

Vavuniya

Disaster Risk Reduction and Preparedness Plan

Towards a Sustainable and Resilient City



Disaster Resilient City Development Strategies for four Cities in the Northern and Eastern Provinces of Sri Lanka



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Australian Government

Department of Foreign Affairs and Trade



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Abbreviations and Acronyms

CBO	Community Based Organisation
CCD	Coastal Conservation Department
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
DFID	Department for International Development
DMC	Disaster Management Centre
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DS	Divisional Secretariat
DSD	Divisional Secretariat Division
FGD	Focus Group Discussion
G.C.E A/L	General Certificate of Education Advanced Level
G.C.E O/L	General Certificate of Education Ordinary Level
GIS	Geographic Information System
GN	Grama Niladhari
GND	Grama Niladhari Division
ha	hectare
HFA	Hyogo Framework for Action
ICTAD	Institute for Construction Training and Development
km	kilometre
km/h	kilometre per hour
LA	Local Authority
LKR	Sri Lankan Rupee
m	metre
mm	millimetre
MPS	Maritimepattu Pradeshiya Sabha
MUC	Mannar Urban Council
NBRO	National Building Research Organisation
NCDM	National Council for Disaster Management
NGO	Non-Government Organisation
NWSDB	National Water Supply and Drainage Board
PS	Pradeshiya Sabha
RDA	Road Development Authority
SLILG	Sri Lankan Institute of Local Governance
SWOT	Strengths, Weaknesses, Opportunities and Threats
UC	Urban Council
UDA	Urban Development Authority
UNISDR	United Nations International Strategy for Disaster Reduction
UNOPS	United Nations Office for Project Services
UOM	University of Moratuwa
VUC	Vavuniya Urban Council

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Foreword

The Disaster Resilient City Development Strategies for Sri Lanka Project is a strategic plan to deliver disaster risk reduction strategies and increase resilience, leading to healthier, sustainable cities throughout Sri Lanka. The project has been implemented by UN-Habitat in collaboration with the Disaster Management Centre (DMC), the Urban Development Authority (UDA), the Sri Lanka Institute of Local Governance (SLILG), the Institute for Construction Training and Development (ICTAD), the University of Moratuwa (UOM), and four Local Authorities: Vavuniya Urban Council, Mannar Urban Council, Maritimpattu Pradeshiya Sabha (Mullaitivu) and Akkaraipattu Municipal Council. This is the second phase of the Disaster Resilient City Development Strategies for Sri Lanka. The first phase was completed in 2013 in Balangoda Urban Council, Ratnapura Municipal Council, Kalmunai Municipal Council and Batticaloa Municipal Council.

The main objective of this project is to establish the planning framework and then assist the Councils to implement selected projects that will enable each local authority to move towards reducing their vulnerability to disasters whilst increasing their sustainability and resilience.

This report compiles identified strategies into a Disaster Risk Reduction and Preparedness Plan developed specifically for the Vavuniya Urban Council. The Plan was prepared by conducting a thorough analysis of background information. This includes a comprehensive baseline assessment which is complimented by a comprehensive technical study incorporating the findings of the vulnerability and risk assessment, and SWOT analysis. These inputs were gathered through a participatory approach that included stakeholder workshops and focus group discussions. The goal of increased resilience and the outcomes of the assessments influenced the strategic directions that shape the action projects proposed in the final part of this document. The action projects component includes detailed descriptions of individual projects, estimated costs, benefits and responsible agencies for project implementation.

Fundamentals of the Plan and proposed activities are aligned with priorities for action from the Hyogo Framework for Action to assist in establishing Vavuniya as a model resilient city.

**United Nations Human Settlements Programme
(UN-Habitat), Sri Lanka.**

Executive Summary

The *Vavuniya Disaster Risk Reduction and Preparedness Plan*, themed “Towards a Sustainable and Resilient City”, was completed through the Disaster Resilient City Development Strategies for Sri Lanka Project. It assesses the current situation in Vavuniya, provides detailed recommendations from a strategic planning perspective and identifies projects that will assist in reducing the risk and vulnerability of the citizens of the city, whilst enhancing resilience and preparedness.

The introductory chapter firstly outlines the background and governance of the project and then presents a small study of resilience, moving from the global level to the context of Sri Lanka and to Vavuniya town itself to explain how the Vavuniya Urban Council area (VUC) was selected for this project. It contains a brief introduction to the project site, as well as an outline of the project methodology, in particular its strong participatory approach and stakeholder involvement elements. The introduction also includes a section on resilience and the Hyogo Framework for Action (HFA). It concludes with an explanation of the disaster response governance framework in Sri Lanka.

This project involved gathering and analysing a large volume of current and historical records across a range of fields. A summary of the analysis is presented in Chapter 2 – Vavuniya Baseline Information. The chapter is divided into a Local Area Profile and a Socio-Economic Profile. The Local Area Profile includes information on the climatic conditions, rainfall, topography, hydrology, soil types and natural hazards in the Vavuniya project area, while the Socio-Economic Profile contains demographics, housing, economic base and land use information.

Background information and stakeholder consultations were used as a base to conduct a number of assessments. These assessments, presented in Chapter 3 – Strategic Assessments, include the following:

- A hazard assessment to consult the community on the nature of the hazards they encounter and where they occur;
- A vulnerability and risk assessment to assess the city's vulnerabilities to disasters (physical, social, economic and environmental) and the ways in which hazards and vulnerability occur, as well as to identify high risk areas;
- A capacity assessment to understand where the strengths and gaps within the current social and institutional models are;
- A strategic SWOT analysis to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in the process of achieving resilience in Vavuniya; and
- A core problem analysis to identify common problems, their locations and to assist in prioritising problem solving.

The assessments used an analysis of the baseline information and a series of interviews and workshops with stakeholders, including local communities and institutions, civil society, the government, the private sector, development practitioners and academics. The assessments produced a series of maps indicating risk levels relating to hazards identified by the community. These maps culminate with the multi-hazard risk map, which identifies ten very high-risk locations within the VUC.



Strategic Directions (Chapter 4)	Action Project Details (Chapter 5)
1. Improve infrastructure to minimise the risk of floods.	<ul style="list-style-type: none"> • Reduce run-off and mitigate flooding at Poonthoddam; • Restore spill canal and two culverts between Vavuniya Kulam and Periyakulam; • Landscape and improve the natural environment of Vavuniya Kulam along Horowpathana Road; • Rehabilitate wastewater purification tanks; • Rehabilitate the main wastewater canal; • Establish a wetland park • Implement a drainage master plan; • Improve the seasonal water retention pond at Thirunavatkulam; • Restore Mamadu Oya bank at 40ft bridge, Nochchimodai; • Restore tanks and the cascade irrigation system; and • Investigate drip irrigation and rainwater harvesting tanks.
2. Using land-use planning to minimise the risk of disasters and to protect natural resources and enhance drought risk reduction techniques.	<ul style="list-style-type: none"> • Improve land use management to restore tank catchments; • Implement multipurpose greenbelts across selected sites; and • Encourage flood and drought resistant model green homes.
3. Sharing and participating in community actions and improving resilience through social empowerment.	<ul style="list-style-type: none"> • Hold community awareness programmes on Disaster Risk Reduction (DRR) and preparedness; • Arrange GIS training programmes for local officers; • Arrange DRR awareness programmes for school children; • Form Community Based Disaster Risk Management Committees in high risk zones; • Form youth and post recovery teams; and • Establish an early warning center with thorough communication with those involved in the agricultural sector at the local level.
4. Planning for recovery and enabling economic opportunities.	<ul style="list-style-type: none"> • Develop a cooperative disaster recovery donation system through VUC; • Establish a local level community DRR fund; • Establish an insurance scheme, with a reputable firm and cooperative bank; and • Provide incentives for DRR initiatives and efforts.
5. DRR through continuous assessment, evaluation and monitoring.	<ul style="list-style-type: none"> • Introduce assessment, evaluation and monitoring processes.

Strategic Directions and Action Projects were derived from the assessments. Chapter 4 – Strategic Directions, outlines the five directions that were developed and how each satisfies the expectations of the Vavuniya project area community as well as simultaneously meeting the priorities and tasks listed through the HFA. Chapter 5 – Action Projects, provides detailed descriptions on the projects. The Strategic Directions and Action Projects are detailed above:

Priority should be given to action projects for which resources and local capacity already exist, as visible

results are then likely to occur. This may motivate stakeholders and create awareness on the importance of Disaster Risk Reduction (DRR) in the city.

This Plan suggests realistic and fundamental improvements to the existing DRR framework of the city — improvements which will minimise the effects of hazards and provide the local authorities and citizens of the VU Carea with a clear and achievable direction to become a sustainable and resilient city.



Introduction



Introduction

This chapter provides a background to introduce the Disaster Resilient City Development Strategies for Sri Lanka Project and how this document, the *Vavuniya Disaster Risk Reduction and Preparedness Plan* (the Plan), was prepared. This includes an explanation of the project background, the rationale for the project (going from the global context to the Sri Lankan context), before briefly introducing the town of Vavuniya. The project methodology, which was based around a participatory approach and encouraged stakeholder involvement, is also outlined. The chapter then moves to resilient cities and defines resilience and provides an introduction to the Hyogo Framework for Action (HFA) tasks and priorities. The benefits from following the HFA priorities in creating and sustaining a resilient city are also explained. Finally, a succinct explanation of the disaster response governance framework in Sri Lanka is provided.

1.1 Project Background

The Disaster Resilient City concept has been introduced globally as a tool for reducing the vulnerability of local government to disasters through training, capacity building and capital investment programmes that identify priorities for building sustainable and resilient communities.

Understanding climate change, development policies, disaster management and the level of knowledge in a society are integral components of the disaster resilient city development approach. Cities require localised and integrated disaster management approaches to mitigate the impacts of hazards. Comprehensive studies on the consequences of climate change, the relationship between urban and financial trends, disaster risk management and sustainable development needs to

underpin disaster resilience work. In this context, UN-Habitat in collaboration with the University of Moratuwa (UOM), the Urban Development Authority (UDA), the Disaster Management Centre (DMC), Vavuniya Urban Council (VUC), Mannar Urban Council (MUC), Maritimpattu Pradeshiya Sabha (MPS), Akkaraipattu Municipal Council (AMC), the Sri Lanka Institute of Local Governance (SLILG) and the Institute for Construction Training and Development (ICTAD), worked on this project to focus on practical outcomes that assist in creating disaster resilient cities in Sri Lanka. This project is financially assisted by the Government of Australia. This is Phase Two of the Project, with Phase One completed in 2013 in Balangoda Urban Council, Ratnapura Municipal Council, Kalmunai Municipal Council and Batticaloa Municipal Council.

The primary goal of the project is to establish sustainable, disaster resilient and healthy cities and townships in disaster prone regions of Sri Lanka. The project is being conducted in the Northern Province (MUC, VUC and MPS), as well as the Eastern Province (AMC). Figure 1: Project Locations, provides a map to illustrate where each Local Authority (LA) is located in Sri Lanka. The Northern and the Eastern Province are both considered to be lagging and all four Councils:

- Have been declared as urban development areas identified under Urban Development Authority law indicating potential for, and government policy that supports, urban growth;
- Do not currently have approved development and land use plans, or their plan is out-dated and does not include disaster risk reduction considerations;
- Are vulnerable to multiple disasters; and
- Have been poorly rated based on socio-economic indicators such as economic performance and poverty, access to basic services and unemployment.



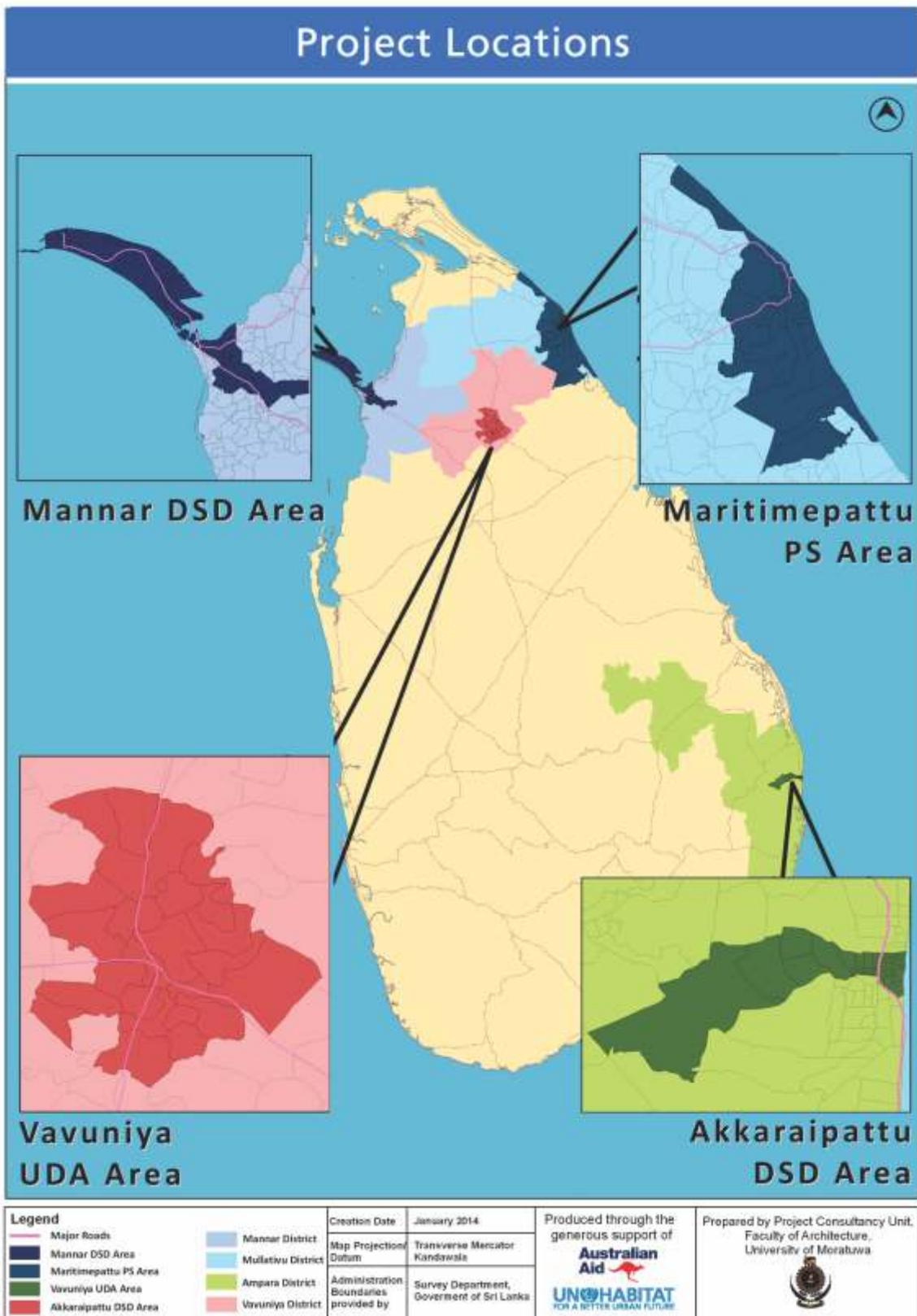


Figure 1: Project Locations

Disaster Risk Reduction and Preparedness Plan - Vavuniya

The Disaster Resilient City Development Strategies Project (Phase Two), has nine outputs:

1. Vulnerability assessments are conducted to promote disaster resilient local development plans;
2. Disaster Preparedness Plans for the selected LAs are prepared;
3. The capacity of the LA is built to enable them to promote disaster resilient human settlements;
4. DRR features are incorporated into the LA's building guidelines and regulations;
5. Improved awareness and capacity of the communities to be disaster resilient;
6. Community partnerships with LAs on disaster response activities promoted in lagging regions;
7. Guidelines for the incorporation of DRR aspects in housing construction introduced to LAs, local house builders and communities;
8. Guidelines and methodology for retrofitting to reduce disaster risk introduced to LAs, local house builders and communities; and
9. Lessons learned and good practices in selected LAs are well captured, documented and disseminated at local and international levels.

