatively low. The threat of sea level rise in coastal communities is shaped at larger extent by the occurrence of fast and intense events, such as the case of storm surges.

This thesis is a pilot project for Ísafjörður assessing potential physical and socio-economic impacts associated with sea-level rise and storm surges. The range of adaptation measures suggested should be regarded as broad examples on how coastal adaptation to sea-level rise can unfold. The specific validity of these adaptation recommendations should be assessed in a follow-up project.

2 Literature Review and State of the Art Research

2.1 Sea-level Change - The Scientific Discussion

The question on the extent to which the sea-level will rise over the 21st century is subject to much scientific and public debate, as sea-level rise is considered one of the most important impacts of anthropogenic induced Climate Change (Michael, 2007) and a serious threat to countries with human settlements and economic activities concentrated in coastal regions (Dasgupta, Laplante, & Meisner, 2008). The issue of a rising sea-level has become quite important to a broad variety of stakeholders, as they have to ensure safe environmental conditions for coastal zone residents.

When discussing sea-level rise it is important to know that the sea-level varies as a result of processes operating on a great range of time-scales, from just a few hours (tides) to millions of years (tectonic movements) (IPCC, 2001). To understand the interdependency of sea-level rises and climatic processes, two components need to be considered:

1. The so-called eustatic sea-level rise relates to the changes of water mass in the oceans, which is mainly driven by the melting of ice sheets and ice caps on land and surface run-off from land.
2. The steric sea-level rise is caused through the thermal expansion of water and mainly driven by changes in temperature and salinity.

According to Church et al. (2001) the pattern of sea-level in ocean basins is maintained by atmospheric pressure and surface wind stress, heat and fresh water (precipitation, evaporation and fresh water runoff from land). The ocean itself is stratified into different layers with different densities with motion along the density surfaces (Ledwell et al., 1993; 1998).

Oceans can be regarded as a central component of the climate system, as they store and transport great quantities of heat (Church et al., 2010). According to Bindoff et al. (2007) more than 90 % of the heat absorbed by the Earth over the last 50 years as a result of global warming is stored in the ocean. This reinforces the importance and the need to understand how the heat content of the ocean varies in space and time in order to successfully predict climate variability and change. As the ocean warms, the water within it expands and sea-level rises as a result. The degree of expansion depends on the amount of heat absorbed and on the water temperature (greater expansion in warm water), pressure (greater expansion at depth), and, to a smaller extent, salinity (greater expansion in saltier water). For example, a 1000 m column of ocean water expands by about 1 or 2 cm for every 0.1°C of warming. Both the temperature and salinity contributions are important for regional changes in sea-level, but the temperature contribution is the most dominating factor in globally averaged changes in sea-level (Church et al., 2010).

Thermal expansion of the ocean was a major contributor to 20th century sea-level rise and is projected to continue during the 21st century and for centuries into the future (IPCC, 2007). However, there are uncertainties about the future quantitative contribution of thermal expansion, as there seems to be a shift towards the accelerated melting of glaciers and ice caps and continental ice sheets in the beginning of the 21st century. As presented in *Table 2* and *Table 3*, the percentage wise contributions to sea-level rise have shifted over the years. The contribution of thermal expansion has decreased, whereas the contribution from glaciers, ice caps and continental ice sheets has increased.

Table 2

Contributions to Sea-level Rise from 1961-2003 (see Domingues et al., 2008)

For 1961-2003:	1.6 mm/yr
Thermal expansion	ca. 40 %
Glaciers and ice caps	ca. 35 %
Continental ice sheets	ca. 25 %

Table 3

Contribution to Sea-level Rise from 2003-2008 (see Cazenave et al., 2008)

For 2003-2008:	2.5 mm/yr
Thermal expansion	ca. 20 %
Glaciers and ice caps	ca. 40 %
Continental ice sheets	ca. 40 %

Church et al. (2001) argued that the rate of climate change depends strongly on the rate at which heat is removed from the ocean surface layers into the ocean interior; if heat is taken up more readily, climate change is held back, but sea-level rises more rapidly. Therefore, climate change simulation requires a model, which represents the sequestration of heat in the ocean and the evolution of temperatures as a function of depth.

Since sea-level is not increasing equally around the world (Costa et al., 2009), it becomes important to consider global, regional and local factors to determine relative sea-level changes (Nicholls, 2002). Taking this into consideration, one should focus attention on the concept of relative sea-level rise. Figure 1 illustrates how different sea-level rise was during the period 1993 and 2003.

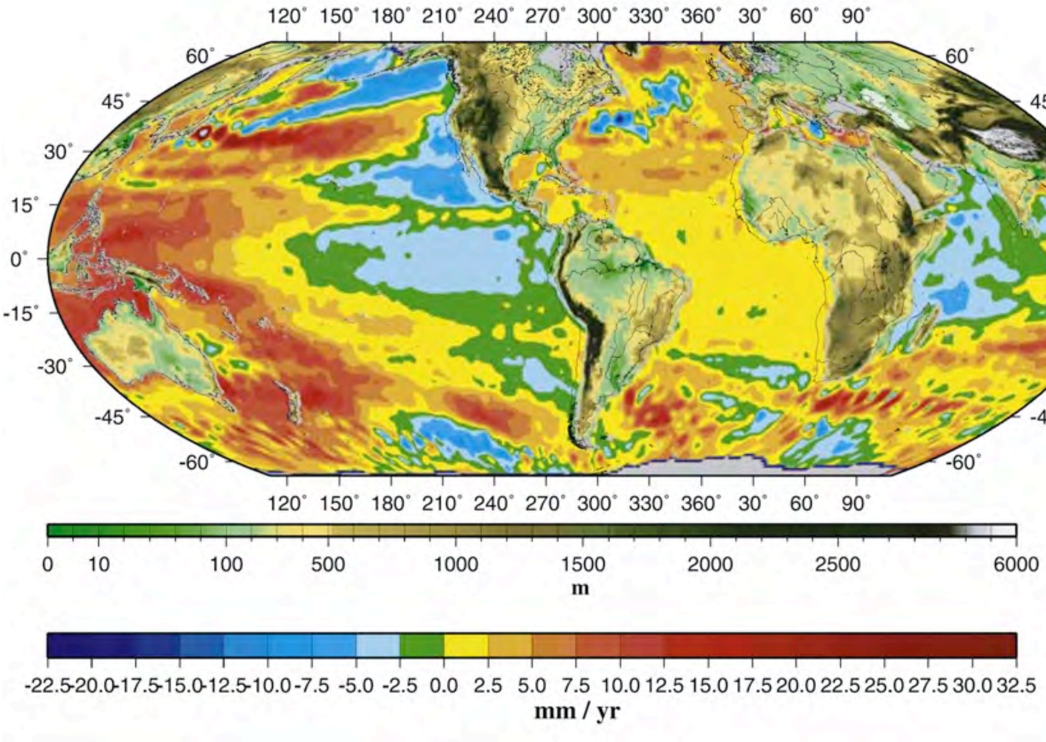

Figure 1. 1993-2003 sea-level rise trends after the TOPEX/Poseidon satellite mission. The figure illustrates how different sea-level rise was during this period. The global average of sea-level rise amounts to 2.8mm/yr (Cavenaze and Nerem, 2004).

Relative sea-level is defined by the sum of the three following components: global mean sea-level rise, regional meteo-oceanographic factors and vertical land movement (Church et al., 2001). This means that regional processes can intensify the relative sea-level rise, for example through isostatic subsidence due to crustal movement (Rassmussen, 2004). However, if the worst-case scenarios of global sea-level rise become realised, they will exceed the afformentioned regional effects (Costa et al., 2009). In addition, ocean currents and mass imbalances could have regional impacts on sea-level. Leverman et al. (2005) showed for North America and Europe an additional sea-level rise depending on the strength of the thermohaline circulation[5] (THC). Similar findings from Tsimplis and Shaw

[5] IPCC glossary definition for THC: Large-scale circulation in the ocean that transforms low-density upper ocean waters to higher-density intermediate and deep waters and returns those waters back to the upper ocean. The circulation is asymmetric, with conversion to dense waters in restricted regions at high latitudes and the return to the surface involving slow upwelling and diffusive processes over much larger geographic regions. The THC is driven by high densities at or

(2008) have shown that the North Atlantic Oscillation pattern could affect regional and seasonal expressions of sea-level rise.

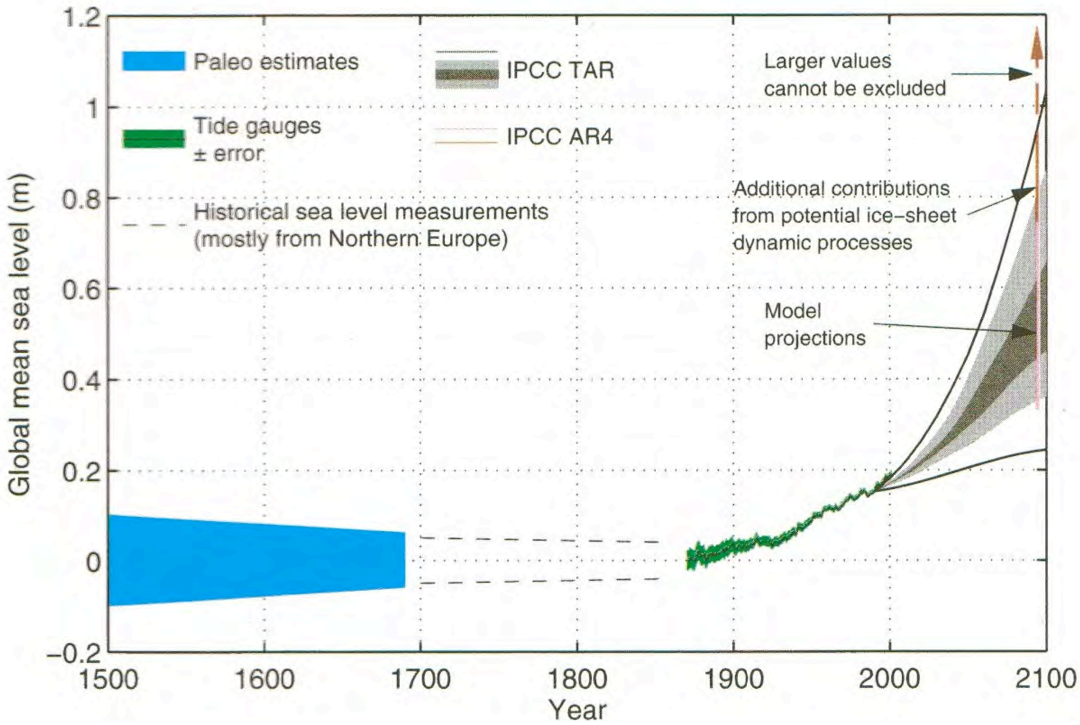

Figure 2. Observed and projected sea-levels from 1500 to 2100 (Church et al., 2010.

Paleo research, historical measurements and tide gauges indicate an upward trend of global sea-level (see Figure 2). The blue band indicates the range of paleo sea-level estimates, the dashed lines from 1700 to 1860 indicate the range of sea-levels inferred from a limited number of long sea-level records, the black line from 1870 to 2006 is an estimate of global averaged sea-level updated from Church and White (2006), and the curves from 1990 to 2100 are the projected sea-level rise for the 21st century. The projected range of global averaged sea-level rise from the IPCC (2001) Third Assessment Report for the period of 1990 to 2100 is shown by the lines and shading (the dark shading is the model average envelope for the range of greenhouse gas scenarios considered, the light shading is

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near the surface, caused by cold temperatures and/or high salinities, but despite its suggestive though common name, is also driven by mechanical forces such as wind and tides.

the envelope for all models and for the range of scenarios, and the outer lines include an allowance for an additional land-ice uncertainty). The IPCC Fourth Assessment Report projections made in 2007 are shown by the bars plotted at 2095, the magenta bar is the range of model projections, and the red bar is the extended range to allow for the potential but poorly quantified additional contribution from the Greenland and Antarctic Ice Sheets' dynamic responses to global warming. The red arrow indicates that larger values cannot be excluded, but the current understanding of these effects is too limited to assess their likelihood, provide a best estimate or an upper bound for sea-level rise (Church et al, 2010).

In sum, the complexity of the factors influencing sea-level changes is evident; in addition, their regional variation make sea-level changes a globally non-uniform phenomenon (see Figure 1).

2.1.1 Sea-level rise projections

Over the last century mean sea-levels rose between 0.1 and 0.25 metres and are expected to continue rising at even faster rates by the end of the 21st century (Nicholls & Mimura, 1998). A number of recent studies point out growing evidence that the IPCC Fourth Assessment Report numbers concerning sea-level rise by the end of the 21st century are possibly underestimated (Moore, & Grinsted, 2010; Grinsted, Moore, & Jevrejeva, 2009; Vermeer & Rahmstorf, 2009; Horton et al., 2008; Jevrejeva). However, the plausibility of this broad new array of sea-level rise projection numbers remains, to a large extent, unsolved (Rahmstorf, 2010), and their capacity to provide robust projections, which are suitable for planning purposes are still unanswered (Lowe & Gregory, 2010).

Due to the large uncertainty of both physical (Holgate, Jevrejeva, Woodworth, & Brewer, 2007) and semi-empirical approaches (Rahmstorf, 2007) in providing sea-level rise numbers, one should ask what aspects future coastal vulnerability studies on sea-level rise need to be considered to take uncertainty seriously (Patt, Klein, & Vega-Leinert, 2005). For this coastal vulnerability assessment, a review of existing projection numbers was created.

A collection and comparison of sea-level change numbers (Jevrejeva, Moore, & Grinsted, 2010; Grinsted, Moore, & Jevrejeva, 2009; Solomon, Plattner, Knutti, & Friedlingstein, 2009; Vermeer & Rahmstorf, 2009; Horton et al., 2008; Pfeffer, Harper & O'Neel, 2008; IPCC, 2007; Rahmstorf, 2007; IPCC, 2001;) (see Figure 2) and study of the current knowledge on sea-level rise reveals that the narrowing of future sea- level rise ranges seems unfeasible in the near future.

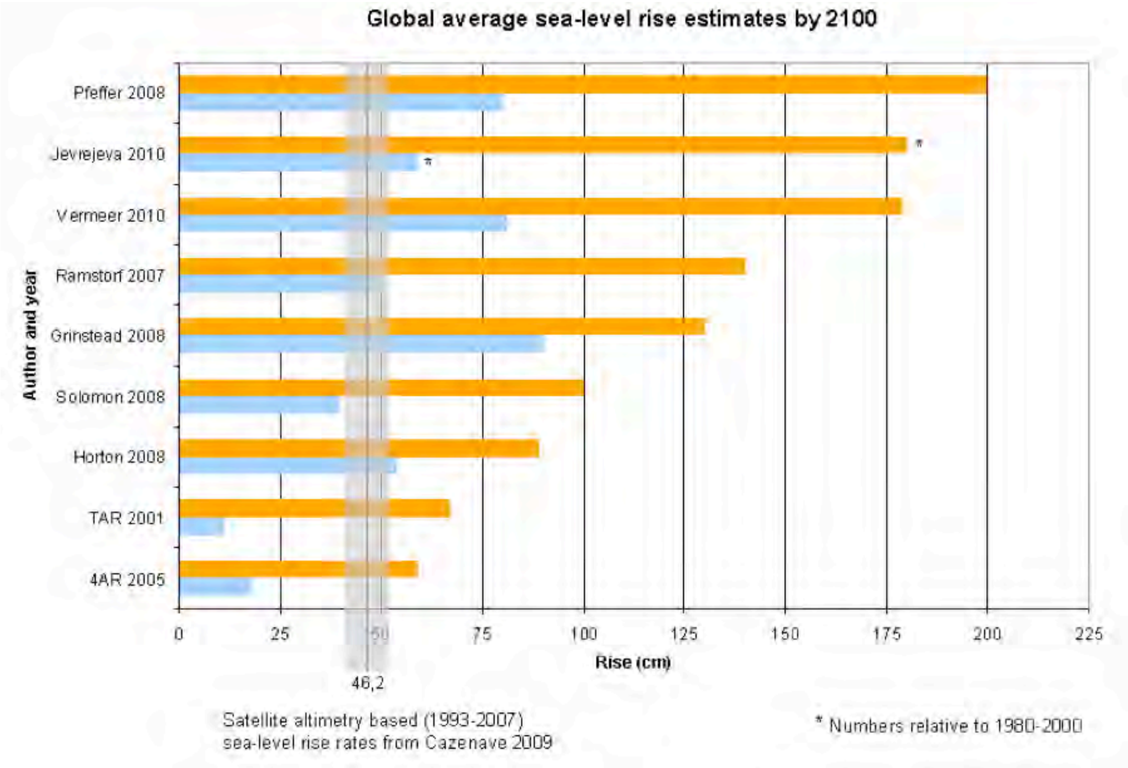

Figure 2. Sea-level rise estimates by 2100. Orange bars representing the upper range, blue bars the lower range. Satellite altimetry-based observations are shown in grey (see respective studies for details) (Meidinger, 2010).

The data gathered reveals major descrepancies in scenario ranges, confidence intervals, ice dynamics assumptions and baseline sea-level numbers (see

Table 4), making the projected numbers difficult to compare.

Table 4

Sea-level Rise Projections by 2100 According to Various Authors. Order Based on Upper Limits (Meidinger, 2010)

Author	Lower limit (cm)	Upper limit (cm)	Details
IPCC Fourth Assessment Report (2005)	18	59	Upper limit under IPCC A1Fi greenhouse gas emissions scenario
IPCC Third Assessment Report (2001)	11	67	Upper limit under IPCC A1Fi greenhouse gas emissions scenario
Horton (2008)	54	89	Upper limit under the IPCC A2 Fourth Assessment Report scenario
Solomon (2008)	40	100	Upper limit under CO2 concentrations exceeding 600 ppm
Grinstead (2008)	90	130	Upper limit under the IPCC A1B Fourth Assessment Report scenario
Ramstorf (2007)	50	140	Upper limit for the range of IPCC Fourth Assessment Report scenarios when statistical error of the fit is included
Vermeer (2010)	81	179	Upper limit for the range of IPCC Fourth Assessment Report scenarios when statistical error of the fit is included
Jevrejeva (2010)	59	180	Upper limit for the range of IPCC Fourth Assessment Report scenarios from 1980- 2000
Pfeffer (2008)	80	200	Upper limit under kinematic scenarios assuming accelerated ice dynamics

Despite the fact that there is still considerable scientific debate about the exact numbers of future sea-level rise, it is undeniable that due to physical effects, such as oceanic thermal inertia, the global mean sea-level will continue to rise throughout the 21st century even if greenhouse gas emissions are stabilised today (Wrigley, 2005).

2.1.2 Changes in extreme sea-levels: Storm surges and waves

It is certain that a rise in global mean sea-level will have negative economic impacts on low lying coastal communities (Costa et al., 2009). However, the risk from flooding increases when high tides combine with storm surges (Woth, Weisse, & Storch 2006; McGranahan et al., 2007). An increase of extreme storm surges due to anthropogenic climate change (Woth et al., 2006) brings up several socio-economic concerns: According to Costa et al., (2009:223):

> "…continued repair of damaged human infrastructures may start to become economically unsustainable, evacuating persons during storm surges events may also become frequent and increased land loss will threaten already stressed ecological ecosystems."

Even if coastal countries within the European Union (EU) have the financial capacity to adapt, it is unclear to what extent sea-level rise adaptation measures can easily be implemented for future coastal planning strategies (Costa et al., 2009). However, without adaptation, some low-lying areas will be economically unviable by 2100 (Nicholls et al., 2007). Since sea-level rise is a relatively slow but continuous process, the associated impacts will pick up in the long run. However, from a policy perspective it is more relevant to take extreme sea-levels (e.g. high astronomical tides, storm surges and waves) into account to be prepared in the short run. The effect of rising sea-levels on the height and frequency of storm surges is of great interest to stakeholders. Unfortunately, it is extremely difficult to estimate the effect of sea-level rise on storm surges. These events are rare by definition, and the impact of a certain storm surge depends on several additional factors, such as the bathymetry of the coast, main wind direction and velocity and coastal morphology.

Due to these effects, most of the assessment models that estimate the impacts of sea-level rise mainly use current return levels (e.g. for a 100 year flood) and add a certain level or climate change related sea-level to the maximum flood value. Such approaches assume that frequency and magnitude of storm surges will not change in the future, an assumption whose validity is still matter of scientific debate (Church et al., 2010).

It was found that storm surges for the North Sea might reach up to 30 cm towards the end of the century. This increase only represents the meteorological induced changes and does not account for changes in the mean sea-level. The change in mean sea-level has to be added to the storm surge, which can be done in a linear way (Woth et al. 2006). The most important point is that for any region under examination, such an assessment has to be done in within that context. In other words, the results of the North Sea study cannot be transferred to other regions (Weisse & Storch, 2008). Hunter (2009) developed a methodology to combine sea-level rise scenarios with standard extreme value statistics. However, the methods allowing the assessment of future risk of storm surges in combination with sea-level rise scenarios are still not adequate.

2.2 Impacts of Sea-level Rise and Storm Surges on Coastal Areas

The inability and associated uncertainty of producing clear-cut sea-level and storm surge estimates is problematic and should be considered when discussing sea-level rise and storm surge impacts on coastal areas. However, in general there is a multitude of coastal impacts that can be caused through climate change. Coastal areas are known to be one of the most dynamic and complex systems on the planet. The natural environment and coastal inhabitants interact directly, and are affected by external terrestrial and marine stresses. Climate change and sea-level rise can directly or indirectly affect the coastal system (see

Figure 3). Any change in the system will have an impact on the coastal area, both biophysically and socio-economically (Church et al., 2010).

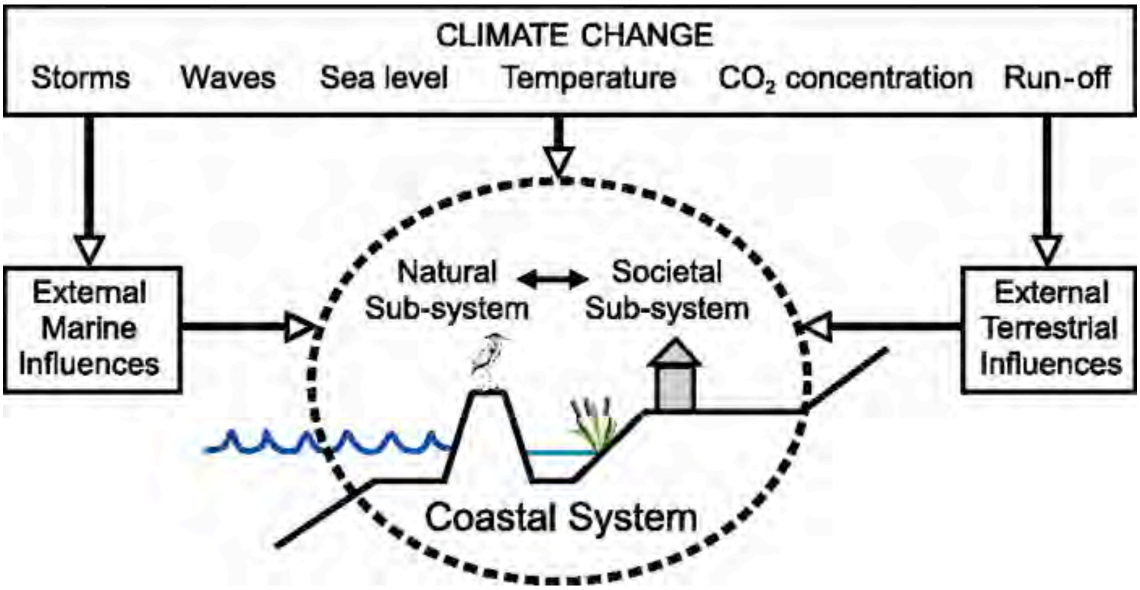

Figure 3. Climate change and the coastal system showing the major climate change factors, including external marine and terrestrial influences (see Church et al., 2010).

A coastal system consists of different habitats, including ecosystems, economic sectors and urban areas. These habitats are under constant stress due to marine and land-based hazards, such as wave impact, storms, surges, river flooding and coastal erosion. An accelerated rise in sea-level will intensify these stresses, especially those where human activities have reduced the natural and socio-economical adaptive capacities (Klein & Nicholls, 1998).

Within the IPCC Third and Fourth Assessment Reports (2001; 2007) a range of potential impacts from climate change and sea-level rise, as well as the associated climate drivers and trends, are identified. Some of those drivers, impacts and effects on the coastal systems are presented and divided into biophysical (*Table 6*) and related socio-economic impacts (Table 6).

Table 6

Main Climate Drivers for Coastal Systems, Their Trends due to Climate Change, and Their Main Physical and Ecosystem Effects. Trend: ↑ increase; ? uncertain; R regional variability (adopted from IPCC, 2007).

Climate driver (trend)	**Biophysical impacts on coastal systems**
Sea-level (↑, R)	Inundation, flood and storm damage; erosion, rising water tables/impeded drainage
Storm intensity (↑, R)	Increased extreme water levels and wave heights; increased episodic erosion; storm damage; risk of flooding and defence failure
Storm frequency (?, R) and Storm track (?, R)	Altered surges and storm waves and hence risk of storm damage and flooding
CO_2 concentration (↑)	Increased CO_2 fertilisation and ocean acidification negatively impacting sensitive organisms
Sea surface temperature (↑, R)	Change in ocean circulation, reduced sea ice cover at higher latitudes and increased algal blooms
Wave climate (?, R)	Altered wave conditions and altered patterns of erosion and accretion

Table 7

Related Socio-economic Impacts on Coastal Systems (IPCC, 2001)

Related socio-economic impacts on coastal systems
Increased loss of property and coastal habitats
Increased flood risk and potential loss of life
Damage to coastal protection works and other infrastructure
Increased disease risk
Loss of renewable and subsistence resources
Loss of tourism, recreation and transportation functions
Loss of nonmonetary cultural resources and values
Impacts on aquaculture through decline in water quality

As can be seen in Table 5, sea-levels are expected to rise, and storm intensity is expected to increase despite the high uncertainty of these predictions. To date, there is no long-term evidence of systematic changes in these types of events over the past 100 years (IPCC, 2007). Analyses of storms are complicated by factors including the localised nature of the events, inconsistency in data observation methods, and the limited areas in which studies have been performed (IPCC, 2007). However, a rise in average sea-levels is expected to cause more episodic and extreme flooding leading to greater damages and increased losses of property and life (see Table 6). Other associated effects are coastal erosion and rising water tables, impeded drainage and salt water intrusion. Most of the above-mentioned effects are expected to be highly variable due to the effect of local differences in the adaptive capacity of ecosystems, economic sectors, coastal inhabitants and countries. Not all of the above mentioned impacts are expected for the town of Ísafjörður. Nevertheless, in a first analysis, one should keep all possible impacts related to sea-level change in consideration to avoid disregarding any important ones.

2.3 Loss of Life in Storm Surge Events and Flood Damages

This section aims to describe the terms loss of life and economic damages as a result of coastal flooding.

According to Jonkman (2007) those who are present in an area exposed to coastal flooding before any signs or warnings are given are refered to as the population or people affected. Therefore, the term loss of life in a storm surge refers to a death that would not have occured without a storm surge event. Storm surges usually occur along the coastline of oceans or big fresh-water lakes. They are usually triggered by storms and low atmospheric pressure that cause high water levels at the coast. Storm surges can reach extremely high water levels when this happens during an astronomical high tide at the coast.

The consequences of a storm surge are diverse in nature. These damages or consequences can be divided into tangible and intangible, depending on whether the losses can be measured in monetary values. Some of the following examples are taken from Jonkman (2007) and Morselt and Evenhuis (2006). Tangible damages include buildings, infrastructure (such as roads), agriculture, vehicles, clean up costs and rescue and evacuation operations. The intangible damages are defined as fatalities, injuries, animals and environmental losses. It is important to distinguish between damages that arise from a constantly rising sea-level and those due to coastal storm surge damages. The surface innundated by sea-level rise will stay flooded permanently, but the innundation happens slowly and with low water velocities. The latter is a sudden event that comes with strong winds and high water velocities. Therefore, the damages and consequences of a storm surge are often more severe than those resulting from slowly rising sea-levels.

According to Jonkman (2007) the methods for estimation of direct economic damage to physical objects such as structures and houses are well established, and the use of damage curves are widespread (see Kok et al., 2005). However, the methods to estimate intangible damages are less developed.

2.4 Examples of Climate Change Adaptation Strategies

In this section, examples of previous work concerned with coastal impacts to sea-level rise are presented. A range of different strategies evaluating sea-level rise impacts are highlighted. Examples show the dependency of local processes in shaping impacts of sea-level rise. For example, Gornitz et al. (2002) investigated the potential impacts of climate change on sea-level rise, coastal flooding and erosion in the New York metropolitan region and how these natural processes interact with increasing urbanisation and land-use changes. A range of climate change scenarios were applied to investigate sea-level rise impacts on selected coastal localities in New York City, Long Island and northern New Jersey. The study used US Army Corps of Engineers models to calculate future coastal flood heights, return intervals and increases in sand volumes for beach nourishment under these scenarios. Thematic maps showing topography, population density, household income levels and housing values were overlaid on sea-level and flood data to assess areas, populations and assets at risk. The implications of these findings for coastal management are discussed. In response to future potential sea-level rise, armoring of the shoreline will be necessary to protect vital infrastructure, such as bridges, airport runways and areas of high population density and property value. However, it was shown that hard or soft defense measures will not be a practical option for the entire New York City metropolitan region, and zoning or land-use policies would need to be established to enable an orderly pullback from the most vulnerable areas. Gorlitz et al. (2002) suggested this could be accomplished by a number of mechanisms, for example, designation of construction setback lines, removal of buildings or hard structures in danger of collapse, and purchase of empty inland space so beaches and wetlands could migrate landward. A further suggestion presented in the study is the related concept of the rolling easement, in which human activities yield to the landward shifting shoreline. Alternatively, the state could have the right to buy land when the sea-level rises by some specified amount. The authors argued that the region will be relatively safe throughout the next 20 years. This period should be used to prepare for future mitigation and adaptation responses. This could be achieved through education outreach. Furthermore, this study provides an initial scientific framework to help coastal-managers, planners, educators, and other concerned stakeholders develop appropiate policies.

El Raey, Dewidar and El Hattab (1999) presented a study on adaptation to the impacts of sea-level rise in Egypt. The options and costs of adaptation were analysed and presented. Possible adaption measures include beach nourishment and groins, breakwaters, legal development regulations, Integrated Coastal Zone Management (ICZM), land-use change and no action. A broad variety of stakeholders took part in a survey. Questionaires were analysed using a coastal resource adaptation decision matrix and adaptation strategy evaluation matrix. The results showed that the majority of stakeholders recommend protection actions, with beach nourishment in combination with limited hard structures being the best immediate option for adaptation, while the ICZM approach is the best available strategic adaptation option. However, the monetary cost was identified as the main barrier hindering the implementation of recommended adaptation measures.

One best practice example from Stavanger in Norway shows that pro-active adaptation measures can help to reduce costs in the long-run. Elevating the proposed concert hall by 1.3 metres will save an estimated NOK 70 million. "As far as Stavanger Municipality is concerned, this is a very interesting case indeed, as it clearly shows that the implementation of climate change measures can have many positive effects. It can actually reduce costs and give a more pleasing architectural impression. Many people believe that climate adaptation measures are all about high costs, and that they reduce the quality for the user. But this is not necessarily the case (Municipality of Stavanger, 2010)," says Stavanger's Chief of Emergency Management Torstein Nielsen.

2.5 Vulnerability, Different Views on the Same Problem

The vulnerability concept has become a central aspect on a variety of inter-connected research fields such as food security, poverty and livelihood, climate change and an important extension to traditional risk-hazard analysis (Wisner et al., 1994); however, the different research communities have taken up the discussion independently (Thomalla et al., 2006). An obvious limitation in achieving a common understanding is the fact that vulnerability is frequently defined using terms that have a variety of meanings when used in diverse contexts by different authors (Clark et al. 2007; Füssel, 2007; Füssel & Klein, 2006; Brooks, 2003). Furthermore Füssel (2007:155) noted that "…the resulting disagreement about the appropriate definition of vulnerability is a frequent cause for misunderstanding in interdisciplinary research on climate change and a challenge for attempts to develop formal models of vulnerability." Despite clarification on vulnerability being pointed out repeatedly as a research need (Jansen & Ostrom, 2006; Brooks, 2003), the clearest preliminary conclusion to date is that there is much confusion (Ionescu et al., 2006). One common and widely applied definition of vulnerability can be found in the IPPC Fourth Assessment Report (2007). Vulnerability is defined as:

> "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2007:883)".

Vulnerability can therefore be regarded as a function of exposure, sensitivity and adaptive capacity (see Figure 4). In the same report **exposure** is defined as "the nature and degree to which a system is exposed to significant climatic variations." **Sensitivity** is "the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).” **Adaptive capacity** is “the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.”

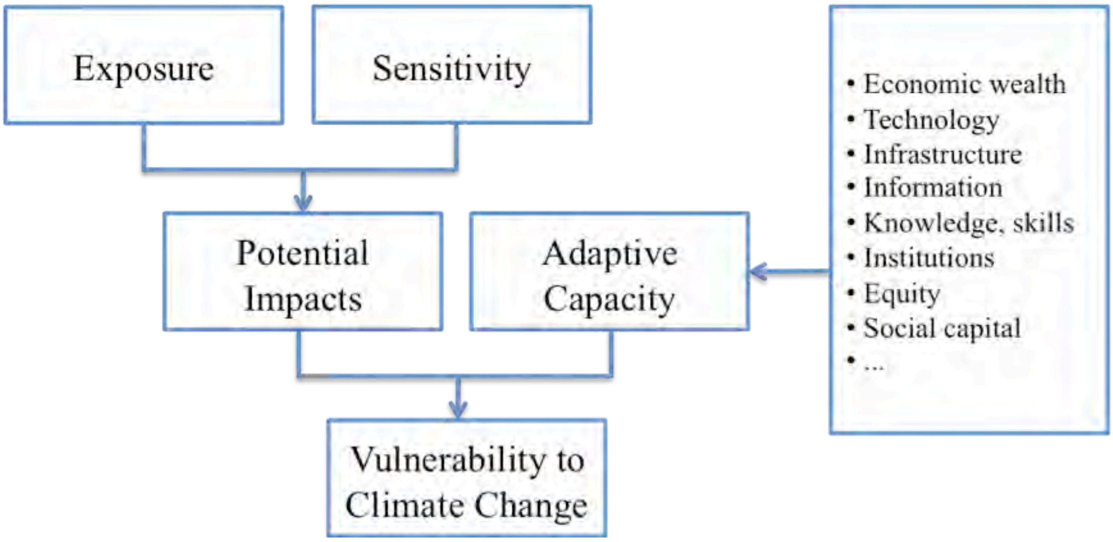

Figure 4. Conceptualization of vulnerability to climate change in the IPCC Third Assessment Report (adopted from IPCC, 2001).