This Disaster Risk Reduction and Preparedness Plan for Vavuniya also includes the outcomes of the vulnerability and disaster risk assessments (outputs one and two as above).

The key project partners, their role, and how their work assists in meeting the outputs listed above, are listed in Table 1.

Project Partner	Role	Meets Project Output
Government of Australia	Financial Assistance	1-9
UN-Habitat Sri Lanka	Mobilisation and Technical Support	1-9
Disaster Management Center	Technical Support	3,5,6
Urban Development Authority	Planning Support	2,4,7,8
University of Moratuwa	Technical Support	1,2
Local Authorities (MUC, VUC, MPS and AMC)	Project Implementation	1-9
Sri Lanka Institute of Local Governance	Project Implementation / Capacity Building	3,4
Institute for Construction Training and Development	Project Implementation / Capacity Building	4,7,8

Table 1: Project Partners

1.2 Rationale for the Project

Disasters interrupt communities and city functions; they result in the loss of properties, loss of commerce, disrupt day-to-day lives and livelihoods, and sometimes take human lives as well. Many countries, especially those that have faced disasters and been badly affected, have updated their policy and development strategies with special consideration to disaster management, risk reduction and adaptation.

Global Context

Globally resilient cities, community development, environmental planning and disaster management have been influenced by several policy frameworks from the first United Nations Conference on Environment and Development held in Rio de Janeiro in 1992, when Agenda 21 was adopted, through to the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.

The United Nations Framework Convention on Climate Change defines climate change as the change that can be attributed "directly or indirectly to human activity that alters the composition of the global atmosphere

and which is in addition to natural climate variability observed over comparable time periods.”¹ Meteorological conditions such as rainfall, temperature, wind and sunshine have changed considerably in their intensity, term and duration over recent decades. With the changed weather patterns, the intensity of natural hazards such as floods, landslides, cyclones and droughts have risen also increasing the vulnerability of human settlements to disasters. Mitigation measures have to be taken to reduce disaster risk with careful evaluation of settlements and their vulnerability to natural hazards.

Global experience indicates that social support networks, building social capital, knowledge sharing and improving self-reliance through capacity building, resource availability and governmental agencies' preparedness, have direct and positive impacts on disaster resistant communities and city development.

Protecting natural areas that can absorb and reduce the impacts of hazards is a strategic solution. Hazard mitigation saves lives and property and reduces vulnerability to future disasters. Avoiding development in hazard-prone areas by steering new development to lower risk areas, safeguarding existing development through engineered structural mitigation, relocating damaged buildings to safer areas following a disaster were practiced by most of the disaster-prone cities.

Strategically planning land uses and constructing new buildings and infrastructure that are located in hazard-prone areas only through the application of strict building codes, design standards, and informed construction practices are also strategic solutions.

A resilient community can minimise economic and social disruptions, and recover much faster after a disaster while safeguarding the citizens and protecting the economic, social, and environmental conditions.

Sri Lankan Context

Sri Lanka is a tropical island with diverse topographic features and with two annual monsoons – the south-west and north-east – which bring heavy rains to particular areas of the country throughout the year. Sri Lanka is affected by many natural hazards: floods, droughts, landslides, cyclones, storms, winds, tsunamis, lightning, coastal erosion and coastal storm surge and inundation – all of which are experienced in differing frequencies and magnitudes. Many districts are affected by multiple hazards. Climatic variations and change has caused an increase in hazard occurrences as well as

other associated issues such as epidemics. This has ultimately resulted in increasing expenditure on social and emergency services and damage recovery.

Additionally urbanisation trends and pressures have increased. The National Physical Plan, which was gazetted in 2011, anticipates that more than 50% of the country's population will be living in declared urban areas by 2030. This urbanisation process will affect the natural environment. Several areas of Sri Lanka are already considered vulnerable to disaster, therefore it is essential to mitigate hazards and create sustainable urban development through innovative, locally driven initiatives.

Studies on global climate change have recognised the need for sustainable solutions for these problems. In this context, the urgent need for specific urban planning guidelines has been recognised and the Resilient City concept has been established as a pathway to build more sustainable cities for the future. As in other countries, in Sri Lanka there is a common agreement to making resilient cities for future generations. Several frameworks, including the HFA provide valuable guidance on resilient city development and how to proceed with implementation.

In Sri Lanka, many declared urban areas do not have development plans, and of those that do, most do not consider disaster risk reduction. Participatory planning approaches are not commonly adopted, especially in the field of disaster risk reduction planning because of a lack of skilled professionals in this area.

The Northern and Eastern Provinces are challenging areas to implement participatory planning processes for disaster risk reduction. Recent history, which has included three decades of conflict and resulted in serious damage throughout the provinces, also now includes many new developments and rebuilding, especially of housing and infrastructure. Vulnerability to natural disasters and disaster risk reduction methodologies must be included in these new developments to ensure their sustainability. The mainstreaming of disaster risk reduction, mitigation, adaptation and response must become an inherent part of LA practices and policies. Furthermore, communities must understand the risks they face and learn how to mitigate these or respond safely. This project has sought to address these issues in the Vavuniya Project Area by identifying the risks and climate change impacts, consulting widely with stakeholders, improving LA policies and linking the community with early warning systems.

¹ Article 1, United Nations Framework Convention on Climate Change, Available online at: http://unfccc.int/essential_background/convention/background/items/2536.php (accessed on 29 July 2014)

Vavuniya Project Area

The Project Area covers the UDA declared Vavuniya Urban Development Area. This includes the administrative boundaries of the Vavuniya Urban Council area, which comprises three full *Grama Niladhari* (GN) divisions and parts of thirteen other GN divisions and *Pradeshiya Sabha* areas. Vavuniya is located in the south of the Northern Province of Sri Lanka, approximately 250km northeast of Colombo. The area is highly vulnerable to flooding however it also suffers from drought, strong winds and lightning strikes. As this is a declared urban development area, future growth will be focused here, which needs to be carefully planned to ensure the existing hazards are mitigated rather than exacerbated. In this report, 'Vavuniya project area' is used to refer to the area under study.

The Plan provides guidance to city planners and decision makers to assist in making Vavuniya a resilient, sustainable and healthy city. DRR measures need to be implemented across multiple levels of city operations; these can be as varied as enforcing building codes, to providing training for community leaders on early warning. Issues that increase vulnerability and the incidence of hazards must be recognised and then solutions implemented to address the root causes.

The Plan will enable the Vavuniya Urban Council to act on addressing the:

- Physical vulnerability – the likelihood of physical impacts on the built environment and population;
- Economic vulnerability – the potential impacts of hazards on economic assets and livelihoods, including the vulnerability of different economic sectors;
- Social vulnerability – the potential impacts of hazardous events on vulnerable groups such as the poor, single-parent households, including female-headed households, pregnant or lactating women, the handicapped, children, and the elderly. Considerations include public awareness about risks, the ability of different groups to cope with catastrophes, and the strength of institutional structures designed to help them cope; and
- Environmental vulnerability – the potential impacts of events on the environment, and the ability of the environment to absorb impacts.

VUC needs to plan interventions to build a resilient physical, social and natural environment for the future safety of the population and this project is intended to provide relevant guidance to urban planners and local authorities to prepare disaster resilient city development strategies for the declared area.

1.3 Project Methodology

A participatory approach is at the core of this project. From the initial stages through to the completion of implementation, the project must meet stakeholder expectations. At the initial stage, the project team developed a stakeholder inventory. Workshops and Focus Group Discussions (FGD) were conducted to introduce the project to various stakeholders, to listen and learn from their knowledge and experiences. Throughout the project, feedback was continually sought from the stakeholders, and opportunities were taken to update them on the progress of the Plan. The project methodology that was established for Phase One of the Disaster Resilient City Development Strategies for Sri Lanka Project was followed, however modifications from lessons learnt were incorporated to facilitate an improved outcome.

The Plan was prepared by conducting a comprehensive baseline technical study and incorporating the findings of the vulnerability and risk assessment, outcomes of the workshops and FGDs as well as field observations. In addition, international case studies were reviewed to understand how other cities in the world have adopted structural and non-structural disaster mitigation measures. Professionals, including Planners, Engineers, Architects and Designers were widely consulted in the plan preparation process. Advice on environmental management, social development, infrastructure planning, economic development and architectural design, including disaster risk reduction methodologies have been combined through this process to provide consistent guidance to the public participation and mobilisation processes.

The framework of the Plan is based on the international strategy for disaster reduction, the HFA (see Section 1.4.1 – Incorporating the Hyogo Framework for Action). Figure 2: Planning Process, illustrates the methodology undertaken in completing this project from data collection through to identifying action projects to build city resilience.

Disaster Risk Reduction Plan – Processes

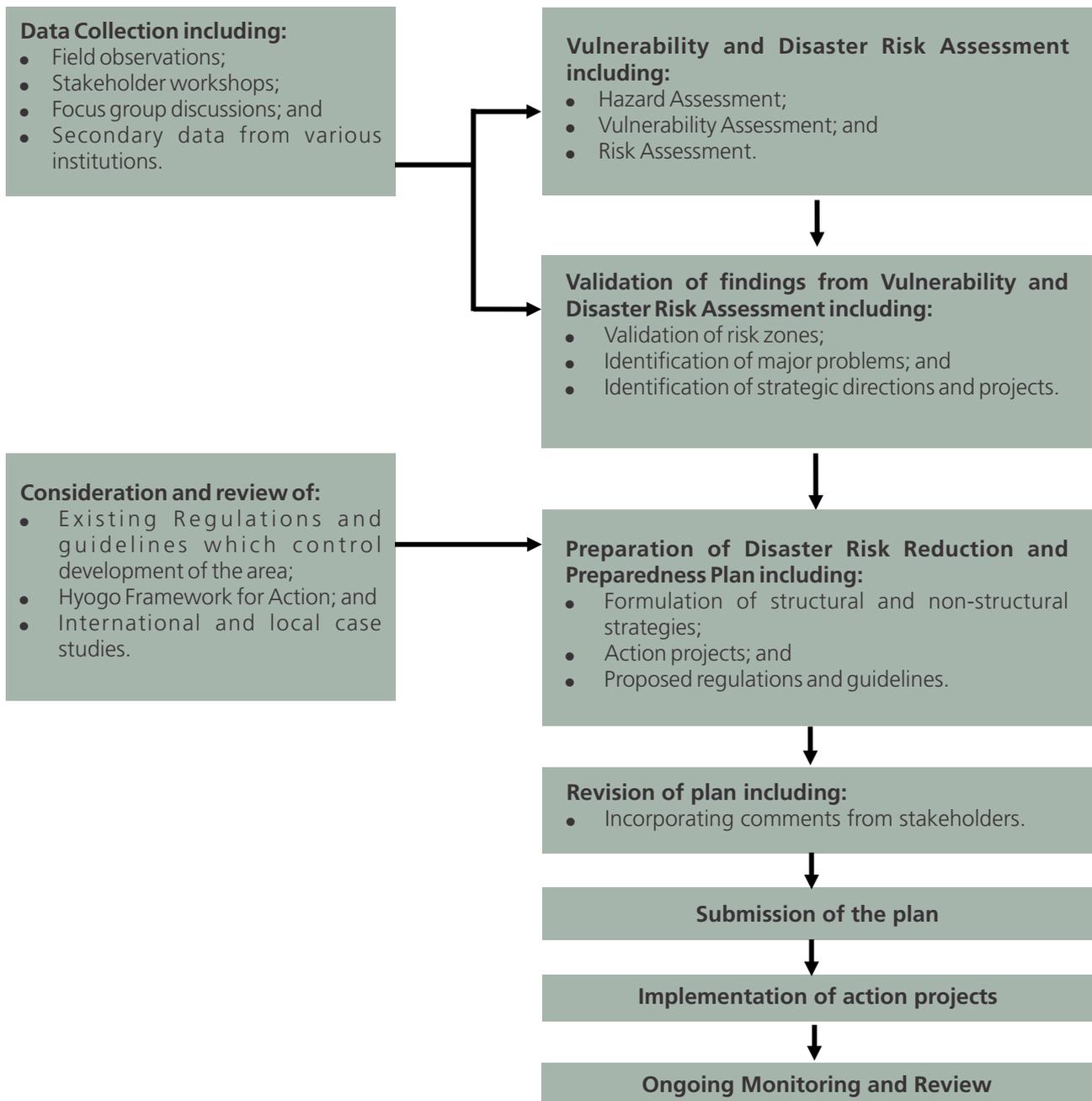


Figure 2: Planning Process

Stakeholder Involvement

Throughout the project, including the vulnerability assessment and the identification of hazards and risk processes were done by participatory mapping with the assistance of local stakeholders. The strategic directions and action projects were identified based on local stakeholder perspectives and knowledge coupled with technical expertise. Community leaders, religious leaders, representatives of local government, provincial council, the divisional secretary and grama niladhari officers, representatives of national government organisations, non-government organisations, community-based organisations, research and academic organisations, women's and youth groups, as well as investors and representatives from business and trade associations were all contacted for their input. Broad public participation is critical in ensuring a higher level of acceptance of the Plan. This includes acceptance of policies for minimising disaster vulnerability, which is an important resource in formulating responses to DRR.

The major benefits of a broad community based planning approach include building confidence in the project and enhancing capabilities to improve disaster preparedness and mitigation, as well as building strong adaptive capacity at the local level. The commitment of individuals and community as a whole, as well as the recognition of traditional organisational structures and knowledge from formal and informal community leaders, alongside capacity building activities is needed for acceptance of the Plan. Local knowledge and actions in disaster mitigation, including resource mobilisation, produce a wide range of appropriate, innovative and area-specific DRR solutions, which are cost-effective and sustainable, and which must be incorporated by the project team. The successful implementation of this Plan will occur following stakeholder involvement and empowering community disaster committees, volunteers and local authority staff.