2.5.1 Characterizing vulnerability concepts

Climate change vulnerability assessments are conducted in a variety of contexts, and for a diverse group of stakeholders motivated by different concerns. Together, Füssel and Klein (2006) defined the following three major concerns:

- Specification of long-term targets for the mitigation of global climate change (the so-called impact assessments).
- Identification of particularly vulnerable regions and/or groups in society to prioritise resource allocation for research and for adaptation (both internationally and nationally) (the so-called vulnerability assessments).
- Recommendation of adaptation measures for specific regions and sectors (the so-called adaptation policy assessments).

Furthermore, Füssel and Klein (2006) have identified three different frameworks within the research domains of climate change and natural hazards that assess the dynamic and integrated nature of environmental and social vulnerability. Within this chapter the three frameworks identified by Füssel and Klein (2006) will be introduced.

Risk-hazard framework (physical). Within the risk-hazard approach vulnerability is defined as the exposure to a specific physical hazard, such as a flood, landslide or drought, and how this particular event affects the people and infrastructure within a region of concern. Füssel and Klein (2006) noted that this definition of vulnerability corresponds most closely to the IPCC definition of sensitivity (see IPCC definition in Chapter 2.5). The respective vulnerability definition refers primarily to physical systems, including built infrastructure, and it is descriptive rather than explanatory. The risk-hazard approach is more difficult to apply to people whose exposure to hazards largely depends on their behavior, as determined by socioeconomic factors (Füssel, 2007). Traditionally, the risk-hazard framework assumes that hazard events are rare, and that the hazard is known and stationary (Downing et al., 1999).

S*ocial constructivist framework (social).* The second perspective characterises vulnerability as a function of social conditions (Füssel & Klein, 2006) that put people or groups at risk to a wide range of climate-related, political, or economical stresses, such as poverty, age and gender (Kelly & Adger, 2000). Therefore vulnerability has to be seen as a human relationship rather than a physical one as with the risk-hazard approach. Within this model vulnerability is socially constructed rather than determined by the occurrence of a physical event.

Therefore, exposure within this model can be determined by the unbalanced distribution of damage and risk among groups and people (Wu et al., 2002). Accordingly, vulnerability is a result of social processes and structures (e.g., monetary capital and real income) within the system that limits access to resources that enable people to cope with stressors. Therefore, "social vulnerability, and how it is produced, becomes the focus, regardless of the nature of the exposure" (Dolan & Walker, 2004:3).

Integrated vulnerability framework (physical and social). The third model integrates both the physical event and the underlying social characteristics of people and groups that lead to risk exposure, and the limited capacity of communities to respond (Liverman, 2001). Therefore, vulnerability can be described as physical risk and a social response within a defined area of concern. It is important to note that integrated vulnerability approaches have helped to understand potential climate change impacts (Klein & Nicholls, 1999). However, integrated vulnerability assessments based on the IPCC definition "…are more interventionist and aimed at reducing risks of potential damages by anticipating impacts and planning adaptation responses" (Dolan & Walker, 2004:3). Therefore, possible adaptation measures fall within narrow management categories including: protect, adapt, retreat and do nothing (Dolan & Walker, 2004). As a result, integrated approaches have to be described as more protection-oriented responses to climate change, rather than proactive responses that would consider a broader group of elements (technical, institutional, economic, and social) that occur in different localities (Klein & Nicholls, 1999).

In Figure 5 a representation of the main characteristics of the vulnerability concepts described above can be found.

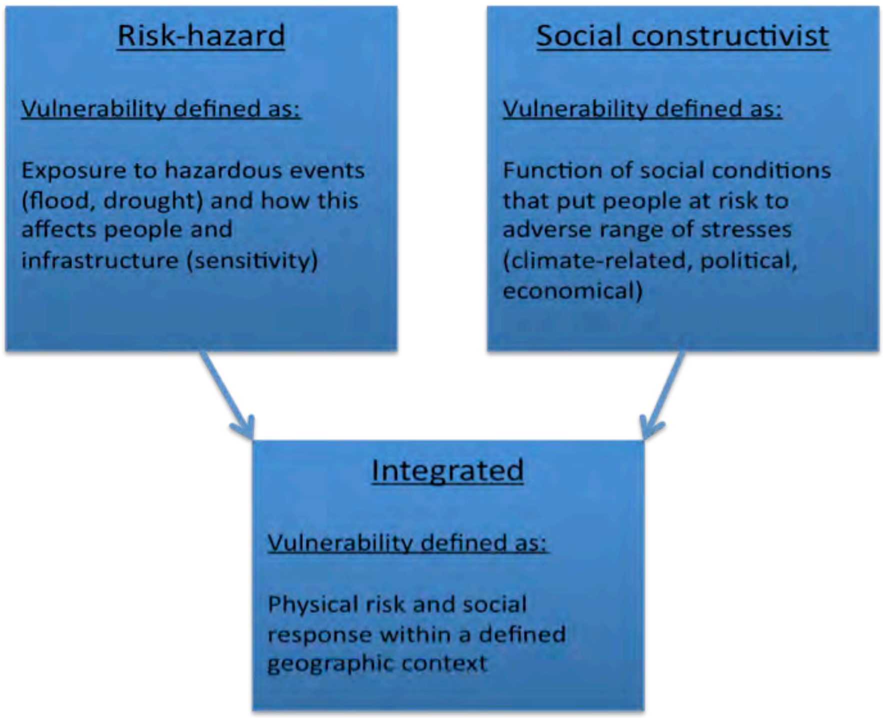

Figure 5. Different definitions of vulnerability according to Füssel and Klein (2006).

2.5.2 Current approaches and limitations in coastal vulnerability assessments.

In the context of coastal vulnerability assessments to climate change, several assessment methodologies have been developed and applied. One of the first methodologies that has been applied in about 25 national assessments and one global assessment is the IPCC Common Methodology for Assessing the Vulnerability of Coastal Areas to Sea-Level Rise (Sterr et al., 2000). The method has been proposed by the former IPCC Coastal Zone Management Subgroup (CZMS) in 1992 (IPCC-CZMS, 1992). The purpose of the Common Methodology is to assist countries in assessing potential coastal impacts and adaptations to sea-level rise, in other words, to conduct first-order or initial coastal vulnerability assessments. Another more extensive methodology is the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations (Carter et al., 1994). Both documents provide frameworks and tools to assess the impacts of climate change by identifying key vulnerabilities.

However, there is a significant difference between the two frameworks. The Common Methodology was developed for vulnerability assessments in coastal zones, whereas the Technical Guidelines have been produced as a more general framework for any natural or socio-economic system (Sterr et al., 2000). Klein and Nicholls (1998) have identified five general limitations of the Common Methodology. Three of the identified limitations can be categorised as technical and data availability constraints:

- Shortage of accurate and complete data necessary to conduct a coastal impact and adaptation assessment (e.g., coastal topography).
- Many case studies used a single global scenario of sea-level rise (1 metre by 2100) and ignored the spatial distribution of relative sea-level rise due to the lack of regional climate scenarios.
- The Common Methodology encourages scientists to consider biophysical responses of the coastal system to sea-level rise. However, there is a lack of data and models for complicated non-linear coastal processes (e.g., coastal erosion and sediment supply).

The further two limitations refer to the difficulties of the Common Methodology in assessing the wide range of technical, institutional, economic and cultural elements present in different places as well as the application of market-evaluation assessment frameworks, which has proven to be inappropriate in many subsistence economies and traditional land-tenure systems (Sterr et al., 2000). Dolan and Walker (2004) argue that the above-mentioned limitations are somewhat related to the broad scale of the Common Methodology and its lack of attention to distinct local characteristics. For example, most climate change simulations are limited in their capacity to explain local and regional effects due to their coarse spatial and temporal scales. Therefore, Jacobs and Bell (1998) noted that it is necessary to downscale global changes for decision-makers or else they will have little value to those who require locally relevant information. Many researchers have evaluated the Common Methodology for assessing coastal vulnerability and have published refined and expanded frameworks (Dolan & Walker, 2004; Klein & Nicholls, 1998; Wu et al. 2002).

Examples of the difficulties exposed above are expressed in Wu et al.'s (2002) integrated vulnerability framework where, in some way, both physical and social vulnerability perspectives have been integrated. Wu et al. (2002) used a Geographical Information System (GIS) approach to assess the physical vulnerability of a coastal region to flood hazards under varying storm intensity and projected sea-level rise scenarios. In addition, they delineated regions of social vulnerability within the community using indicators such as age, gender, race, income and housing conditions. In combination, this identified the broader vulnerability of the area and its distribution within a community to flood hazards and sea-level rise. Dolan and Walker (2004) noted that most vulnerability assessments do not produce adequate results for local coastal zone management. Furthermore, they argued that efforts to improve vulnerability assessments should be kept up, and that other approaches to assist coastal communities with physical and social vulnerabilities via enhancing their adaptive capacity should be pursued. In addition, it should be mentioned that the implications of time and spatial scales should be considered when a coastal vulnerability assessment is conducted.

2.5.3 Considerations of scale

In terms of coastal vulnerability to sea-level rise it is important to highlight the issues of time and spatial scales. While the most destructive coastal hazards tend to develop quickly and at relatively small scales, most climate change projections have broad spatial scales and are aimed at predicting future climate over several decades or centuries.

Coastal vulnerability assessments aim to help coastal communities in identifying potential vulnerabilities and adapting to risks of long-term climate change and accelerated sea-level rise (Dolan & Walker, 2004). However, it is important to realise that the most severe impacts due to climate variability will happen in the short-term (e.g., extreme storm surges, enhanced erosion) (Wu et al., 2002) since coastal communities are more likely to adapt in response to changes in the frequency and magnitude of short-term climate variability events rather than a gradual, longer-term change in average conditions such as sea-level rise (Smit et al., 1999).

2.6 Summary

Sea-level rise scientists are still uncertain about the exact numbers on climate change induced sea-level rise and storm surges. However, decision-makers recognise that there should be a focus on relative sea-level changes due to the fact that sea-level rise is not increasing equally around the world. Most of the impacts associated with sea-level rise and storm surges are expected to be highly variable around the world due to local characteristics. The comparison of several sea-level rise studies revealed that the lower bound ranges of sea-level rise have already been reached, if not exceeded in some cases. To date, several different climate change adaptation strategies have been developed and applied and decision-makers realise that they often have several strategies at hand, which need to be evaluated in order to chose the best applicable solution for each indiviual coastal setting.

In the context of coastal vulnerability assessments to climate change, several assessment methodologies have been developed. However, the complexity of most vulnerability assessment methodologies (and large number of vulnerabilitiy indicators used) often limits or hinders their potential outcomes and results.

3 Description of the Study Area

In the following chapter a community profile of the study area addressed in this thesis is presented giving the the reader contextual information for understanding case study specific characteristics.

3.1 General Information

Ísafjörður is a town in the mountainous Westfjord region of Iceland. The town is part of the Ísafjarðarbær municipality and located around the Skutulsfjörður fjord extending to the southwest from the bay Ísafjarðardjúp (see Figure 6). The Skutulsfjörður fjord is surrounded by steep mountains that reach up to about 700 m a.s.l. The slopes of these mountains are carved by shallow gullies and cut by glacier valleys. The Holtahverfi housing area is located at the head of the fjord just below the northern hillside of a mountain called Kubbi. To the northwest of Skutulsfjörður is the Eyrarfjall mountain below which a great number of buildings is located, as well as a peninsula where a large and also the oldest part of the Ísafjörður settlement can be found.

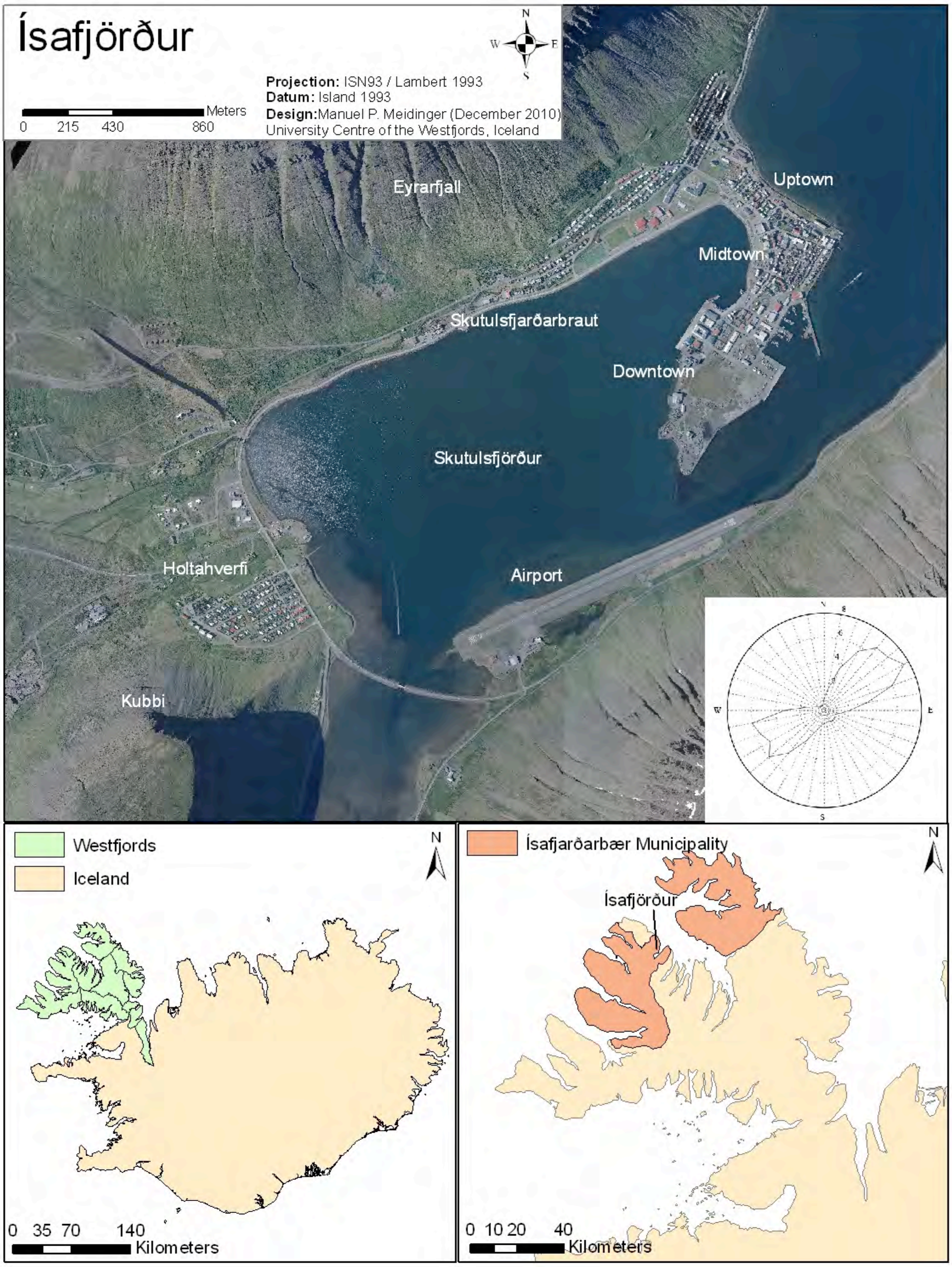

Figure 6. Maps showing the location of the Westfjords and the Ísafjarðarbær municipality (lowers pannels) and Ísafjörður (main panel). On the right, a wind rose showing the main wind directions (Arnalds et al., 2002).

Figure 7. Street map of Ísafjörður (N1 Road Atlas, 2008).

According to the Landnámabók[6] (the book of settlement) the area of Skutulsfjörður was first settled in the 9th century. In the 16th century the town grew in size due to the establishment of a trading post for foreign merchants (see Figure 8). Until the second half of the 18th century there were about twelve farms located in Skutulsfjörður. More dense settlements started to form on the Skutulsfjarðareyri peninsula in the early 19th century. This is also where some of the oldest buildings of Iceland can be found. In the last years of the 19th century and the beginning of the 20th century the settlement started to develop towards the Eyrarfjall mountain. The houses in the area of Holtahverfi, below the mountain Kubbi, were built in 1976–1983 (Arnalds et al., 2002). The Skutulsfjarðarbraut road (see Figure 7) connects the old settlement with the newer areas of the town.

[6] The book of settlement can be accessed through http://www.snerpa.is/net/snorri/landnama.htm

Figure 8. Old houses in Ísafjörður, Downtown, Sudurtangi (Meidinger, 2010).

3.2 Economy and Demographics

Statistics Iceland (2010) provides only statistical information on the labour market for the capital of Reykjavik, the area surrounding the capital and for other regions; thus, an in-depth demographic and social characterization of the case study area is fairly limited. In 2009, agricultural and fishing sectors employed 12.7 % of the inhabitants in regions of Iceland oustide the capital. Industry sector employed 25.1 % and the service sector employed 62.2 %. Until the 1980s fishing was the main industry in Ísafjörður. However, amongst other factors, changed career expectations following increased education, political fishing restrictions in the 1980s, and the strong ISK in the 2000s up to the collapse, led to a significant decrease of people working in the fishing industry. The gross domestic product in 2009 was 1,500,765 ISK / 38,035 USD. The economic growth in 2009 was -6.9 % and is not expected to be positive again before 2011 (Statistics Iceland, 2010).

In the year 2010 the population of Ísafjörður had a total of 2674 inhabitants (see Figure 9). As can be seen in Figure 9 and Figure 10 there has been a decrease in the population since the beginning of the 1990s. Some of the reasons for this decline were, amongst other factors, the above mentioned reasons, which led the inhabitants to seek work elsewhere. However, three different future demographic projections predict a continuous population increase for the Ísafjarðarbær municipality towards the year 2020 (see Figure 10). The population projections for the Ísafjarðarbær municipality are here considered a proxy for the population growth trend in the town of Ísafjörður since it comprises about 70% of the municipality's total population.

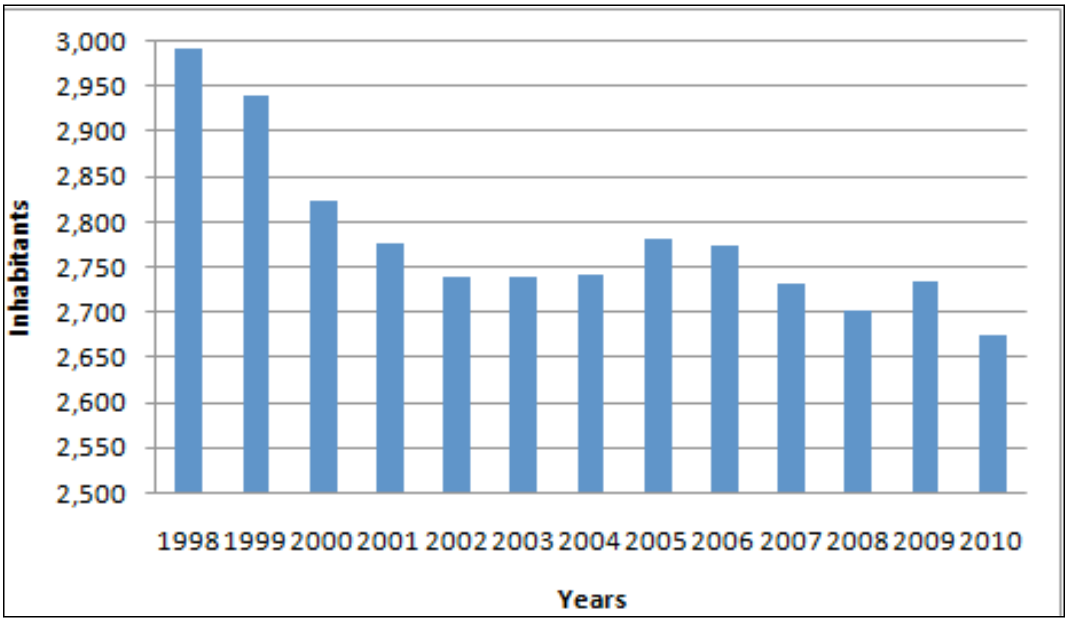

Figure 9. Population of Ísafjörður for 1998-2010. Blue bars = inhabitants. (Statistics Iceland, 2010).

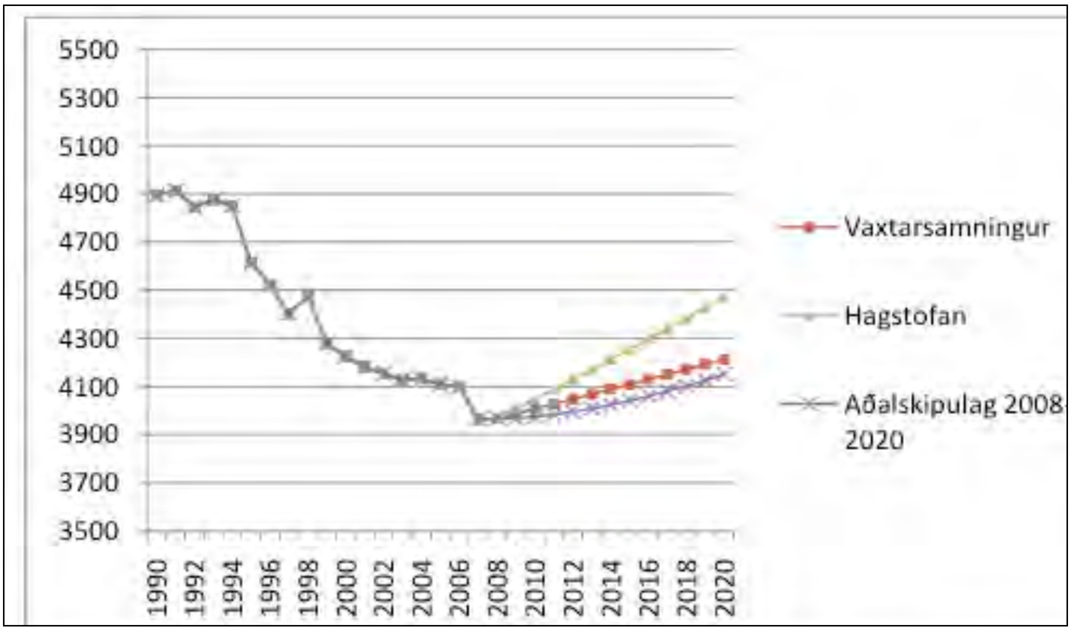

Figure 10. Demographic projections for the Ísafjarðarbær municipality until 2020. X-axis showing years and y-axis showing number of inhabitants (Ísafjarðarbær Municipal Master Plan, 2010).

3.3 Climatic Conditions

The climate in the Westfjords of Iceland is influenced by the rocky geography of the area, with high mountains and narrow fjords, and a location adjacent to the Denmark Strait, which separates Iceland from Greenland and occasionally brings sea ice into the fjords. The annual mean temperature in the low lying coastal areas is 3 to 4 °C with February and March being the coldest months, and July and August being the warmest months of the year. The sea breeze tends to lower the summer temperature, yielding a reduced annual range in temperature. The coldest temperature measured at the coast is -20 °C, but -21.9 °C at high elevations. In the Westfjords region the warmest temperatures range from 18 to 23 °C. (Arnalds et al., 2002)

The recorded wind speeds are lowest in July and highest in January. The annual mean wind speed is 4 to 5 m/s at the coast, with north-easterlies predominating. The 10-minute average winds at these locations can go as high as 24 to 28 m/s with gusts in the range of 42 to 45 m/s. In the low-lying coastal areas the orography exerts a strong influence on the local wind characteristics, with wind directions in the fjords predominantly "inwards" or "outwards" (see Figure 6). In the case of Ísafjörður this means the main wind directions are usually from the northeast and from the west-southwest (see Figure 6). The north-easterlies are stronger and more common during winter. The precipitation in the Westfjords is highly variable. The annual precipitation for Ísafjörður is 700 to 1000 mm. The region as a whole receives above average snowfall. Observations of snow cover in Ísafjörður show that the snow remains until late spring (Arnalds et al., 2002).

3.4 Coastal Setting

According to general thinking sea-level rise is not regarded as a traditional issue of concern in Iceland. This is also shown through a noteable lack of concern within Iceland's Fourth Communication on Climate Change (NC4, 2006). An explanation could be the rocky and steep morphological character of the Icelandic coast.

According to Gehrels et al. (2006) the relative sea-level on the west coast of Iceland has risen by 1.3 m since AD 100. The Reykjavik tide gauge has measured a relative sea-level rise of 2.39 +/- 0.5 mm per year for the past 50 years (Gehrels et al., 2006). The relative sea-level rise in Reykjavik may be slightly higher than in the Westfjords because of a higher subsidence rate. As can be seen in Figure 11, the onset of rapid sea-level rise in Iceland is estimated to have occurred between 1800 and 1840, earlier than in the western Atlantic (Gehrels et al., 2006) but this is fairly consistent with the observations made at three different locations in Poland, the Netherlands and France (Church et al, 2010).

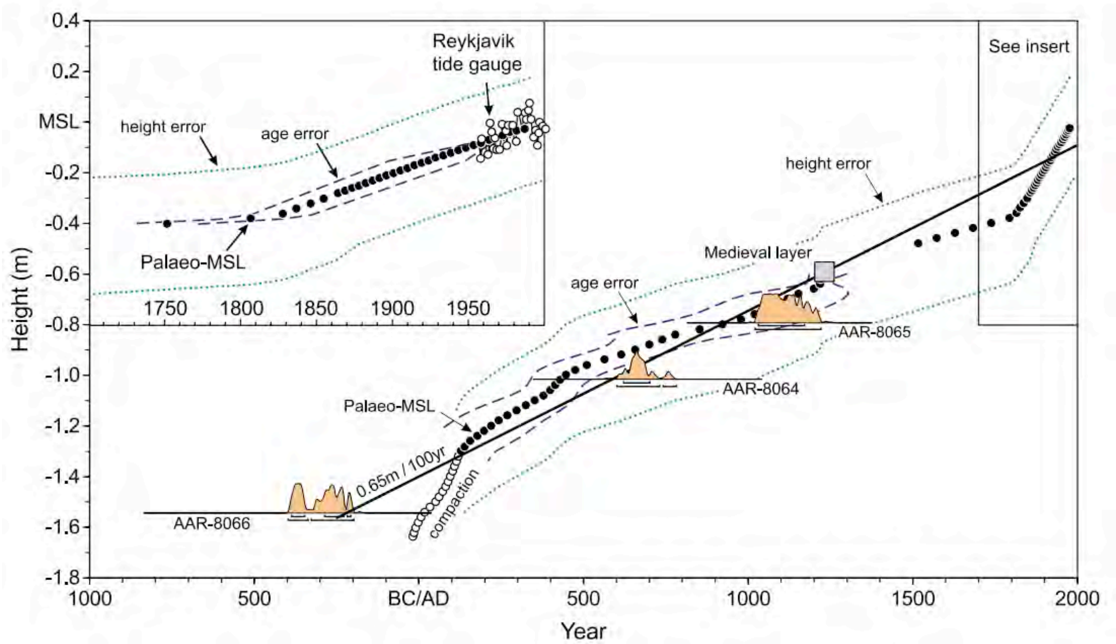

Figure 11. Relative sea-level changes at Viðarholmi, western Iceland. Solid circles represent reconstructed sea-level positions. The trend line through the Mediaeval Pumice sea-level index point and the three basal peat index points (AAR) shows a long-term sea-level rise of 0.65 m per 1000 years. The youngest part of the reconstruction corresponds well with sea-level observations at Reykjavik (PSMSL 2004). The recent acceleration of sea-level rise is dated to 1800-1840 (as taken from Gehrels et al., 2006).

As can be seen in Figure 12, it seems that most places in the Westfjords have isostatic glacial rebound rates ranging from -1 to +3 mm per year (Árnadóttir et al., 2007).

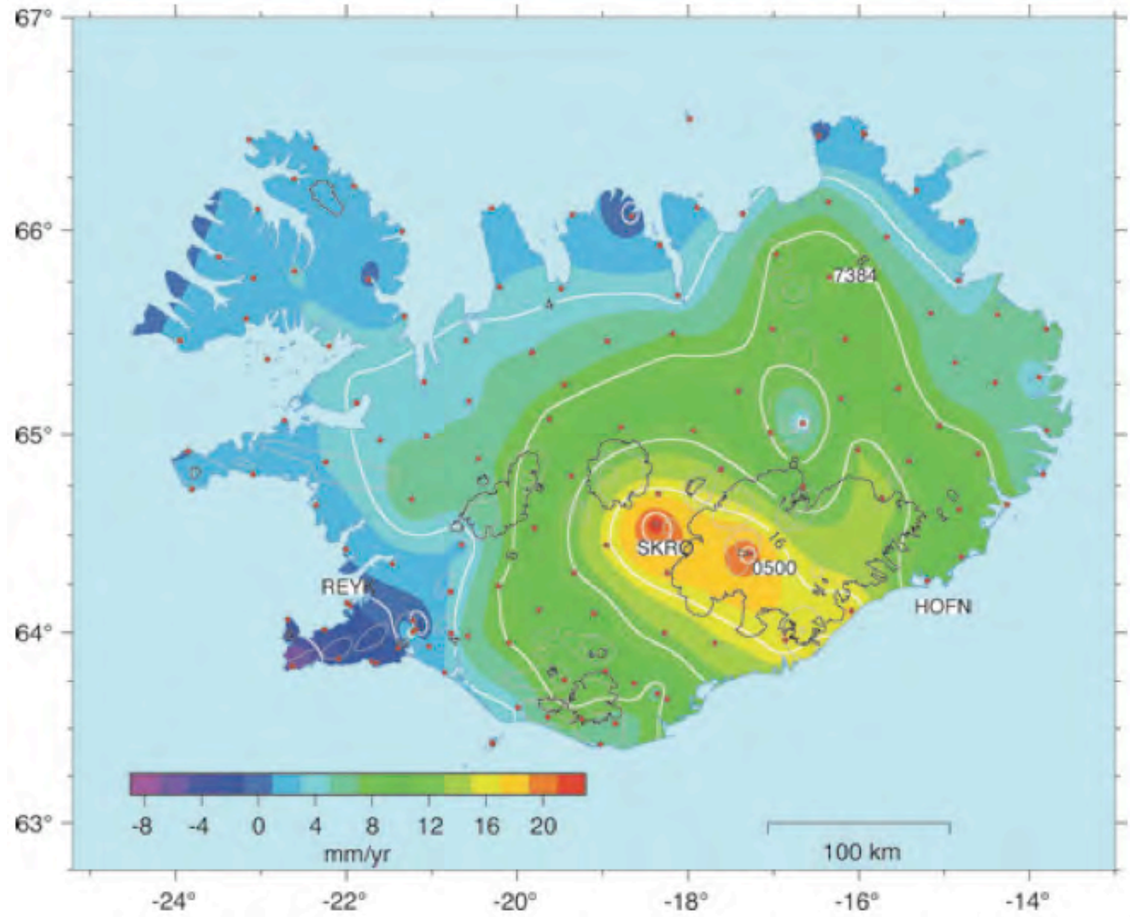

Figure 12. Vertical velocities (1993–2004) and the GPS network in Iceland (1999–2004). Positive numbers indicate uplift and negative are subsidence. Contour lines are drawn every 4 mm yr−1 . The red dots show the GPS station locations (Árnadóttir et al., 2007).

Similar to a Norwegian case study in Hordaland (Antonijevic and Lucas, n.d.), the most distinctive coastal feature in the Ísafjarðarbær municipality is the fjords. They branch and constitute a very long coastline, mainly rocky and steep, presumably giving it quite a low vulnerability[7] towards sea level rise.

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[7] The Intergovernmental Panel on Climate Change (IPCC, 2007) defined vulnerability as the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Antonijevic and Lucas (n.d.) describe vulnerability as a function of exposure, sensitivity and adaptive capacity. Therefore, exposure is the degree or extent of contact with the change, in this case sea-level rise; sensitivity is the degree to which the system is affected and adaptive capacity is the ability to adjust to the changes.

However, in the past the town of Ísafjörður has experienced several coastal flood events due to storm surges (see Figure 15). These events have caused economic damage to several coastal assets and infrastructure in Ísafjörður and the surrounding area. Trausti Jónsson (2010) from the Meteorological Office of Iceland was kind enough to provide some information on past coastal flood events in the Ísafjarðarbær municipality. A collection of the most relevant information is presented: In 1895 a strong northerly storm caused significant damage in Ísafjarðardjúp. In 1916 a severe storm surge affected Ísafjörður, damaging several houses, a number of storage houses and some fish processing plants. In 1957 a strong storm created a storm surge which seriously damaged the Ísfjörður harbour. Hafnarstræti, the main shopping street in Ísafjörður, was damaged and cellars were flooded. In 1973 another storm surge damaged streets and lead to the flooding of cellars in Ísafjörður. The local newspaper Bæjarins besta (www.bb.is) provided two pictures for the most recent coastal flood event in late December 2006 (see Figure 13 and Figure 14).

Figure 13. Picture showing the main shopping street (Hafnarstræti) in Ísafjörður. The picture was taken during a flood event in late December 2006. (Picture provided by local newspaper Bæjarins besta).

Figure 14. Picture taken in Neðstikaupstaður (Downtown) in Ísafjörður during a flood event in late December 2006 (Picture provided by local newspaper Bæjarins besta).

Figure 15. Ísafjörður on November 19th 1936 (Safnahúsið Eyrartúni, 2010).

Within the municipality the majority of human settlements and economic activities are located in low-lying and flat areas at the bottom of the steep fjords. It is important to mention that Ísafjörður is partly built on a sand spit that reaches long into the fjord, exposing it to sea-level rise and wind-induced inundations from three different directions

(Figure 17). The oldest part of the sand spit was naturally formed (see Figure 16) and has been artificially extended by landfill. In general the ground level elevation of the sand spit is extremely low and there is no room for landward retreat. In addition, the sand spit is permanently exposed to coastal processes such as wave erosion and longshore drift. The Ísafjörður domestic airport is located on an artificial landfill at the end of the fjord, facing possible inundation from future sea-level rise. The local economic activity in the municipality is concentrated along the coastline and depends on the coastal zone as location for several reasons such as fisheries and tourism. This dependency might increase the sensitivity towards coastal inundation as it was expected in the Norwegian case study (Antonijevic and Lucas, n.d). As there is still considerable scientific debate on how much sea-level will rise in the 21st century, one has to keep in mind that all projection estimates indicate a rise in local sea-levels and an increase in storm surges for the Northern Atlantic Ocean. Therefore, one has to consider that the vulnerability of infrastructure and people will increase in the future, assuming that there will be no further adaptation towards a rising sea-level and an increase in storm surges.

Figure 16. Old picture of Ísafjörður from the beginning of the 20th century, without the artificial extension of the sand spit (Byggdasafn Vestfjarda, 2005).

Figure 17. Picture showing today's Ísafjörður in the fjord Skutulsfjörður (Picture taken by Ágúst Atlason).

4 Methodology

4.1 Proposed Conceptual Framework to Assess the Vulnerability of Ísafjörður's Coastal System to Storm Surges and Sea-level Rise

The framework (Figure 18) of this study starts by dividing the costal system into physical and socio-economic sub-systems that are dynamically interconnected. The socio-economic sub-system consists of the infrastructure that are expected to suffer damages (roads and buildings) and the coastal inhabitants. According to the IPCC (2001; 2007), fiscal damages and impacts on humans are two of the most important problems in coastal areas associated with increased sea-levels rise. The physical sub-system is made of components whose interaction will ultimatly result in potential flood depth in the case study, for example, storm surge component associated with accelerating sea-level rise. Potential flood depth directly impacts the socio-economic sub-system's infrastructure components leading to economic damages and also indirectly impacts the coastal inhabitants. The study focuses its attention on the two impact categories highlighted in Figure 18. First, the social impacts are defined as the number of people affected during flooding events. Second, the economic impacts are denoted as damages to infrastructure, including roads and buildings. The potential impacts/damages to buildings and roads arise from the force of water when flooding occurs. The degree of damage ranges from 0% (not affected) to 100% (total destruction).

According to Jonkman (2007), the number of fatalities due to a flood event is determined by the characteristics of the flood (e.g., flood depth, flood velocity, rise rate), the possibilities for warning, evacuation and shelter, and the loss of shelter due to the collapse of buildings. For this study it is assumed that during a flood event people remain indoors and that no evacuation measures take place. The methodology of this lives lost calculation will be described in chapter 4.3.3. Broadly, the number of peopl affected is defined as the number of individuals living in buildings which are impacted by flooding.

Based on this number, different magnitudes of flood depth, and empirical functions developed in flood hazard context (Jonkman, 2007), potential people affected was calculated.

In theory, one can undergo a deep investigation of all conceivable links and interactions of each sub-system. In practice, such an excercise is constrained by data availability and biased by the researcher's perception of the system itself. For example, a social scientist might view household income as an important aspect to include in the socio-economic system while an economist is more concerned with the macro economic damage expected at the settlement. By expanding the framework, one can apply the proposed methodology to other coastal locations within Iceland and compare the difference in impact, something that can hardly be achieved by detailed community approaches of socio-economic systems.

In the context of this work, vulnerability starts with the estimation of impacts and ends with the suggestion of management options that counteract the effects of accelerated sea-level rise in the Ísafjörður region.

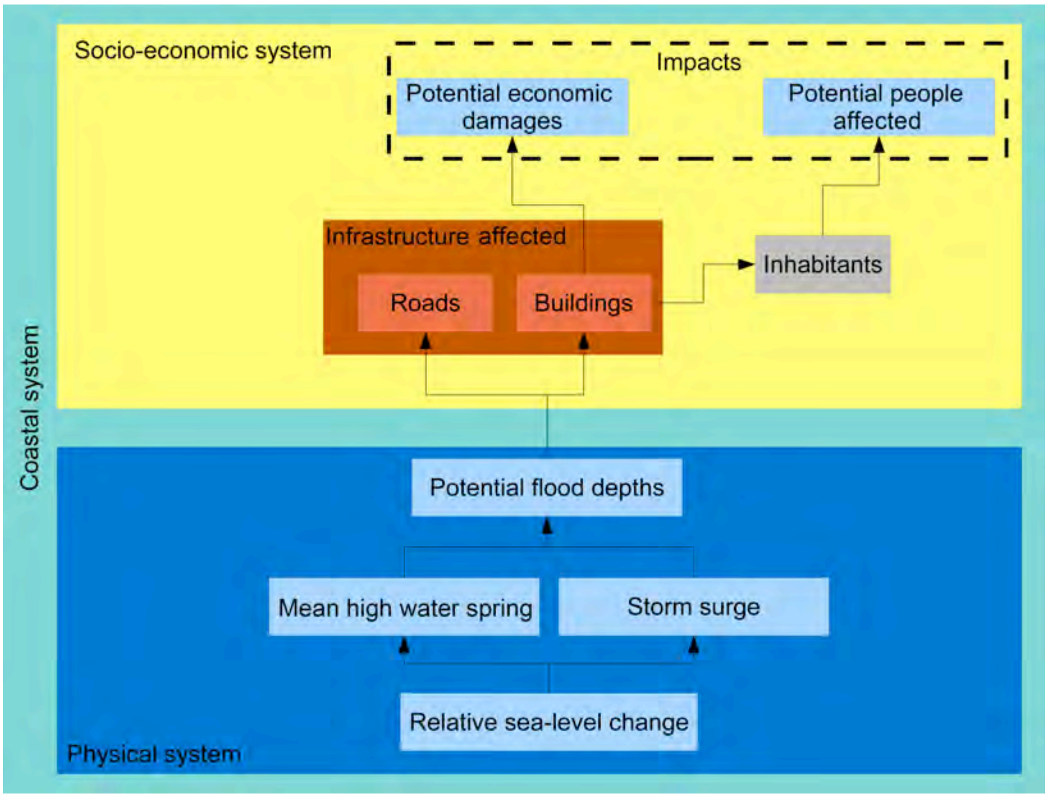

Figure 18. Proposed conceptual framework for Ísafjörður.

4.2 Data and Material Used

Relevant data regarding the study area was gathered in close cooperation with several private Icelandic companies and governmental institutions on local and national levels. Table 7 lists the data used and gives a short description of the data characteristics and the data sources.

Table 8

Table Lists the Data Used, Data Descriptions and Data Sources

Data	Description	Source
Aerial photographs	11 JPEGs; taken on 19/06/2008 between 17:48-17:58 UTC; Projection Lambert 1993	Loftmyndir ehf. (www.loftmyndir.is)
Contour lines	Shapefile; vertical distance 1 m; Projection Lambert 1993	Loftmyndir ehf. (www.loftmyndir.is)
Coastline	Shapefile; Polyline; Projection Lambert 1993	Landmælingar Íslands
Survey station points	Obtained from spatial planning maps	Tækniþjónusta Vestfjarða hf., Consulting Engineers
Houses	Shapefile; Polygon; Projection Lambert 1993	Snertill (www.snertill.is)
Roads	Shapefile; Polygon; Projection Lambert 1993	Snertill (www.snertill.is)
Addresses	Street names and house numbers; Excel; downloaded 15/11/2010	Infrapath 2010[8]
People per residence	Amount of people registered per residence, Excel; downloaded 15/11/2010	Infrapath 2010
Fire insurance values	Insurance value for each house in ISK; Excel; downloaded 15/11/2010	Infrapath 2010
Sea-level rise scenarios	Time series; Relative sea-level; Excel	DIVA-Tool
Storm surge value	Predicted storm surge height for 13/09/2010	Icelandic Maritime Administration
Mean High Water Spring	Single value (2.2m); Tidal Charts Ísafjörður	Icelandic Maritime Administration
Avalanche Hazard Zoning	Shapefile, Polyline, Projection Lambert 1993	Teiknistofan Eik.

A set of 11 aerial photographs for almost the entire fjord called “Skutulsfjörður” was purchased from the Icelandic company Loftmyndir ehf. (www.loftmyndir.is). All aerial photographs were taken on July 19th 2008 from 17:48-17:58 coordinated universal time (UTC) using the Lambert 1993 projection in Jpeg format.

The private software company Snertill (www.snertill.is), provided shapefiles for houses and public roads via its web based geographical information system application

Infrapath 2010[8]. Both houses and public roads are in polygon format. The number of people residing in each building as well as the assessed fire insurance value for each house (from year 2010) were also extracted from the web based geographical information system Infrapath 2010. The data were accessed on 15/11/2010.

4.2.1 Sea-level rise scenarios and storm surge height

Future sea-level rise estimates were created with the Dynamic Interactive Vulnerability Tool (DIVA). The Dynamic Interactive Vulnerability Tool is a stand alone geographical information system consisting of 7 modules (see Table 8) (Hinkel & Klein, 2009). DIVA is the result of the DINAS coast project[9], which was carried out between 2001 and 2004. The strategy of the approach is to divide the global coast into 12.148 coastal segments with similar characteristics (McFadden et al., 2007).

Table 9

Explanation of the 7 Modules Used Within DIVA (Hinkel & Klein, 2009)

Module Name	Author	Description
River Effect	Rob Maaten	Calculates the distance from the river mouth over which variations in sea level are noticeable.
Wetland Change	Loraine McFadden	Calculates area change in km² due to sea-level rise for seven types of wetlands.
Flooding	Robert Nicholls	Calculates flooding due to sea-level rise and storm surges.
Wetland Valuation	Luke Brander	Calculates the value of different wetland types as a function of GDP, population density and wetland area.
Indirect Erosion	Luc Bijsterbosch, Zheng Bing Wang	This is a reduced version of the Delft Hydraulics ASMITA model. It calculates the loss of land, the loss of sand and the demand for nourishment due to indirect erosion in tidal basins.
Total Erosion	Robert Nicholls	Calculates direct erosion based on the Bruun rule. Adds up direct erosion and indirect erosion in tidal basins.
Adaptation	Richard Tol	Calculates socio-economic impacts of the geodynamic effects, taking into account preset and/or user-defined adaptation options.

The segment used for this project is numbered 8266 and is highlighted in Figure 19. This segment represents the Westfjord region in Iceland.

[8] The web based Infrapath 2010 GIS -service for Ísafjörður is available at http://www.infrapath.is/mapguide/fusion/templates/mapguide/isafjordur/

[9] Dynamic and Interactive Assessment of National, Regional and Global Vulnerability of COASTal Zones to Climate Change and Sea-Level Rise, www.dinas-coast.net

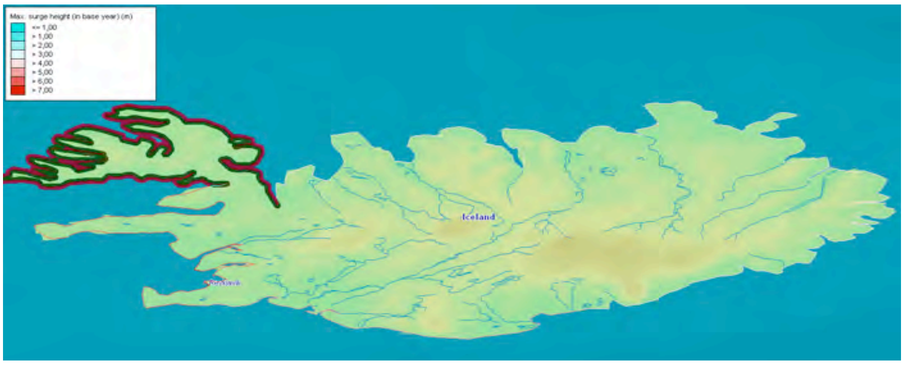

Figure 19. Screenshot from DIVA showing the highlighted coastal segment used for this project (Map projection: WGS84).

For each coastal segment, the DIVA Tool provides a multitude of parameters such as population density, wetland area, frequency and height of storm surges and area flooded. Some of the DIVA data for segment 8266 are shown below (*Table 10*). The values are not generalized for the entire coast of Iceland but for each coastal segment.

Table 10

Selected Storm Surge and Subsidence Parameters from DIVA for Segment 8266

	1 in 1 year surge height (in base year)	**1 in 10 year surge height (in base year)**	**1 in 100 year surge height (in base year)**	**1 in 1000 year surge height (in base year)**	**Max. surge height (in base year)**	**Uplift / subsidence**
Unit	m	m	m	m	m	mm/year
Value	2.098	2.229	2.364	2.503	5.503	-0.039

DIVA is designed to explore the vulnerability of coastal regions to sea-level rise. It comprises a global database of natural system and socioeconomic factors, relevant scenarios, a set of impact-adaptation algorithms and a customised graphical-user interface. For site-specific applications DIVA must be modified, because local features are not yet included. Although the tool does not provide a vulnerability indicator for certain coastal regions, is includes meaninfull indicators of vulnerability, such as people at risk, damage and adaptation costs (Costa et al., 2009). For this project only the relative sea-level rise estimates from DIVA were used. Because of its low spatial resolution the tool can barely be used as a decision support tool. Instead, the developers envision DIVA as system that supports discussions about sea-level rise and related impacts (Hinkel & Klein, 2009).

As can be seen above, the DIVA-Tool used a coastal subsidence rate of -0.039 mm per year for the coastal segment of interest. Due to the lack of clarity about consistent uplift or subsidence numbers for the region, it was decided to use the sea-level rise estimations made by the DIVA-Tool, taking into account the subsidence rate of -0.039 mm per year. The calculated storm surge heights for the coastal segment of interest from DIVA all exceed 2 metres (2.098 to 2.364 m), and hence a predicted storm surge height value provided by the Icelandic Maritime Administration (IMA) was used. The location of the examined community is situated at the head of a fjord. The predicted local storm surge value provided by the IMA is here assumed to be more adequate due to its higher spatial resolution. The origin for the predicted storm surge value lies in close proximity to the study area, while the storm surge value provided by DIVA was a product of generalization for the entire coastal segment.

4.2.2 Storm surge height

Currently, predictions of extreme water level a few days ahead are produced for a number of regions using the output data from numerical weather-prediction models to drive storm surge models (Flather, 2000). A storm surge value (0.84 m) was provided by the Icelandic Maritime Administration that just recently started an online weather and sea state information system[10] that provides real time information as well as forecast simulations to predict tides, waves and storm surges for Icelandic waters. The geographical coordinates for the predicted value are: Lat 66.100 and Lon -22.800 (see Table 10).

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[10] The online sea and weather state information system can be accessed through http://vs.en.sigling.is/

Table 12

The Highest Storm Surge Height Value Predicted by the Weather and Sea State Information System (Icelandic Maritime Administration, 2010)

Date of highest predicted storm surge height near Isafjördur	Surge height (m)
13/09/2010	0.84

Due to the cause of uncertainty about future projections of sea-level rise for this project, different and equally probable scenarios of temperature and subsequent sea-level rise were constructed for this study. These scenarios build upon the so-called SRES story lines of socio-economic development that are extensively used by the IPCC. In this thesis, the concern is not so much on how impacts will develop according to a proposed scenario but instead on what impacts are associated with a fixed temperature or sea-level rise target.

Drawing upon this perspective, three normative scenarios were formulated, two regarding fixed temperature targets and one regarding a global mean increase in sea-level. The choice of the temperature and sea-level rise targets were based on both scientific evidences of accelerated mean sea-level rise and prescribed policy temperature goals in order to avoid dangerous climate change. A description and fundamentals of the elaborated scenarios are described below.

4.2.3 One metre sea-level rise world scenario

This scenario is based on the assumption that global sea-level rise reaches 1 metre by year 2100. This assumption is in line with several authors such as Rahmstorf (2007) and Church et al. (2010). As discussed before, a global mean sea-level rise tells little about the regional variability. By making use of the DIVA tool, the global mean sea-level of one metre was translated to a regionalised value for the Westfjord region displayed as a blue line in the graphic (Figure 20) below. Please note that the graphic reflects changes in relative sea-level, this is the net effect of sea-level changes after including the land subsidence rate of -0.039 mm/year. One can observe that the Westfjord region behaves in a similar manner to the imposed global sea-level trend experience around 1 metre relative sea-level rise by 2100. The storm surge value is shown in red (see discussion in 4.2.2) and is assumed static during the entire time frame of the projections for all scenarios. As mentioned before, trends in storm surge intensity in a changing climate are still subject to great levels of uncertainty, especially in areas like the Westfjords which lack a long-term consistent storm intensity recording.

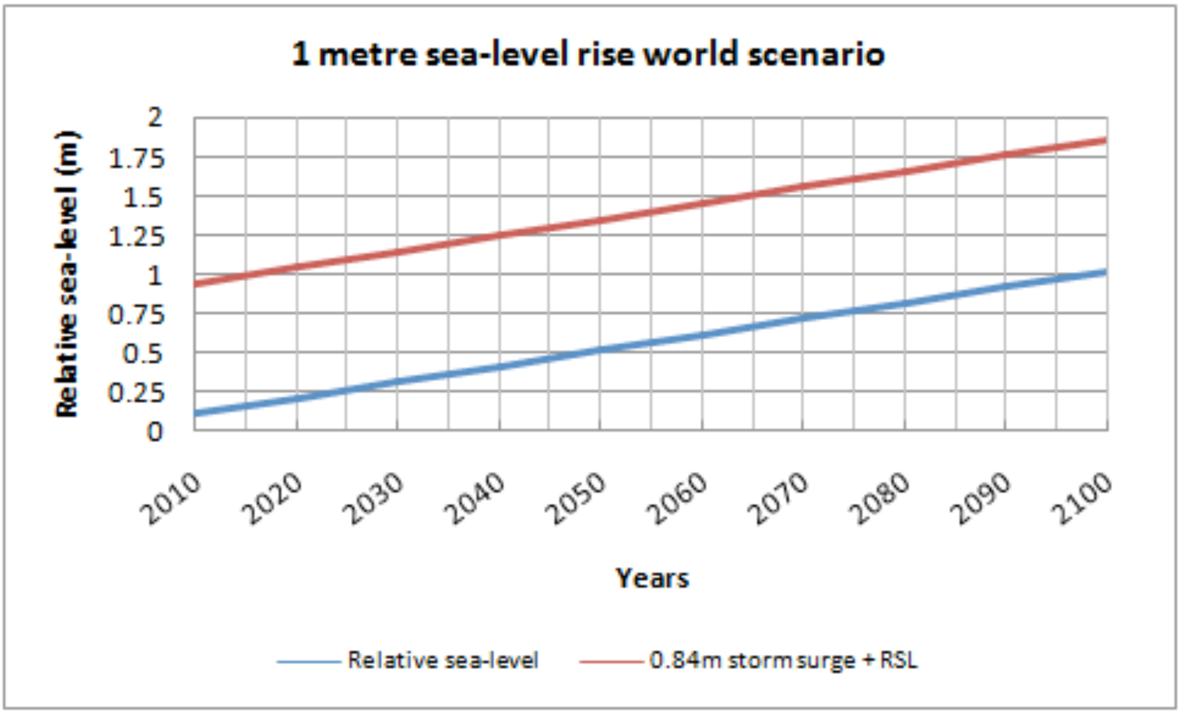

Figure 20. 1 metre sea-level rise world scenario with relative sea-level change (+0.102 m/10 years) and 0.84 m storm surge + relative sea-level (Meidinger, 2010).

4.2.4 Two degree world

The scenario named two degree world reflects a world where the increase in global mean temperature is kept below 2 degrees Celcius by the end of the 21st century in comparison with pre-industrial levels. This means that sea-level rise numbers are calculated for an increase in global mean temperature of 1.9 degrees Celcius by 2100. The reason for the construction of this scenario lies in the fact that more than 100 countries have now taken an increase of 2 degrees in the global mean temperature as a guardrail for their mitigation and adaptation efforts regarding climate change. In addition, the efforts of current climate negotiations under the UNFCCC framework for avoiding dangerous anthropogenic climate change make use of the same temperature target. Figure 21 represents a world where policy negotiations succeed in keeping the increase of global mean temperature below two degrees. In this light, the Westfjords region is expected to experience a relative sea-level rise of around 0.5 m by year 2100 relatively to the year 1995 level, about half the magnitude of the previous scenario.

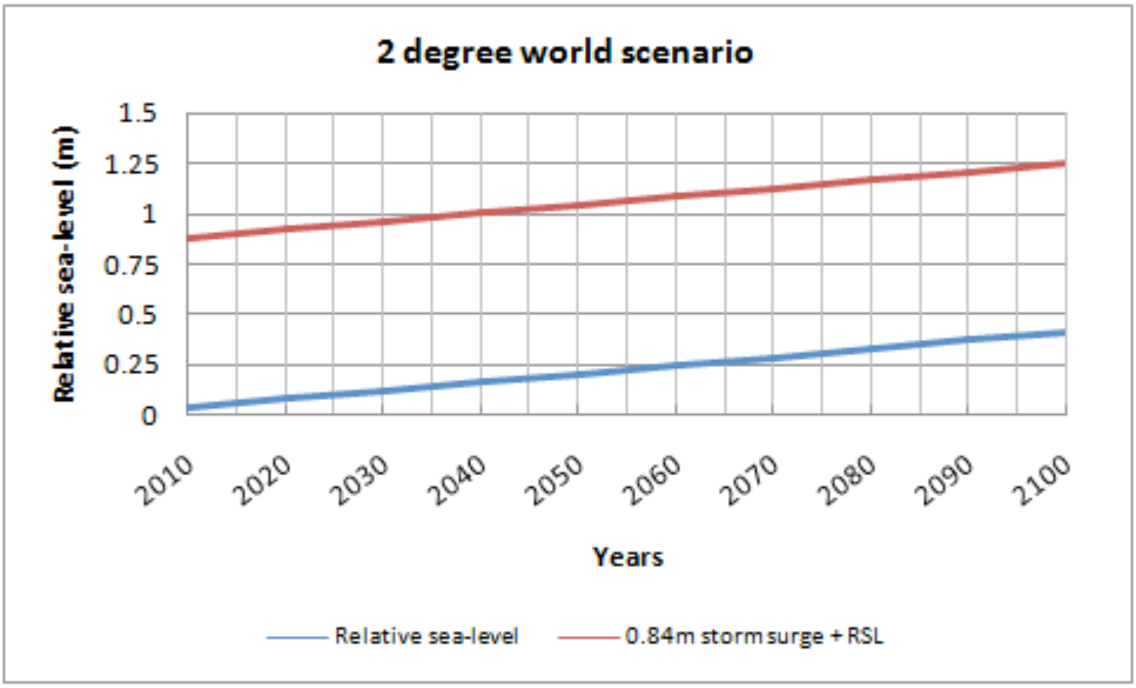

Figure 21. 2 degree world scenario with relative sea-level change (+0.041 m/10 years) and 0.84 m storm surge + relative sea-level (Meidinger, 2010).

4.2.5 Three degree world

In this scenario nations fail to implement adequate climate policies to limit the increase in global mean temperature by year 2100. Instead, global mean temperature increases by 3 degrees Celcius towards the end of the 21st century in comparison with pre-industrial levels. With the realistic prospect that the 2 degree target will fail if current trends of greenhouse emissions are maintained, this scenario provides a description of the consequences of a business as usual policy. The expected relative sea-level rise range of this scenario (0.78 m) is situated between the values obtained in a 1 metre sea-level rise world scenario and the 2 degree world scenario (see Figure 22).

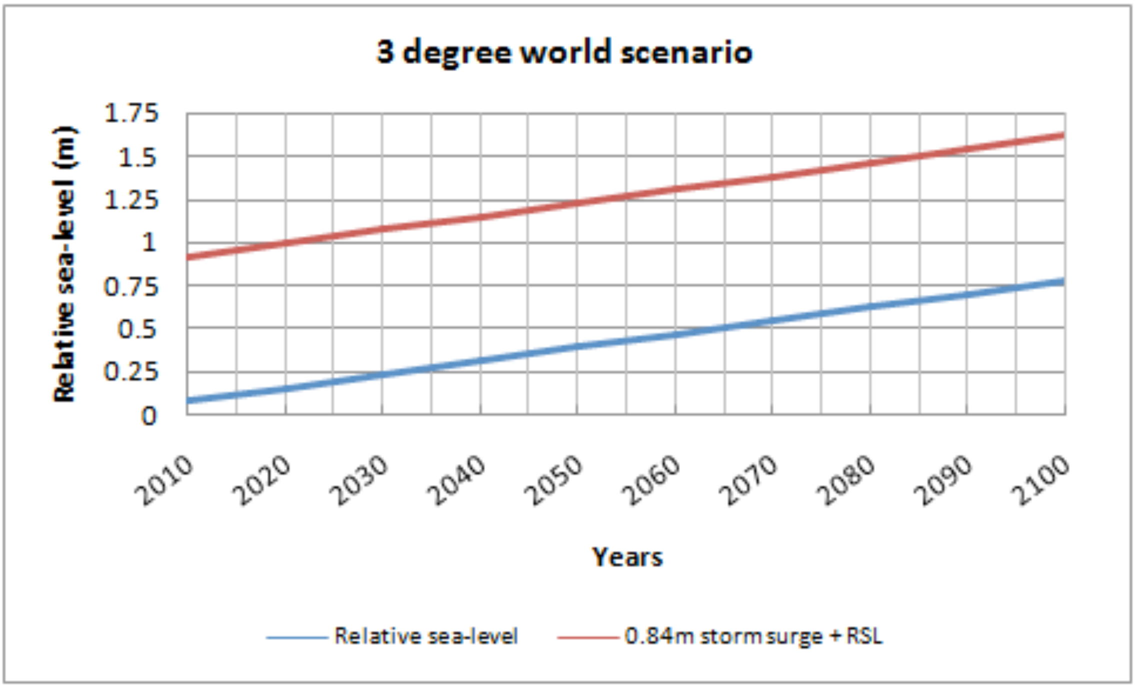

Figure 22. 3 degree world scenario with relative sea-level change (+0.078 m/10 years) and 0.84 m storm surge + relative sea-level (Meidinger, 2010).

Some relevant aspects regarding coastal processes such as coastal erosion and sedimentation supply where not tackled in this thesis. Although these processes could be relevant in determining the local magnitude of sea-level rise impacts, the lack of data does currently not allow further considerations. In addition, until today there are no regional sea-level rise estimates available for Iceland and no long-term tide gauge installed in Ísafjörður.

4.3 Processed Data and Applied GIS-methods

In order to identify areas prone to coastal flooding, a three-dimensional surface model was created. This was done using the create TIN feature within ArcGIS 9.2. A dataset of contour lines in shapefile[11] format was purchased from Loftmyndir ehf with a vertical resolution of 1 metre and the same projection characteristics as the aerial photographs. The purchased dataset did not include a contour line with the zero metre value, representing the coastline or mean sea-level. Therefore, the lowest elevation value within the contour lines data set was 1 metre. To overcome this, a shapefile representing the coastline of Skutulsfjörður was provided by the National Land Survey of Iceland (Landmælingar Íslands / LMI). The assigned value to this data set was 0 metres. By overlaying the provided coastline contour with aerial photographs displaying the coast, it was noted that mismatches between the two data sets ocoured mostly in areas with sharp edges and corners (such as the Ísafjörður harbour). Local improvements to the coastline provided by the LMI were achieved through manual edits executed in overlay mode with the aerial photographs. According to LMI, this is the best dataset available. In additon to the minimum inputs required to create the three dimensional surface model (contour lines), an additional 22 ground control points were obtained from plans at the local office of Tækniþjónusta Vestfjarða hf. (Consulting Engineers) in Ísafjörður. These points were digitalized as a point file and used as auxiliar input data along with the contour lines to create the digital elevation model. To refine the surface topography the road polygons were used as an additional input data.

4.3.1 Flood depths and design water levels

This analysis relies on the overlay of a digital elevation model (DEM) and a specific inundation Design Water Level (DWL) layer representing the flood depth for each time interval and sea-level rise scenario applied.

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[11] Shapefile is a popular geospatial vector data format for geographic information systems software. They spatially describe geometries as points, polylines and polygons. For further information see http://webhelp.esri.com/arcgisdesktop/9.2

The first step in this approach is to create a digital elevation model. In order to achieve this, the contour lines (1 metre intervals) and coastline were used as primary input data to create a TIN[12] (Triangulated Irregular Network) model of the study area. In order to improve the quality of the TIN, especially in problem regions such as the harbour, where sharp concrete edges are abundant, the obtained land-survey marks were used. These control points were put into the TIN as secondary data, using the edit TIN option within ArcMap 9.2. Once the TIN was completed it was converted into a raster with a grid size resolution of 1 x 1 m using the 3D Analyst extension within ArcMap 9.2.

4.3.2 Flood script

For this study, a flood script for ArcInfo 9.2 was developed based on the methodology described by Poulter and Halpin (2008) in which a grid cell representing the terrain becomes flooded if its elevation is less than the projected sea level and if it is connected to an adjacent grid cell that was flooded or open water. The connectivity definition used for this coastal vulnerability assessment is the “eight-side rule”, where the grid cell is connected if any of its cardinal and diagonal directions were adjacent to a flooded cell (see Figure 23). One of the disadvantages when applying the “zero-side rule” is the fact that it does not consider surface connectivity at all between grid cells (Moorhead & Brinson, 1995; Titus & Richman, 2001).

[12] A TIN is a vector data structure depicting geographic surfaces as contiguous non-overlapping triangles. The vertices of each triangle match the elevation of the terrain exactly. This means that a topographic surface is represented by several triangles, with each triangle face having an approximate slope, aspect and surface area. Once a TIN is created, the elevation of any point on the triangle’s continuous surface can be interpolated (Environmental Modeling Research Laboratory, 2010).

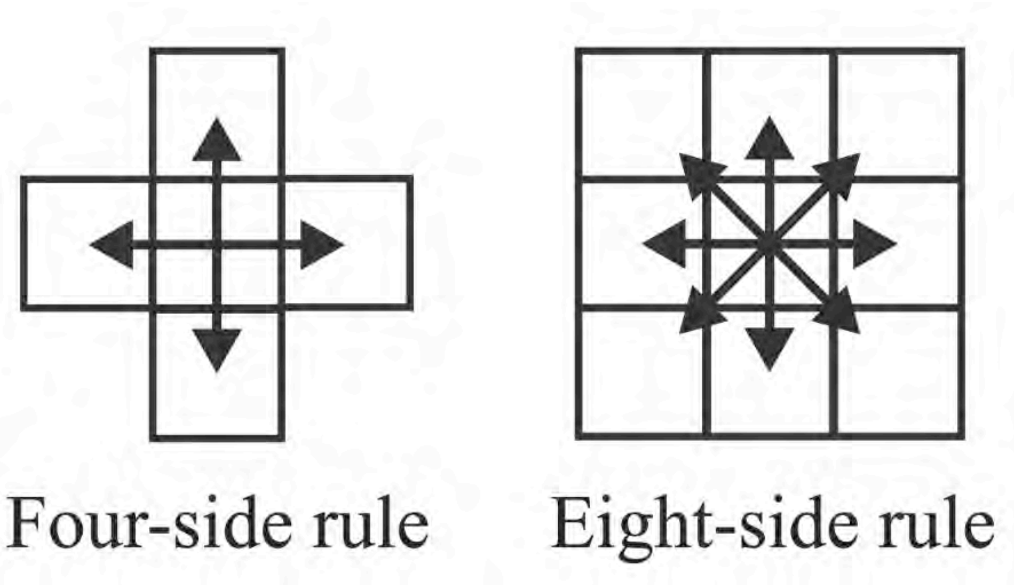

Figure 23. Presentation of the "four-side" and "eight-side" rule (adapted from Poulter & Halpin, 2008).

According to Poulter and Halpin (2008) the "four-sided rule" may have the potential to underestimate surface flow connections because only cardinal cell sides are allowed to be connected, whereas the "eight-side rule" may have the potential to overestimate connectivity by allowing flow to occur across cell corners. A flooded or inundated area is identified when the analysis shows that the DEM elevation is less or equal to the chosen Design Water Level (DWL).

A similar approach to Gravelle (2008) was used to create the different Design Water Levels (DWL) for each sea-level rise scenario. The Design Water Level layers represent a simulated extreme water level of possible flooding around the coastline of Ísafjörður based on the chosen sea-level rise scenario. The following equation (Eq 1) was used to calculate the Design Water Levels (DWL):

(Eq 1)

$$\mathbf{DWL = (MHWS - MSL) + SLR + SS}$$

where DWL= design water level; MHWS= mean high water spring; MSL= mean sea level; SLR= sea-level rise; SS= storm surge.

DWL layers consist of three components:

- Mean high water spring (MHWS) for Ísafjörður,
- Effect of sea-level rise (three scenarios based on DIVA projections),
- Predicted storm surge value for a location close to Ísafjörður from the Icelandic Maritime Administration.

The DWL consists of the sea-level rise estimates and the storm surge value added to the mean high water spring, which is used here as a simulated extreme water level under the three previously described scenarios. The MHWS value has a different vertical datum (Harbour System; Tækniþjónusta Vestfjarða hf.) from the digital elevation model. Therefore a correction was applied by subtracting the mean-sea level value of 1.07 m (Tækniþjónusta Vestfjarða hf.) from the MHWS. The tides in Iceland waters are semidiurnal[13]. MHWS values are often used in vulnerability analysis studies as a measure of maximum possible risk during high tides (Gravelle, 2008). The mean high water spring is defined as the highest level spring tides reach on the average (around every fortnight) over a period of time (often 19 years). According to the Icelandic Maritime Administration, the MHWS for Ísafjörður is +2.2 m. The complexity of tides and vertical datum is explained in Figure 24.