1.4 Resilient Cities

This section provides an overview of the concept of a 'Resilient City.' The understanding of this topic is drawn from findings of reviewed international case studies, journals and scholarly activity that examines the policies and strategies required to anticipate and respond to unexpected events that damage or destroy the social, environmental and economic fabric of cities.

The concept of resilience is at the centre of a large and expanding body of research and application. As a result

the term 'resilience' has acquired a range of definitions. Some recent definitions include:

- "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate and to recover from the effects of a hazard in a timely and efficient manner including through the preservation and restoration of its essential basic structures and functions" – United Nations Office for Disaster Reduction (UNISDR) (2009);
- "Disaster Resilience is the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses – such as earthquakes, drought or violent conflict – without compromising their long-term prospects" – DFID Approach Paper Defining Disaster Resilience (2011); and
- A disaster resilient city "is one where people participate, decide and plan their city together with the local government authorities, based on their capacities and resources. It has a competent and accountable local government that caters for sustainable urbanisation with participation from all groups" – UNISDR, My City is Getting Ready (2012).

These definitions have helped to shape this Plan and the methodology that was employed to produce it.

Climate change, increasing rates of urbanisation, poor quality housing and infrastructure coupled with communities living on land that is disaster prone has resulted in more frequent and severe disasters across the world. Defining Disaster Resilience: A DFID Approach estimates that in "2010 natural disasters affected more than 200 million, killed nearly 270,000 people and caused \$110 billion in damages"². Resilience is therefore required to be at the core of city development strategies. Resilience extends from the physical to include institutional, social and economic factors.

Attributes of a resilient city include permanent houses, community and individual ownership of land, adequate food and income sources, family and community support mechanisms (especially in times of crisis), broad local knowledge as well as good leadership and management. Adaptation is a strong attribute of a resilient city. This enables the city to absorb future shocks and stresses to its social, economic, environmental, technical and infrastructure to enable these functions to continue through, or resume shortly after, a disaster.

There are many reasons for cities to prioritise resilience as part of their political and sustainable development

² Defining Disaster Resilience: A DFID Approach, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/186874/defining-disaster-resilience-approach-paper.pdf (accessed on 29 July 2014)

agenda including improving environmental, social and economic conditions, and preparing for the future variables of climate change. Resilient cities have a more adaptive capacity for coping in any situation therefore minimising vulnerability. *Making Cities Resilient: My City is Getting Ready!* informs local government, mayors and local actors of the benefits of building a resilient city. By capitalising on existing opportunities and capacities, a resilient city can minimise the potential consequences of hazards. A holistic vision of where the city stands with respect to risk and development can also assist in saving extra expenditure that would have been spent on recovering damages from disasters.

A resilient city also encourages participation, strengthens democracy and promotes consensus. Agreeing on city planning and realistic disaster resilience objectives generally represent the interests and expectations of all city sectors.³

Resilient city development must always prioritise actions strategically to respond to the needs of vulnerable or critical sectors and groups. *Making Cities Resilient, My City is Getting Ready!* shows the importance of assigning and managing resources according to existing realities and needs for DRR in short, medium and long term strategies from a development and sustainability perspective. It also indicates that information sharing, strengthening the leadership of local authorities and encouraging a sense of self-worth among all city sectors improves city capacities.⁴

1.4.1 Incorporating the Hyogo Framework for Action

The Hyogo Framework for Action 2005 – 2015: Building Resilience of Nations and Communities to Disasters (HFA) was a key outcome of the World Conference on Disaster Reduction which was held in 2005 in Hyogo, Japan.

In recognising the need for local governments to undertake DRR by implementing the HFA, a guide for implementing the HFA by local stakeholders was developed including the following tasks which are aligned to the five priorities of the HFA:

1. Ensure that DRR is a national and a local priority with a strong institutional basis for implementation;
2. Identify, assess and monitor disaster risks and enhance early warning systems;

3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels;
4. Reduce the underlying risk factors; and
5. Strengthen disaster preparedness for effective response at all levels.

Post 2015 Framework for Disaster Risk Reduction

Currently, The Post-2015 Framework for Disaster Risk Reduction (HFA2): Report from 2013 Global Platform Consultations provides some insight into the future structures for building resilience. This document highlights twelve interventions or focus areas for DRR:

1. The importance of community-level involvement;
2. Targeting and including the most vulnerable populations;
3. Women as leaders;
4. Children and youth: new generation of opportunity;
5. Health;
6. Integrating climate change adaptation, development and disaster risk reduction;
7. The role of science;
8. Knowledge-sharing and education;
9. Capacity-building: financing, risk assessment, preparedness and early warning;
10. Private sector involvement in disaster risk reduction;
11. Political will and leadership; and
12. Governance, accountability, transparency and inclusiveness.

These new elements have been considered in preparing and developing this Plan.

1.5 Disaster Response Governance

At the national level, the Ministry of Disaster Management (the Ministry) is responsible for the implementation of government policies and managing international and national funds in relation to disasters and DRR. The National Council for Disaster Management (NCDM) is under the Ministry and responsible for disaster management in Sri Lanka under the Sri Lanka Disaster Management Act No. 13 of 2005. The formulation of a national policy and programme on the management of disasters is the prime responsibility of the NCDM. The DMC, National Building Research Organisation (NBRO), Department of Meteorology, and National Disaster Relief Services Centre all function under the Ministry.

³ Characteristics of a Disaster-Resilient Community: A Guidance Note (2007)
⁴ www.unisdr.org/campaign/resilientcities/

Disaster Risk Reduction and Preparedness Plan - Vavuniya

The main duties of the DMC are:

- Disaster risk assessment, data collection, research and analysis;
- Disaster management technology, mitigation and DRR;
- Forecasting and early warning;
- Emergency operations in case of a disaster;
- Preparedness planning at National, District, Divisional and Grama Niladhari (GN) levels;
- Training, education and public awareness;
- Formulate and implement National Disaster Management Plan and National Emergency Operation Plan;
- Implement, coordinate and monitor activities related to hazard mapping, risk assessment, disaster mitigation, disaster preparedness, management of emergency operations and post-disaster activities;
- Coordinate with mandated technical agencies on the issue of early warnings for natural hazards and disseminate such warnings to vulnerable communities on time; and
- Coordinate and facilitate emergency response, relief and recovery measures in the event of a disaster.

Under DMC, District Disaster Management Coordinators, District Secretariats, District Committees and Provincial Level Disaster Management Committees function as intermediate coordinators in Disaster Risk Management (DRM).

Specialised institutions such as the NBRO, Centre for Housing Planning and Building, UDA, National Physical

Planning Department, Coastal Conservation Department (CCD), Sri Lanka Land Reclamation and Development Corporation, Irrigation Department, Central Environment Authority (CEA), Department of Meteorology, Geological Survey and Mines Bureau, Road Development Authority (RDA), and the Ministry of Agriculture play important roles in different aspects of Disaster Risk Management. Figure 3 illustrates the institutional framework of disaster governance in Sri Lanka.

At a regional level, provincial councils, district secretariats, line departments, Non-Government Organisations (NGOs) and regionally networked Community Based Organisations (CBOs), play a major role in DRR. These bodies are responsible for implementing the policies and strategies with funding, resources and support directed by the NCDM.

At a local level, Local Authority Committees, Military, Police, Private Sector, NGOs, CBOs, Civil Society, Divisional Level Committees, GN officers and GN committees, village volunteer groups, business communities and Divisional Secretariats implement DRR related projects. This includes the distribution of subsidies, primary level data collection, knowledge sharing and providing other necessary support to regional and national levels. Other groups related to Early Warning, Medical and Health, Search and Rescue, Coordination and Village Task Forces are also responsible for DRR at the grassroots level.



City officials engaged in DRR planning

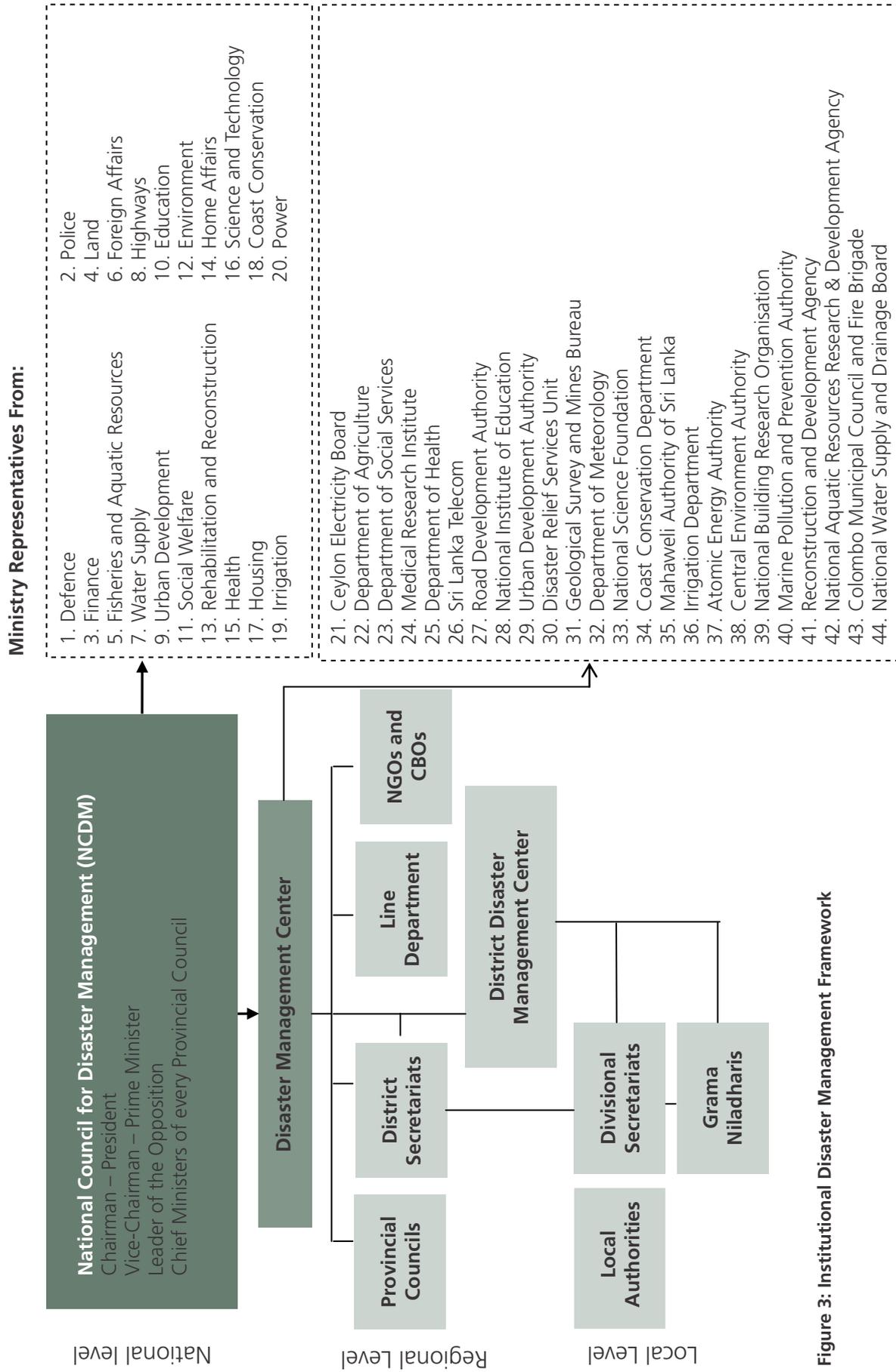


Figure 3: Institutional Disaster Management Framework

1.6 Conclusion

The Plan was formulated through a combination of participatory processes, technical analysis of secondary data and stakeholder feedback. The Plan and process builds the community's capability to develop a resilient city with strong adaptive capacity. This requires an understanding of what can make a city and community resilient and enable people to face disasters and recover faster.

Several common principles of successful resilience development frameworks are incorporated in this Plan. These include:

- Encourage personal and community preparedness;
- Encourage civic responsibility;
- Encourage productive actions to be taken by individuals to protect themselves and their community during an incident;
- Foster self and community reliance;
- Use effective risk communication to strengthen community resilience by providing accurate information and strong communication networks;
- Fill the gap between the Local Authority and the community they serve; and
- Explore traditional and novel structural measures that can be used to build capacity, for knowledge sharing and to make resilient communities.

The project team has gathered information, local knowledge and evidence from lessons learnt to deliver a Plan to be implemented. Many widely established comprehensive resilience city development mechanisms have been identified at the international level and this document combines these with local knowledge and practices to provide a solid platform to move towards a resilient city.

The following chapters in this Plan provide detailed information on the Vavuniya area in Chapter 2 – Vavuniya Baseline Information. This includes both a physical area profile and a socio-economic profile. Chapter 3 – Strategic Assessment, provides details on the vulnerability, risk, hazard and capacity assessments as well as the SWOT and Core Problem Analyses that were undertaken. Chapter 4 – Strategic Directions, outlines the five key directions that were developed during the project with strong input from community consultation to enable the Vavuniya project area to become resilient. Finally, Chapter 5 – Action Projects, provides details on the project proposals that were developed under each of the five strategies to improve the resilience of Vavuniya. Chapter 6 concludes the document.

2

Baseline Information



Baseline Information

The analysis of baseline information provides a starting point for understanding the environmental, social and economic situation in the VUC area. The baseline information was collected from primary sources including field visits, workshops and observations as well as secondary data sources including the city resource profile, the District Statistical Handbook of Vavuniya, administrative reports, development plans and data from government bodies.

This chapter focuses on VUC as the project area and includes a local area profile section which studies the climatic conditions, rainfall, topography, hydrology, soil types and natural hazards. This is followed by the socio-economic section which focuses on the demography, housing, economic base, and land uses.

2.1 Local Area Profile

Vavuniya is located in the south of the Northern Province of Sri Lanka. The Vavuniya township is located approximately 250km northeast of Colombo. The urban centre of Vavuniya is located at 08°49' North and 80°29' East. The city is strategically located and has good links through the A9 and A30 roads, as well as through the

railway line. There are good connections to Jaffna, Kilinochchi, Trincomalee, Mannar, Anuradhapura and Dambulla. Vavuniya acts as an economic hub and many commuters travel daily to the city. Vavuniya also has good schools and healthcare facilities. The city plays a regionally important role linking the cities of the north, east, west and south. Vavuniya is a first order city in terms of the urban hierarchy within Sri Lanka.

The UDA declared Urban Development Area of Vavuniya includes the Vavuniya Urban Council area, which includes three full Grama Niladhari (GN) divisions and parts of thirteen other GN divisions and Pradeshiya Sabha areas. It is nearly 169km² in area and covers 10% of the land area of Vavuniya District. The project area is illustrated in Figure 4. Vavuniya has an Urban Development Plan that was gazetted in 2009 (gazette number 1633/06), however this plan fails to include DRR measures. The Urban Development Plan will be revised to include DRR following the recommendations made in this plan. Close consultation with the UDA has been a feature of this planning process.

This section of the report reviews the climatic conditions, rainfall, topography, hydrology and soil types in the Vavuniya project area.



Vavuniya Town center



Figure 4: Location of Vavuniya Project Area

2.1.1 Climatic Conditions

VUC is located in the dry zone – it has a typical dry zone climate with annual rainfall of about 1300mm and an average temperature of 28.5°C⁵. The project area experiences heavy rains from October to December during the North East monsoonal season. This water is the main source for cultivation in the *maha* season.

Analysis of records indicates that the project area receives a 10km/h average wind speed. The wind most commonly comes from the south-west, although alternative north-easterlies are also recorded.⁶

2.1.2 Rainfall

Within the limits of the Project Area there are no significant differences in the rainfall pattern. The northeast monsoon period (October – December) is when the highest monthly rainfall is received in Vavuniya, conversely, the dry season months of June, July and August is when the lowest rainfall is received. Figure 5: Monthly Rainfall Averages 1957-2011 provides averages of rainfall on a monthly basis over this time period.

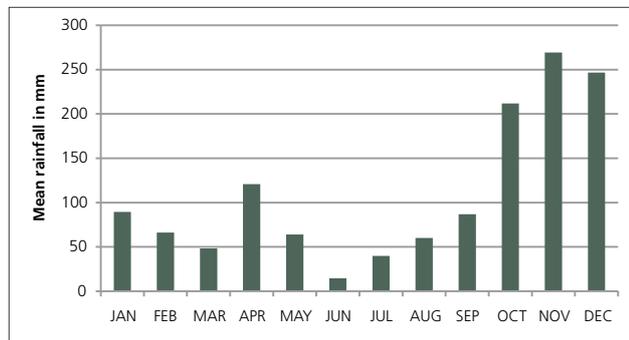


Figure 5: Monthly Rainfall Averages 1957-2011

2.1.3 Topography

The terrain of VUC is generally flat and located between 70m to 130m above mean sea level. Figure 6 shows the variations in topography throughout the area.

2.1.4 Hydrology

Vavuniya District is situated in a catchment area which includes two main seasonal rivers called Paranki Aru and Pali Aru. The tributaries of the Per Aru, Thurumpamoodai, Periyakaddu, Chalampan Aru are also in the catchment. The area also includes some major tanks (Vavuniya Kulam, Rajendrankulam, Marudhamadu, Irattaiperiyakulam), as well as a number of small and medium tanks. The hydrological system has been adapted to agricultural requirements and there are 23 major irrigation schemes and 698 minor irrigation schemes in the project area. A large number of tanks and irrigations schemes are abandoned or have not been maintained and are damaged and this exacerbates flooding. This system failure has resulted in the over-extraction of water from tube wells, which in turn, can lead to a drought. Figure 7 illustrates the hydrology of the project area.



Vavuniya Kulam, the largest tank located in the city

5 Meteorological Records, 1957-2011, Meteorological Department, Sri Lanka
6 ibid

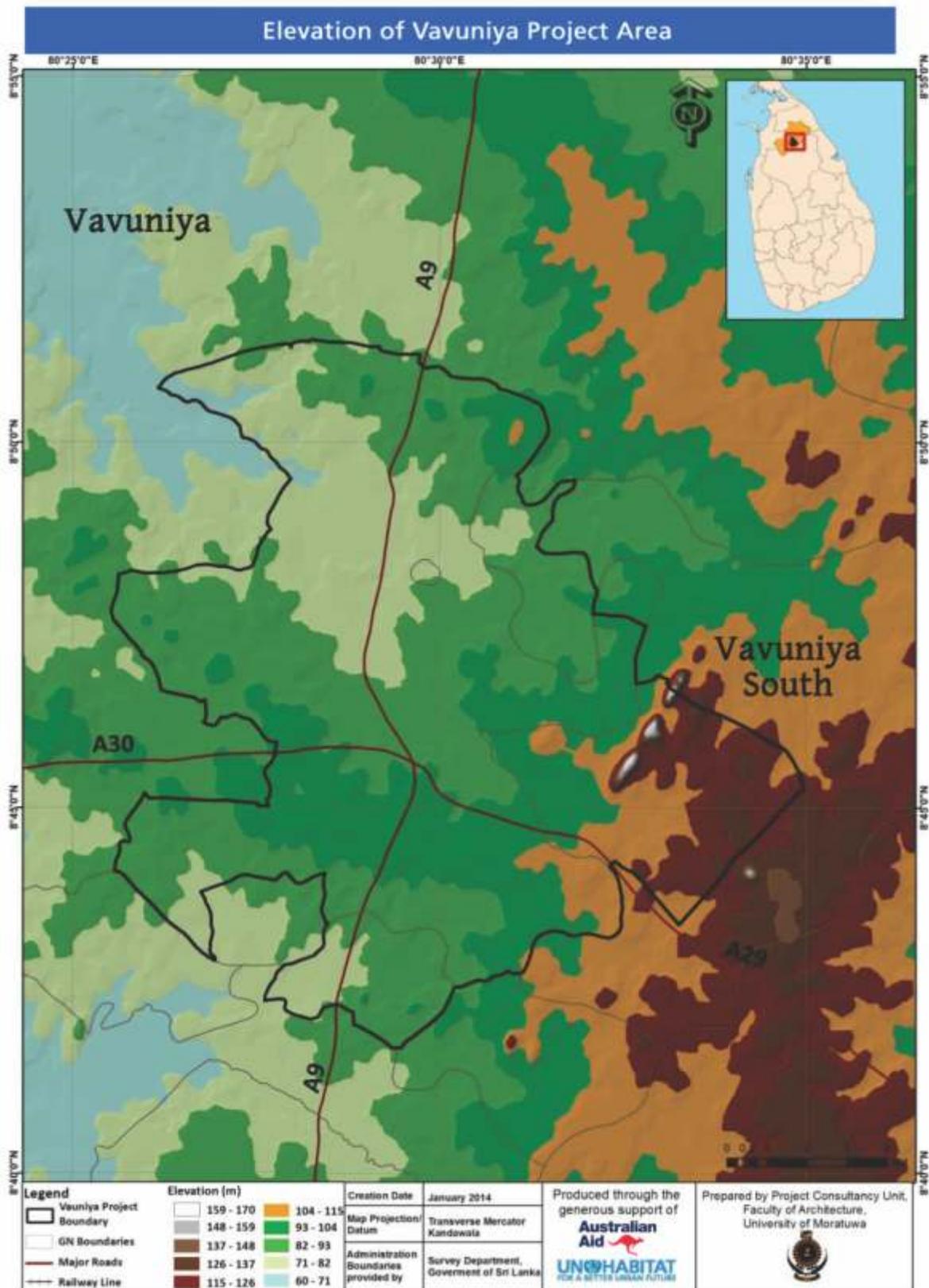


Figure 6: Topography of the Project Area

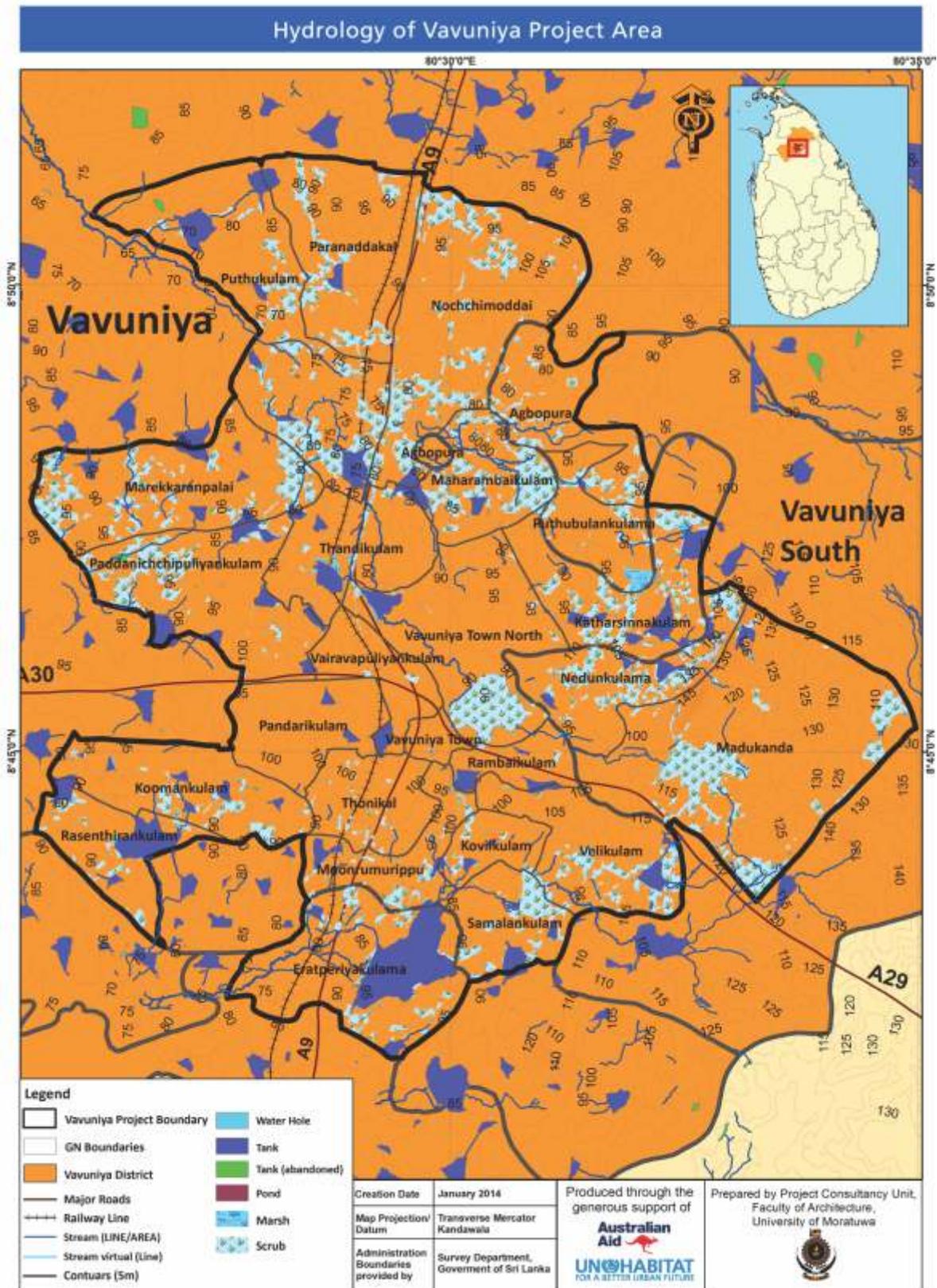


Figure 7: Hydrology within the Project Area

2.1.5 Soil Types

The vast majority of the Vavuniya District consists of highly fertile reddish brown earth, low humid clays and alluvial soil. This is appropriate for paddy and dry land crops as well as scrub and dry forest trees. The flat terrain and the rich soils enable Chena cultivation.

The *Statistical Handbook Vavuniya, 2012* has identified that in the most parts of the area there are hard crystalline rocks with limited ground water potential. Table 2 provides a snapshot of the soil profile.

Soil Profile of the Project Area	Percentage
Reddish Brown Earths and Low Humic Gley Soils (undulating terrain)	92%
Alluvial Soil of Variable drainage and texture (flat terrain)	4%
Rock Knob Plain	2%
Erosional Remnants (Inselberge)	1%
Soildized Solonetz and Solonchaks (flat terrain)	1%

Table 2: Soil Profile

2.1.6 Natural Hazards

The hazards that have been identified in the Vavuniya project area by stakeholders consulted through the planning process are floods, droughts, cyclones or strong winds and lightening. Floods and droughts are the most common hazards.

Floods

Floods are common during the period of December to January when the area receives heavy rain from the northeast monsoon; this includes flash floods as well as floods that remain for days, and sometimes weeks. Low-lying land surrounding Vavuniya tank including, Poonthoddam, Rambikulam, Sri Nagar, Nochchimodai, Thonikal, Thandikulam flood seasonally. The Mamadu Oya and overflow from the Nochchimodai tank also contribute to flooding. Other factors that contribute to flooding include illegal settlements in catchment areas, illegal and improper buildings, settlements in low lying areas, damaged sluice gates, inadequate stormwater drainage systems and poor maintenance of the tanks and canal network which reduces the carrying capacity of the land.

Drought

The Project Area falls within the dry zone of Sri Lanka, and experiences very little rainfall between July and October. As there is a high dependence on agriculture, droughts have a clear impact on livelihoods. Both crops and animals suffer during the extreme dry situations. Deforestation increases the effect of drought, as does the over-extraction of water from tube wells. The Thonikal, Parandakkal and Nochchimodai area are commonly affected by droughts. The poor maintenance of tanks, including the invasion of weed species such as *salfenia*, also contributes to drought as water is not stored for the dry season period.

Strong Winds

The area is hit by strong winds in November and December each year. These destructive strong winds destroy crops and cultivated fields. Cyclones were last reported in this area in both 2011 and 2012. Inappropriate construction, lack of protection walls and large trees were identified as the reasons strong winds have such an effect on the area. Sri Nagar, Vavuniya Town North, Marakarampanai, Manippuram and Kovilkulam are often affected by strong winds.

Lightning

Lightening is a very common hazard in the area during the monsoon. The many open paddy lands in the area, increases the chance of lightning strikes.

2.2 Socio-Economic Profile

This section of the report reviews the demography, housing, economic base, social services and land uses in the Vavuniya Project Area. The information presented here highlights how vulnerable the communities within the project area are to natural hazards.