[13] There are 12 hours and 25 minutes between consecutive floods (www.fisheries.is)

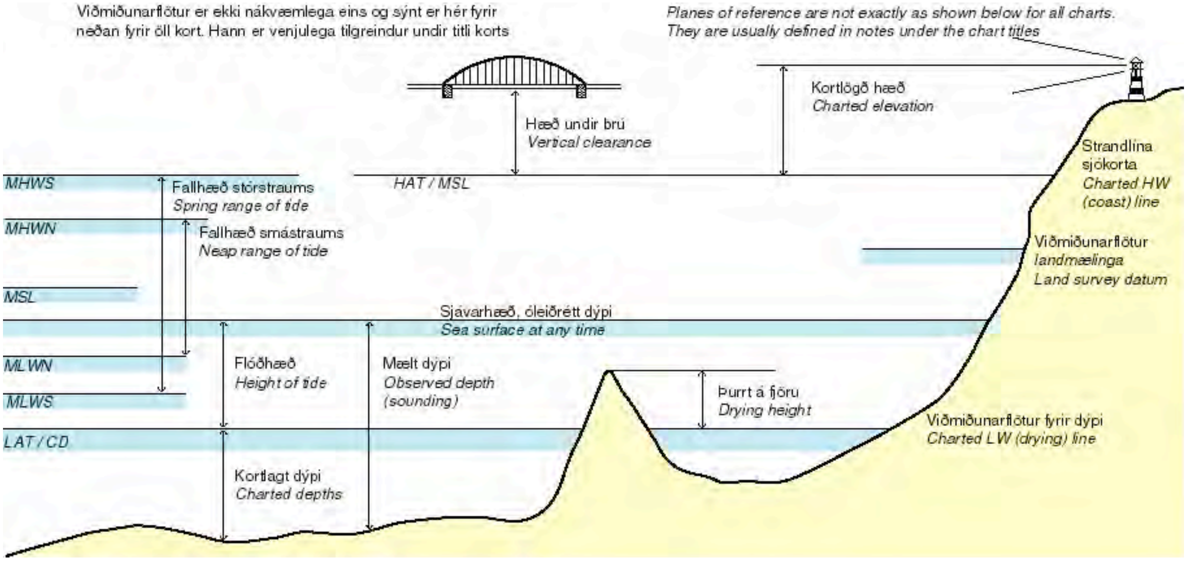

Figure 24. Graphic shows complexity of different water levels and different reference systems (IMO, 2010).

The second component added to the DWL layer was the sea-level rise projection values provided by DIVA. The third component added was a constant value (0.84 m) for a storm surge in close proximity to the study area, just outside of Skutulsfjörður.

The flood script creates one flood layer every 10 years adding the calculated sea-level rise value for each increment (Table 11) on top of the previously created layer. The flood script started its routine above the 1.97 m level ((MHWS-MSL) + SS), meaning that each increment of sea-level rise contributes effectively to raise the DWL. A total of 30 DWL layers were created for further GIS analysis, see details of maximum levels and increments in Table 11.

Table 13

Maximum SLR Values and Linear 10-year Increments of Sea-level Rise for the Three Scenarios. Eq 1 (DWL = (MHWS-MSL)+SLR+SS).

Sea-level rise scenario	**Year 2100**	**10-year increments**
1 metre sea-level world	1.02m	0.102m
3 degree world	0.78m	0.078m
2 degree world	0.41m	0.041m

In order to assess the loss of life and the damage to buildings and roads, it was necessary to calculate the flood depth for each 10-year time increment. Therefore, the original DEM elevation values were subtracted from the corresponding DWL layer elevation values using the raster calculator within ArcMap 9.2. In the context of this study we will only look at the consequences from storm surges under sea-level rise. The consequences from progressive sea-level rise alone will not be investigated in this study.

4.3.3 Loss of life

Jonkman (2007) extensively analyses loss of life as one of the major consequences of flood events. In the context of this thesis, the empirical function developed by Jonkman (2007) is used to estimate the loss of life from flooding. The function is derived from an analysis of the big North Sea storm surge event in the Netherlands and the UK in 1953. It relates the local flood mortality (e.g., the fraction of people killed) to the local flood characteristics (e.g., flood depth). The 1953 storm surge event occured at night and there were no substantial warnings given and most fatalities occured in areas with vulnerable and low quality buildings. Jonkman (2007) distinguishes between three different hazard zones with different flood characteristics. For this study, the function representing the “zone with rapidly rising waters” was used (see Figure 25).

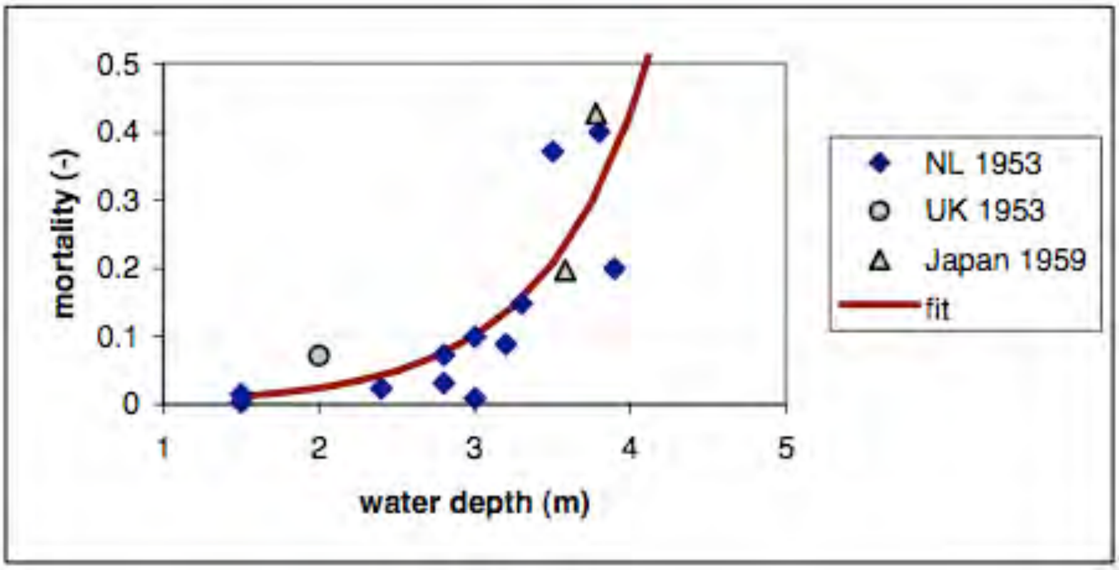

Figure 25. Relationship between mortality and water depth for locations with rapidly rising water (Jonkman, 2007).

According to Jonkman (2007) the flood characteristics are generally relatively homogeneous within each zone. Therefore, these zones are representative for loss of life estimations even if all three zones do not exist (e.g., if no structural sea defence is used). The following equation (Eq 2) was used to estimate the loss of life in relation to the flood depth:

(Eq 2)

M(h) = exp ((d-4.58) / 0.69), [14]

where M(h) = mortality (-); d = water depth (m)

This function was applied to the calculated mean flood depth at each house for each increment of all the sea-level rise scenarios applied. The calculated mortality rate was then multiplied with the number of inhabitants for each house to obtain the number of people affected. In cases where houses had no inhabitants the calculated mortality rate is 0. The average loss of life numbers for each 10-year increment are shown in Table 12. As can be

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[14] EXP - returns e raised to the nth power, where e = 2.71828183

seen, no direct flood casualties are expected if population numbers remain steady. This is an aggregated measure of people affected including all age and social classes. This means, that concrete statements of vulnerability for social groups cannot be made but instead the function is used to measure the overall people affected within the settlement.

The purpose of this thesis is to address the vulnerability of the coastal system of Isafjördur. The empirical function used to assess mortality estimates from flooding only provides an aggregated measure of the fragility of the coastal inhabitants. Due to its macroscopic nature, the function does not allow to infer on consequences by social or age group, as required in social vulnerability studies.

Table 14

Average Loss of Life Numbers

Year	2100	2090	2080	2070	2060	2050	2040	2030	2020	2010	2000
1 meter sea-level rise world	0.49	0.36	0.29	0.20	0.15	0.12	0.06	0.05	0.01	0.01	0.01
3 degree world	0.24	0.19	0.15	0.13	0.11	0.06	0.05	0.01	0.01	0.01	0.01
2 degree world	0.06	0.05	0.05	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01

4.3.4 Damage to buildings

To calculate damage to buildings in relation to the predicted flood depth, the "standard method[15]" (Vrisou van Eck & Kok, 2001) was applied. It is assumed that all affected buildings can be categorised as low-rise buildings consisting of two floors. The concave shape of the function shows that the lowest floors of these buildings often contain assets for living that are important for all other levels, for example basement storage rooms, central installations and central areas on the ground floor. Thus, damage to the first living floor also has consequences for the storeys above (Vrisou van Eck & Kok, 2001). The flood depth, wave effects and the water flow rate are considered important factors for calculating the damage factors for low-rise housing. Both wave effects and the water flow rate may

[15] The Standard Method was developed in the late 1990's by HKV consultants and TNO, under supervision of the Dutch Ministry of Transport, Public Works and Watermanagement (Rijkswaterstaat). It has been continuously updated since.

cause a building to collapse, yielding the greatest damage. The probability of a house collapsing as a result of wave effects is determined with equation (Eq 3):

(Eq 3)

$$\mathbf{P(f)_{storm} = ß * 10^{-3} * h^{1.8} * r}$$

where $P(f)_{storm}$ = probability of collapsing due to storm; ß = material factor; r = protection factor

With the standard method, it is assumed that the material factor for low-rise housing is 0.8 (Vrisou van Eck & Kok, 2001). The material factor of 0.8 stands for “brickwork”. The protection factor is a value between zero and one and can be seen as an “exposure” factor. A value of one means “no protection” and a value of zero means full protection. It is assumed that in the case of Isafjördur, buildings are not subjected to protection; therefore r = 1. The probability of a building collapsing showed to have very little influence on the final damage calculations due to the low flood depths obtained from the scenarios and lack of reliable information regarding the r protection factor. Therefore, for the following damage function (see Figure 26) it is assumed that the probability of a building collapsing is 0 (P = 0):

F(h) = P + (1 - P)*(1 – sumsq (sumsq ((1 – max (0,min (d,6))/6)))) [16]

where F(h) = damage factor; d = flood depth (m); with P = 0

[16] min - returns the smallest number in a set of values. Ignores logical values and text.
max - returns the largest number in a set of values. Ignores logical values and text.
sumsq - returns the sum of squares of the arguments. The arguments can be numbers, arrays, names or references to cells that contain numbers. Can also be understood as the sum of squared deviations, an unscaled, or unadjusted measure of dispersion (also called variability).

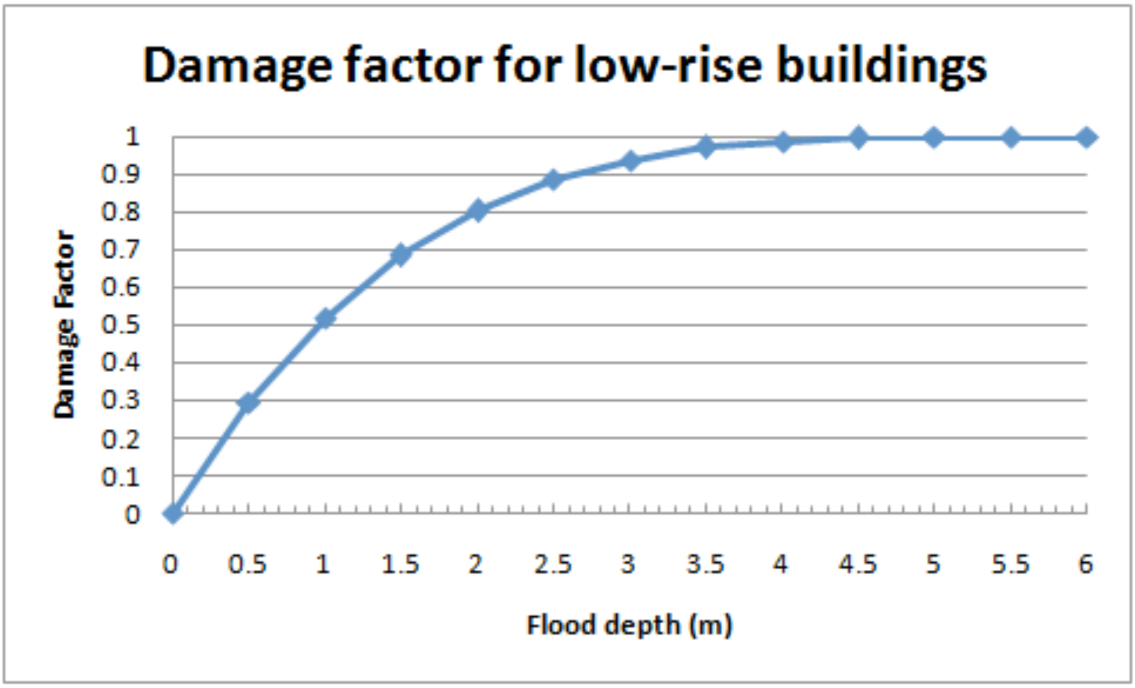

Figure 26. Damage factor for low-rise housing (with no storm and water flow rate of 0 m/s) (Meidinger, 2010).

Once the damage factor for each individual building was calculated, it was multiplied with the corresponding fire insurance value for each specific building for each increment of the sea-level rise scenarios applied. The fire insurance includes the total value of a house and is updated on a regular basis. A more accurate assessment of damages to buildings would need to comply with all the factors exposed in the standard damage function (Jonkman, 2007; Vrisou van Eck & Kok, 2001).

4.3.5 Damage to roads

The following function from the "standard method" (Vrisou van Eck & Kok, 2001) was used to calculate the damage factor for public roads (see Figure 27):

$$\mathbf{F(h) = MIN(0.28*h,\ 0.18*h + 0.1,\ 1)}$$

where F(h) = damage factor; h = flood depth (m)

Once the damage factor was calculated for each individual road segment, the average damage fraction for each increment of the sea-level rise scenarios was calculated. Individual road segments were determined by administrative street names and as provided by Snertill. In addition, the total area of flooded public roads was calculated for each increment of the sea-level rise scenarios.

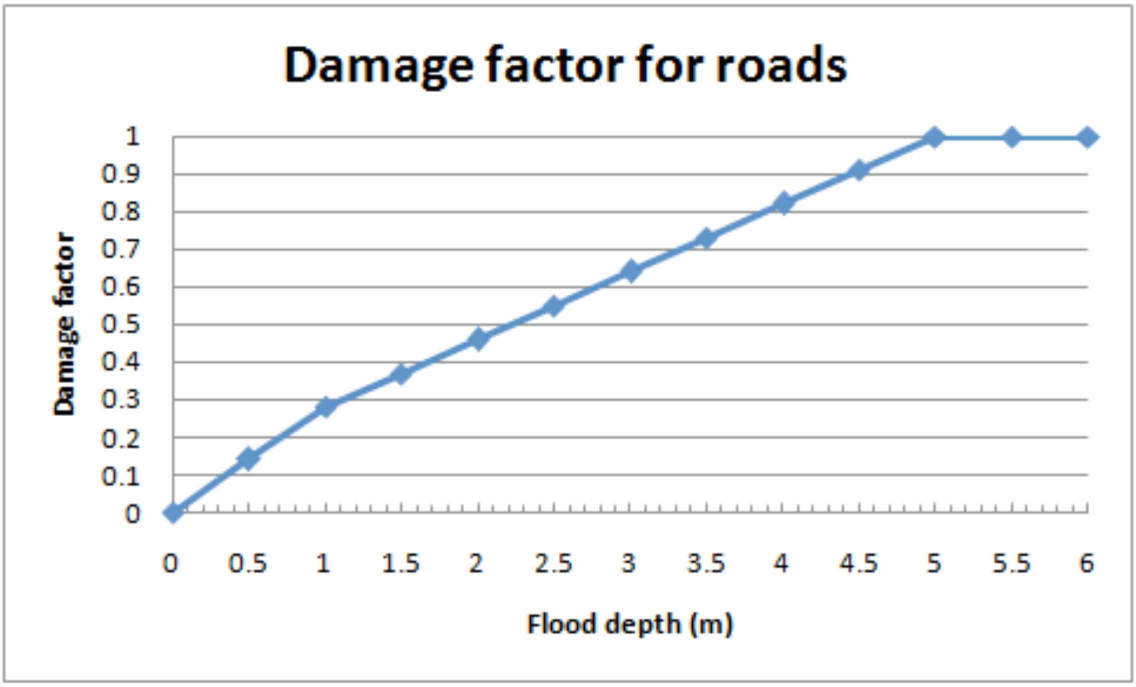

Figure 27. Damage factor for roads (with no storm and water flow rate of 0 m/s) (Meidinger, 2010).

Unfortunately, due to the lack of reliable replacement costs for roads, only the average damage factor and extent of flooded roads were calculated.

4.4 Data Analysis

By overlaying the different Design Water Level layers created for the future scenarios on top of the DEM layer, a flood depth layer could be created. If the coastal elevation in the DEM was less than the DWL grid cell value for a specific scenario (DEM ≤ DWL), then the corresponding cell was assigned the value of the difference between the DWL and the DEM value. This was repeated using the different DWL scenarios. From this, final map outputs of flooded areas were produced under different combinations of the DWL scenarios. In addition, high risk and important areas of the fjord and village (e.g., the airport) were examined in further detail. By making use of the Zonal Statistics extension, the average depths of the different data sets (houses, inhabitants per building and public roads) were calculated. In the case of inhabitants and houses, the obtained average flood depths where used as the depth factor on the previously mentioned functions. The steps and processes described in the above sections are shown in the following graph (Figure 28).

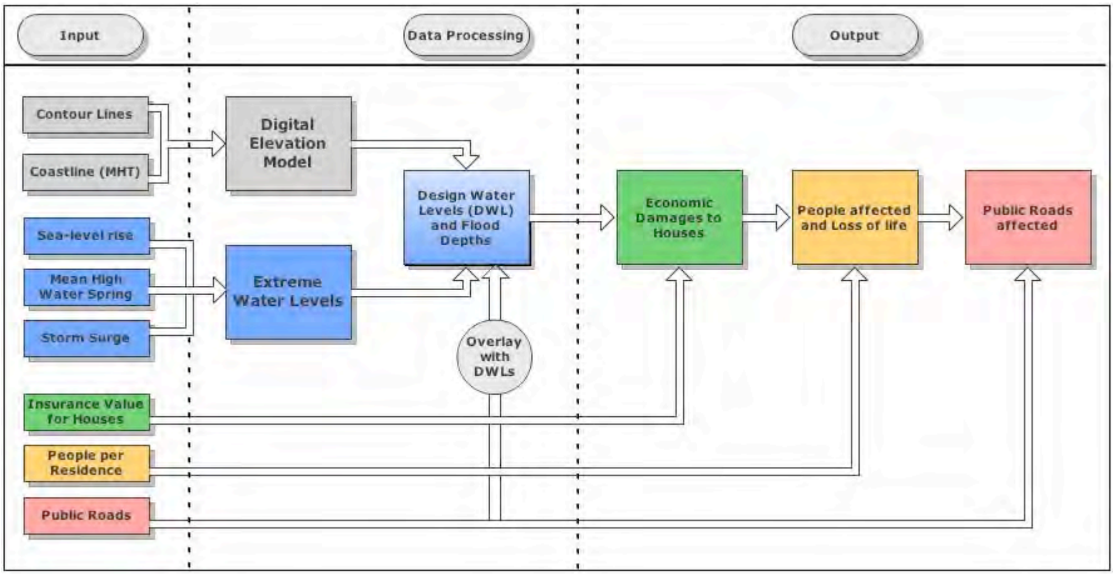

Figure 28. Graphic showing the methodology workflow (Meidinger, 2010).

5 Results

5.1 Coastal Flooding Due to Simulated Extreme Water Levels

The following maps (Figure 29, Figure 30, Figure 31) indicate the spatial distribution and extension of coastal flooding and the calculated flood depths in year 2100 according to the simulated extreme water levels for the three sea-level rise scenarios (2 degree world, 3 degree world and 1 metre sea-level world). The calculated flood depths for each building are shown within the maps using colour gradients. The reader is advised to recall Figure 6 andFigure 7 for visual support, as street names and localities are not indicated in the flood depth maps.

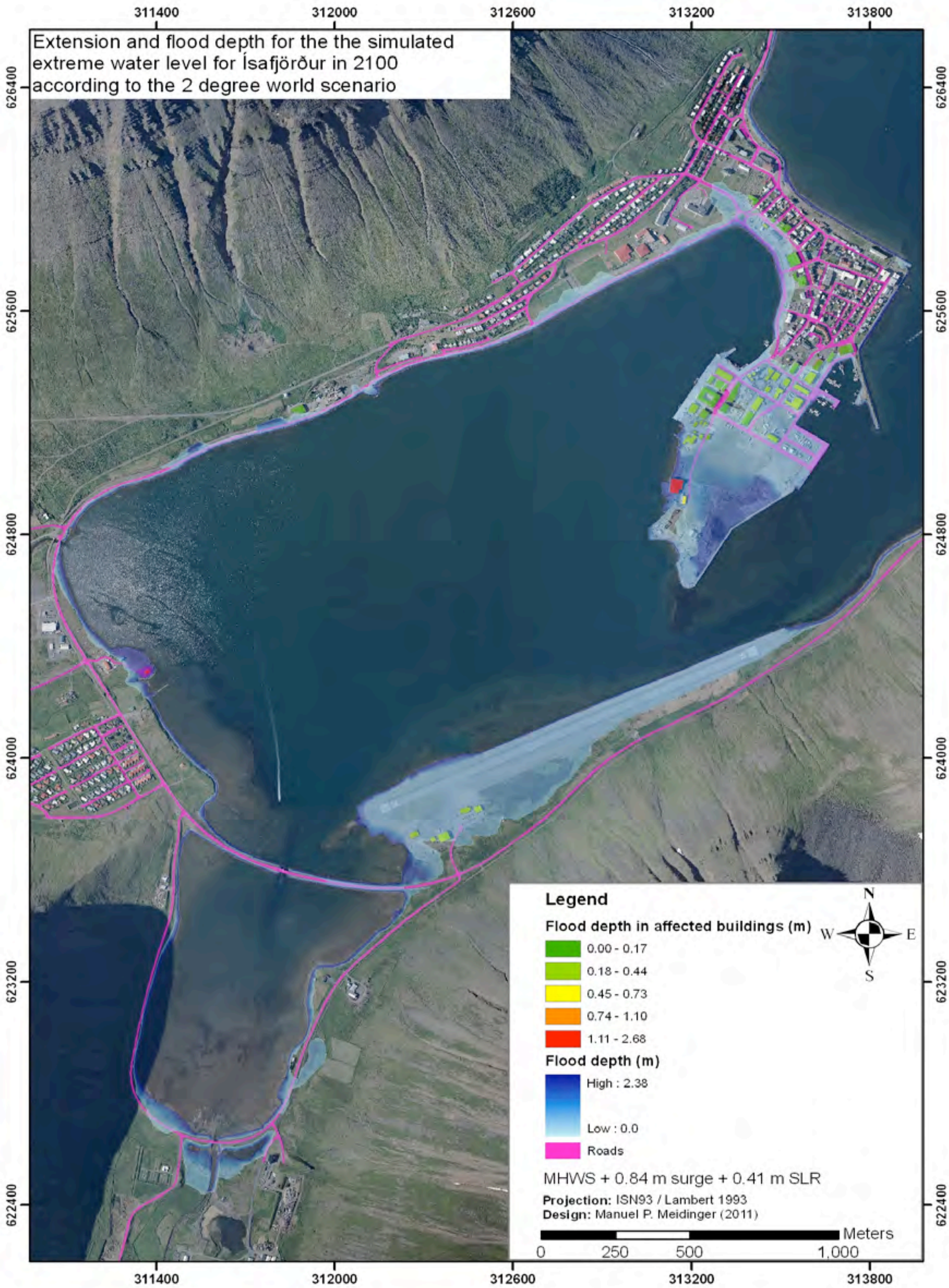

Figure 29. Map showing extension and flood depths for the simulated extreme water level for Ísafjörður in year 2100 according to the 2 degree world scenario. Flood depths for affected buildings are shown with a colour gradient.

Figure 29 reveals that Neðstikaupstaður (Downtown), the southernmost section of the sand spit will be affected the most in the 2 degree world scenario. This location is the area where the local heritage museum, some of the oldest houses, the main harbour, most of the industrial warehouses, industrial and commercial buildings, as well as the University Centre of the Westfjords are located. The flood depths inside affected buildings range from 0 – 2.68 m for the Downtown area.

Some parts of Miðkaupstaður (Midtown), mainly the area situated in the southwest along Pollgata and Hafnarstraeti, are affected by coastal flooding to a smaller extent. The affected buildings in Midtown include a gas station, the main church, the police station and the town's administrative centre. The flood depths inside affected buildings in the Midtown area range from 0 – 0.17 m. In addition, a substantial part of the road called Skutlusfjardarbraut is flooded, restricting the access to and from Ísafjörður by road. One industrial building along Skutlusfjardarbraut is affected with flood depths of up to 0.17 m. In addition, the entire area of the domestic airport of Ísafjörður in the south is affected by flooding. All of the buildings and facilities located on the airport's property are shown to be flooded by up to 0.44 m. This limits operational capacity of the airport, restricting aircraft support (e.g., for evacuation purposes). At the head of Skutulsfjörður two buildings are shown to be flooded by up to 2.68 m.

According to the 2 degree world scenario with a sea-level rise value of 0.41 m, a total number of 38 properties and 37 people would be affected by coastal flooding. The majority of the affected buildings, however, is located in Downtown Isafjördur. Only a small proportion of the affected buildings have been identified as private dwellings.

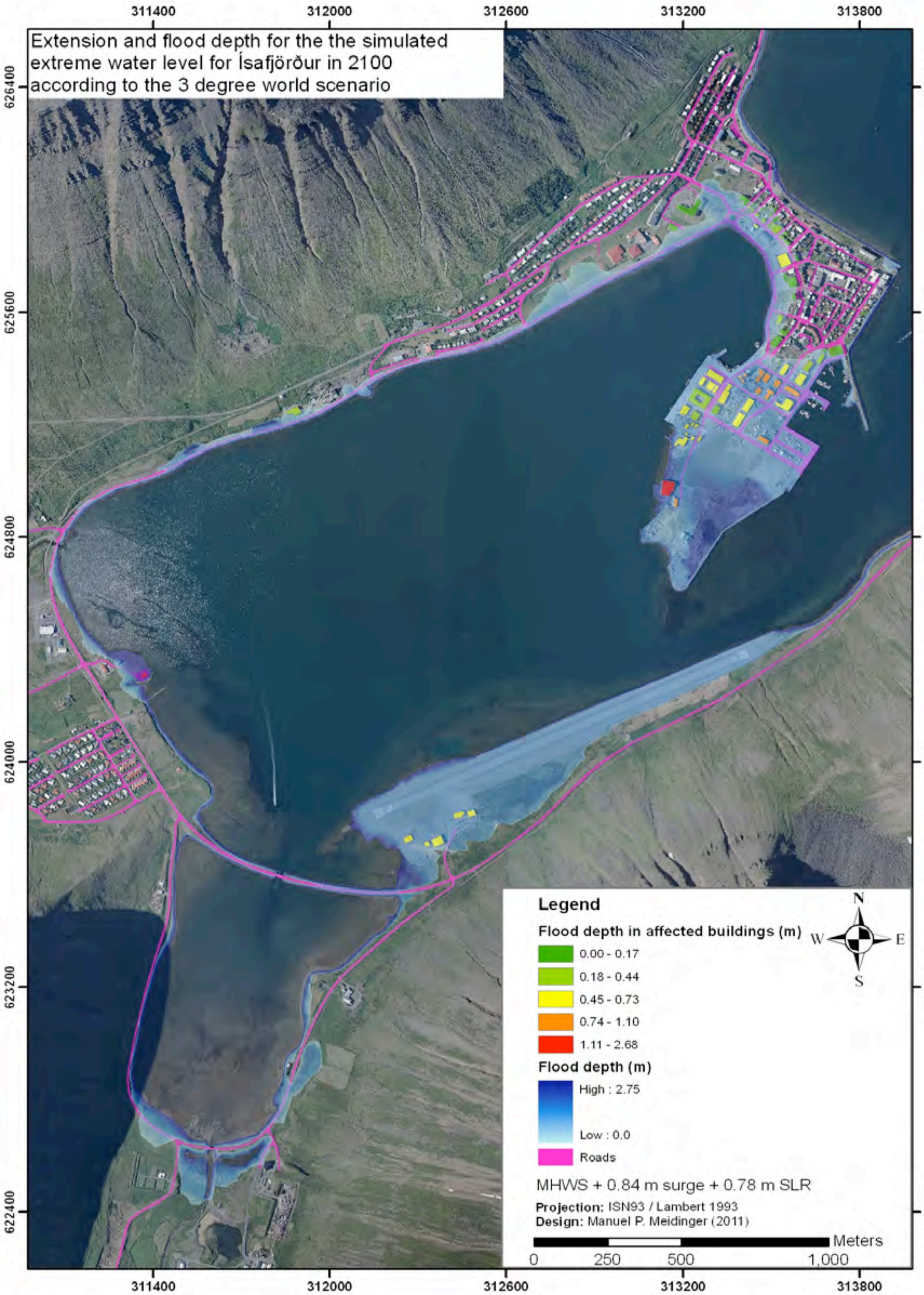

Figure 30. Map showing extension and flood depths for the simulated extreme water level for Ísafjörður in year 2100 according to the 3 degree world scenario. Flood depths for affected buildings are shown with a colour gradient.

As shown in Figure 30, the entire area of Neðstikaupstaður (Downtown) is affected by flooding. The flood depths inside some of the affected buildings have increased. Most of the affected buildings in the downtown area are of commercial or industrial character and include the main harbour, the heritage museum, some of the oldest houses of Ísafjörður, industrial buildings, warehouses, the University Centre of the Westfjords and a gas station. Miðkaupstaður (Midtown) is mainly affected by flooding in the area between Pollgata and Hafnarstræti. An increased number of private dwellings are now subject to flooding. The map reveals that flood depths inside buildings have increased to up to 0.73 m.

Unlike the previous scenario, the local hospital and a small proportion of the retirement home are now affected by coastal flooding with flood depths of up to 0.17 m inside buildings. The entire airport is predicted to be flooded, with building flood depths of up to 0.73 m. As for the 2 degree world most parts of the connection road Skutlusfjardarbraut are flooded hindering access to and from Ísafjörður. One industrial building along Skutlusfjardarbraut is affected with flood depths of up to 0.44 m. At the head of Skutulsfjörður two buildings are shown to be flooded by up to 2.68 m.

In the 3 degree world scenario with a sea-level rise value of 0.78 m, a total number of 61 properties and 126 inhabitants would be affected by coastal flooding. The overall amount of affected public dwellings has increased in comparison to the previously described scenario.

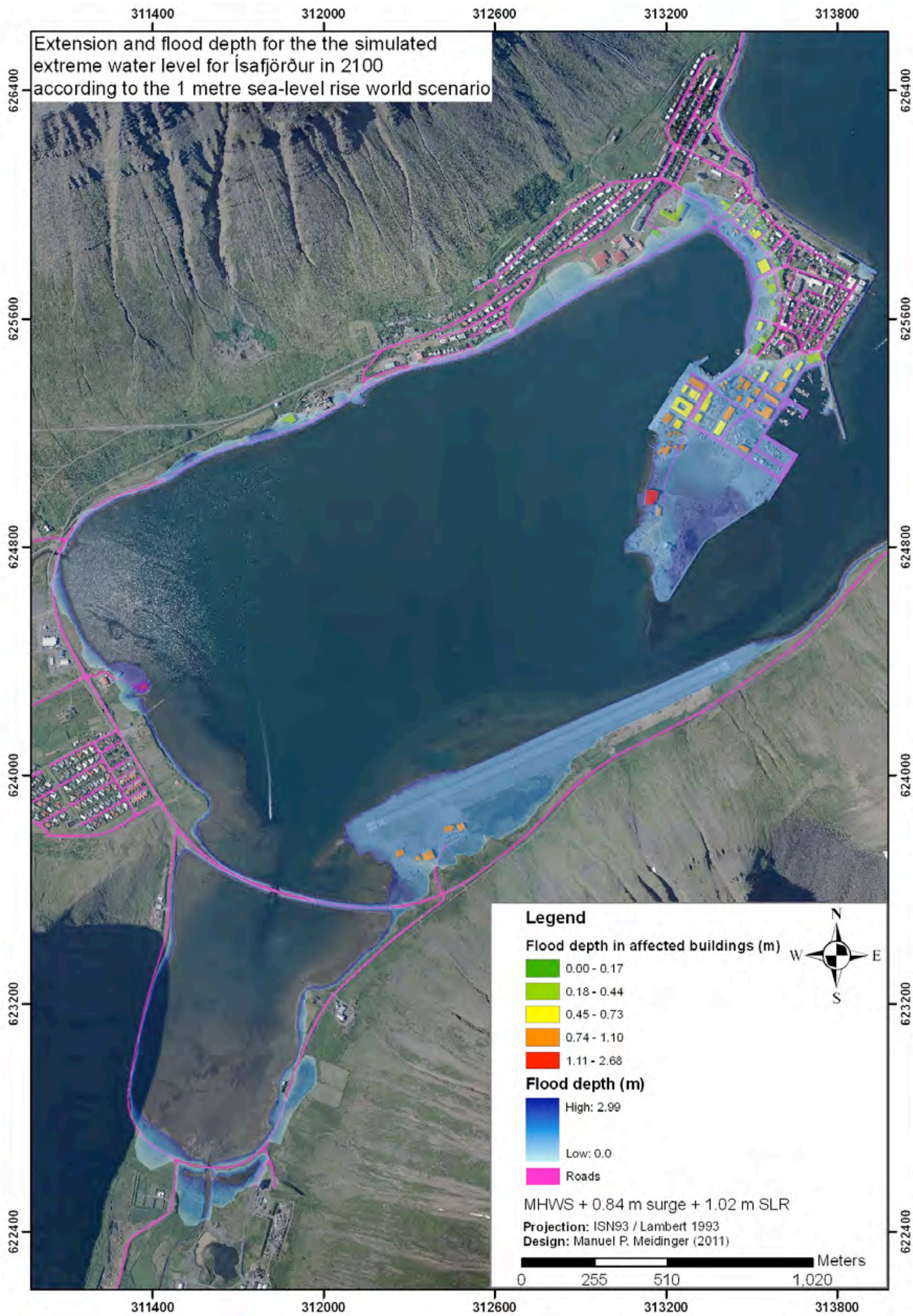

Figure 31. Map showing extension and flood depths for the simulated extreme water level for Ísafjörður in year 2100 according to the 1 metre sea-level rise world scenario. Flood depths for affected buildings are shown with a colour gradient.