2.2.1 Demography

The *Census and Statistical Report, Sri Lanka (2012)*, recorded the total population of the project area, which includes 28 GN divisions as 83,277. The population density varies throughout the area with Vavuniya Division having the highest density of around 226 persons per km². Pandarikulam and Thonikal also have high densities, while the other areas record relatively low population densities. The highest population of all GN divisions is in Thonikal (9,286 people). Both population and building density reduce with distance from the town centre, as illustrated in Figure 8: Population Densities within the Project Area. The female population is 51% and the male population is 49% of the total population.⁷

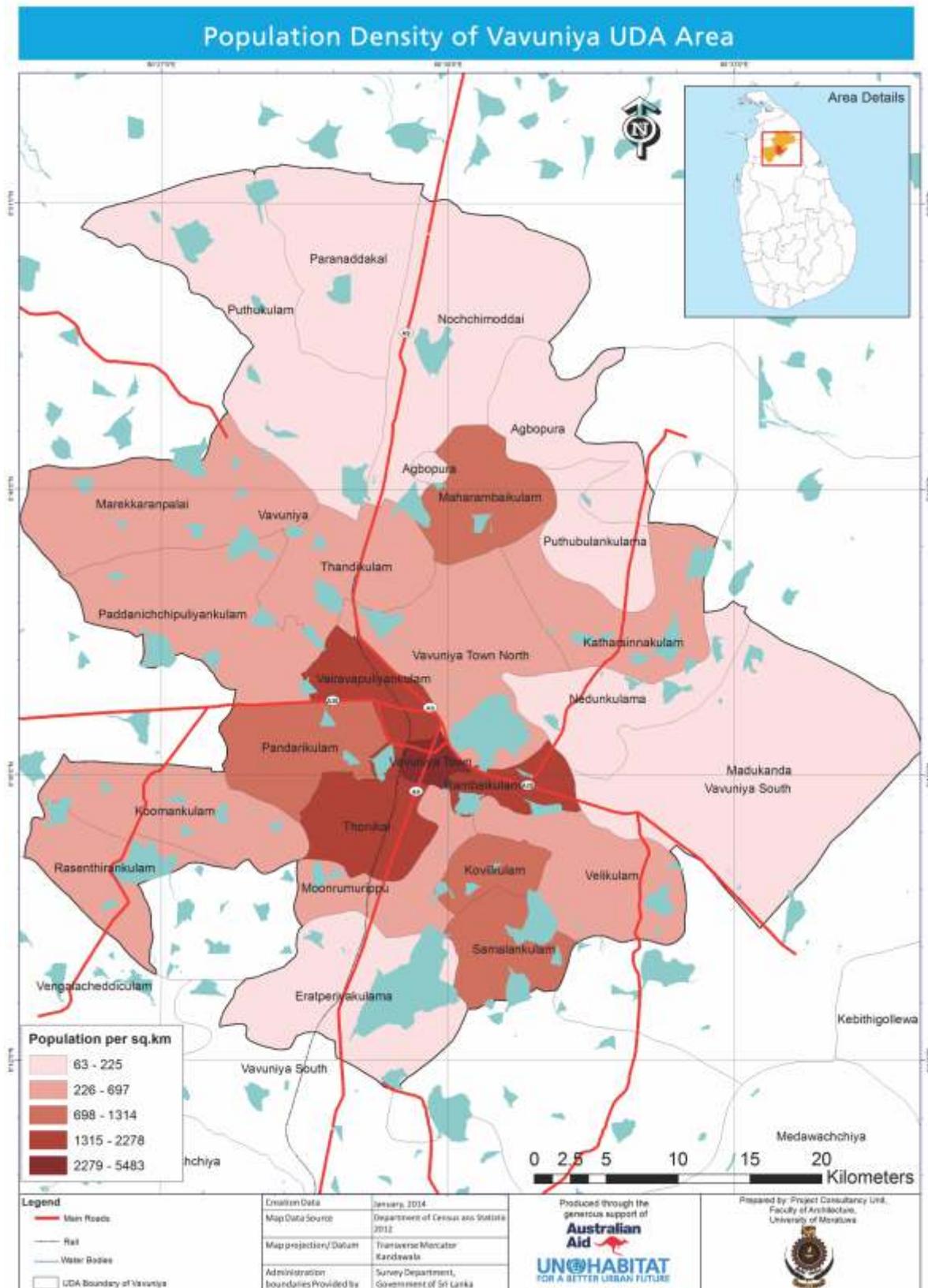


Figure 8: Variation of population density in project area



Ongoing construction of a house in resettlement area

The census has not been consistently recorded in Vavuniya: the 1991 census was not held because of the civil conflict, and the 2001 census was also not held in Vavuniya North and parts of Vavuniya Divisional Secretariat Division.

A feature of the Vavuniya project area is that it draws a large commuting population. The approximate daily commuting population into the Project Area in 2007 was about 25,000-30,000⁸. The commuters come from surrounding towns including Omanthai and Cheddikulam as well as from Mullaitivu and Mannar areas, for commercial, services and administrative needs.

A population projection has been conducted, based on available data from the UDA, for the year 2035 using a growth rate of 1.5%. This results in a population of 121,279 in 2035.

Resettlement has also been a feature of the demographics in Vavuniya. There have been 11,552 families (39,695 persons) have been resettled in 90 GN Divisions in Vavuniya District (there are no records of the exact resettlement numbers within the Project Area).⁹ To assist the population, including the resettled people, a considerable amount of capital has been spent on development activities in the Project Area including the improvement of schools, buildings, roads, cleaning of

wells, renovation of hospitals, supply of electricity, construction of co-operative outlets, renovation of tanks, clearing of abandoned paddy land and providing other agriculture facilities.

Vavuniya is a majority Tamil city with Tamils representing approximately 92% of the total population. The remainder of the population is divided between Sri Lankan Moor (4%), Sinhalese (3%) and other (1%).¹⁰ In terms of religion, the majority of the population is Hindu (79%), followed by Catholics (16%), Muslims (4%) and other (1%).¹¹

2.2.2 Housing

Housing condition plays a significant role influencing the vulnerability of people, as well as affecting their ability to respond following a hazardous event. In the Vavuniya Project Area, 13% of the houses are temporary, 44% are permanent and 43% are semi-permanent.¹² The housing status is measured by the materials that are used on the walls and roof. Figure 9: Materials Used for House Roof Construction and Figure 10: Materials Used for House Walls Construction provide a breakdown of the most common materials. The most common material for house roofs is asbestos and cement is the most commonly used material for house walls. Sanitary facilities also indicate the standard of living and in the project area, most people use toilets located outside of their houses.

8 UDA Northern Province –Vavuniya, 2007
 9 Statistical Hand Book of Vavuniya District, 2012
 10 Census and Statistical Report 2012, Sri Lanka
 11 Census and Statistical Report 2012, Sri Lanka
 12 Census and Statistical Report 2012, Sri Lanka

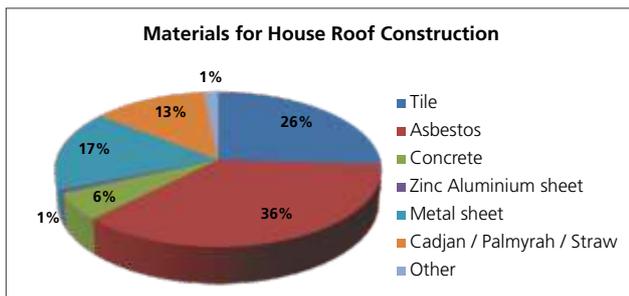


Figure 9: Materials Used for House Roof Construction

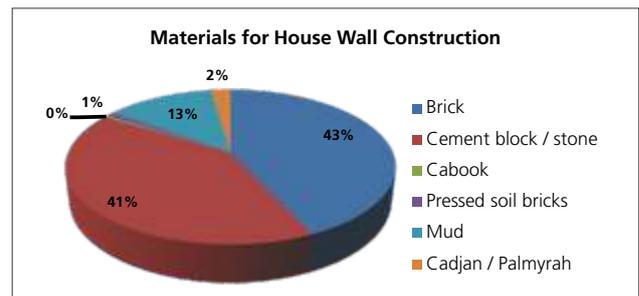


Figure 10: Materials Used for House Walls Construction

2.2.3 Economic Base

The economy of the project area mainly depends on agriculture; however, Vavuniya town plays a key role as an economic driver of the surrounding region. Vegetables, fish and other essential commodities from all over Sri Lanka are distributed in Vavuniya, which acts as a central market place. The civil conflict did disrupt the economic development of the city, however, economic progress has occurred in recent years. Vavuniya acts as a hub offering a range of business activities, a variety of shops, including textile and jewellery, a number of restaurants and hotels, as well as many small-scale shops such as hardware and services.

Agriculture and agro-based activities are the main two economic drivers for the citizens of the project area.

Paddy and black gram cultivation drive the economy. The tanks support both the agriculture and inland fishery industry.

Human and natural resources are the key factors behind the economic development of the area. Several development plans have been prepared and attempts have been made to promote industrial activities and to develop the agriculture processing industry as well as agricultural diversification, highlighting the importance of agriculture to the economy.

In terms of employment, physical labour is the most common field, with 49% of the labour force working in this field. Following this, the next single biggest employment field is the government sector (15%).



'Modern market' for vegetables at Horowpathana road

2.2.4 Land Use

The main land uses in the Vavuniya Project Area are: agricultural, environmentally sensitive, residential, commercial and public. The *Statistical Handbook of Vavuniya, 2012*, indicates that the majority of the total land in the Vavuniya Project Area (approximately 73%) is used for agriculture. Abandoned tanks, barren lands, canal bunds, quarries, rock sites are all classified as developable land and this category represents nearly 20% of the total land area. Other uses such as residential, commercial, industrial, public and semi-public, parks and playgrounds, infrastructure, roads and circulation cover 17% of the total land area and are also considered as developed land.

The Project Area includes 119km² of land which has been identified as a new development area by the UDA.

Agricultural land

The main agriculture activity is paddy and seasonal dry gram cultivation. Paddy land lies throughout the Urban Development Area and is often bounded by residential areas of the town. In addition, to paddy, cultivation of other field crops, livestock farming, forestry and inland fisheries are the main components of the agriculture category. In Vavuniya, 64% of families are engaged in agriculture-related activities.

Major, medium and minor irrigation tanks, including anicuts are widespread throughout the area as these are the predominant irrigation method for paddy. Considerable amounts of paddy land have been abandoned due to failures in the irrigation systems coupled with unexpected climatic variation based impacts such as changing of rainfall patterns.

Maintaining paddy lands and continuing cultivation is essential as the majority of the population of Vavuniya is dependent on agriculture for their livelihood. Cultivated

paddy land also provides environmental 'lungs' for the city of Vavuniya.

Environmentally Sensitive Areas

The Vavuniya urban development area includes the following environmentally sensitive zones:

- Forest reservations (categorised as dense forest);
- Marshy lands;
- Scrub;
- Tank reservations and catchments;
- Cannel reservation; and
- Water bodies.

Residential Uses

Residential uses cover approximately 10% of the Project Area. Compared to other cities like Trincomalee or Batticaloa, the Vavuniya area has a lower percentage of residential land. The average plot size is about 26 perches per housing unit, which is also a low building density.

Commercial Uses

The main commercial activities are located along the Kandy, Horowpathana and Bazaar Roads, as well as near the railway reservation. Many urban development initiatives are being implemented by VUC to promote the economic development of the city, this includes a wholesale market. Development in commercial areas needs to be well planned to capitalise on the location potential of Vavuniya as an attractive central market place to surrounding regional cities.

Public and Semi-Public Uses

The public and semi-public land use category includes administration, education, health and religious activities, however many places are underutilised and the prime locations mean they have the potential to be converted into other higher value urban uses.

Figure 11: Vavuniya Project Area Land Uses provides an illustration of the areas covered by each category of use.



Rice cultivation in Vavuniya



Bazaar road early in the morning

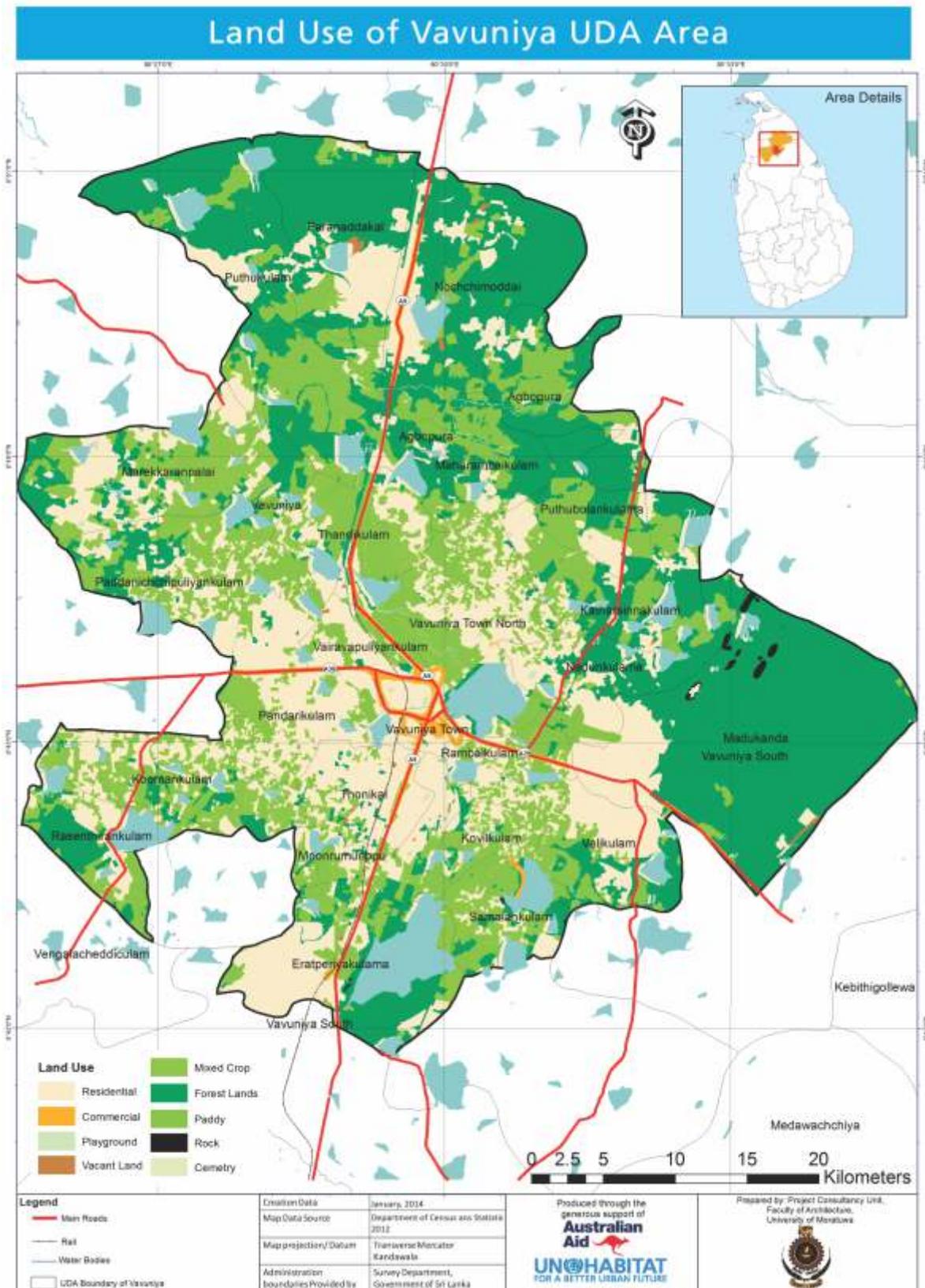


Figure 11: Vavuniya Project Area Land Uses

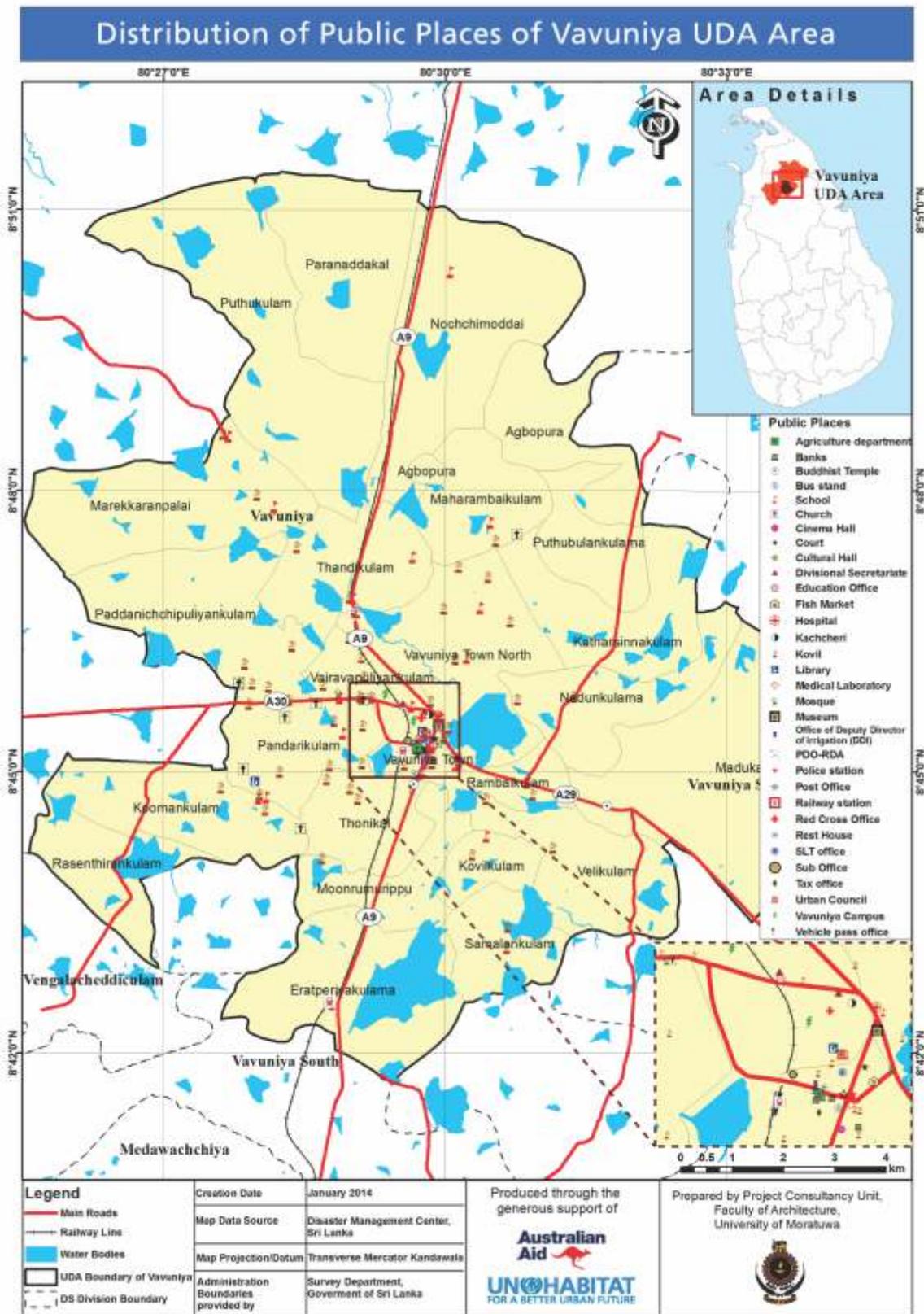


Figure 12: Public Places within Vavuniya

Changes of land use and land cover arising from new economic development have also resulted in changing hazards, especially flash floods. With the unplanned development and little consideration of DRR measures, such as proper drainage lines, and guidelines for building on low-lying land, the city has started to suffer from several issues.

The provision of infrastructure and maintenance of public places reflects Vavuniya's status as a first order city. Figure 12: Public Places within Vavuniya, illustrates the number of public places, as well as the concentration within the Urban Council area – the centre of Vavuniya.

2.3 Conclusion

This chapter provided a background to the Project Area's physical, social, environmental and economic situation. Vavuniya town acts as an administrative and service

centre for the surrounding region: It is a first order town and important centre within the region. The chapter highlights some of the challenges that Vavuniya faces, including the haphazard development practices and the need for a strategic development plan that includes DRR features. The chapter highlighted vulnerabilities such as the extremes in rainfall and the precarious economic position of large numbers of the community who are dependent on agriculture, which can easily be disrupted by natural hazards. This background was used to understand the city and helped to shape the strategic assessments that are discussed in Chapter 3, Strategic Assessments.

3

Strategic Assessments



Strategic Assessments

The baseline information provided a basis for conducting an analysis of the existing situation in the Vavuniya Project Area. The Strategic Assessments, keeping the presence of hazards and the occurrence of disasters as foremost concerns were able to build on the baseline information from Chapter 2, and identify issues, locations, root causes, potential solutions and key stakeholders required to improve the resilience of Vavuniya.

The Strategic Assessments were conducted in four parts:

1. Undertaking a hazard, vulnerability, risk and capacity assessment – identifying hazards, social, economic, natural and physical vulnerabilities and locations (both single and multiple);
2. Weather Forecasting for Vavuniya – analysis of rainfall, temperature, wind speeds and other climatic data from 1958 to provide indicative forecasts;
3. Analysis of strategic Strengths, Weaknesses, Opportunities and Threats (SWOT) – systematic analysis of strengths, weaknesses, threats and opportunities to enable Vavuniya to develop as a disaster resilient city; and
4. Core Problem Analysis – threats and weaknesses identified through the SWOT were focused on to both address and predict major problems.

Stakeholder consultations and field observations were also important in testing the validity of the Strategic Assessments process.

3.1 Methodology

Detailed analysis and stakeholder consultations form the basis of the Strategic Assessments. Stakeholders include local communities, government institutions, civil society, the private sector, development practitioners and academics.

3.1.1 Hazard, Vulnerability, Risk and Capacity Assessments

These assessments are interlinked and dependent on each other for an optimal outcome to achieve the following:

1. Identify natural hazards in the city of Vavuniya;
2. Identify the consequences of the natural hazards;
3. Recognise the different elements at risk in the city, (for example vulnerable groups and their locations) and to evaluate their risk level;
4. Identify social, economic and environmental vulnerability dimensions in the area;
5. Assess information on current disaster adaptation measures and their constraints; and
6. Identify the root causes of the problems related to disasters in identified locations (especially in areas at risk from more than one hazard).

The assessments assist in identifying issues, priorities and key actors and in building commitment. The level of exposure, vulnerability and adaptive capacity are core elements in these assessments.

A series of hazard, vulnerability and risk maps have been produced as outcomes of the Hazard, Vulnerability and Risk Assessments.

Hazard Assessment

The Hazard Assessment determines which hazards will be evaluated in the vulnerability assessment and the priority levels for interventions. To establish hazard levels, the following equation can be used:

$$(\text{Frequency} + \text{Area Impact}) \times \text{Potential Damage Magnitude} = \text{Total Score}$$

The hazard assessment that was conducted in this project was based on the *Sorsogon City Climate Change Vulnerability Assessment*.¹³ An additional element was included in the process detailing natural hazards by their intensity and frequency. Community Hazard Mapping enabled stakeholders to identify the areas they have experienced as vulnerable to different types of hazards. The people and resources located within the hazardous area are considered to be at risk from hazards and may or may not be vulnerable to hazard impacts. The assessment is also integrated with projected climate scenarios and previous climate related disaster occurrences. This includes incorporating peoples' accounts of past events as well as observations from the site visits. Table 3 outlines the Hazard Assessment Process.

1. Preparation of Hazard Inventory using secondary and primary data.
2. Analysis of projected climate scenarios and previous climate related disasters.
3. Community-based hazard location mapping to identify experiences of hazards, locations and history.
4. Analysis of climate data, community inputs and hazard inventory data.
5. Mapping hazard locations using the Geographical Information System
6. Verification of hazard locations by <ol style="list-style-type: none"> a. Field Visits b. Stakeholder Workshops (validation workshops) c. NBRO Data, UDA Data, DMC Information
7. Preparation of Final Hazard Maps

Table 3: Hazard Assessment Process

In the Vavuniya Project area, floods, droughts and strong winds were recorded as hazards. They have caused significant losses to lives and properties on a number of occasions over a number of years.

Vulnerability and Risk Assessment

The vulnerability and risk assessment process follows the conceptual framework developed by the European Commission on Assessing Vulnerability to Natural Hazards in Europe: A Manual on Concept Methodology and Tools, and the procedures presented in the *Sorsogon City Climate Change Vulnerability Assessment*.

The potential impact of the hazard on economic, social and environmental dimensions of society, and the degree of risk depends on the vulnerability (or fragility), and the lack of resilience of a society (and of the environment). Assessment of hazards, city vulnerability

rankings and calculations of risk therefore need to be done to appropriately identify danger. The assessment process was modified using practical lessons that have been learnt throughout the project. The mapping techniques and identification of risk elements was done based on a technical research paper, "A Study on Extracting Important Elements for Vulnerability Assessment in a Sri Lankan Context" which was carried out by the University of Moratuwa. This identified that traditionally under-represented communities, including women, youth and marginalized groups, such as the urban poor, are often more susceptible to climate change driven impacts given their limited adaptive capacity and the vulnerable locations of their settlements (for example, informal communities on unprotected coastal areas). The process adopted to assess vulnerability is provided in Table 4. A diagram representing the Hazard, Vulnerability and Risk Assessment process is provided in Figure 13.

1. Identify city elements at risk
2. Develop indicators based on exposure and fragility for social, economic and environmental dimensions of the city
3. Mapping elements at risk: <ul style="list-style-type: none"> - Identify vulnerable groups and their locations; - Spatial analysis of vulnerability elements; and - Produce maps that show the spatial configurations of city elements
4. Quantifying / assessing vulnerability elements in each disaster: <ul style="list-style-type: none"> - Assessing vulnerability for weighted overlay process in risk assessment
5. Prepare vulnerability dimension maps

Table 4: Process to Assess Vulnerability

Risk Assessment

The risk is the result of identifying hazards, vulnerabilities and capacities of a particular system. This can be illustrated as follows:

$$Risk = \frac{Hazard \times Vulnerability}{Capacity}$$

Capacity demonstrates the combination of the strengths, attributes and resources available within a community, society or organisation that can reduce the level of risk, or the results of a disaster. The risk assessment consists of three steps: the hazard assessment, the vulnerability assessment and the capacity assessment. The risk assessment process is provided in Table 5.

1. Validation of hazard assessment and hazard maps by stakeholders.
2. Validation of vulnerability of social, economic and environmental values.
3. Capacity assessment of the city using selected indicators.
4. Amalgamation of hazards, vulnerability and capacity assessments, with spatial analysis.
5. Preparation of social, economic and environmental risk maps for flood, droughts and strong winds.
6. Preparation of composite flood, drought and strong winds maps through weighted overlay of spatial analysis.
7. Formation of multiple risk area maps for Vavuniya by combining composite disaster maps.

Table 5: Risk Assessment Process

Capacity Assessment

The capacity assessment is the final step and it addresses the ability to face and respond to the impacts of hazards. The capacity assessment may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management at city level. The availability of early

warning systems, local knowledge, hazard forecasting technologies and backup plans are important elements of the capacity assessment. The capacity assessment documents the existing assets of a community in a project area that increase, or decrease the ability to cope while responding to a hazard.



Sediment deposited has gradually reduced the capacity of Vavuniya Kulam

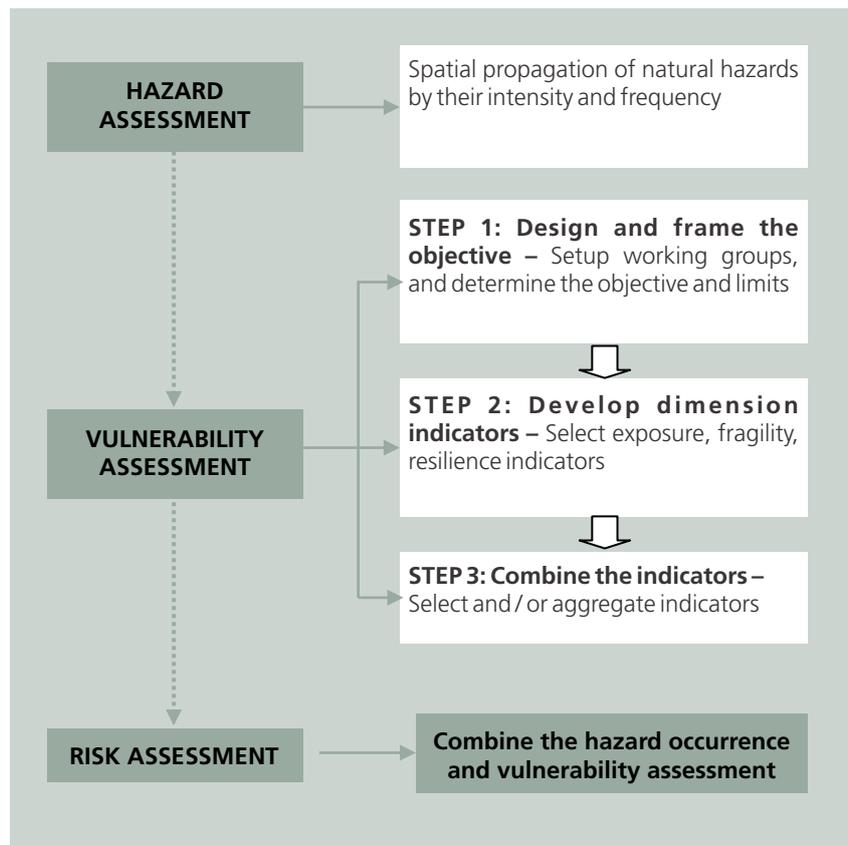


Figure 13: Vulnerability and Risk Assessment Methodology

3.2 Community Hazard Assessment

Community hazard mapping was conducted through workshops that included GN officers, UDA officers and other local authority officers working alongside the community. The locations they identified were then visited by the project team who conducted further informal interviews with both community groups and individuals.

Floods, droughts and strong winds were identified as the main hazards affecting the Project Area. It was noted that the communities are alert to the hazards that they regularly face. The results of the mapping workshop are visible in Figure 14: Community Hazard Mapping – Flooding, Figure 15: Community Hazard Mapping – Drought and Figure 16: Community Hazard Mapping – Strong Winds.