Visual analysis of the 1 metre sea-level rise world scenario (Figure 31) shows that the entire area of Neðstikaupstaður (Downtown) is affected by coastal flooding with increased flood depth values inside of flooded buildings. For Miðkaupstaður (Midtown) the analysis reveals that most affected properties are located along Pollgata and Hafnarstræti, where increased flood depths are shown. In addition, the properties along the streets Sólgata, Hrannargata, Mánagata and Mjallargata are shown to be flooded in the 1 metre sea-level rise world. Again, the amount of private dwellings affected by coastal flooding has increased. The flood depths inside the hospital and retirement home have also increased to values of up to 0.44 m while in the domestic airport flood depths inside buildings are estimated to be as high as 1.10 m. As for the two previous described scenarios, most parts of the connection road Skutlusfjardarbraut are flooded hindering access to and from Ísafjörður. One industrial building along Skutulsfjarðarbraut shows flood depths of up to 0.44 m. At the head of Skutulsfjörður, two buildings are shown to be flooded by up to 2.68 m.

In the 1 metre sea-level rise world scenario with a sea-level rise value of 1.02 m, a total number of 92 properties and 237 inhabitants (based on year 2010 data) would be affected by coastal flooding. Most flooded buildings in Downtown are industrial or commercial, whereas the majority of affected buildings in Midtown are private dwellings.

5.2 Loss of Life as a Result of Flooding

The numbers of casualties as a result of flooding were calculated for all three sea-level rise scenarios and the results for each 10-year increment are shown in Figure 32. The results express the product of probability of loss of life for different flood magnitudes (Jonkman, 2007) and the number of inhabitants at each structure.

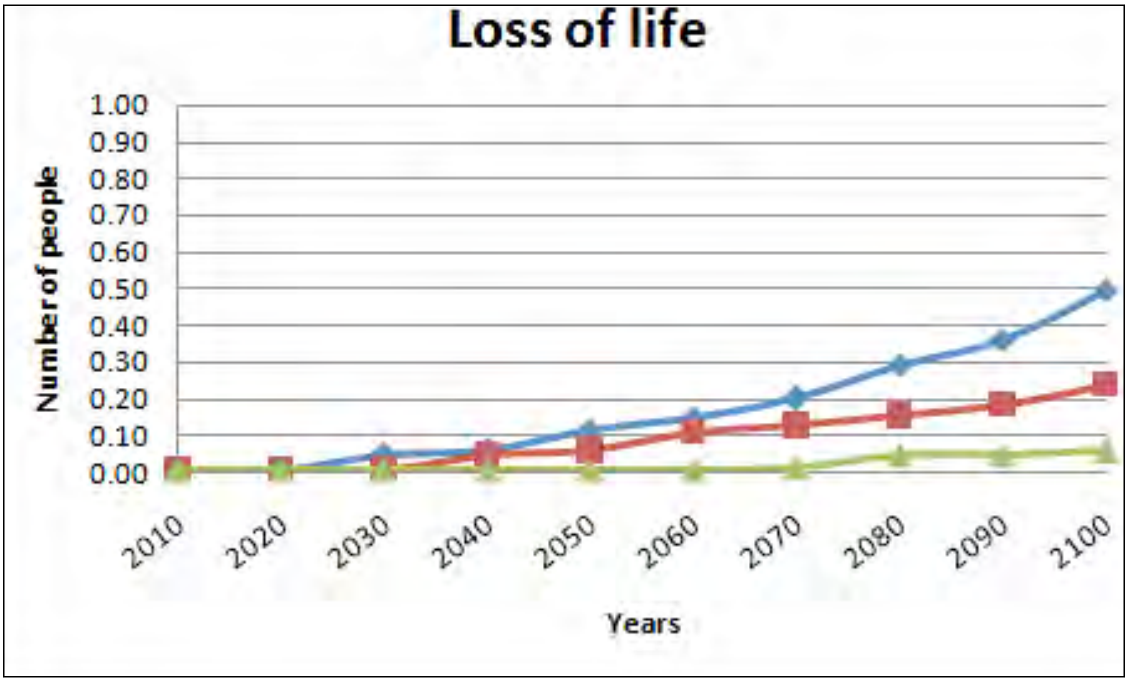

Figure 32. Loss of life numbers for the three sea-level rise scenarios. Blue line = 1 metre sea-level rise world; red line = 3 degree world; green line = 2 degree world (Meidinger, 2010).

The loss of life numbers (see Figure 32) for the calculated 10-year increments of the 2 degree world scenario are relatively low throughout the entire time frame of analysis. The estimated loss of life numbers for the 3 degree world scenario start to increase more rapidly from 2030 onwards, resulting in a final loss of life number of 0.24 by the year 2100. For the 1 metre sea-level rise world scenario, the loss of life numbers start to increase sharply from 2050 on, resulting in a final loss of life number of 0.49 by the year 2100. Analysis reveals that the estimated loss of life numbers increases with greater flood depths as the scenarios proceed; however, no flood casualties are expected for the applied scenarios until year 2100.

5.3 Economic Building Damages as a Result of Flooding

In this work only the consequences of storm surges under accelerating sea-level rise are investigated. Although progressive sea-level rise will very likely impact Ísafjörður in the future, damages are more related with increased erosion rates or inundated land that becomes unavailable for longer periods of time. Due to the long time scales of the phenomenon, researchers assume that in case of progressive sea-level rise markets have the time to adjust to the impacts. In addition, inundation resulting exclusively from increasing sea-levels was found to be relatively low. The threat of sea level rise in coastal communities is shaped at larger extent by the occurrence of fast and intense events, such as the case of storm surges.

The economic damages to buildings as a result of coastal flooding for the three sea-level rise scenarios were calculated for each 10-year increment and are shown in Figure 33. The monetary values in Figure 33 show the economic damages to buildings based on the assumption that the economic situation in Iceland will remain static until year 2100, an assumption that is very unlikely.

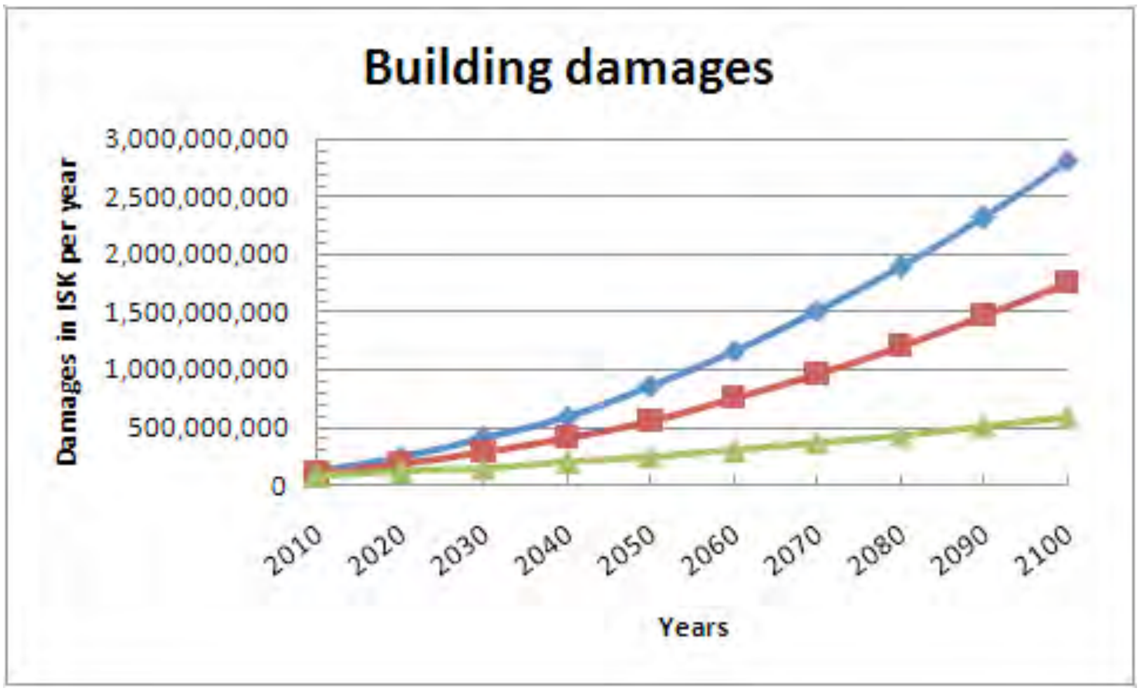

Figure 33. Economic damages to buildings in ISK for the three scenarios if the economic situation were to remain the same. Blue line = 1 metre sea-level rise world; red line = 3 degree world; green line = 2 degree world (Meidinger, 2010).

For the 2 degree world scenario, building damages in relation to the calculated flood depths are estimated to be around 600 million ISK in year 2100. In a 3 degree world scenario building damages are estimated to be around 1.75 billion ISK in the year 2100. Finally, damages around 2.8 billion ISK are estimated for the 1 metre sea-level rise world scenario in year 2100.

In a static socio-economic coastal system, the flood depth is the dominating factor in determining the economic damage to buildings. The most serious damage occurs when flood depth numbers are the highest and mean land elevation is the lowest. These estimated economic damages represent only the physical impact on buildings touched by flooding. Total economic damages are, of course, wider since they also include costs such as disruption in business or temporary relocation of the affected inhabitants, all of which are indirect impacts.

In the context of such an extended time frame (in this case 90 years) analysing economic impacts, one should proceed by applying an appropriate discount rate. This has to do with the fact that the calculations are based on current values of insured property, values that will change in the future. This is a standard economic methodology required by numerous authorities such as the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 2010). Drawing upon this perspective, a constant discount rate of 3% per year was applied to the calculated damages. The resulting cumulative damages to buildings are shown in Figure 34. Figure 34 shows the total expected damages that might occur during a certain time frame (e.g., the damages for year 2050 in Figure 33 show the expected damages for one year if the economic situation remains unchanged; whereas the calculated damages for year 2050 in Figure 34 show the cumulative damages expected until year 2050 with an applied discount rate of 3 % per year).

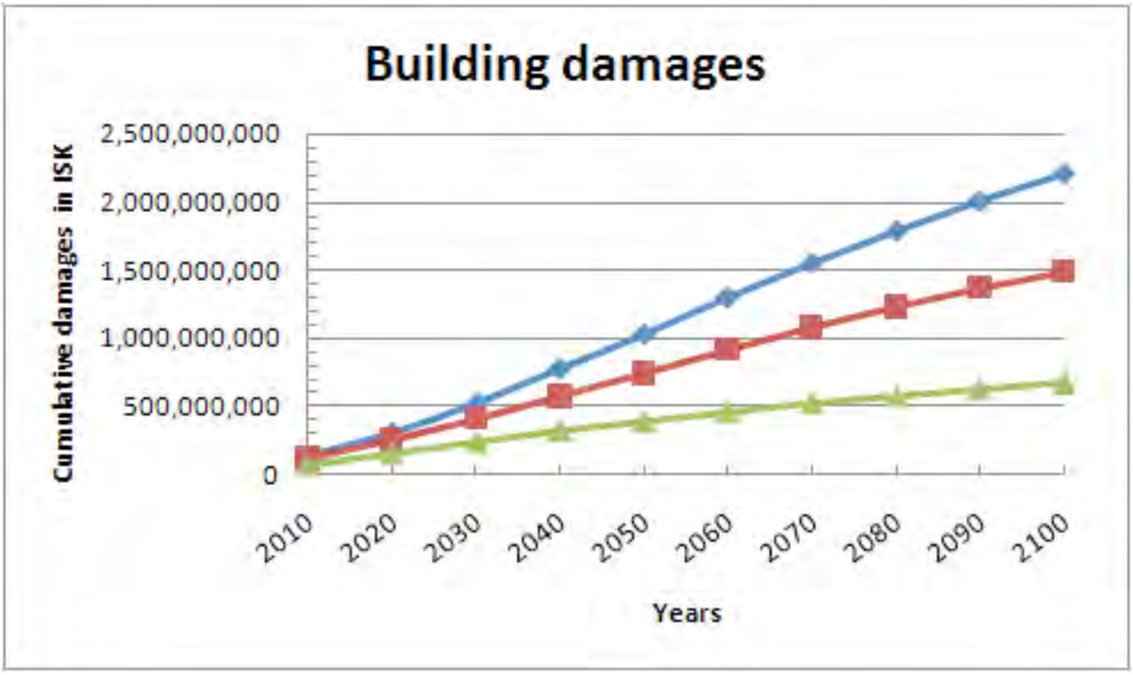

Figure 34. Cumulative damages to buildings in ISK for the three scenarios with an applied discount rate of 3 % per year. Blue line = 1 metre sea-level rise world; red line = 3 degree world; green line = 2 degree world (Meidinger, 2010).

5.4 Extent and Damage Fractions of Flooded Roads

The spatial extents of flooded roads were calculated for each 10-year increment of the three sea-level rise scenarios applied and results are shown in Figure 35.

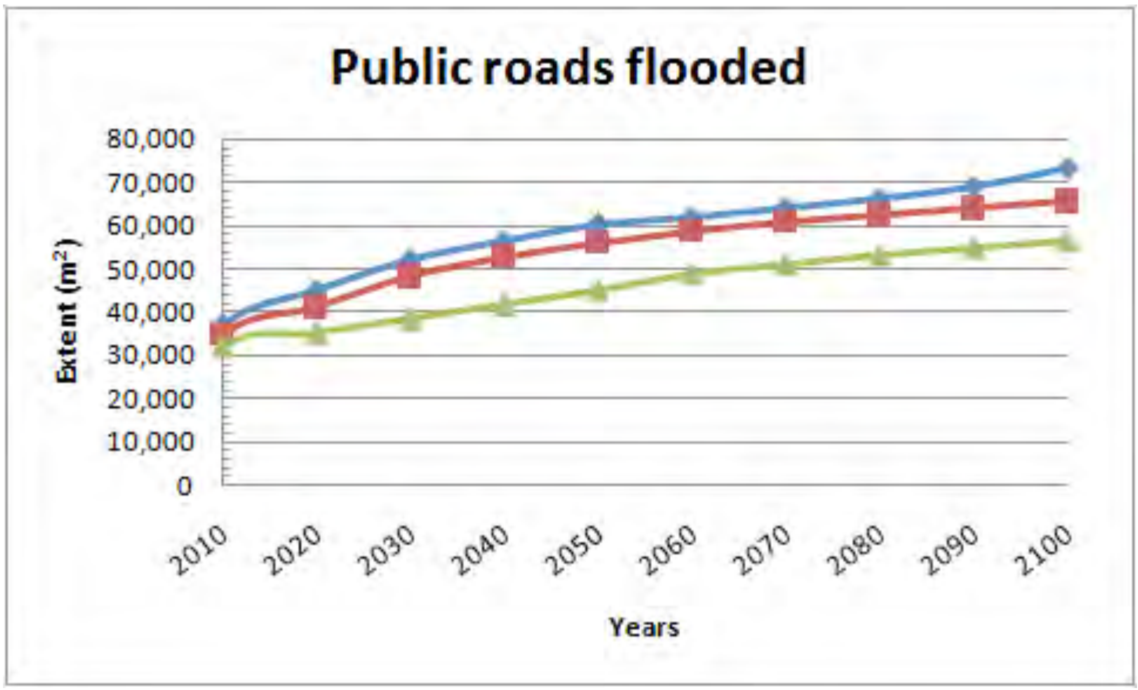

Figure 35. Area of flooded public roads. Blue line = 1 metre sea-level world; Red line = 3 degree world; Green line = 2 degree world (Meidinger, 2010).

The 2 degree world scenario shows the smallest extent of flooded public roads. The quantitative increase in flooded roads remains relatively small until 2020 when numbers start to increase more rapidly. For the 2 degree world scenario, approximately 56.000 m^2 of public roads are affected by coastal flooding in year 2100. The 3 degree world scenario shows a more steady increase in comparison to the 2 degree world scenario, and accounts for 65.000 m^2 of flooded public roads in year 2100, an increase of 16.02 % from the 2 degree world scenario. In the 1 metre sea-level rise world scenario, the greatest amount of flooded public roads was identified. Approximately 73.000 m^2 of public roads are affected by coastal flooding in year 2100. This reflects an increase of 30.35 % from the 2 degree world scenario. As can be seen in Figure 35, the extent of flooded public roads increases with rising extreme water levels.

The resulting averaged damage fractions for the roads in relation to the flood depths were calculated for each 10-year increment of the three applied scenarios, and they are shown in Figure 36.

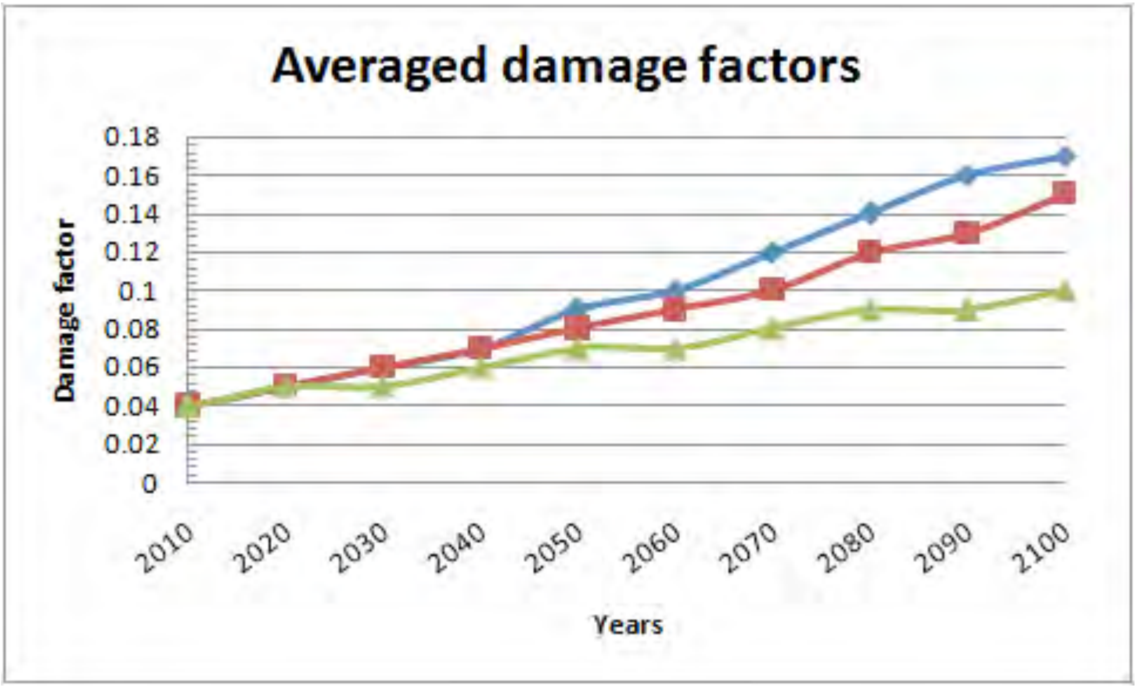

Figure 36. Averaged damage factors for roads for the three scenarios. Blue line = 1 metre sea-level rise world; red line = 3 degree world; green line = 2 degree world (Meidinger, 2010).

The 2 degree world scenario shows the smallest damage factors to roads in relation to the flood depth. The highest value for this scneario is reached in year 2100, yielding an averaged damage factor of 10 %. According to this scenario, in year 2100 the 56.000 m^2 of affected roads are expected to experience a 10 % level of damage. Again, in the 3 degree world scenario the calculated damage factors for the affected roads in relation to the flood depth reveal a steady increase towards the end of the century. The maximum value of 15 % is reached in year 2100. Therefore, it is expected that in year 2100 the 65.000 m^2 of affected roads will experience a 15 % level of damage. The highest calculated damage factors in relation to the flood depth were found for the 1 metre sea-level rise world scenario. It is expected that 17 % of the total road area of 73.000 m^2 will be damaged. Damages for the 3 degree world and 1 metre sea-level rise scenario stay relatively close until year 2040, when the 1 metre sea-level rise world scenario starts to increase.

As depicted by the two previous graphs (Figure 35 and Figure 36) not only does the total extent of flooded roads increase with higher flood depths, but the degree of damage increases as well. It is worth to notice that although the extension of roads affeted is considerable, the values of damages remain relatively low, never overcoming 18% of destruction in average.

6 Discussion

Up to this point, the thesis has analysed the potential socio-economic impacts resulting from strom surges associated with an increase of sea-level rise in the Ísafjörður region. Many of the features within the coastal system were assumed to be static (e.g. storm surge value, population, number of houses), either by lack of data, or more often due to the complexity of certain processes. Although somewhat limited, the following management options serve the purpose to indicate that adaptation options regarding sea-level rise are more numerous than the usual protect or retreat options.

6.1 Management Option 1: Identification of Population Thresholds for Ísafjörður until 2100

Assuming that trends of the demographic projections (Municipal Master Plan, 2010) are verified, the vulnerability of people living within the Ísafjörður coastal system is expected to increase as more people move into the areas prone to coastal flooding (compare Figure 29, Figure 30 and Figure 31). From a pro-active coastal management point of view it is relevant to estimate the systems' capacity to cope with an increase in population.

Using the estimated average mortality rates for each scenario[17], the additional population that the coastal systems can support to maintain a mortality rate below one person was calculated, results are expressed in Table 13.

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[17] Mortality rate * number of inhabitants = number of casualties

Mortality rate * X < 1 casualty

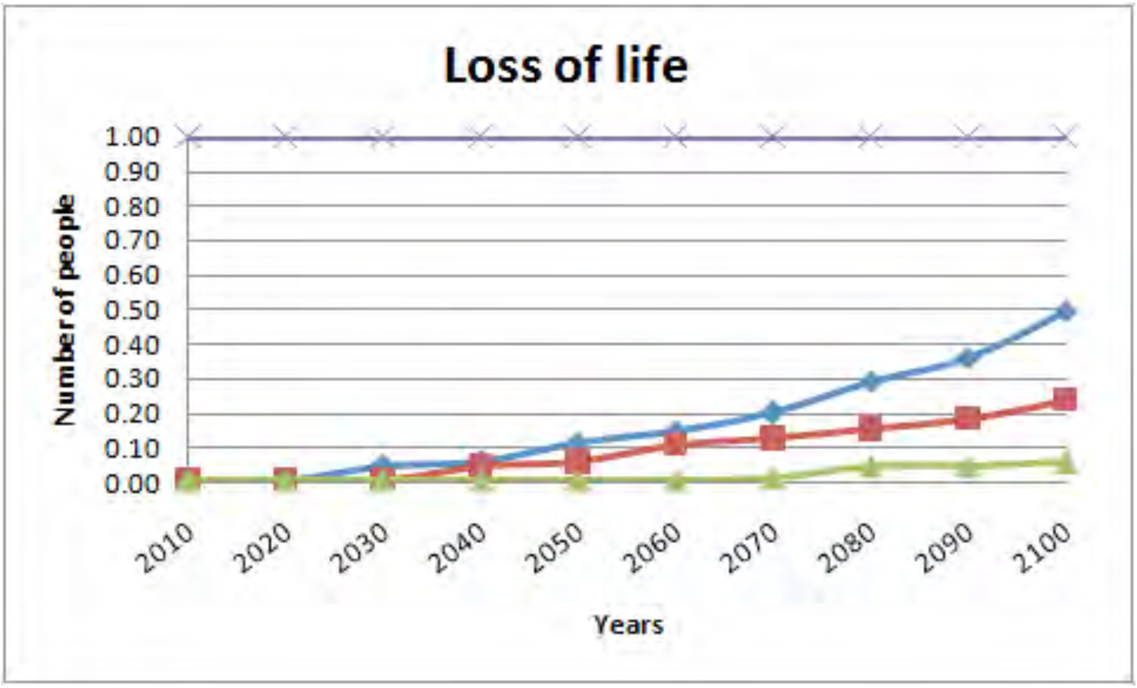

Figure 37. Loss of life for the three sea-level rise scenarios. Blue line = 1 metre sea-level rise world; red line = 3 degree world; green line = 2 degree world; purple line = 1 person dies threshold (Meidinger, 2010).

Table 15

Number of Inhabitants Affected by Flooding in 2100 (Based on 2010 Numbers), the Thresholds for Population Growth and the Max. Allowed Population Growth until 2100

Scenario	Affected inhabitants (based on 2010 numbers) in 2100	Population thresholds in 2100	Max. allowed population growth until 2100	Max. allowed population growth per 10-year increment
2 degree world scenario	37 people	357 people	320 people	36 people
3 degree world scenario	126 people	286 people	160 people	18 people
1 metre sea-level rise world scenario	237 people	265 people	28 people	3 people

The 2 degree world scenario, yielding the smallest sea-level rise numbers, shows the greatest potential for population growth. The area prone to coastal flooding in 2100 can take up an additional number of 320 inhabitants until 2100, or 36 additional residents every 10 years until 2100. For the 3 degree world scenario, the coastal area denotes the capacity to accomodate an additional 160 people before the mortality threshold is reached, or an uptake of 18 coastal residents every 10 years. The tolerance for the 1 metre sea-level rise world scenario is consequently smaller in comparison to the previous two scenarios. By the year 2100, the margin of population growth is substantially decreased. No more than 28 inhabitants can be safely located in the depicted low-lying areas. This hinders a potential population growth to only three residents per decade until the end of this century.

One should understand that the numbers proposed are guidelines or suggestions. In theory, the coastal areas of the Ísafjörður region can be subjected to moderate population growth while keeping the mortality rate low. Nevertheless, any population increase at the coast will push the coastal system closer to its population limit, thus enhancing the risk of flood casualties in the future. In addition, the inherent uncertanty of the empirical function used should be considered.

Taking the above-described policy-option into account, decision-makers (Municipal Master Plan, 2010) can now plan for future patterns of population growth at the coast making use of the indicative numbers here proposed. Nevertheless, they should also be aware of the potential consequences and trade-offs of their decisions. Althought the costal system of Ísafjörður can be subjected to moderate growth of population, the magnitude of the growth is largely shaped by the intensity of future storm heights, which, despite the best efforts, remain largely uncertain under the phenomenon of sea-level rise (see discussion chapter 2.1.2 & 2.2).

6.2 Management Option 2: Prioritizing Actions to Lower Building Damages

As sea-levels are expected to rise in the future, the accumulation of extreme water level situations is expected to suffer an increase, resulting in greater economic flood damages. Additional increase in damages is also expected to occur if further development in areas prone to flooding is carried out. In the long-run, the continuous repair of damaged infrastructure may become economically inefficient. The individual vulnerability of buildings can be reduced if protection measures are applied or if future development is concentrated on areas that are not prone to coastal flooding.

Due to the topographic conditions within Skutulsfjörður and the fact that the old parts of Ísafjörður (Midtown and Downtown) are located on an artifically extended sand spit make the application of retreat technologies limited. For example, the creation of setback zones, a common technology when facing sea-level rise (Sterr et al., 2003) is not feasible since Ísafjörður is water-locked. The option to undergo a managed realignment and retreat is also not feasible since there is no room for such an approach, and the untilled areas further up the fjord walls are all prone to snow avalanches. Moreover, the construction of buildings is not permitted or subject to strict requirements (e.g., building code) within those hazard zones, as can be seen in Figure 38.

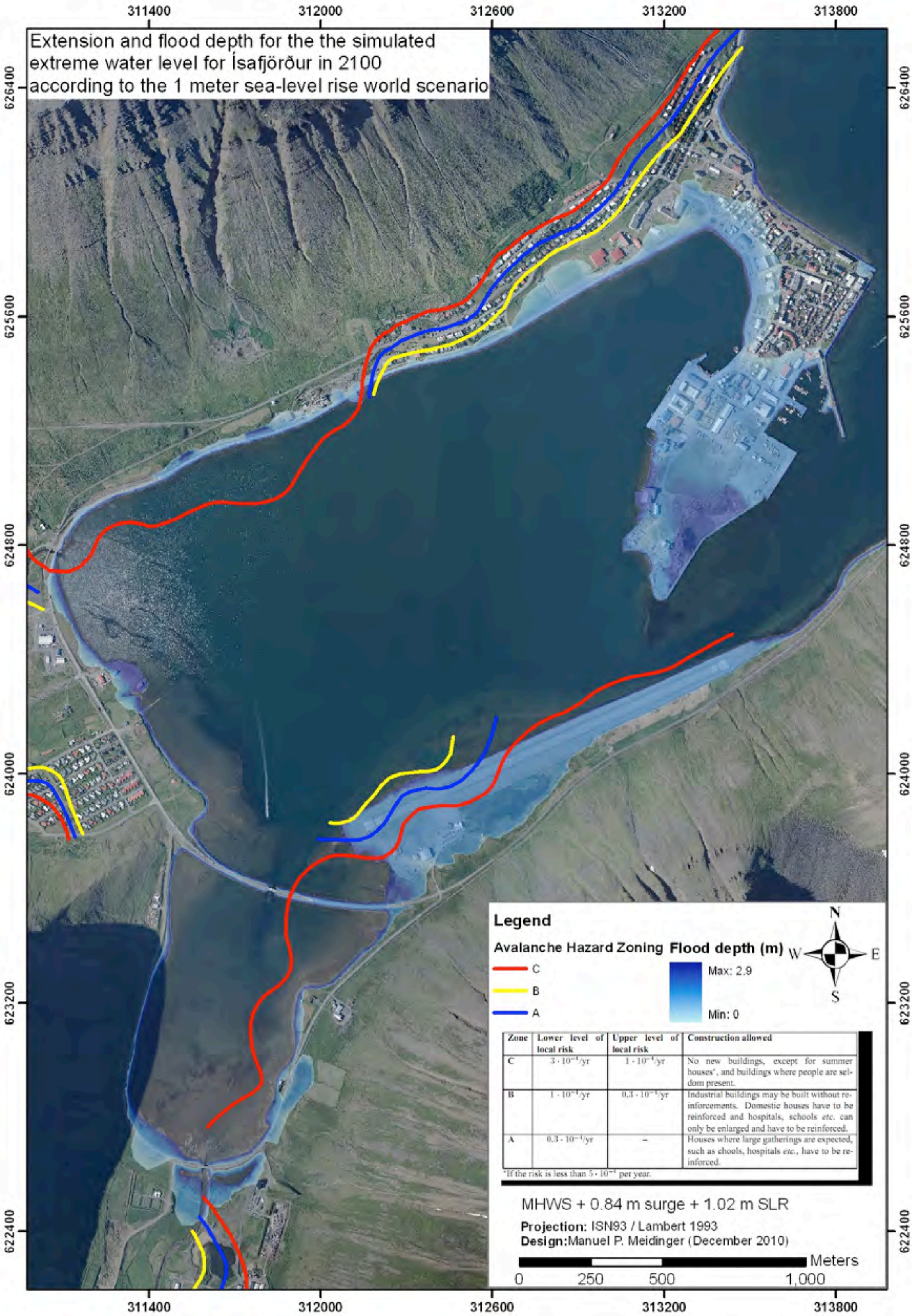

Figure 38. Map of Ísafjörður showing the extent of flooding and the snow avalanche hazard zoning (Explanatory box taken from Arnalds et al., 2004).

In a long-term perspective, local and national decision makers should consider the option to relocate the residents and threatened buildings of the sand spit in Ísafjörður to a location that is not under direct threat of storm surge flooding. It is expected that such measure would raise large resistance from the threatened population. Therefore, local authorities should first prioritise their interventions to assets or population groups that are most likely to be negatively affected by flooding.

One possible priority is to protect local cultural heritage buildings that are expected to suffer flood damages in the future. To date (2010), the sand spit of Ísafjörður holds a large number of old buildings, ten of which are protected by law. According to Icelandic law18, a building is protected when it was built before the year 1850 or when an application for protection has been forwarded to the minister of culture (Húsafriðunarnefnd, 2010). The construction year of the oldest protected building in Ísafjörður dates back to 1757. The spatial explicit analysis carried out shows that six buildings of cultural importance, protected by law, are expected to be prone to economic damages by flooding in the future (see Figure 39 and Table 14*)*.

[18] Senior National Heritage Law, no. 52/1969 (http://www.hfrn.is/husaskra/)

Figure 39. Cultural heritage buildings prone to flooding until 2100 under the three SLR scenarios applied.

Table 16

Fire Insurance Values for Protected Buildings and the Damage (in ISK) in 2100 for Each Scenario

Address	**Fire insurance value (ISK)**	**Damage for 1 metre sea-level rise world scenario (year 2100)**	**Damage for 3 degree world scenario (2100)**	**Damage for 2 degree world scenario (2100)**
Suðurtangi 2[19]	136.076.000	68.174,076	53.750.020	28.167.732
Aðalstræti 7[20]	146.000.000	13.286,000	2.482.000	not affected
Aðalstræti 8[21]	23.245.000	398.650	not affected	not affected
Total damage (ISK)		**81.858.726**	**56.232.020**	**28.167.732**

Prioritising the protection of these buildings means that not only the cultural heritage of the Ísafjörður region is preserved but also that the overall expected economic damages can be lowered in case of a flood. In Table 16 one can see the monetary values (undiscounted) of the expected economic flood damages for the six culturally important buildings according to the three previously mentioned scenarios. Elevating the proposed buildings by 0.95 m, 0.14 m and 0.03 m (see Table 15) can lower the economic damage as a result from flooding by up to 81.858.726 ISK, depending on the assumed sea-level rise scenario.