Community Hazard Mapping

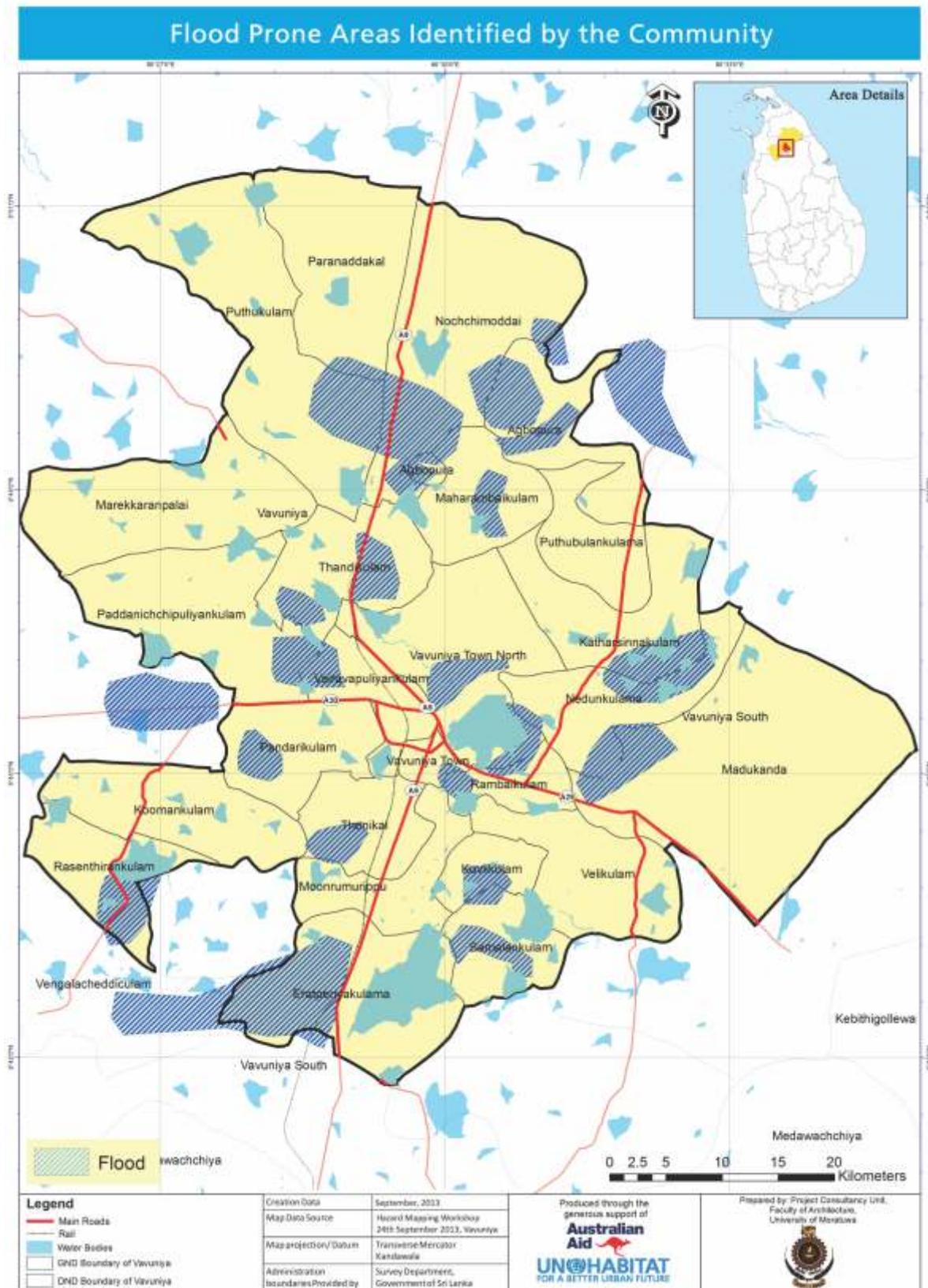


Figure 14: Community Hazard Mapping – Flooding

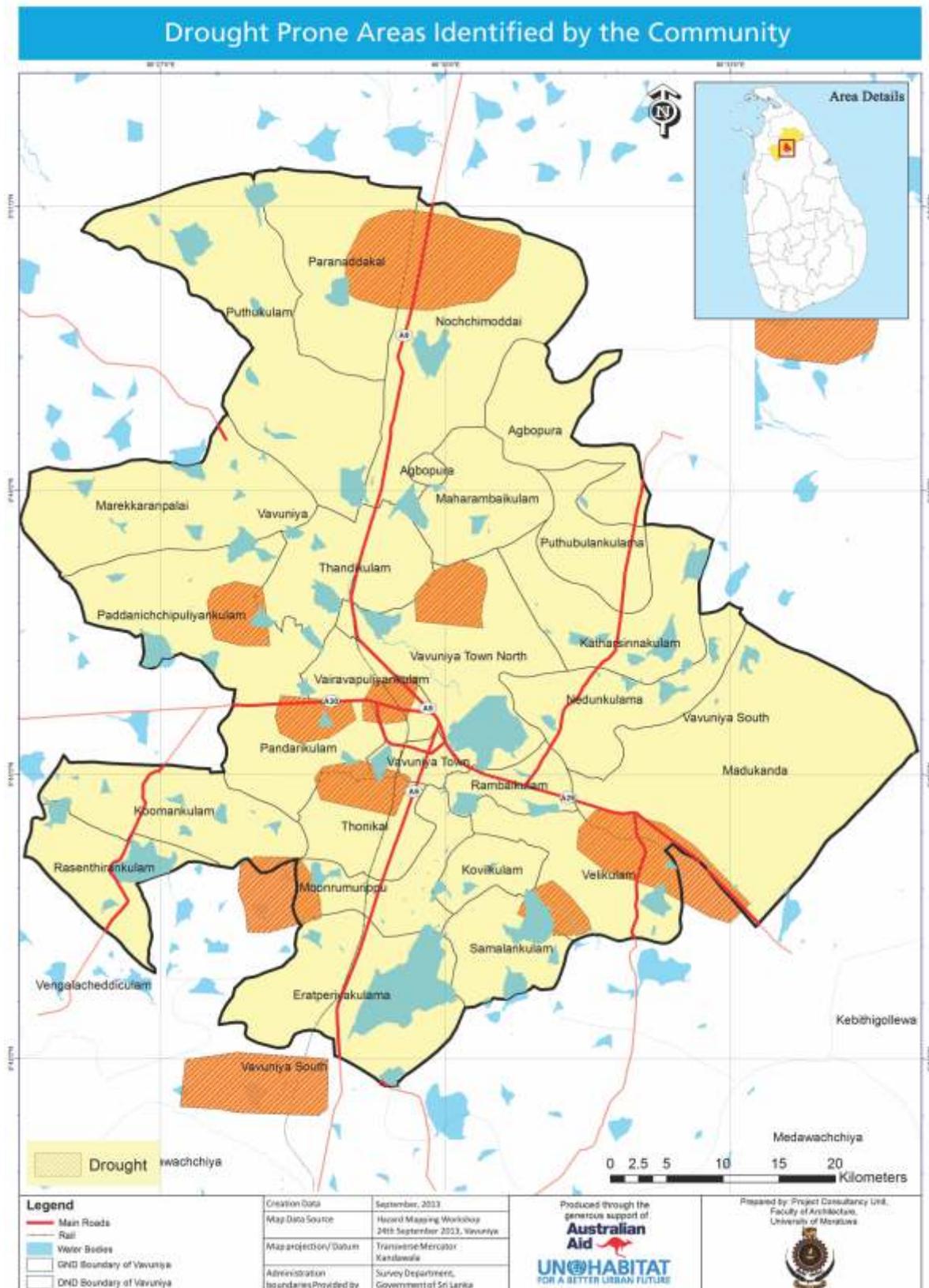


Figure 15: Community Hazard Mapping – Drought

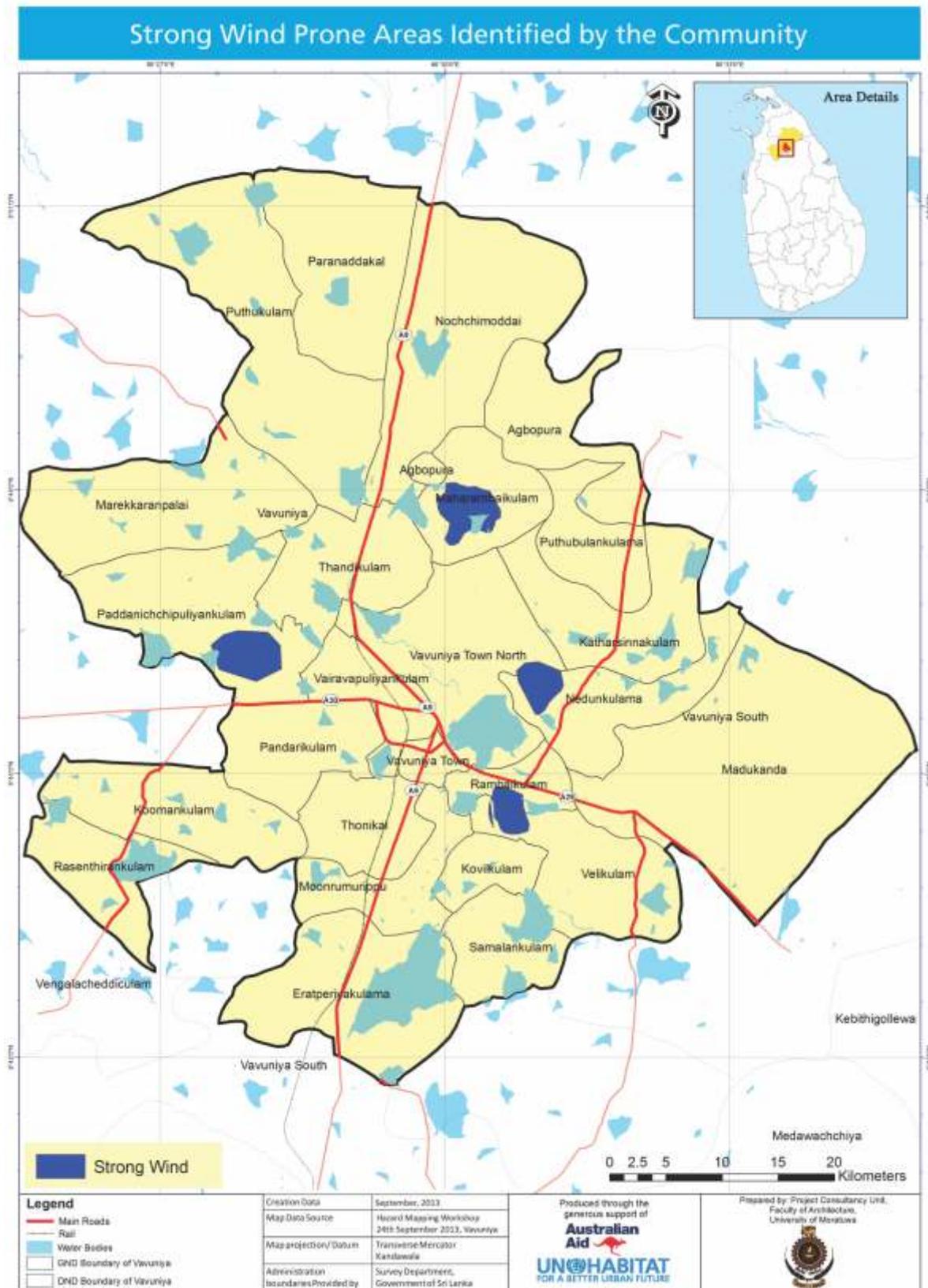


Figure 16: Community Hazard Mapping – Strong Winds

3.3 Detailed Hazard Mapping

The hazard types were identified, and their locations were mapped; then following detailed analysis, a rating of 'very high', 'high', 'moderate', 'low' and 'not affected' was assigned. This approach combines the hazard assessment and the technical assessment by using information from the community and

stakeholders with hazard inventory data. Detailed hazard maps were prepared and are presented below in the following order: Figure 17: Hazard Map – Flood, Figure 18: Hazard Map – Drought and Figure 19: Hazard Map – Strong Winds. As risk mitigation measures are improved the maps must be updated to reflect the changes.