[19] Including Krambúðin, Faktorshúsið, Turnhúsið and Tjöruhúsið

[20] Edinborgarhúsið

[21] Jónassenshús

Table 17

Mean Flood Depth (in m) for Each Affected Address and Scenario

Address	Flood depth for 1 metre sea-level rise world scenario (2100)	Flood depth for 3 degree world scenario (2100)	Flood depth for 2 degree world scenario (2100)
Suðurtangi 2	0.95m	0.71m	0.34m
Aðalstræti 7	0.14m	0.03m	not affected
Aðalstræti 8	0.03m	not affected	not affected

The economic costs of the proposed interventions would need to be assessed in order to fully evaluate the monetary value saved in case of flooding. Nevertheless, this thesis exposes that considerable damages to cultural heritage sites can be estimated and actions prioritised. The actions should be articulated with long term prespective to restrict further developments within the Downtown area of the sand spit, as this area is highly susceptible to future impacts from storm surges.

6.3 Management Option 3: Elevating the Sand Spit

If pressure for new coastal development is verified within the undeveloped Downtown area of the sandpit (see Figure 40), then local planners and decision-makers have the option to consider elevating the existing sand spit above the maximum calculated flood height for the 1 metre sea-level rise world scenario. This would permit flood damages to be lowered once development starts.

The extension of the undeveloped area of the sand spit proposed for elevation is shown in Figure 40. In order to elevate this area above the critical flood height of 2.9 metres for the 1 metre sea-level rise scenario in 2100, approximately 180.640 m^3 of fill material (e.g. gravel or sand) would be required. This management-option is expected to minimise potential economic flood damages to buildings and infrastructure because all new developments would be located above the maximum flood height for the 1 metre sea-level rise scenario for 2100. In addition, the Ísafjörður system could accomodate a larger number of residents in accordance with the demographic projections presented, without increasing the potential loss of life numbers discussed above. In order to provide an economic valuation of the required costs for this management option it is assumed that landfill elevation costs (cost of delivered fill material + cost of grading and compaction) are about 20 US-dollars or 2.250 ISK (convertion rate from april 2011) per m^3 (Burrus et a., 2001). The total required cost of this management option would account to about 406 million ISK.

Figure 40. Map of Isafjördur showing the flood extent and flood depth for the 1 metre sea-level rise world scenario in 2100 and the undeveloped area of the sand spit in Downtown.

6.4 Other Management Recommendations

Additional management options to minimize impacts of sea-level rise and storm surges are suggested. However, these recommendations are more broad-based and part of the good-practices that should be promoted in general.

- One of the most important steps to accommodate a rising sea-level and storm surge impacts is to improve the local emergency planning. This could involve introducing an early warning system and developing evacuation systems similar to the avalanche measures.
- The local municipality should inform its residents about the threats associated with sea-level rise and storm surges and inform them about hazard insurance to prepare for possible future flood events.
- Local decision-makers should consider the option to improve the drainage system in Ísafjörður. This could be done through increasing pipe diameters and pump capacity.

6.5 Protect Against Sea-level Rise and Storm Surges

Protection of the built environment in the coastal zone is often seen as a costly but effective protection measure by both politicians and the public. In a sense, the construction of such infrastructures provides a false sense of security. If it is true that smaller flood events will be filtered by the adaption measure, nevertheless protection structures will hardly prevent extreme flooding. The construction of a tidal barrier or water lock (Figure 41) in combination with the reinforcement of the coastal protection measures already in place (breakwaters) is a possible adaptation measure to lower the overall vulnerability of Ísafjörður in terms of a rising sea-level and storm surges. However, one has to think about the advantages and disadvantages associated with such a costly and high impact project. The realisation of this adaptation measure needs to be thouroughly discussed by local and national decision-makers, as the economic costs are expected to be very high and the ecological impacts unknown. Depending on the size of the tidal barrier, certain ships may be unable to pass through the construction, restricting loading and unloading and shelter. Therefore, this project needs to be discussed by all stakeholders, as during the summer months, Ísafjörður serves as a tourist location for several large cruise ships that are important for the local economy. Furthermore, with a larger number of ice-free months expected during summer, more ships will pass through the Northeast Passage and Denmark Straight. Ísafjörður also has a strategic advantage due to its location to supply or maintain large cargo ships.

Figure 41. Proposed tidal barrier for Ísafjörður.

7 Conclusion

A digital elevation model was created from 1 metre contour lines and used for GIS analysis. Due to the uncertainty on future projections of sea-level rise, three equally probable normative scenarios (temperature and sea-level worlds) were constructed. Two scenarios explore the variation in regional sea-level at the case study area under fixed global temperature targets (2 degree world, 3 degree world). The third scenario assumes an increase in mean global seal-level of 1 metre by the end of the current century (1 metre sea-level rise world). The estimated regional sea-level rise numbers for year 2100 range from 0.5 to 1 meter. A fixed and predicted storm surge value of 0.84 m was added on top of these sea-level rise estimates. It was shown that the town can allow future population growth in the areas prone to flooding until the specific scenario tresholds are reached. The town can handle a population growth of 28 to 320 additional people in the flood prone areas until 2100. The estimated economic damage to buildings in year 2100 ranges from 594 million ISK for the 2 degree world scenario to a maximum of 2.8 billion ISK for the 1 meter sea-level rise world. The damage to roads affected from flooding in year 2100 range from 10% for the 2 degree world scenario to 17% for the 1 meter sea-level rise world.

By comparing the upper and lower bounds of the sea-level rise scenarios here proposed, the lowest impacts were observed in the 2 degree world scenario. The results reinforce that the long term target to stabilising the increase of global temperature below 2 degrees Celsius by the end of this century will be beneficial for Ísafjörður and very likely to other coastal locations in Iceland. The results of this thesis reveal that sea-level rise and storm surge impacts are expected to affect the coastal town Ísafjörður more severely in the future. Nevertheless, the town possesses time and a considerable range of management options to prepare for the impacts since these are expected to be relatively low in the next few decades.

If population projections are confirmed and the number of residents in Ísafjörður increases, the additional pressure on the coastal system will demand for enhanced coastal management options to reduce negative impacts. In the case of potential loss of life, the coastal system thresholds are calculated and potential population growth rates for particular mortality rate thresholds are given. The overall management suggestion to reduce Ísafjörður's vulnerability (the economic costs and population affected) to local impacts of sea-level rise and storm surge related risks, is to steer future development away from high risk areas.

Although preliminary, this assessment provides valuable guidance regarding the elaboration of future coastal vulnerability assessments in Iceland. This is, focussing on assessing particular thresholds of the analysed system, and providing a mangment options space targeted at minimizing the calculated impacts. This study is a pilot project and a useful tool for educational purposes in the town of Ísafjörður. For example, the produced maps can be used on campaings for flood risk awarness and the sea-level scenario exercise an example of ways dealing with climate-change uncertainty.

By making use of this thesis, the climate-change implications on local as well as national and regional policies can be assessed. For example, the spatial analysis could be overlaid with local land use zoning, representing a powerful tool for informing future land use zoning and regulation decisions.

The validity of the results obtained are limited to the study area (for other study areas the variables' values can be extended and/or reduced) and degree of system understanding (uncertainty of demographic projections, economic development and stimuli estimates) (Szlafsztein, 2005). As mentioned previously, desired data for vulnerability assessments was not available at the time this research was carried out. This includes, explicit spatial regional climate and sea-level rise trends or local tide gauge records and incremental erosion rates.

Periodical updates of this first preliminary coastal vulnerability assessment should be carried out (e.g. once every 10 years) incorporating changes in scientific knowledge and data updates. This thesis launches the foundation of how a vulnerability assessment that takes into account the Icelandic coastal specificities can be operated.

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Appendix A

FLOOD SCRIPT

/* flood model simulation based on raster connectivity (based on Poulter and Halpin, 2008)

/* Input grids:

/* Land elevation grid with water surface and a continuous ocean/estuary water buffer with values marked as -99999.

/* Input Filename should be "landelev"

/* Elevation no data value should be nodata

/* Output:

/* Inundation grids

/* Summary text file of sea level and area inundated

&echo &on

/* Setting the initial elevation and simlation values

&sv depth = 0 /* Current sea level

&sv max_flood = 10 /* Maximum flood level to be analysed for ci:grasp

&sv slr_incr = 1 /* Increment of sea level rise. In this case run analysis every 1 metre.

/* Set the counters for the loop

&sv scenario = 1

/* Start the flooding loop

&do &while %depth% < %max_flood% /* Preforms the loop until maximum flood value is reached

&sv rg = 8 /* Defines the reiong group to be used, in this case all the neighbourg cells (8)

flood_tmp = setnull(landelev > %depth%, 1) /* This will create a nodata grid above current sea level

region_tmp = regiongroup(flood_tmp, # , eight, #, #, #) /* Groups areas based on contagios eith side rule

flood_value = region_tmp.count /* Restructures value atribute table so that COUNT is now VALUE

docell

flood_area }= flood_value.value /* Creates scalar for highest value that is always flooded area adjacend to oceans/rivers

end

```
&sv flood_area = [show flood_area]                    /* Show flooded area to save

flood_%rg%_%scenario% = setnull(flood_value ^= %flood_area%, 1)       /*create flood contagion
NoData grid

/* Creating outputs in ascii style baby

/* &sv file = flood_area.txt

/* &sv file_unit = [open %file% openstatus -append]          /* Opens the ascii file and set it to append

/* &sv line = [quote %scenario%_%rg%_%depth%_%flood_area%]   /`Prepares data for ascii input

/* &sv writestat = [write %file_unit% %line%]          /* Write data to file

/* &sv closestat = [close %file_unit%]                 /* Close ascii file

Kill flood_tmp all                 /* Kill off temp grids; except for final flood grid

kill region_tmp all

kill flood_value all

&sv depth = %depth% + %slr_incr%             /* Add next slr increment

&sv scenario = %scenario% + 1            /* Add next scenario indentification

&end

&echo &off

/* Created by LuÌs Costa – 2009
```

Appendix B

Data loss of life numbers

Year	2100	2090	2080	2070	2060	2050	2040	2030	2020	2010	2000
1 meter sea-level rise world	0.49	0.36	0.29	0.20	0.15	0.12	0.06	0.05	0.01	0.01	0.01
3 degree world	0.24	0.19	0.15	0.13	0.11	0.06	0.05	0.01	0.01	0.01	0.01
2 degree world	0.06	0.05	0.05	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Data affected roads (extent and damage fractions)

	2100	2090	2080	2070	2060	2050	2040	2030	2020	2010	2000	
Area (in sqm)	73336	69164	66180	64032	62047	60025	56507	52290	45121	36692	8650	1 meter SLR world
Damage factor	0.17	0.16	0.14	0.12	0.1	0.09	0.07	0.06	0.05	0.04	0.04	
Area (in sqm)	65409	63794	62266	60952	58586	55899	52577	48019	41000	34852	8650	3 degree world
Damage factor	0.15	0.13	0.12	0.1	0.09	0.08	0.07	0.06	0.05	0.04	0.04	
Area (in sqm)	56465	55025	53245	51165	48743	45128	41595	38399	35107	32245	8571	2 degree world
Damage factor	0.1	0.09	0.09	0.08	0.07	0.07	0.06	0.05	0.05	0.04	0.04	

Data building damages and cumulative building damages in ISK

Building damages in ISK										
Year	2100	2090	2080	2070	2060	2050	2040	2030	2020	2010
1 meter sea-level rise world	196,788,569	217,593,146	238,398,760	256,221,003	263,918,404	261,718,292	243,171,394	219,173,122	179,555,906	130,685,403
3 degree world	122,420,571	137,846,470	151,192,389	163,369,985	172,296,369	168,483,040	167,864,488	155,889,045	136,711,411	108,351,755
2 degree world	41,577,350	47,836,243	54,999,345	61,734,299	68,141,229	74,358,389	79,127,748	83,160,022	83,396,244	72,876,664
Cumulative damage in ISK										
Year	2100	2090	2080	2070	2060	2050	2040	2030	2020	2010
1 meter sea-level rise world	2,207,223,999	2,010,435,430	1,792,842,283	1,554,443,523	1,298,222,521	1,034,304,117	772,585,825	529,414,431	310,241,309	130,685,403
3 degree world	1,484,425,522	1,362,004,951	1,224,158,482	1,072,966,093	909,596,108	737,299,739	568,816,699	400,952,211	245,063,166	108,351,755
2 degree world	667,207,533	625,630,183	577,793,940	522,794,594	461,060,295	392,919,066	318,560,677	239,432,929	156,272,907	72,876,664

Data damage fractions/flood depth/economic damages for 1 metre SLR world scenario

FID	Address	Insurance Va	Insurance value (ISK)	Residents	Constructior	Elevation	fd2999			fd2888			fd2786			fd2684			fd2582			fd2480			fd2378			fd2276			fd2174			fd2072			fd1970		
86	Torfnes 138842	1941650	1941650000	0	1982	3.309	0.217	0.149	289447184.607	0.177	0.113	218679643.521	0.133	0.086	166242286.703	0.091	0.059	114903345.397	0.051	0.034	65653510.439	0.019	0.013	24927021.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
8	Hafnarstræti 1	1181250	1181250000	7	1986	2.634	0.365	0.222	261994743.228	0.256	0.161	190621297.203	0.170	0.109	128384494.534	0.117	0.076	89705218.064	0.075	0.049	57820490.786	0.052	0.034	40109432.184	0.012	0.008	9201474.772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
79	Suðurgata 12	441100	441100000	0	1954	2.313	0.686	0.385	169663457.798	0.575	0.332	146263241.702	0.470	0.280	123456793.094	0.371	0.225	99352136.713	0.269	0.168	73900924.796	0.171	0.109	48049780.228	0.133	0.086	37723129.414	0.073	0.048	21132999.336	0.016	0.011	4801614.460	0.000	0.000	0.000	0.000	0	0
81	Suðurgata 8	406150	406150000	0	1980	2.130	0.869	0.465	189016077.824	0.758	0.418	169606448.740	0.656	0.371	150649433.657	0.554	0.321	130575183.380	0.452	0.269	109340640.671	0.350	0.214	86902934.164	0.248	0.156	63214578.363	0.146	0.094	38232473.643	0.067	0.044	17844754.231	0.026	0.017	6973539.239	0.000	0	0
51	Hafnarstræti 9R	404450	404450000	0	2001	2.301	0.698	0.390	157815891.601	0.587	0.338	136505806.272	0.485	0.286	115735254.533	0.383	0.232	93826110.511	0.283	0.176	71060396.885	0.217	0.137	55530333.305	0.170	0.108	43675887.211	0.122	0.079	31915125.680	0.076	0.049	19987161.576	0.038	0.025	10243493.017	0.000	0	0
66	Sindragata 11	343950	343950000	0	1986	2.080	0.919	0.486	167014366.898	0.808	0.439	151040100.574	0.706	0.394	135425331.114	0.604	0.346	118889748.944	0.502	0.295	101385223.045	0.400	0.241	82878932.948	0.298	0.184	63333368.734	0.198	0.125	43102284.429	0.119	0.077	26502874.584	0.057	0.038	12959535.014	0.000	0	0
23	Mjallargata 1	281450	281450000	18	1988	2.493	0.506	0.297	83602614.531	0.395	0.238	67122168.264	0.293	0.182	51089531.869	0.194	0.123	34668132.592	0.140	0.090	25339165.691	0.091	0.059	16629873.366	0.043	0.028	7899161.883	0.001	0.000	103928.088	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
82	Suðurgata 9	255550	255550000	0	1947	2.305	0.694	0.389	99287039.613	0.583	0.336	85794393.919	0.481	0.284	72642347.365	0.379	0.230	58740479.674	0.277	0.172	44060819.212	0.175	0.112	28574879.770	0.117	0.076	19328817.803	0.071	0.047	11942406.714	0.028	0.019	4794863.741	0.000	0.000	0.000	0.000	0	0
31	Pollgata 4	248000	248000000	22	1990	2.504	0.495	0.292	72304438.849	0.384	0.233	57898518.068	0.282	0.175	43491015.875	0.180	0.115	28502454.138	0.086	0.056	13909178.541	0.035	0.023	5665666.973	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
63	Silfurtorg 2	237500	237500000	0	1979	2.711	0.288	0.179	42416776.977	0.177	0.113	26805050.425	0.078	0.051	12184808.129	0.027	0.018	4232593.248	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
91	Ísafjarðarflugvöllur 139003	225760	225760000	0	1965	2.046	0.953	0.499	112725501.813	0.842	0.454	102448745.999	0.740	0.409	92401822.033	0.638	0.362	81753115.484	0.536	0.312	70479062.917	0.434	0.260	58588931.419	0.339	0.208	46876440.723	0.251	0.157	35416065.552	0.162	0.104	23425015.098	0.070	0.046	10323435.713	0.000	0	0
85	Sólgata 1	177900	177900000	0	1993	2.639	0.360	0.219	39027808.526	0.249	0.156	27767840.874	0.158	0.101	17957657.667	0.104	0.067	12004903.535	0.061	0.040	7135507.693	0.036	0.024	4250813.166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
71	Sindragata 5	162250	162250000	0	1980	2.431	0.568	0.328	53291510.109	0.457	0.272	44107895.493	0.355	0.217	35168080.787	0.253	0.159	25730257.366	0.155	0.100	16174167.555	0.092	0.060	9736070.347	0.056	0.037	6022500.411	0.019	0.013	2061635.258	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
72	Sindragata 6	157450	157450000	0	1990	2.294	0.705	0.393	61942833.035	0.594	0.341	53679104.695	0.492	0.290	45623042.610	0.390	0.236	37106780.836	0.288	0.179	28113116.062	0.200	0.127	19951247.802	0.144	0.093	14597858.093	0.095	0.062	9783144.252	0.049	0.032	5035603.939	0.005	0.003	537530.199	0.000	0	0
61	Pólgata 1	151600	151600000	0	1959	2.878	0.151	0.097	14684641.773	0.068	0.044	6731828.729	0.025	0.016	2469583.869	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
88	Torfnes 177545	147300	147300000	0	1997	2.884	0.175	0.112	16442188.143	0.113	0.073	10745856.585	0.059	0.039	5729204.939	0.020	0.013	1908064.822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
41	Austurvegur 2	146150	146150000	0	1931	2.970	0.033	0.022	3152268.353	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
44	Aðalstræti 7	146000	146000000	0	1907	2.959	0.141	0.091	13254198.862	0.087	0.057	8290299.255	0.040	0.026	3854916.326	0.009	0.006	875341.956	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
64	Sindragata 1	142900	142900000	0	1989	2.796	0.249	0.156	22263360.143	0.220	0.139	19819976.253	0.176	0.112	16040459.691	0.131	0.084	12064382.044	0.086	0.056	8034636.258	0.040	0.026	3760039.167	0.004	0.003	387179.379	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
67	Sindragata 12	136950	136950000	0	1995	2.036	0.963	0.503	68944160.676	0.852	0.458	62748158.794	0.750	0.414	56689914.759	0.648	0.367	50268059.467	0.546	0.317	43468327.009	0.444	0.265	36276176.797	0.342	0.209	28676793.764	0.240	0.151	20635088.341	0.144	0.092	12645961.410	0.079	0.051	7035895.060	0.000	0	0
35	Suðurtangi 2	136076	136076000	5	1964	2.043	0.956	0.501	68127200.765	0.845	0.455	61945282.997	0.743	0.411	55901320.154	0.641	0.364	49495101.210	0.539	0.314	42712432.434	0.437	0.261	35538847.528	0.335	0.205	27959606.630	0.233	0.147	19959697.115	0.144	0.093	12627905.516	0.074	0.049	6605159.690	0.196	0.12452418	16944752.8
14	Hafnarstræti 7	131550	131550000	11	1960	2.886	0.113	0.073	9649873.595	0.012	0.008	1015794.790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
68	Sindragata 14	130500	130500000	0	1997	2.290	0.709	0.395	51590975.281	0.598	0.343	44757811.673	0.496	0.292	38096060.580	0.394	0.238	31053459.073	0.292	0.181	23615761.113	0.190	0.121	15768457.894	0.088	0.057	7496790.550	0.034	0.023	2954144.767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
78	Suðurgata 11	130300	130300000	0	1984	2.354	0.645	0.366	47634657.463	0.534	0.311	40564317.072	0.432	0.258	33676108.234	0.330	0.203	26398746.722	0.228	0.144	18717845.444	0.126	0.081	10618757.556	0.036	0.024	3119240.348	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
89	Ásgeirsgata 1	127200	127200000	0	1975	2.318	0.681	0.383	48655134.720	0.570	0.329	41890208.723	0.468	0.277	35296981.105	0.366	0.223	28328771.888	0.264	0.165	20971623.827	0.162	0.104	13211326.578	0.066	0.043	5483839.657	0.013	0.008	1071860.187	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
13	Hafnarstræti 6	94200	94200000	7	1928	2.997	0.014	0.009	869186.560	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
28	Mánagata 4	92250	92250000	7	1928	2.663	0.336	0.206	19006811.532	0.225	0.142	13093989.612	0.123	0.080	7351466.672	0.075	0.049	4515635.173	0.025	0.016	1516316.402	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
75	Sindragata 9	89680	89680000	0	1974	2.000	0.999	0.517	46396934.509	0.888	0.473	42424324.591	0.786	0.430	38538354.094	0.684	0.384	34417505.823	0.582	0.335	30052500.788	0.480	0.284	25433878.848	0.378	0.229	20552004.180	0.276	0.172	15397057.193	0.174	0.111	9959039.839	0.072	0.047	4227774.310	0.000	0	0
65	Sindragata 10	83100	83100000	0	1985	1.958	1.041	0.533	44319088.544	0.930	0.490	40728773.987	0.828	0.448	37214823.564	0.726	0.403	33486710.389	0.624	0.355	29535904.674	0.522	0.305	25353710.057	0.420	0.252	20931263.601	0.318	0.196	16259535.794	0.216	0.136	11329329.812	0.114	0.074	6131284.433	0.000	0	0
73	Sindragata 7	80850	80850000	0	1984	2.039	0.960	0.502	40588282.807	0.849	0.457	36922721.418	0.747	0.412	33338811.539	0.645	0.365	29539948.260	0.543	0.316	25517703.808	0.441	0.263	21263487.066	0.339	0.207	16768548.616	0.237	0.149	12023973.996	0.136	0.087	7062014.263	0.052	0.034	2746617.636	0.000	0	0
9	Hafnarstræti 12	80000	80000000	3	1926	2.809	0.190	0.121	9672249.807	0.079	0.052	4141605.797	0.018	0.012	977964.614	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
70	Sindragata 3	76750	76750000	0	1987	2.347	0.652	0.369	28314374.186	0.541	0.315	24166050.196	0.439	0.262	20124279.885	0.362	0.220	16913529.558	0.260	0.162	12464446.474	0.161	0.103	7900927.963	0.084	0.055	4190441.792	0.040	0.026	2009443.998	0.003	0.002	137848.295	0.000	0.000	0.000	0.000	0	0
42	Aðalstræti 17	74750	74750000	0	1956	3.000	0.012	0.008	575555.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
47	Hafnarstræti 2	69800	69800000	0	1928	3.026	0.016	0.011	759552.714	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
46	Græningarður 138982	67800	67800000	0	1982	2.625	0.374	0.227	15402050.528	0.278	0.173	11728087.488	0.204	0.129	8778911.311	0.149	0.096	6477115.341	0.103	0.067	4532621.324	0.068	0.045	3031976.307	0.042	0.028	1881201.829	0.005	0.003	209994.863	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
33	Sundstræti 26	66650	66650000	8	1964	3.040	0.125	0.081	5381453.661	0.066	0.043	2873097.381	0.010	0.007	465119.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
15	Hafnarstræti 8	66250	66250000	6	1928	2.977	0.023	0.015	1015840.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
11	Hafnarstræti 18	64460	64460000	2	1906	2.574	0.425	0.254	16404477.102	0.314	0.193	12461632.464	0.212	0.134	8629049.647	0.123	0.080	5141990.239	0.066	0.043	2795350.478	0.027	0.018	1150478.978	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
12	Hafnarstræti 4	62750	62750000	8	1927	2.998	0.015	0.010	618427.944	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
3	Aðalstræti 15	62650	62650000	8	1870	2.996	0.025	0.017	1045643.717	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
49	Hafnarstræti 21	61750	61750000	0	1979	2.109	0.890	0.474	29272928.599	0.779	0.427	26357521.100	0.677	0.381	23509402.057	0.575	0.332	20492749.424	0.473	0.280	17301043.248	0.371	0.226	13927635.960	0.269	0.168	10365761.989	0.167	0.107	6608528.632	0.066	0.043	2664902.811	0.011	0.008	466564.293	0.000	0	0
10	Hafnarstræti 14	58500	58500000	9	1927	2.847	0.152	0.097	5690120.360	0.051	0.033	1947295.234	0.004	0.003	155009.965	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
69	Sindragata 15a	56800	56800000	0	1996	2.016	0.983	0.511	29029936.567	0.872	0.466	26489625.837	0.770	0.423	24005206.836	0.668	0.376	21371101.135	0.566	0.327	18583413.719	0.464	0.275	15630135.719	0.362	0.220	12511144.409	0.260	0.162	9218203.210	0.158	0.101	5744961.684	0.079	0.052	2935103.776	0.000	0	0
87	Torfnes 138846	56450	56450000	0	1979	3.774	0.017	0.011	631033.726	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
90	Ásgeirsgata 3	55200	55200000	0	1972	2.173	0.826	0.447	24665732.436	0.715	0.398	21960179.204	0.613	0.350	19319055.187	0.511	0.299	16523581.219	0.409	0.246	13567858.623	0.307	0.189	10445875.456	0.205	0.130	7151511.199	0.103	0.067	3678535.302	0.033	0.022	1212286.506	0.000	0.000	0.000	0.000	0	0
2	Aðalstræti 13	54950	54950000	6	1885	2.916	0.108	0.070	3835622.451	0.086	0.056	3083029.300	0.014	0.009	505723.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
40	Austurvegur 1	51350	51350000	0	1924	2.845	0.154	0.099	5070229.977	0.097	0.063	3245131.989	0.029	0.019	989118.210	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
38	Sólgata 5	51300	51300000	5	1903	2.909	0.094	0.061	3143423.731	0.033	0.022	1128751.496	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
25	Mánagata 1	51000	51000000	3	1963	2.338	0.661	0.373	19020173.351	0.550	0.319	16276700.975	0.448	0.267	13603450.942	0.346	0.211	10778739.437	0.244	0.153	7796949.863	0.142	0.091	4652364.153	0.051	0.034	1712215.373	0.005	0.003	171576.614	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
18	Hrannargata 2	46770	46770000	7	1906	2.468	0.531	0.310	14482549.163	0.420	0.252	11780472.304	0.318	0.196	9151151.064	0.216	0.136	6376354.667	0.114	0.074	3450813.662	0.033	0.022	1010719.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
0	Austurvegur 13	44850	44850000	8	1928	3.138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
60	Njarðarsund 2	44000	44000000	0	1983	1.957	1.042	0.534	23487211.202	0.931	0.491	21587609.317	0.829	0.448	19728415.461	0.727	0.404	17755881.754	0.625	0.356	15665492.917	0.523	0.306	13452645.475	0.421	0.253	11112648.457	0.319	0.196	8640720.623	0.217	0.137	6031994.178	0.115	0.075	3281513.614	0.000	0	0
43	Aðalstræti 27	43750	43750000	0	1916	2.946	0.061	0.040	1743021.192	0.002	0.001	47187.152	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
84	Suðurtangi 7	43250	43250000	0	1964	1.894	1.105	0.557	24088280.005	0.994	0.515	22290315.756	0.892	0.475	20529174.578	0.790	0.431	18659311.374	0.688	0.386	16676343.342	0.586	0.337	14575797.742	0.484	0.286	12353116.867	0.382	0.231	10003654.348	0.280	0.174	7522679.054	0.178	0.113	4905372.132	0.076	0.04963754	2146823.61
1	Aðalstræti 11	43150	43150000	7	1904	2.901	0.122	0.079	3396605.890	0.092	0.060	2598596.139	0.026	0.017	749275.441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
58	Mjósund 3	41800	41800000	0	1980	1.992	1.007	0.521	21762177.521	0.896	0.477	19919784.703	0.794	0.433	18117433.595	0.692	0.388	16205961.223	0.590	0.339	14181049.599	0.488	0.288	12038296.943	0.386	0.234	9773217.691	0.284	0.177	7381242.488	0.182	0.116	4857718.192	0.080	0.053	2197915.846	0.000	0	0
59	Mánagata 5	40550	40550000	0	1897	2.783	0.216	0.137	5537872.627	0.105	0.068	2771725.626	0.029	0.019	774584.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
26	Mánagata 2	40280	40280000	4	1889	2.405	0.594	0.341	13735955.122	0.483	0.285	11487770.364	0.381	0.231	9298683.219	0.279	0.173	6987078.725	0.177	0.113	4548468.296	0.098	0.064	2576724.321	0.069	0.045	1810368.381	0.016	0.011	440693.693	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
83	Suðurtangi 6	38550	38550000	0	1947	1.148	1.850	0.771	29731342.785	1.740	0.746	28749197.430	1.638	0.721	27776393.187	1.536	0.693	26732906.528	1.434	0.664	25615393.853	1.332	0.633	24420434.287	1.230	0.600	23144529.686	1.128	0.565	21784104.628	1.026	0.528	20335506.420	0.924	0.488	18795004.165	0.822	0.44510486	17158792.4
62	Pólgata 2	38550	38550000	0	1943	2.984	0.039	0.026	991002.249	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
74	Sindragata 8	38150	38150000	0	1974	1.997	1.002	0.519	19782933.716	0.891	0.474	18096054.919	0.789	0.431	16445931.323	0.687	0.385	14696009.079	0.585	0.337	12842343.215	0.483	0.285	10880911.698	0.381	0.231	8807617.755	0.279	0.173	6618286.441	0.177	0.113	4308666.896	0.075	0.049	1874424.306	0.000	0	0
56	Mjósund 1	37750	37750000	0	1973	1.991	1.008	0.521	19662917.390	0.897	0.477	17999698.860	0.795	0.434	16372585.553	0.693	0.388	14646948.041	0.591	0.340	12818887.181	0.489	0.288	10884428.161	0.387	0.234	8839520.495	0.285	0.177	6680038.031	0.183	0.117	4401778.946	0.081	0.053	2000458.546	0.000	0	0
20	Hrannargata 4	37050	37050000	5	1930	2.673	0.326	0.200	7414150.597	0.215	0.136	5026261.035	0.113	0.073	2707380.471	0.025	0.017	616178.352	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
45	Djúpvegur 138926	34750	34750000	0	1984	0.317	2.682	0.906	31498367.981	2.571	0.893	31040991.134	2.469	0.880	30579655.598	2.367	0.866	30076565.606	2.265	0.850	29529274.666	2.163	0.833	28935266.628	2.061	0.814	28291955.683	1.959	0.794	27596686.370	1.857	0.773	26846733.568	1.755	0.749	26039302.501	1.653	0.72436054	25171528.7
16	Hrannargata 1	33600	33600000	4	1909	2.503	0.496	0.292	9808536.795	0.385	0.233	7830438.728	0.283	0.176	5906284.922	0.181	0.115	3876337.097	0.079	0.052	1736777.245	0.018	0.012	402965.317	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
29	Mánagata 6	33150	33150000	4	1965	2.887	0.117	0.076	2515921.118	0.052	0.034	1139535.061	0.015	0.010	322129.211	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
53	Mjallargata 4	32850	32850000	0	1885	2.835	0.181	0.115	3779922.121	0.120	0.078	2557398.875	0.069	0.045	1476781.235	0.028	0.018	599757.268	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
22	Hrannargata 8	32550	32550000	2	1920	2.896	0.103	0.067	2183249.029	0.020	0.013	423453.202	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
27	Mánagata 3	31600	31600000	3	1927	2.561	0.438	0.261	8261756.292	0.327	0.201	6342279.612	0.225	0.142	4476239.914	0.123	0.079	2508664.047	0.035	0.023	730854.979	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
77	Suðurgata 10	28200	28200000	0	1956	2.274	0.725	0.403	11352775.603	0.614	0.351	9889339.229	0.512	0.300	8462364.127	0.410	0.247	6953565.875	0.308	0.190	5359874.365	0.206	0.130	3678164.625	0.117	0.075	2128384.249	0.078	0.051	1431437.554	0.019	0.013	361346.266	0.000	0.000	0.000	0.000	0	0
48	Hafnarstræti 20	28150	28150000	0	1913	2.325	0.674	0.379	10671369.801	0.563	0.326	9168108.841	0.461	0.274	7703118.183	0.359	0.219	6154921.613	0.257	0.161	4520426.255	0.155	0.099	2796483.224	0.054	0.036	1002851.022	0.003	0.002	64389.805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
30	Mánagata 9	26950	26950000	3	1898	2.975	0.050	0.033	882868.224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
19	Hrannargata 3	26900	26900000	5	1898	2.786	0.213	0.135	3624899.516	0.102	0.066	1787033.521	0.024	0.016	433052.951	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
32	Sundstræti 14	26600	26600000	6	1930	2.676	0.323	0.199	5287615.139	0.212	0.134	3571138.483	0.119	0.077	2056143.135	0.062	0.041	1087913.226	0.021	0.014	376241.259	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
54	Mjallargata 5	25750	25750000	0	1856	2.910	0.098	0.064	1635455.013	0.039	0.026	669575.384	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
6	Aðalstræti 9	25300	25300000	5	1919	2.830	0.197	0.125	3164731.729	0.122	0.079	1994137.877	0.070	0.046	1157369.315	0.029	0.019	488914.702	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
4	Aðalstræti 25	23750	23750000	3	1927	2.986	0.027	0.018	430878.408	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
5	Aðalstræti 8	23450	23450000	3	1933	2.996	0.025	0.017	394905.695	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
7	Fjarðarstræti 39	22450	22450000	3	1881	2.980	0.037	0.025	552749.303	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
52	Hrannargata 10A	21800	21800000	0	1903	2.999	0.012	0.008	170778.594	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
50	Hafnarstræti 5	21400	21400000	0	1943	2.921	0.078	0.051	1094647.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
39	Sólgata 7	19050	19050000	7	1903	2.999	0.016	0.011	208323.166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
24	Mjallargata 8	18700	18700000	1	1924	2.920	0.090	0.059	1094162.472	0.022	0.014	267818.287	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
34	Sundstræti 28	17700	17700000	10	1969	3.004	0.127	0.082	1450392.500	0.076	0.050	881046.773	0.053	0.035	621302.767	0.008	0.005	91595.624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
17	Hrannargata 10	15550	15550000	7	1928	2.976	0.029	0.019	297304.157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
55	Mjallargata 6A	15100	15100000	0	1897	2.997	0.023	0.016	234999.386	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
36	Sólgata 2	14800	14800000	1	1902	2.488	0.511	0.300	4435150.486	0.400	0.241	3571149.432	0.298	0.184	2730386.564	0.196	0.125	1843270.490	0.094	0.061	908129.914	0.024	0.016	235562.355	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
21	Hrannargata 6	14600	14600000	2	1898	2.801	0.198	0.126	1834404.203	0.087	0.057	829112.868	0.011	0.007	107121.068	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
37	Sólgata 4	14000	14000000	2	1908	2.671	0.328	0.202	2821125.199	0.217	0.137	1919989.450	0.115	0.075	1044875.241	0.033	0.022	304995.532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
76	Sundstræti 11	11550	11550000	0	1898	2.995	0.023	0.015	178818.183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0
80	Suðurgata 138758	7250	7250000	0	1950	1.986	1.013	0.523	3789080.462	0.902	0.479	3470533.810	0.800	0.436	3158876.507	0.698	0.390	2828330.716	0.596	0.342	2478148.248	0.494	0.291	2107566.383	0.392	0.237	1715807.867	0.290	0.180	1302080.916	0.188	0.119	865579.146	0.086	0.056	405479.969	0.000	0	0
57	Mjósund 2	0	0	0	1949	2.450	0.549	0.319	0.000	0.438	0.262	0.000	0.336	0.206	0.000	0.234	0.147	0.000	0.249	0.156	0.000	0.158	0.102	0.000	0.082	0.054	0.000	0.010	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0

Data damage fractions/flood depth/economic damages for 3 degree world scenario

FID	Adress	Assessed_f	val*1000	Number_inh	Year_built	Mean_elev	fd2750			fd2672		
22	Djúpvegur 138926	34750	34750000	0	1984	0.317	2.433	0.875	30406986.673	2.355	0.864	30014521.425
53	Suðurtangi 6	38550	38550000	0	1947	1.148	1.602	0.711	27416345.183	1.523	0.690	26605341.176
54	Suðurtangi 7	43250	43250000	0	1964	1.894	0.856	0.460	19881861.470	0.778	0.426	18431977.909
32	Njarðarsund 2	44000	44000000	0	1983	1.957	0.793	0.433	19045400.537	0.715	0.398	17516159.619
36	Sindragata 10	83100	83100000	0	1985	1.958	0.792	0.432	35923908.694	0.714	0.398	33015655.864
50	Suðurgata 138758	7250	7250000	0	1950	1.986	0.764	0.420	3044408.280	0.686	0.385	2788166.517
28	Mjósund 1	37750	37750000	0	1973	1.991	0.759	0.418	15774986.139	0.681	0.382	14437274.933
30	Mjósund 3	41800	41800000	0	1980	1.992	0.758	0.418	17455476.823	0.680	0.382	15973709.210
45	Sindragata 8	38150	38150000	0	1974	1.997	0.753	0.415	15839908.691	0.675	0.380	14483391.987
46	Sindragata 9	89680	89680000	0	1974	2.000	0.750	0.414	37111230.469	0.672	0.378	33916828.551
40	Sindragata 15a	56800	56800000	0	1996	2.016	0.734	0.407	23092915.521	0.656	0.371	21051092.288
38	Sindragata 12	136950	136950000	0	1995	2.036	0.714	0.398	54465628.855	0.636	0.361	49487984.498
44	Sindragata 7	80850	80850000	0	1984	2.039	0.711	0.396	32023011.159	0.633	0.360	29078461.789
17	Suðurtangi 2	136076	136076000	5	1964	2.043	0.707	0.395	53682390.851	0.629	0.358	48716954.748
60	Ísafjarðarflugvöllur	225760	225760000	0	1965	2.046	0.704	0.393	88713373.050	0.626	0.357	80459677.822
37	Sindragata 11	343950	343950000	0	1986	2.080	0.670	0.377	129699733.453	0.592	0.340	116881176.122
25	Hafnarstræti 21	61750	61750000	0	1979	2.109	0.641	0.364	22464279.961	0.563	0.326	20126460.773
51	Suðurgata 8	406150	406150000	0	1980	2.130	0.620	0.354	143694174.994	0.542	0.315	128138072.728
59	Ásgeirsgata 3	55200	55200000	0	1972	2.173	0.577	0.332	18350544.747	0.499	0.293	16184282.498
47	Suðurgata 10	28200	28200000	0	1956	2.274	0.476	0.282	7939346.894	0.398	0.240	6770538.571
39	Sindragata 14	130500	130500000	0	1997	2.290	0.460	0.273	35654651.735	0.382	0.231	30199218.913
43	Sindragata 6	157450	157450000	0	1990	2.294	0.456	0.271	42670732.574	0.378	0.229	36073817.622
26	Hafnarstræti 9R	404450	404450000	0	2001	2.301	0.449	0.267	108118646.595	0.371	0.225	91163095.310
52	Suðurgata 9	255550	255550000	0	1947	2.305	0.445	0.265	67822853.212	0.367	0.223	57054375.320
49	Suðurgata 12	441100	441100000	0	1954	2.313	0.437	0.261	115099972.846	0.359	0.219	96428704.966
58	Ásgeirsgata 1	127200	127200000	0	1975	2.318	0.432	0.258	32881145.637	0.354	0.216	27483665.023
24	Hafnarstræti 20	28150	28150000	0	1913	2.325	0.425	0.255	7166355.223	0.347	0.212	5967167.674
10	Mánagata 1	51000	51000000	3	1963	2.338	0.412	0.248	12624076.395	0.334	0.205	10436203.292
41	Sindragata 3	76750	76750000	0	1987	2.347	0.410	0.247	18929841.136	0.350	0.214	16402471.597
48	Suðurgata 11	130300	130300000	0	1984	2.354	0.396	0.239	31152797.984	0.318	0.196	25516335.398
11	Mánagata 2	40280	40280000	4	1889	2.405	0.345	0.211	8497041.778	0.267	0.167	6706862.445
42	Sindragata 5	162250	162250000	0	1980	2.431	0.319	0.197	31894877.334	0.241	0.152	24586343.773
29	Mjósund 2	0	0	0	1949	2.450	0.300	0.185	0.000	0.222	0.140	0.000
6	Hrannargata 2	46770	46770000	7	1906	2.468	0.282	0.175	8188692.303	0.204	0.129	6040100.467
18	Sólgata 2	14800	14800000	1	1902	2.488	0.262	0.164	2422665.369	0.184	0.117	1735779.153
9	Mjallargata 1	281450	281450000	18	1988	2.493	0.257	0.161	45221737.619	0.185	0.118	33184052.195
5	Hrannargata 1	33600	33600000	4	1909	2.503	0.247	0.155	5202107.972	0.169	0.108	3630388.080
14	Pólgata 4	248000	248000000	22	1990	2.504	0.246	0.154	38291559.368	0.168	0.108	26686445.159
12	Mánagata 3	31600	31600000	3	1927	2.561	0.189	0.120	3793580.494	0.111	0.072	2270341.670
23	Grænigarður 13898	67800	67800000	0	1982	2.625	0.181	0.115	7802472.482	0.143	0.092	6248115.436
4	Hafnarstræti 18	64460	64460000	2	1906	2.574	0.176	0.112	7227076.844	0.114	0.074	4776190.414
35	Sindragata 1	142900	142900000	0	1969	2.796	0.160	0.103	14650403.828	0.126	0.082	11650952.753
2	Hafnarstræti 1	1181250	1181250000	7	1986	2.634	0.150	0.097	114005877.712	0.112	0.073	85837642.062
55	Sólgata 1	177900	177900000	0	1993	2.639	0.136	0.088	15609251.053	0.098	0.064	11345351.155
56	Torfnes 138842	1941650	1941650000	0	1982	3.309	0.118	0.076	148493556.055	0.086	0.056	108974820.599
13	Mánagata 4	92250	92250000	7	1928	2.663	0.099	0.064	5925652.343	0.069	0.046	4195374.847
15	Sundstræti 14	26600	26600000	6	1930	2.676	0.099	0.064	1704695.105	0.056	0.037	977818.946
19	Sólgata 4	14000	14000000	2	1908	2.671	0.079	0.052	724939.713	0.026	0.017	243543.337
8	Hrannargata 4	37050	37050000	5	1930	2.673	0.077	0.050	1859643.399	0.020	0.013	498971.339
34	Silfurtorg 2	237500	237500000	0	1979	2.711	0.056	0.037	8800826.413	0.022	0.015	3538941.468
1	Aðalstræti 9	25300	25300000	5	1919	2.830	0.053	0.035	878564.594	0.027	0.018	453188.879
27	Mjallargata 4	32850	32850000	0	1885	2.835	0.050	0.033	1075514.783	0.024	0.016	514573.450
16	Sundstræti 28	17700	17700000	10	1969	3.004	0.049	0.032	567998.367	0.000	0.000	0.000
57	Torfnes 177545	147300	147300000	0	1997	2.884	0.043	0.028	4132422.391	0.016	0.011	1560610.729
21	Aðalstræti 7	146000	146000000	0	1907	2.959	0.026	0.017	2551970.006	0.003	0.002	327996.520
31	Mánagata 5	40550	40550000	0	1897	2.783	0.015	0.010	408964.204	0.000	0.000	0.000
33	Pólgata 1	151600	151600000	0	1959	2.878	0.015	0.010	1466072.604	0.000	0.000	0.000
20	Austurvegur 1	51350	51350000	0	1924	2.845	0.012	0.008	416680.796	0.000	0.000	0.000
0	Aðalstræti 11	43150	43150000	7	1904	2.901	0.010	0.007	298173.171	0.000	0.000	0.000
7	Hrannargata 3	26900	26900000	5	1898	2.786	0.007	0.005	129449.386	0.000	0.000	0.000
3	Hafnarstræti 12	80000	80000000	3	1926	2.809	0.005	0.004	282091.811	0.000	0.000	0.000

FID	Adress	fd2594			fd2516			fd2438			fd2360		
22	Djúpvegur 138926	2.277	0.852	29596037.777	2.199	0.839	29150411.714	2.121	0.825	28676494.238	2.043	0.811	28173114.116
53	Suðurtangi 6	1.446	0.668	25750818.422	1.367	0.645	24851244.557	1.289	0.620	23905066.159	1.212	0.594	22910699.292
54	Suðurtangi 7	0.700	0.391	16915649.574	0.622	0.354	15330676.811	0.544	0.316	13675630.325	0.466	0.276	11947851.846
32	Njarðarsund 2	0.637	0.362	15917687.695	0.559	0.324	14247926.179	0.481	0.284	12504787.002	0.403	0.243	10686149.925
36	Sindragata 10	0.636	0.361	30012544.091	0.558	0.323	26856752.988	0.480	0.284	23562309.925	0.402	0.242	20125234.487
50	Suðurgata 138758	0.608	0.348	2520389.974	0.530	0.309	2240737.795	0.452	0.269	1948863.509	0.374	0.227	1644412.273
28	Mjósund 1	0.603	0.345	13039398.463	0.525	0.307	11579560.266	0.447	0.266	10056017.004	0.369	0.224	8466879.464
30	Mjósund 3	0.602	0.345	14425305.433	0.524	0.306	12808298.207	0.446	0.266	11120690.487	0.368	0.224	9360456.578
45	Sindragata 8	0.597	0.342	13065935.787	0.519	0.304	11585741.777	0.441	0.263	10040986.093	0.363	0.221	8429836.942
46	Sindragata 9	0.594	0.341	30579008.160	0.516	0.302	27093539.518	0.438	0.262	23456132.797	0.360	0.219	19662433.978
40	Sindragata 15a	0.578	0.333	18917882.752	0.500	0.294	16690596.402	0.422	0.253	14366509.443	0.344	0.210	11942856.356
38	Sindragata 12	0.558	0.323	44288361.248	0.480	0.284	38860315.647	0.402	0.242	33197191.961	0.324	0.199	27292322.487
44	Sindragata 7	0.555	0.322	26002780.071	0.477	0.282	22792008.758	0.399	0.240	19442244.731	0.321	0.197	15949621.569
17	Suðurtangi 2	0.551	0.320	43530402.696	0.473	0.280	38116255.513	0.395	0.239	32467960.998	0.317	0.195	26578857.116
60	Ísafjarðarflugvöllur	0.548	0.318	71838774.648	0.470	0.278	62839702.825	0.395	0.238	53777754.738	0.324	0.199	44970340.008
37	Sindragata 11	0.514	0.301	103495859.767	0.436	0.260	89527287.069	0.358	0.218	74958785.207	0.280	0.174	59773400.880
25	Hafnarstræti 21	0.485	0.286	17685839.173	0.407	0.245	15133419.781	0.329	0.202	12484196.889	0.251	0.157	9717115.540
51	Suðurgata 8	0.464	0.276	111900465.174	0.386	0.234	94961764.527	0.308	0.190	77302054.927	0.230	0.145	58901171.049
59	Ásgeirsgata 3	0.421	0.252	13924102.811	0.343	0.210	11567117.432	0.265	0.165	9110602.026	0.187	0.119	6551791.386
47	Suðurgata 10	0.320	0.197	5551675.316	0.242	0.152	4281958.241	0.164	0.105	2959370.771	0.106	0.069	1932839.135
39	Sindragata 14	0.304	0.188	24511760.832	0.226	0.142	18585785.611	0.148	0.095	12414719.588	0.072	0.047	6189321.457
43	Sindragata 6	0.300	0.185	29196540.086	0.225	0.142	22338856.162	0.175	0.112	17574016.278	0.138	0.089	13983287.263
26	Hafnarstræti 9R	0.294	0.182	73724127.367	0.235	0.148	59755156.585	0.198	0.125	50715577.137	0.162	0.101	41848772.765
52	Suðurgata 9	0.289	0.179	45829130.148	0.211	0.134	34134377.667	0.154	0.099	25180023.148	0.108	0.070	17838880.798
49	Suðurgata 12	0.281	0.174	76966669.593	0.203	0.129	56691833.365	0.154	0.099	43566404.900	0.122	0.079	34927157.484
58	Ásgeirsgata 1	0.276	0.172	21857817.871	0.198	0.126	15997190.724	0.120	0.078	9895360.745	0.054	0.036	4519484.092
24	Hafnarstræti 20	0.269	0.168	4717300.952	0.191	0.121	3415347.186	0.113	0.073	2059878.727	0.041	0.027	753470.336
10	Mánagata 1	0.256	0.160	8156086.609	0.178	0.113	5781169.795	0.100	0.065	3308863.589	0.039	0.026	1312764.031
41	Sindragata 3	0.272	0.169	13000344.657	0.194	0.123	9456358.528	0.126	0.081	6245979.444	0.074	0.048	3719335.146
48	Suðurgata 11	0.240	0.151	19642899.962	0.162	0.104	13525939.829	0.084	0.055	7158839.708	0.030	0.020	2592569.751
11	Mánagata 2	0.189	0.120	4842103.880	0.116	0.075	3024240.526	0.088	0.058	2318840.134	0.061	0.040	1616978.850
42	Sindragata 5	0.164	0.105	17060117.909	0.112	0.073	11825283.559	0.072	0.047	7634965.555	0.049	0.012	5233565.902
29	Mjósund 2	0.240	0.151	0.000	0.194	0.123	0.000	0.116	0.075	0.000	0.064	0.042	0.000
6	Hrannargata 2	0.126	0.081	3802992.726	0.054	0.035	1646600.971	0.014	0.009	421190.030	0.000	0.000	0.000
18	Sólgata 2	0.106	0.069	1020692.709	0.042	0.027	406624.648	0.007	0.004	65533.143	0.000	0.000	0.000
9	Mjallargata 1	0.146	0.094	26347076.172	0.107	0.070	19630679.928	0.070	0.046	12979692.882	0.035	0.023	6593400.136
5	Hrannargata 1	0.091	0.059	1994305.650	0.036	0.024	808860.948	0.000	0.000	0.000	0.000	0.000	0.000
14	Pólgata 4	0.095	0.062	15301399.382	0.052	0.034	8409726.567	0.018	0.012	2924357.097	0.000	0.000	0.000
12	Mánagata 3	0.041	0.027	853605.656	0.005	0.003	109264.186	0.000	0.000	0.000	0.000	0.000	0.000
23	Grænigarður 13898	0.110	0.071	4826414.192	0.078	0.051	3468791.339	0.055	0.036	2473796.274	0.035	0.023	1589305.229
4	Hafnarstræti 18	0.071	0.046	2979626.386	0.041	0.027	1730397.810	0.005	0.003	206299.825	0.000	0.000	0.000
35	Sindragata 1	0.091	0.059	8489960.559	0.056	0.037	5282084.141	0.023	0.015	2134826.357	0.000	0.000	0.000
2	Hafnarstræti 1	0.079	0.052	61098460.307	0.062	0.041	47858210.997	0.035	0.023	26958382.471	0.002	0.002	1862406.392
55	Sólgata 1	0.065	0.042	7560203.208	0.043	0.028	5051854.227	0.035	0.023	4090357.318	0.000	0.000	0.000
56	Torfnes 138842	0.057	0.037	72131308.623	0.034	0.022	43054777.555	0.020	0.013	25989536.430	0.000	0.000	0.000
13	Mánagata 4	0.030	0.020	1827712.940	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	Sundstræti 14	0.024	0.016	416613.506	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	Sólgata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Hrannargata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
34	Silfurtorg 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	Aðalstræti 9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	Mjallargata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	Sundstræti 28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
57	Torfnes 177545	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	Aðalstræti 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	Mánagata 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	Pólgata 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	Austurvegur 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	Aðalstræti 11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	Hrannargata 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Hafnarstræti 12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FID	Adress	fd2282			fd2204			fd2126			fd2048			fd1970		
22	Djúpvegur 138926	1.965	0.795	27639071.637	1.887	0.779	27071148.726	1.809	0.762	26474099.379	1.731	0.744	25840657.333	1.653	0.724	25171528.7
53	Suðurtangi 6	1.133	0.567	21866533.299	1.056	0.539	20770935.928	0.978	0.509	19622242.852	0.900	0.478	18418766.591	0.822	0.445	17158792.4
54	Suðurtangi 7	0.388	0.235	10145451.464	0.310	0.191	8266312.322	0.232	0.146	6308285.103	0.154	0.099	4269192.980	0.076	0.050	2146823.61
32	Njarðarsund 2	0.325	0.200	8789866.530	0.247	0.155	6813757.975	0.169	0.108	4755614.114	0.091	0.059	2613199.108	0.000	0.000	0
36	Sindragata 10	0.324	0.199	16541406.939	0.246	0.154	12806771.311	0.168	0.107	8917132.518	0.090	0.059	4868282.728	0.000	0.000	0
50	Suðurgata 138758	0.296	0.183	1327040.219	0.218	0.137	996374.345	0.140	0.090	652052.707	0.062	0.041	293702.946	0.000	0.000	0
28	Mjósund 1	0.291	0.180	6810313.201	0.213	0.135	5084435.983	0.135	0.087	3287341.938	0.057	0.038	1417092.830	0.000	0.000	0
30	Mjósund 3	0.290	0.180	7525542.846	0.212	0.134	5613864.886	0.134	0.087	3623312.121	0.056	0.037	1551754.482	0.000	0.000	0
45	Sindragata 8	0.285	0.177	6750358.135	0.207	0.131	5000707.439	0.129	0.083	3178934.451	0.051	0.034	1283079.898	0.000	0.000	0
46	Sindragata 9	0.282	0.175	15708027.328	0.204	0.129	11588438.603	0.126	0.081	7299131.499	0.048	0.032	2835512.072	0.000	0.000	0
40	Sindragata 15a	0.266	0.166	9416833.483	0.188	0.119	6785598.548	0.111	0.072	4081189.941	0.066	0.044	2476193.413	0.000	0.000	0
38	Sindragata 12	0.246	0.154	21138918.835	0.169	0.108	14765730.717	0.111	0.072	9829416.777	0.066	0.043	5952058.914	0.000	0.000	0
44	Sindragata 7	0.243	0.152	12310138.697	0.165	0.105	8519639.445	0.092	0.060	4883140.771	0.037	0.024	1953900.091	0.000	0.000	0
17	Suðurtangi 2	0.239	0.150	20442198.207	0.162	0.104	14124688.605	0.154	0.074	10075843.007	0.055	0.036	4934776.640	0.196	0.125	16944752.8
60	Ísafjarðarflugvöllur	0.257	0.160	36209379.070	0.189	0.120	27121634.108	0.120	0.077	17479697.308	0.047	0.031	7005770.024	0.000	0.000	0
37	Sindragata 11	0.201	0.129	44228499.254	0.140	0.090	30974869.530	0.088	0.058	19834254.588	0.045	0.029	10101902.276	0.000	0.000	0
25	Hafnarstræti 21	0.173	0.111	6835075.259	0.095	0.062	3834928.791	0.032	0.021	1290617.794	0.003	0.002	138631.270	0.000	0.000	0
51	Suðurgata 8	0.152	0.098	39738852.215	0.085	0.056	22607143.088	0.046	0.030	12374406.431	0.018	0.012	4821857.198	0.000	0.000	0
59	Ásgeirsgata 3	0.109	0.070	3887885.524	0.047	0.031	1721250.193	0.016	0.011	594173.293	0.000	0.000	0.000	0.000	0.000	0
47	Suðurgata 10	0.078	0.051	1446733.262	0.035	0.023	661426.285	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
39	Sindragata 14	0.037	0.024	3181916.479	0.002	0.002	209544.574	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
43	Sindragata 6	0.097	0.063	9945815.411	0.060	0.039	6183196.471	0.029	0.019	3016748.587	0.000	0.000	0.000	0.000	0.000	0
26	Hafnarstræti 9R	0.125	0.081	32643188.183	0.089	0.058	23399638.540	0.055	0.036	14680931.932	0.028	0.019	7575423.842	0.000	0.000	0
52	Suðurgata 9	0.074	0.048	12382017.222	0.040	0.027	6799684.717	0.009	0.006	1490137.381	0.000	0.000	0.000	0.000	0.000	0
49	Suðurgata 12	0.077	0.050	22202568.805	0.031	0.021	9129647.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
58	Ásgeirsgata 1	0.016	0.010	1316366.640	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
24	Hafnarstræti 20	0.007	0.005	130164.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
10	Mánagata 1	0.006	0.004	213970.983	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
41	Sindragata 3	0.042	0.028	2132532.353	0.014	0.009	699587.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
48	Suðurgata 11	0.002	0.001	139419.753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
11	Mánagata 2	0.019	0.013	507137.951	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
42	Sindragata 5	0.021	0.014	2228442.289	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
29	Mjósund 2	0.013	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
6	Hrannargata 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
18	Sólgata 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
9	Mjallargata 1	0.006	0.004	1189544.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
5	Hrannargata 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
14	Pólgata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
12	Mánagata 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
23	Grænigarður 13898	0.011	0.007	480162.799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
4	Hafnarstræti 18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
35	Sindragata 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2	Hafnarstræti 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
55	Sólgata 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
56	Torfnes 138842	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
13	Mánagata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
15	Sundstræti 14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
19	Sólgata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
8	Hrannargata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
34	Silfurtorg 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1	Aðalstræti 9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
27	Mjallargata 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
16	Sundstræti 28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
57	Torfnes 177545	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
21	Aðalstræti 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
31	Mánagata 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
33	Pólgata 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
20	Austurvegur 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
0	Aðalstræti 11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
7	Hrannargata 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
3	Hafnarstræti 12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0

Data damage fractions/flood depth/economic damages for 2 degree world scenario

FID	Adress	Assessed_f	value*1000	people	Year_Built	Mean_elev	fd2380			fd2339			fd2298			fd2257			fd2216
5	Djúpvegur 1389:	34750	34750000	0	1984	0.317	2.063	0.815	28305060.856	2.022	0.807	28032399.141	1.981	0.799	27751177.755	1.940	0.790	27461216.919	1.899
32	Suðurtangi 6	38550	38550000	0	1947	1.148	1.232	0.601	23170347.671	1.191	0.587	22634543.880	1.150	0.573	22084860.595	1.109	0.558	21521060.170	1.067
33	Suðurtangi 7	43250	43250000	0	1964	1.894	0.486	0.287	12397902.214	0.445	0.265	11470018.635	0.404	0.243	10521361.041	0.363	0.221	9551622.366	0.322
13	Njarðarsund 2	44000	44000000	0	1983	1.957	0.423	0.254	11159782.473	0.382	0.231	10183340.637	0.341	0.209	9185283.749	0.300	0.186	8165295.872	0.259
15	Sindragata 10	83100	83100000	0	1985	1.958	0.422	0.253	21020343.341	0.381	0.231	19174946.219	0.340	0.208	17288707.693	0.299	0.185	15361030.941	0.258
29	Suðurgata 13875	7250	7250000	0	1950	1.986	0.394	0.238	1723697.967	0.353	0.215	1560255.705	0.312	0.192	1393214.575	0.271	0.169	1222522.133	0.230
10	Mjósund 1	37750	37750000	0	1973	1.991	0.389	0.235	8880704.464	0.348	0.213	8027591.811	0.307	0.190	7155710.375	0.266	0.166	6264785.589	0.225
12	Mjósund 3	41800	41800000	0	1980	1.992	0.388	0.235	9818835.725	0.347	0.212	8873873.966	0.306	0.189	7908125.099	0.265	0.166	6921285.063	0.224
24	Sindragata 8	38150	38150000	0	1974	1.997	0.383	0.232	8849372.217	0.342	0.209	7984451.624	0.301	0.186	7100522.290	0.260	0.162	6197308.391	0.219
25	Sindragata 9	89680	89680000	0	1974	2.000	0.380	0.230	20650319.736	0.339	0.208	18613779.071	0.298	0.184	16532506.747	0.257	0.161	14405849.435	0.216
19	Sindragata 15a	56800	56800000	0	1996	2.016	0.364	0.221	12573952.625	0.323	0.198	11272961.436	0.282	0.175	9943475.862	0.241	0.151	8585083.352	0.200
17	Sindragata 12	136950	136950000	0	1995	2.036	0.344	0.211	28829811.085	0.303	0.187	25660368.256	0.262	0.164	22421751.277	0.221	0.140	19112956.123	0.180
37	Ísafjarðarflugvö	225760	225760000	0	1965	2.046	0.341	0.209	47129108.013	0.305	0.189	42566722.800	0.269	0.168	37836187.214	0.235	0.148	33348997.682	0.198
23	Sindragata 7	80850	80850000	0	1984	2.039	0.341	0.209	16859054.899	0.300	0.185	14984367.858	0.259	0.162	13068882.893	0.218	0.137	11111822.361	0.177
4	Suðurtangi 2	136076	136076000	5	1964	2.043	0.337	0.207	28112213.350	0.296	0.183	24951315.636	0.255	0.160	21721513.608	0.214	0.135	18421814.318	0.173
16	Sindragata 11	343950	343950000	0	1986	2.080	0.300	0.185	63726846.332	0.259	0.162	55577416.919	0.218	0.137	47283327.668	0.181	0.115	39703546.918	0.149
8	Hafnarstræti 21	61750	61750000	0	1979	2.109	0.271	0.169	10437457.805	0.230	0.145	8952619.919	0.189	0.120	7435787.583	0.148	0.095	5886503.897	0.107
30	Suðurgata 8	406150	406150000	0	1980	2.130	0.250	0.157	63691132.142	0.209	0.133	53817814.128	0.168	0.108	43732524.878	0.127	0.082	33432259.434	0.093
36	Ásgeirsgata 3	55200	55200000	0	1972	2.173	0.207	0.131	7217802.931	0.166	0.106	5845042.058	0.125	0.080	4443033.433	0.085	0.055	3046992.866	0.054
9	Hafnarstræti 9R	404450	404450000	0	2001	2.301	0.171	0.109	44083642.865	0.151	0.097	39249988.787	0.132	0.085	34463970.978	0.113	0.073	29711027.039	0.095
22	Sindragata 6	157450	157450000	0	1990	2.294	0.146	0.094	14792916.475	0.126	0.081	12815481.115	0.105	0.068	10771879.288	0.086	0.056	8829620.524	0.066
28	Suðurgata 12	441100	441100000	0	1954	2.313	0.134	0.086	38046701.687	0.111	0.072	31684157.432	0.087	0.057	24962342.746	0.061	0.040	17712958.235	0.037
31	Suðurgata 9	255550	255550000	0	1947	2.305	0.118	0.076	19498695.875	0.098	0.064	16291059.925	0.081	0.053	13514110.349	0.063	0.041	10500079.531	0.045
26	Suðurgata 10	28200	28200000	0	1956	2.274	0.118	0.076	2150569.468	0.095	0.062	1745446.025	0.082	0.053	1504319.690	0.072	0.047	1331264.339	0.045
18	Sindragata 14	130500	130500000	0	1997	2.290	0.090	0.059	7663162.539	0.061	0.040	5212473.805	0.044	0.029	3753254.258	0.025	0.017	2168721.026	0.007
20	Sindragata 3	76750	76750000	0	1987	2.347	0.086	0.056	4288510.620	0.063	0.041	3168191.633	0.048	0.032	2426794.673	0.033	0.022	1666397.161	0.015
11	Mjósund 2	0	0	0	1949	2.450	0.084	0.055	0.000	0.043	0.028	0.000	0.019	0.013	0.000	0.003	0.002	0.000	0.000
3	Mánagata 2	40280	40280000	4	1889	2.405	0.068	0.044	1785703.654	0.048	0.031	1261913.536	0.027	0.018	707416.256	0.009	0.006	234007.742	0.000
35	Ásgeirsgata 1	127200	127200000	0	1975	2.318	0.067	0.044	5588017.043	0.042	0.028	3543764.213	0.023	0.015	1956489.989	0.005	0.003	411972.668	0.000
21	Sindragata 5	162250	162250000	0	1980	2.431	0.057	0.038	6086206.293	0.041	0.027	4392592.283	0.026	0.017	2761496.837	0.013	0.009	1425985.696	0.000
7	Hafnarstræti 20	28150	28150000	0	1913	2.325	0.056	0.037	1028229.473	0.030	0.020	566340.683	0.012	0.008	224303.307	0.000	0.000	0.000	0.000
2	Mánagata 1	51000	51000000	3	1963	2.338	0.052	0.034	1741306.030	0.027	0.018	902677.628	0.013	0.009	440616.233	0.000	0.000	0.000	0.000
1	Mjallargata 1	281450	281450000	18	1988	2.493	0.044	0.029	8205595.479	0.026	0.017	4846699.903	0.011	0.007	1994100.668	0.000	0.000	0.000	0.000
6	Grænigarður 13!	67800	67800000	0	1982	2.625	0.041	0.027	1839533.574	0.026	0.017	1171674.359	0.011	0.007	496378.272	0.000	0.000	0.000	0.000
27	Suðurgata 11	130300	130300000	0	1984	2.354	0.037	0.024	3176195.616	0.023	0.015	1983932.796	0.008	0.005	689595.012	0.000	0.000	0.000	0.000
0	Hafnarstræti 1	1181250	1181250000	7	1986	2.634	0.012	0.008	9450102.805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	Sindragata 1	142900	142900000	0	1969	2.796	0.006	0.004	577238.808	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
34	Sólgata 1	177900	177900000	0	1993	2.639	0.000	0.000	19453.397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Data loss of life for 1 metre global sea-level rise

FID	Adress	Prop_value	Number_inh	Year_Built	Mean_elev	fd2999	lof 2999	pa 2999	fd2888	lof 2888	pa 2888	fd2786	lof 2786	pa 2786	fd2684	lof 2684	pa 2684
45	Djúpvegur 1	7530	0	1984	0.317	2.68	0.06864	0.00	2.57	0.06	0.00	2.47	0.05	0.00	2.37	0.04	0.00
83	Suðurtangi 6	5430	0	1947	1.148	1.85	0.02058	0.00	1.74	0.02	0.00	1.64	0.02	0.00	1.54	0.01	0.00
84	Suðurtangi 7	9280	0	1964	1.894	1.10	0.00699	0.00	0.99	0.01	0.00	0.89	0.01	0.00	0.79	0.00	0.00
60	Njarðarsund	9560	0	1983	1.957	1.04	0.00638	0.00	0.93	0.01	0.00	0.83	0.00	0.00	0.73	0.00	0.00
65	Sindragata 1	18050	0	1985	1.958	1.04	0.00637	0.00	0.93	0.01	0.00	0.83	0.00	0.00	0.73	0.00	0.00
80	Suðurgata 1	3147	0	1950	1.986	1.01	0.00611	0.00	0.90	0.01	0.00	0.80	0.00	0.00	0.70	0.00	0.00
56	Mjósund 1	8120	0	1973	1.991	1.01	0.00607	0.00	0.90	0.01	0.00	0.80	0.00	0.00	0.69	0.00	0.00
58	Mjósund 3	9040	0	1980	1.992	1.01	0.00607	0.00	0.90	0.01	0.00	0.79	0.00	0.00	0.69	0.00	0.00
74	Sindragata 8	8240	0	1974	1.997	1.00	0.00602	0.00	0.89	0.01	0.00	0.79	0.00	0.00	0.69	0.00	0.00
75	Sindragata 9	19296	0	1974	2.000	1.00	0.00599	0.00	0.89	0.01	0.00	0.79	0.00	0.00	0.68	0.00	0.00
69	Sindragata 1	12450	0	1996	2.016	0.98	0.00585	0.00	0.87	0.00	0.00	0.77	0.00	0.00	0.67	0.00	0.00
67	Sindragata 1	30090	0	1995	2.036	0.96	0.00569	0.00	0.85	0.00	0.00	0.75	0.00	0.00	0.65	0.00	0.00
73	Sindragata 7	17550	0	1984	2.039	0.96	0.00566	0.00	0.85	0.00	0.00	0.75	0.00	0.00	0.64	0.00	0.00
35	Suðurtangi 2	47053	5	1964	2.043	0.96	0.00563	0.03	0.85	0.00	0.02	0.74	0.00	0.02	0.64	0.00	0.02
91	Ísafjarðarflu	47805	0	1965	2.046	0.95	0.00560	0.00	0.84	0.00	0.00	0.74	0.00	0.00	0.64	0.00	0.00
66	Sindragata 1	74850	0	1986	2.080	0.92	0.00533	0.00	0.81	0.00	0.00	0.71	0.00	0.00	0.60	0.00	0.00
49	Hafnarstræti	13900	0	1979	2.109	0.89	0.00512	0.00	0.78	0.00	0.00	0.68	0.00	0.00	0.58	0.00	0.00
81	Suðurgata 8	85070	0	1980	2.130	0.87	0.00497	0.00	0.76	0.00	0.00	0.66	0.00	0.00	0.55	0.00	0.00
90	Ásgeirsgata	11800	0	1972	2.173	0.83	0.00466	0.00	0.71	0.00	0.00	0.61	0.00	0.00	0.51	0.00	0.00
77	Suðurgata 1	6030	0	1956	2.274	0.73	0.00403	0.00	0.61	0.00	0.00	0.51	0.00	0.00	0.41	0.00	0.00
68	Sindragata 1	29080	0	1997	2.290	0.71	0.00394	0.00	0.60	0.00	0.00	0.50	0.00	0.00	0.39	0.00	0.00
72	Sindragata 6	33930	0	1990	2.294	0.70	0.00391	0.00	0.59	0.00	0.00	0.49	0.00	0.00	0.39	0.00	0.00
51	Hafnarstræti	92090	0	2001	2.301	0.70	0.00387	0.00	0.59	0.00	0.00	0.48	0.00	0.00	0.38	0.00	0.00
82	Suðurgata 9	53060	0	1947	2.305	0.69	0.00385	0.00	0.58	0.00	0.00	0.48	0.00	0.00	0.38	0.00	0.00
79	Suðurgata 1	93970	0	1954	2.313	0.69	0.00381	0.00	0.57	0.00	0.00	0.47	0.00	0.00	0.37	0.00	0.00
89	Ásgeirsgata	27400	0	1975	2.318	0.68	0.00378	0.00	0.57	0.00	0.00	0.47	0.00	0.00	0.37	0.00	0.00
48	Hafnarstræti	5970	0	1913	2.325	0.67	0.00374	0.00	0.56	0.00	0.00	0.46	0.00	0.00	0.36	0.00	0.00
25	Mánagata 1	23940	3	1963	2.338	0.66	0.00367	0.01	0.55	0.00	0.01	0.45	0.00	0.01	0.35	0.00	0.01
70	Sindragata 3	15650	0	1987	2.347	0.65	0.00362	0.00	0.54	0.00	0.00	0.44	0.00	0.00	0.36	0.00	0.00
78	Suðurgata 11	28300	0	1984	2.354	0.65	0.00359	0.00	0.53	0.00	0.00	0.43	0.00	0.00	0.33	0.00	0.00
26	Mánagata 2	18903	4	1889	2.405	0.59	0.00333	0.01	0.48	0.00	0.01	0.38	0.00	0.01	0.28	0.00	0.01
71	Sindragata 5	35200	0	1980	2.431	0.57	0.00321	0.00	0.46	0.00	0.00	0.36	0.00	0.00	0.25	0.00	0.00
57	Mjósund 2	538	0	1949	2.450	0.55	0.00312	0.00	0.44	0.00	0.00	0.34	0.00	0.00	0.23	0.00	0.00
18	Hrannargata	19394	7	1906	2.468	0.53	0.00304	0.02	0.42	0.00	0.02	0.32	0.00	0.02	0.22	0.00	0.01
36	Sólgata 2	7490	1	1902	2.488	0.51	0.00295	0.00	0.40	0.00	0.00	0.30	0.00	0.00	0.20	0.00	0.00
23	Mjallargata 1	107170	18	1988	2.493	0.51	0.00293	0.05	0.40	0.00	0.04	0.29	0.00	0.04	0.19	0.00	0.03
16	Hrannargata	16855	4	1909	2.503	0.50	0.00289	0.01	0.39	0.00	0.01	0.28	0.00	0.01	0.18	0.00	0.01
31	Pollgata 4	94870	22	1990	2.504	0.50	0.00289	0.06	0.38	0.00	0.05	0.28	0.00	0.05	0.18	0.00	0.04
27	Mánagata 3	14445	3	1927	2.561	0.44	0.00266	0.01	0.33	0.00	0.01	0.22	0.00	0.01	0.12	0.00	0.01
11	Hafnarstræti	23120	2	1906	2.574	0.42	0.00261	0.01	0.31	0.00	0.00	0.21	0.00	0.00	0.12	0.00	0.00
46	Grænigarður	14700	0	1982	2.625	0.37	0.00242	0.00	0.26	0.00	0.00	0.20	0.00	0.00	0.15	0.00	0.00
8	Hafnarstræti	258710	7	1986	2.634	0.36	0.00239	0.02	0.26	0.00	0.01	0.17	0.00	0.01	0.12	0.00	0.01
85	Sólgata 1	38800	0	1993	2.639	0.36	0.00237	0.00	0.25	0.00	0.00	0.16	0.00	0.00	0.10	0.00	0.00
28	Mánagata 4	19390	7	1928	2.663	0.34	0.00229	0.02	0.23	0.00	0.01	0.12	0.00	0.01	0.07	0.00	0.01
37	Sólgata 4	6726	2	1908	2.671	0.33	0.00227	0.00	0.22	0.00	0.00	0.12	0.00	0.00	0.03	0.00	0.00
20	Hrannargata	16620	5	1930	2.673	0.33	0.00226	0.01	0.21	0.00	0.01	0.11	0.00	0.01	0.03	0.00	0.01
32	Sundstræti 1	11223	6	1930	2.676	0.32	0.00225	0.01	0.21	0.00	0.01	0.12	0.00	0.01	0.06	0.00	0.01
63	Silfurtorg 2	51300	0	1979	2.711	0.29	0.00214	0.00	0.18	0.00	0.00	0.08	0.00	0.00	0.03	0.00	0.00
64	Sindragata 1	30650	0	1969	2.796	0.25	0.00202	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.13	0.00	0.00
86	Torfnes 1388	420100	0	1982	3.309	0.24	0.00199	0.00	0.18	0.00	0.00	0.13	0.00	0.00	0.09	0.00	0.00
59	Mánagata 5	14150	0	1897	2.783	0.22	0.00193	0.00	0.11	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
19	Hrannargata	12815	5	1898	2.786	0.21	0.00192	0.01	0.10	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00
21	Hrannargata	9325	2	1898	2.801	0.20	0.00188	0.00	0.09	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
6	Aðalstræti 9	10215	5	1919	2.830	0.20	0.00187	0.01	0.12	0.00	0.01	0.07	0.00	0.01	0.03	0.00	0.00
9	Hafnarstræti	19424	3	1926	2.809	0.19	0.00186	0.01	0.08	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
53	Mjallargata 4	6920	0	1885	2.835	0.18	0.00183	0.00	0.12	0.00	0.00	0.07	0.00	0.00	0.03	0.00	0.00
88	Torfnes 1775	32400	0	1997	2.884	0.17	0.00181	0.00	0.11	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00
40	Austurvegur	16640	0	1924	2.845	0.15	0.00176	0.00	0.10	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
10	Hafnarstræti	19527	9	1927	2.847	0.15	0.00175	0.02	0.05	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
61	Pólgata 1	32550	0	1959	2.878	0.15	0.00175	0.00	0.07	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
44	Aðalstræti 7	30700	0	1907	2.959	0.14	0.00173	0.00	0.09	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00
34	Sundstræti 2	23550	10	1969	3.004	0.13	0.00169	0.02	0.08	0.00	0.02	0.05	0.00	0.02	0.01	0.00	0.00
33	Sundstræti 2	30710	8	1964	3.040	0.12	0.00169	0.01	0.07	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00
1	Aðalstræti 1	12790	7	1904	2.901	0.12	0.00168	0.01	0.09	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.00
29	Mánagata 6	7090	4	1965	2.887	0.12	0.00167	0.01	0.05	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00
14	Hafnarstræti	44330	11	1960	2.886	0.11	0.00166	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
2	Aðalstræti 1	18816	6	1885	2.916	0.11	0.00165	0.01	0.09	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00
22	Hrannargata	14895	2	1920	2.896	0.10	0.00164	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	Mjallargata 5	4220	0	1856	2.910	0.10	0.00162	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38	Sólgata 5	19196	5	1903	2.909	0.09	0.00161	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
24	Mjallargata 8	8426	1	1924	2.920	0.09	0.00160	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	Hafnarstræti	4460	0	1943	2.921	0.08	0.00158	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	Aðalstræti 2	14310	0	1916	2.946	0.06	0.00154	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	Mánagata 9	12515	3	1898	2.975	0.05	0.00151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	Pólgata 2	8120	0	1943	2.984	0.04	0.00149	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Fjarðarstræt	11670	3	1881	2.980	0.04	0.00149	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41	Austurvegur	32750	0	1931	2.970	0.03	0.00148	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Hrannargata	8703	7	1928	2.976	0.03	0.00147	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Aðalstræti 2	10826	3	1927	2.986	0.03	0.00147	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Aðalstræti 8	11803	3	1933	2.996	0.03	0.00146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Aðalstræti 1	28759	8	1870	2.996	0.03	0.00146	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	Mjallargata 6	8519	0	1897	2.997	0.02	0.00146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	Sundstræti 1	6268	0	1898	2.995	0.02	0.00146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Hafnarstræti	21422	6	1928	2.977	0.02	0.00146	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Torfnes 1388	12200	0	1979	3.774	0.02	0.00144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39	Sólgata 7	8492	7	1903	2.999	0.02	0.00144	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	Hafnarstræti	20645	0	1928	3.026	0.02	0.00144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Hafnarstræti	25364	8	1927	2.998	0.02	0.00144	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	Hafnarstræti	28535	7	1928	2.997	0.01	0.00144	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52	Hrannargata	11240	0	1903	2.999	0.01	0.00143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	Aðalstræti 1	26727	0	1956	3.000	0.01	0.00143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Austurvegur	16763	8	1928	3.138	0.00	0.00000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FID	fd2582	lof 2582	pa 2582	fd2480	lof 2480	pa 2480	fd2378	lof 2378	pa 2378	fd2276	lof 2276	pa 2276	fd2174	lof 2174	pa 2174	fd2072	lof 2072	pa 2072	fd1970	lof 1970	pa 1970
45	2.26	0.04	0.00	2.16	0.03	0.00	2.06	0.03	0.00	1.96	0.02	0.00	1.86	0.02	0.00	1.75	0.02	0.00	1.65	0.0	0.0
83	1.43	0.01	0.00	1.33	0.01	0.00	1.23	0.01	0.00	1.13	0.01	0.00	1.03	0.01	0.00	0.92	0.01	0.00	0.82	0.0	0.0
84	0.69	0.00	0.00	0.59	0.00	0.00	0.48	0.00	0.00	0.38	0.00	0.00	0.28	0.00	0.00	0.18	0.00	0.00	0.08	0.0	0.0
60	0.63	0.00	0.00	0.52	0.00	0.00	0.42	0.00	0.00	0.32	0.00	0.00	0.22	0.00	0.00	0.12	0.00	0.00	0.00	0.0	0.0
65	0.62	0.00	0.00	0.52	0.00	0.00	0.42	0.00	0.00	0.32	0.00	0.00	0.22	0.00	0.00	0.11	0.00	0.00	0.00	0.0	0.0
80	0.60	0.00	0.00	0.49	0.00	0.00	0.39	0.00	0.00	0.29	0.00	0.00	0.19	0.00	0.00	0.09	0.00	0.00	0.00	0.0	0.0
56	0.59	0.00	0.00	0.49	0.00	0.00	0.39	0.00	0.00	0.29	0.00	0.00	0.18	0.00	0.00	0.08	0.00	0.00	0.00	0.0	0.0
58	0.59	0.00	0.00	0.49	0.00	0.00	0.39	0.00	0.00	0.28	0.00	0.00	0.18	0.00	0.00	0.08	0.00	0.00	0.00	0.0	0.0
74	0.59	0.00	0.00	0.48	0.00	0.00	0.38	0.00	0.00	0.28	0.00	0.00	0.18	0.00	0.00	0.08	0.00	0.00	0.00	0.0	0.0
75	0.58	0.00	0.00	0.48	0.00	0.00	0.38	0.00	0.00	0.28	0.00	0.00	0.17	0.00	0.00	0.07	0.00	0.00	0.00	0.0	0.0
69	0.57	0.00	0.00	0.46	0.00	0.00	0.36	0.00	0.00	0.26	0.00	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.00	0.0	0.0
67	0.55	0.00	0.00	0.44	0.00	0.00	0.34	0.00	0.00	0.24	0.00	0.00	0.14	0.00	0.00	0.08	0.00	0.00	0.00	0.0	0.0
73	0.54	0.00	0.00	0.44	0.00	0.00	0.34	0.00	0.00	0.24	0.00	0.00	0.14	0.00	0.00	0.05	0.00	0.00	0.00	0.0	0.0
35	0.54	0.00	0.02	0.44	0.00	0.01	0.34	0.00	0.01	0.23	0.00	0.01	0.14	0.00	0.01	0.07	0.00	0.01	0.20	0.0	0.0
91	0.54	0.00	0.00	0.43	0.00	0.00	0.34	0.00	0.00	0.25	0.00	0.00	0.16	0.00	0.00	0.07	0.00	0.00	0.00	0.0	0.0
66	0.50	0.00	0.00	0.40	0.00	0.00	0.30	0.00	0.00	0.20	0.00	0.00	0.12	0.00	0.00	0.06	0.00	0.00	0.00	0.0	0.0
49	0.47	0.00	0.00	0.37	0.00	0.00	0.27	0.00	0.00	0.17	0.00	0.00	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.0	0.0
81	0.45	0.00	0.00	0.35	0.00	0.00	0.25	0.00	0.00	0.15	0.00	0.00	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.0	0.0
90	0.41	0.00	0.00	0.31	0.00	0.00	0.20	0.00	0.00	0.10	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
77	0.31	0.00	0.00	0.21	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
68	0.29	0.00	0.00	0.19	0.00	0.00	0.09	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
72	0.29	0.00	0.00	0.20	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.0	0.0
51	0.28	0.00	0.00	0.22	0.00	0.00	0.17	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00	0.04	0.00	0.00	0.00	0.0	0.0
82	0.28	0.00	0.00	0.18	0.00	0.00	0.12	0.00	0.00	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
79	0.27	0.00	0.00	0.17	0.00	0.00	0.13	0.00	0.00	0.07	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
89	0.26	0.00	0.00	0.16	0.00	0.00	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
48	0.26	0.00	0.00	0.15	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
25	0.24	0.00	0.01	0.14	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
70	0.26	0.00	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
78	0.23	0.00	0.00	0.13	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
26	0.18	0.00	0.01	0.10	0.00	0.01	0.07	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
71	0.16	0.00	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
57	0.25	0.00	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
18	0.11	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
36	0.09	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
23	0.14	0.00	0.03	0.09	0.00	0.03	0.04	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
16	0.08	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
31	0.09	0.00	0.04	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
27	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
11	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
46	0.10	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
8	0.07	0.00	0.01	0.05	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
85	0.06	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
28	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
32	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
64	0.09	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
86	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0

Data loss of life for 3 degree world scenario

FID	Adress	Prop_value	Number_inh	Year_Built	Mean_elev	fd2750	lof 2750	pa 2750	fd2672	lof 2672	pa 2672	fd2594	lof 2594	pa 2594	fd2516	lof 2516	pa 2516	fd2438	lof 2438	pa 2438	fd2360	lof 2360	pa 2360	fd2282	lof 2283	pa 2283	fd2204	lof 2204	pa 2204	fd2126	lof 2126	pa 2126	fd2048	lof 2048	pa 2048	fd1970	lof 1970	pa 1970
22	Djúpvegur 1	7530	0	1984	0.317	2.43	0.04784	0.00	2.35	0.04	0.00	2.28	0.04	0.00	2.20	0.03	0.00	2.12	0.03	0.00	2.04	0.03	0.00	1.96	0.02	0.00	1.89	0.02	0.00	1.81	0.02	0.00	1.73	0.02	0.00	1.65	0.02	0.00
53	Suðurtangi 6	5430	0	1947	1.148	1.60	0.01435	0.00	1.52	0.01	0.00	1.45	0.01	0.00	1.37	0.01	0.00	1.29	0.01	0.00	1.21	0.01	0.00	1.13	0.01	0.00	1.06	0.01	0.00	0.98	0.01	0.00	0.90	0.01	0.00	0.82	0.00	0.00
54	Suðurtangi 7	9280	0	1964	1.894	0.86	0.00487	0.00	0.78	0.00	0.00	0.70	0.00	0.00	0.62	0.00	0.00	0.54	0.00	0.00	0.47	0.00	0.00	0.39	0.00	0.00	0.31	0.00	0.00	0.23	0.00	0.00	0.15	0.00	0.00	0.08	0.00	0.00
32	Njarðarsund	9560	0	1983	1.957	0.79	0.00445	0.00	0.72	0.00	0.00	0.64	0.00	0.00	0.56	0.00	0.00	0.48	0.00	0.00	0.40	0.00	0.00	0.33	0.00	0.00	0.25	0.00	0.00	0.17	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
36	Sindragata 1	18050	0	1985	1.958	0.79	0.00444	0.00	0.71	0.00	0.00	0.64	0.00	0.00	0.56	0.00	0.00	0.48	0.00	0.00	0.40	0.00	0.00	0.32	0.00	0.00	0.25	0.00	0.00	0.17	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
50	Suðurgata 13	3147	0	1950	1.986	0.76	0.00426	0.00	0.69	0.00	0.00	0.61	0.00	0.00	0.53	0.00	0.00	0.45	0.00	0.00	0.37	0.00	0.00	0.30	0.00	0.00	0.22	0.00	0.00	0.14	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
28	Mjósund 1	8120	0	1973	1.991	0.76	0.00423	0.00	0.68	0.00	0.00	0.60	0.00	0.00	0.53	0.00	0.00	0.45	0.00	0.00	0.37	0.00	0.00	0.29	0.00	0.00	0.21	0.00	0.00	0.14	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
30	Mjósund 3	9040	0	1980	1.992	0.76	0.00423	0.00	0.68	0.00	0.00	0.60	0.00	0.00	0.52	0.00	0.00	0.45	0.00	0.00	0.37	0.00	0.00	0.29	0.00	0.00	0.21	0.00	0.00	0.13	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
45	Sindragata 8	8240	0	1974	1.997	0.75	0.00420	0.00	0.68	0.00	0.00	0.60	0.00	0.00	0.52	0.00	0.00	0.44	0.00	0.00	0.36	0.00	0.00	0.29	0.00	0.00	0.21	0.00	0.00	0.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
46	Sindragata 9	19296	0	1974	2.000	0.75	0.00418	0.00	0.67	0.00	0.00	0.59	0.00	0.00	0.52	0.00	0.00	0.44	0.00	0.00	0.36	0.00	0.00	0.28	0.00	0.00	0.20	0.00	0.00	0.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
40	Sindragata 1	12450	0	1996	2.016	0.73	0.00408	0.00	0.66	0.00	0.00	0.58	0.00	0.00	0.50	0.00	0.00	0.42	0.00	0.00	0.34	0.00	0.00	0.27	0.00	0.00	0.19	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
38	Sindragata 1	30090	0	1995	2.036	0.71	0.00397	0.00	0.64	0.00	0.00	0.56	0.00	0.00	0.48	0.00	0.00	0.40	0.00	0.00	0.32	0.00	0.00	0.25	0.00	0.00	0.17	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
44	Sindragata 7	17550	0	1984	2.039	0.71	0.00395	0.00	0.63	0.00	0.00	0.55	0.00	0.00	0.48	0.00	0.00	0.40	0.00	0.00	0.32	0.00	0.00	0.24	0.00	0.00	0.16	0.00	0.00	0.09	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
17	Suðurtangi 2	47053	5	1964	2.043	0.71	0.00393	0.02	0.63	0.00	0.02	0.55	0.00	0.02	0.47	0.00	0.01	0.40	0.00	0.01	0.32	0.00	0.01	0.24	0.00	0.01	0.16	0.00	0.01	0.11	0.00	0.01	0.06	0.00	0.01	0.20	0.00	0.01
60	Ísafjarðarflug	47805	0	1965	2.046	0.70	0.00391	0.00	0.63	0.00	0.00	0.55	0.00	0.00	0.47	0.00	0.00	0.39	0.00	0.00	0.32	0.00	0.00	0.26	0.00	0.00	0.19	0.00	0.00	0.12	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
37	Sindragata 1	74850	0	1986	2.080	0.67	0.00372	0.00	0.59	0.00	0.00	0.51	0.00	0.00	0.44	0.00	0.00	0.36	0.00	0.00	0.28	0.00	0.00	0.20	0.00	0.00	0.14	0.00	0.00	0.09	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
25	Hafnarstræti	13900	0	1979	2.109	0.64	0.00357	0.00	0.56	0.00	0.00	0.49	0.00	0.00	0.41	0.00	0.00	0.33	0.00	0.00	0.25	0.00	0.00	0.17	0.00	0.00	0.10	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	Suðurgata 8	85070	0	1980	2.130	0.62	0.00346	0.00	0.54	0.00	0.00	0.46	0.00	0.00	0.39	0.00	0.00	0.31	0.00	0.00	0.23	0.00	0.00	0.15	0.00	0.00	0.09	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
59	Ásgeirsgata	11800	0	1972	2.173	0.58	0.00325	0.00	0.50	0.00	0.00	0.42	0.00	0.00	0.34	0.00	0.00	0.26	0.00	0.00	0.19	0.00	0.00	0.11	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	Suðurgata 10	6030	0	1956	2.274	0.48	0.00281	0.00	0.40	0.00	0.00	0.32	0.00	0.00	0.24	0.00	0.00	0.16	0.00	0.00	0.11	0.00	0.00	0.08	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39	Sindragata 1	29080	0	1997	2.290	0.46	0.00274	0.00	0.38	0.00	0.00	0.30	0.00	0.00	0.23	0.00	0.00	0.15	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	Sindragata 6	33930	0	1990	2.294	0.46	0.00273	0.00	0.38	0.00	0.00	0.30	0.00	0.00	0.23	0.00	0.00	0.17	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Hafnarstræti	92090	0	2001	2.301	0.45	0.00270	0.00	0.37	0.00	0.00	0.29	0.00	0.00	0.24	0.00	0.00	0.20	0.00	0.00	0.16	0.00	0.00	0.12	0.00	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
52	Suðurgata 9	53060	0	1947	2.305	0.45	0.00269	0.00	0.37	0.00	0.00	0.29	0.00	0.00	0.21	0.00	0.00	0.15	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	Suðurgata 12	93970	0	1954	2.313	0.44	0.00265	0.00	0.36	0.00	0.00	0.28	0.00	0.00	0.20	0.00	0.00	0.15	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	Ásgeirsgata	27400	0	1975	2.318	0.43	0.00264	0.00	0.35	0.00	0.00	0.28	0.00	0.00	0.20	0.00	0.00	0.12	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Hafnarstræti	5970	0	1913	2.325	0.42	0.00261	0.00	0.35	0.00	0.00	0.27	0.00	0.00	0.19	0.00	0.00	0.11	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Mánagata 1	23940	3	1963	2.338	0.41	0.00256	0.01	0.33	0.00	0.01	0.26	0.00	0.01	0.18	0.00	0.01	0.10	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41	Sindragata 3	15650	0	1987	2.347	0.41	0.00255	0.00	0.35	0.00	0.00	0.27	0.00	0.00	0.19	0.00	0.00	0.13	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	Suðurgata 11	28300	0	1984	2.354	0.40	0.00250	0.00	0.32	0.00	0.00	0.24	0.00	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	Mánagata 2	18903	4	1889	2.405	0.35	0.00232	0.01	0.27	0.00	0.01	0.19	0.00	0.01	0.12	0.00	0.01	0.09	0.00	0.01	0.06	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	Sindragata 5	35200	0	1980	2.431	0.32	0.00224	0.00	0.24	0.00	0.00	0.16	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	Mjósund 2	538	0	1949	2.450	0.30	0.00218	0.00	0.22	0.00	0.00	0.24	0.00	0.00	0.19	0.00	0.00	0.12	0.00	0.00	0.06	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Hrannargata	19394	7	1906	2.468	0.28	0.00212	0.01	0.20	0.00	0.01	0.13	0.00	0.01	0.05	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Sólgata 2	7490	1	1902	2.488	0.26	0.00206	0.00	0.18	0.00	0.00	0.11	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Mjallargata 1	107170	18	1988	2.493	0.26	0.00204	0.04	0.19	0.00	0.03	0.15	0.00	0.03	0.11	0.00	0.03	0.07	0.00	0.03	0.04	0.00	0.03	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Hrannargata	16895	4	1909	2.503	0.25	0.00202	0.01	0.17	0.00	0.01	0.09	0.00	0.01	0.04	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Pollgata 4	94870	22	1990	2.504	0.25	0.00201	0.04	0.17	0.00	0.04	0.09	0.00	0.04	0.05	0.00	0.03	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Mánagata 3	14445	3	1927	2.561	0.19	0.00185	0.01	0.11	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Grænigarður	14700	0	1982	2.625	0.18	0.00183	0.00	0.14	0.00	0.00	0.11	0.00	0.00	0.08	0.00	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Hafnarstræti	23120	2	1906	2.574	0.18	0.00182	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	Sindragata 1	30650	0	1969	2.796	0.16	0.00178	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Hafnarstræti	258710	7	1986	2.634	0.15	0.00175	0.01	0.11	0.00	0.01	0.08	0.00	0.01	0.06	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	Sólgata 1	38800	0	1993	2.639	0.14	0.00172	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	Torfnes 1388	420100	0	1982	3.309	0.12	0.00167	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	Mánagata 4	19390	7	1928	2.663	0.10	0.00163	0.01	0.07	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Sundstræti 1	11223	6	1930	2.676	0.10	0.00162	0.01	0.06	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Sólgata 4	6726	2	1908	2.671	0.08	0.00158	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Hrannargata	16620	5	1930	2.673	0.08	0.00157	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	Silfurtorg 2	51300	0	1979	2.711	0.06	0.00153	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	Aðalstræti 9	10215	5	1919	2.830	0.05	0.00152	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	Mjallargata 4	6920	0	1885	2.835	0.05	0.00151	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	Sundstræti 2	23550	10	1969	3.004	0.05	0.00151	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57	Torfnes 1775	32400	0	1997	2.884	0.04	0.00150	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Aðalstræti 7	30700	0	1907	2.959	0.03	0.00146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	Mánagata 5	14150	0	1897	2.783	0.02	0.00144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	Pólgata 1	32550	0	1959	2.878	0.01	0.00144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Austurvegur	16640	0	1924	2.845	0.01	0.00143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Aðalstræti 1	12790	7	1904	2.901	0.01	0.00143	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Hrannargata	12815	5	1898	2.786	0.01	0.00142	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Hafnarstræti	19424	3	1926	2.809	0.01	0.00142	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Data loss of life for 2 degree world scenario

FID	Adress	Prop_value	Number_inh	Year_Built	Mean_elev	fd2380		lof 2380	pa 2380	fd2339	lof 2339	pa 2339	fd2298	lof 2298	pa 2298	fd2257	lof 2257	pa 2257	fd2216	lof 2216	pa 2216	fd2175	lof 2175	pa 2175	fd2134	lof 2134	pa 2134	fd2093	lof 2093	pa 2093	fd2052	lof 2052	pa 2052	fd2011	lof 2011	pa 2011	fd1970	lof 1970	pa 1970
5	Djúpvegur 1	7530	0	1984	0.317	2.06	0.03	0.02799	0.00	2.02	0.03	0.00	1.98	0.02	0.00	1.94	0.02	0.00	1.90	0.02	0.00	1.86	0.02	0.00	1.82	0.02	0.00	1.78	0.02	0.00	1.73	0.02	0.00	1.69	0.02	0.00	1.65	0.02	0.00
32	Suðurtangi 6	5430	0	1947	1.148	1.23	0.01	0.00839	0.00	1.19	0.01	0.00	1.15	0.01	0.00	1.11	0.01	0.00	1.07	0.01	0.00	1.03	0.01	0.00	0.99	0.01	0.00	0.94	0.01	0.00	0.90	0.01	0.00	0.86	0.00	0.00	0.82	0.00	0.00
33	Suðurtangi 7	9280	0	1964	1.894	0.49	0.00	0.00285	0.00	0.44	0.00	0.00	0.40	0.00	0.00	0.36	0.00	0.00	0.32	0.00	0.00	0.28	0.00	0.00	0.24	0.00	0.00	0.20	0.00	0.00	0.16	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00
13	Njarðarsund	9560	0	1983	1.957	0.42	0.00	0.00260	0.00	0.38	0.00	0.00	0.34	0.00	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
15	Sindragata 1	18050	0	1985	1.958	0.42	0.00	0.00260	0.00	0.38	0.00	0.00	0.34	0.00	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
29	Suðurgata 1	3147	0	1950	1.986	0.39	0.00	0.00249	0.00	0.35	0.00	0.00	0.31	0.00	0.00	0.27	0.00	0.00	0.23	0.00	0.00	0.19	0.00	0.00	0.15	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
10	Mjósund 1	8120	0	1973	1.991	0.39	0.00	0.00248	0.00	0.35	0.00	0.00	0.31	0.00	0.00	0.27	0.00	0.00	0.23	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
12	Mjósund 3	9040	0	1980	1.992	0.39	0.00	0.00247	0.00	0.35	0.00	0.00	0.31	0.00	0.00	0.27	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
24	Sindragata 8	8240	0	1974	1.997	0.38	0.00	0.00245	0.00	0.34	0.00	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25	Sindragata 9	19296	0	1974	2.000	0.38	0.00	0.00244	0.00	0.34	0.00	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.17	0.00	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
19	Sindragata 1	12450	0	1996	2.016	0.36	0.00	0.00239	0.00	0.32	0.00	0.00	0.28	0.00	0.00	0.24	0.00	0.00	0.20	0.00	0.00	0.16	0.00	0.00	0.12	0.00	0.00	0.09	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
17	Sindragata 1	30090	0	1995	2.036	0.34	0.00	0.00232	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.12	0.00	0.00	0.09	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
37	Ísafjarðarflu	47805	0	1965	2.046	0.34	0.00	0.00231	0.00	0.31	0.00	0.00	0.27	0.00	0.00	0.24	0.00	0.00	0.20	0.00	0.00	0.16	0.00	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
23	Sindragata 7	17550	0	1984	2.039	0.34	0.00	0.00231	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.14	0.00	0.00	0.10	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
4	Suðurtangi 2	47053	5	1964	2.043	0.34	0.00	0.00230	0.01	0.30	0.00	0.01	0.26	0.00	0.01	0.21	0.00	0.01	0.17	0.00	0.01	0.14	0.00	0.01	0.12	0.00	0.01	0.09	0.00	0.01	0.06	0.00	0.01	0.02	0.00	0.01	0.20	0.00	0.01
16	Sindragata 1	74850	0	1986	2.080	0.30	0.00	0.00217	0.00	0.26	0.00	0.00	0.22	0.00	0.00	0.18	0.00	0.00	0.15	0.00	0.00	0.12	0.00	0.00	0.09	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
8	Hafnarstræti	13900	0	1979	2.109	0.27	0.00	0.00209	0.00	0.23	0.00	0.00	0.19	0.00	0.00	0.15	0.00	0.00	0.11	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	Suðurgata 8	85070	0	1980	2.130	0.25	0.00	0.00202	0.00	0.21	0.00	0.00	0.17	0.00	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
36	Ásgeirsgata	11800	0	1972	2.173	0.21	0.00	0.00190	0.00	0.17	0.00	0.00	0.12	0.00	0.00	0.08	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Hafnarstræti	92090	0	2001	2.301	0.17	0.00	0.00180	0.00	0.15	0.00	0.00	0.13	0.00	0.00	0.11	0.00	0.00	0.09	0.00	0.00	0.08	0.00	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
22	Sindragata 6	33930	0	1990	2.294	0.15	0.00	0.00174	0.00	0.13	0.00	0.00	0.11	0.00	0.00	0.09	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	Suðurgata 12	93970	0	1954	2.313	0.13	0.00	0.00171	0.00	0.11	0.00	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	Suðurgata 9	53060	0	1947	2.305	0.12	0.00	0.00167	0.00	0.10	0.00	0.00	0.08	0.00	0.00	0.06	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Suðurgata 10	6030	0	1956	2.274	0.12	0.00	0.00167	0.00	0.10	0.00	0.00	0.08	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Sindragata 1	29080	0	1997	2.290	0.09	0.00	0.00160	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Sindragata 3	15650	0	1987	2.347	0.09	0.00	0.00159	0.00	0.06	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	Mjósund 2	538	0	1949	2.450	0.08	0.00	0.00159	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Mánagata 2	18903	4	1889	2.405	0.07	0.00	0.00155	0.01	0.05	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	Ásgeirsgata	27400	0	1975	2.318	0.07	0.00	0.00155	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Sindragata 5	35200	0	1980	2.431	0.06	0.00	0.00153	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Hafnarstræti	5970	0	1913	2.325	0.06	0.00	0.00153	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Mánagata 1	23940	3	1963	2.338	0.05	0.00	0.00152	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	Mjallargata 1	107170	18	1988	2.493	0.04	0.00	0.00150	0.03	0.03	0.00	0.03	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Grænigarður	14700	0	1982	2.625	0.04	0.00	0.00150	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	Suðurgata 11	28300	0	1984	2.354	0.04	0.00	0.00149	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Hafnarstræti	258710	7	1986	2.634	0.01	0.00	0.00143	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Sindragata 1	30650	0	1969	2.796	0.01	0.00	0.00142	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	Sólgata 1	38800	0	1993	2.639	0.00	0.00	0.00141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00