School children preparing community hazard maps

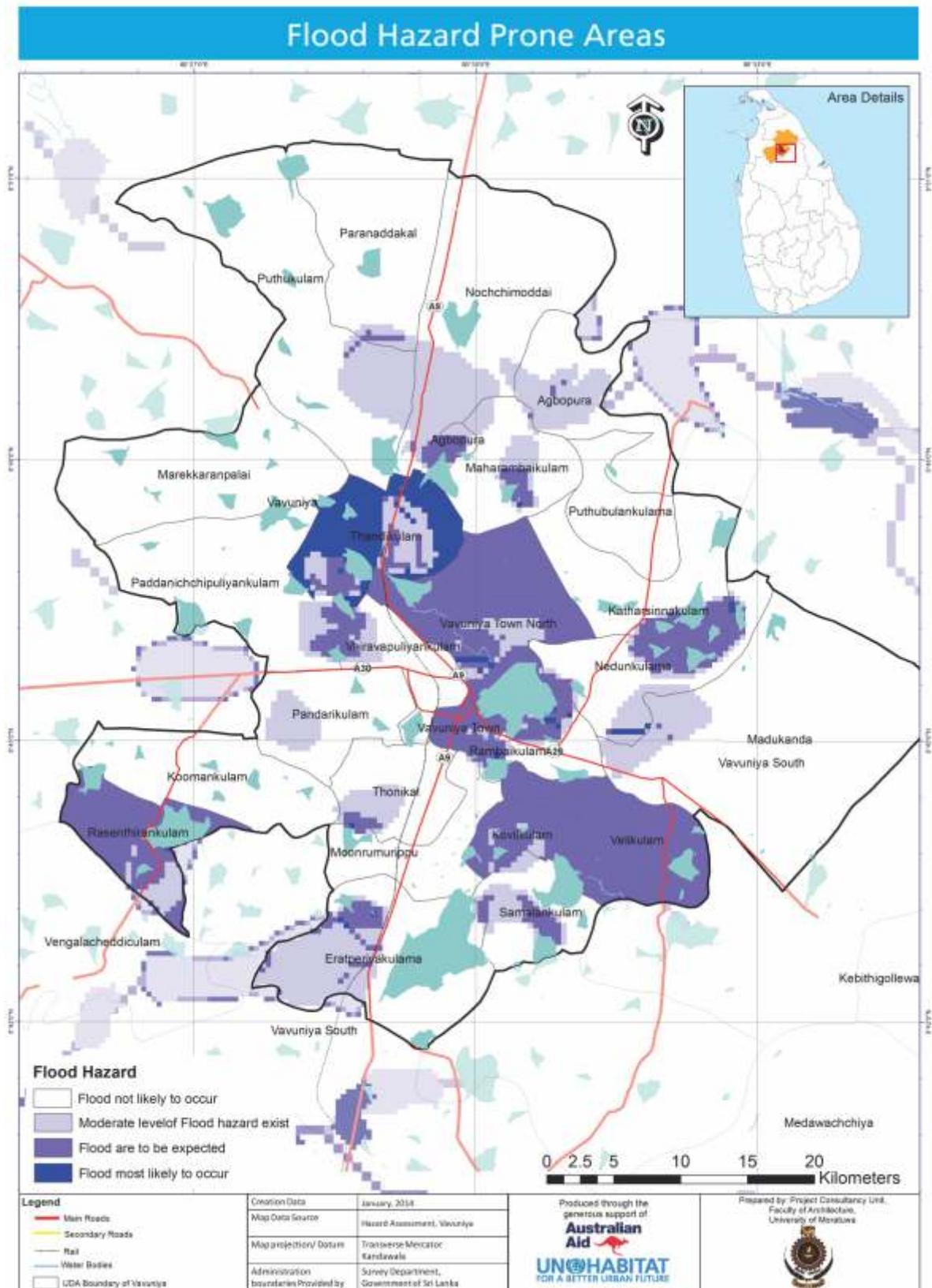


Figure 17: Hazard Map – Flood

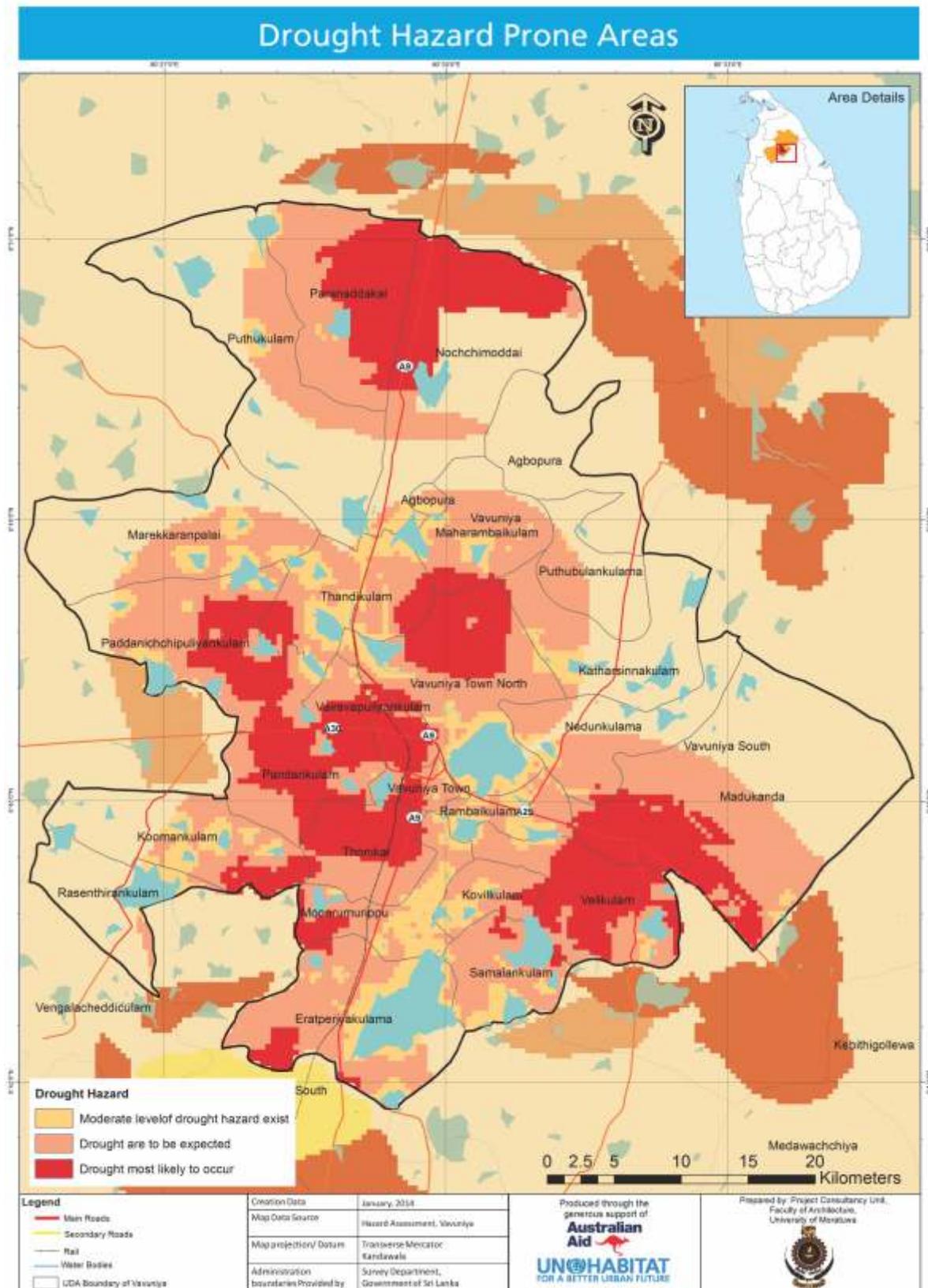


Figure 18: Hazard Map – Drought

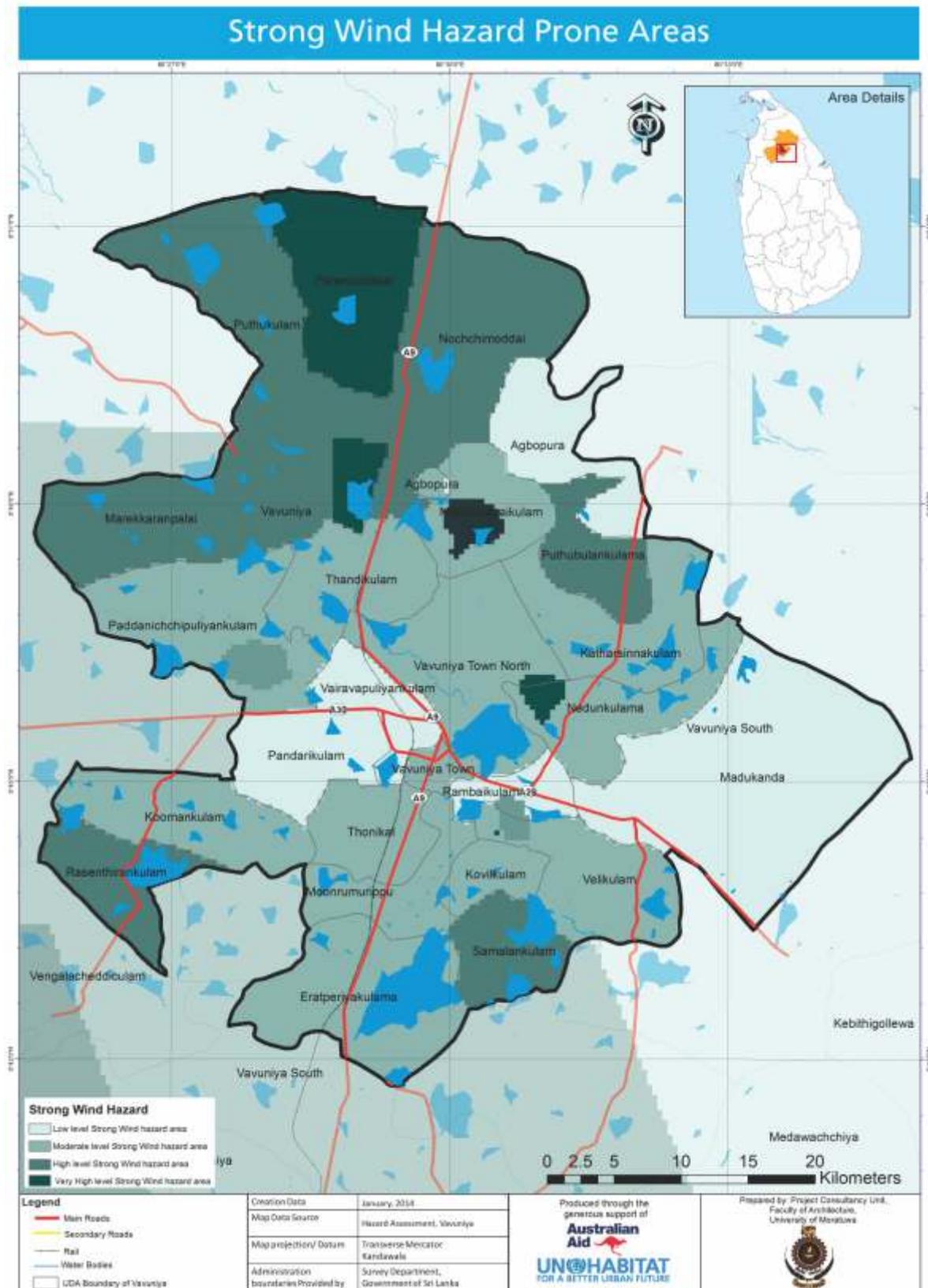


Figure 19: Hazard Map – Strong Winds

3.4 Vulnerability and Risk Assessment

The selection of criteria for the vulnerability and risk assessment combined the research conducted, the community hazard mapping results and the results of interviews with professionals to establish vulnerable elements for each hazard and to assign values to those

elements. Table 6 outlines the hazards, the vulnerability dimensions and the elements at risk. From this process, the economic, social and environmental vulnerability levels were mapped against a classification system of low, moderate, high and very high. These maps are provided at Figure 20: Social Vulnerability, Figure 21 Economic Vulnerability and Figure 22: Environmental Vulnerability.

Hazard	Vulnerability Dimension	Elements at Risk
Flood	Social	Built-up area
		Population
		Children
		Elderly population
		Women
		Disabled population
		Public gathering places and buildings (schools, hospitals, government buildings)
	Economic and Infrastructure	Built-up area (commercial and industrial land)
		Agricultural land
		Agricultural employment
		Low income population
		Safe drinking water
		Bridges
Environment	Road network	
	Parks	
	Scrub	
	Forest	
Drought	Social	Marsh
		Built-up area (residential)
		Children, women, disabled people
	Economic	Population without access to safe water source
		Agricultural land
		Agricultural employment
		Home gardens
		Low income population
	Environmental and Bio-physical	Unemployed population
		Soil (water holding capacity)
Forest / scrub		
		Marshes

Hazard	Vulnerability Dimension	Elements at Risk
Strong winds	Social	Housing condition – roofs, walls, floor, sanitation
		Population including children and women
		Elderly population
		Disabled population
	Economic and Infrastructure	Agricultural land
		Low income population
		Bridges
	Environmental	Parks / playgrounds
Forest		

Table 6: Hazard, Vulnerability and Risk Considerations



Flash floods due to poor drainage at Ponthoddam village

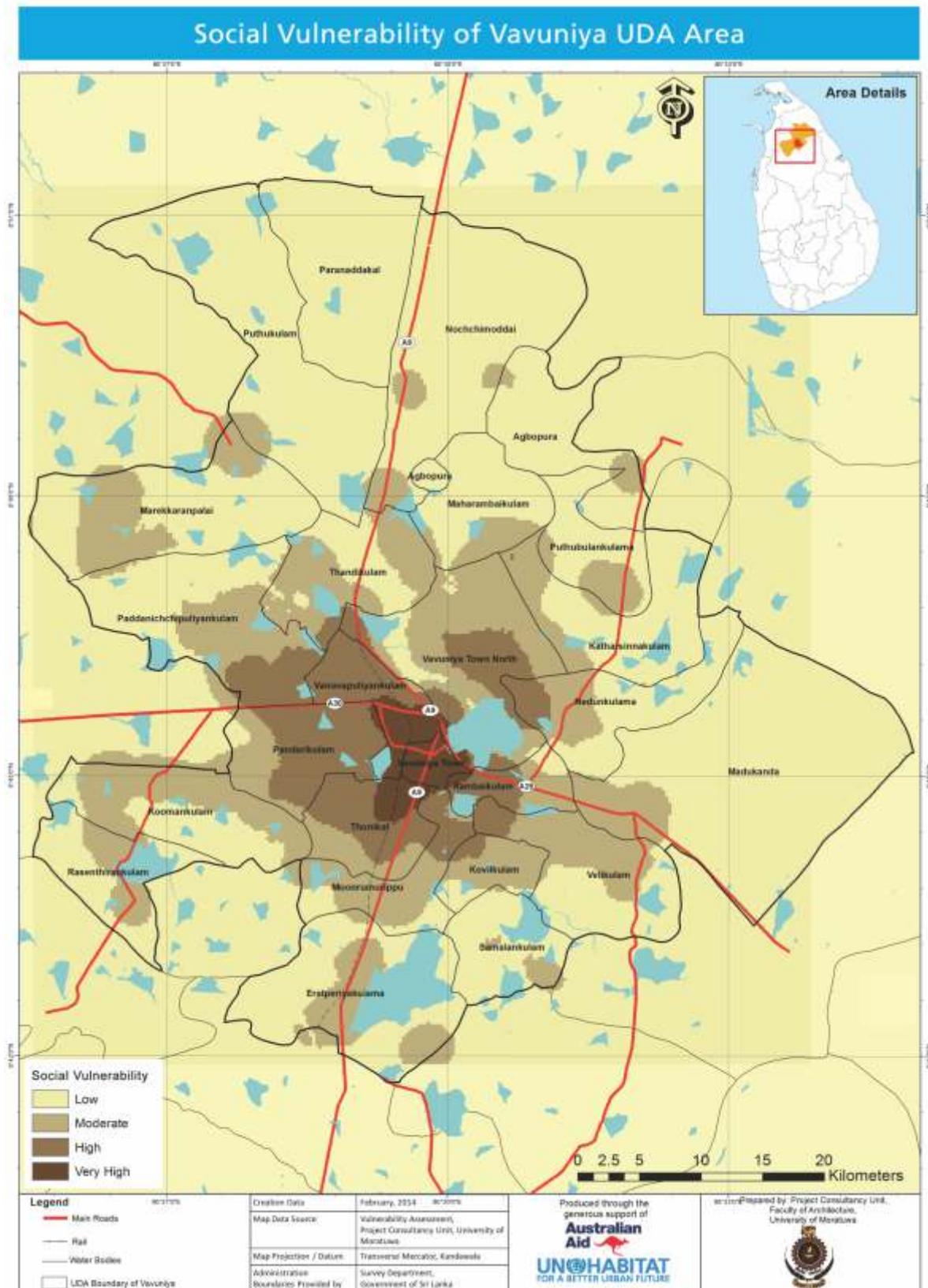


Figure 20: Social Vulnerability

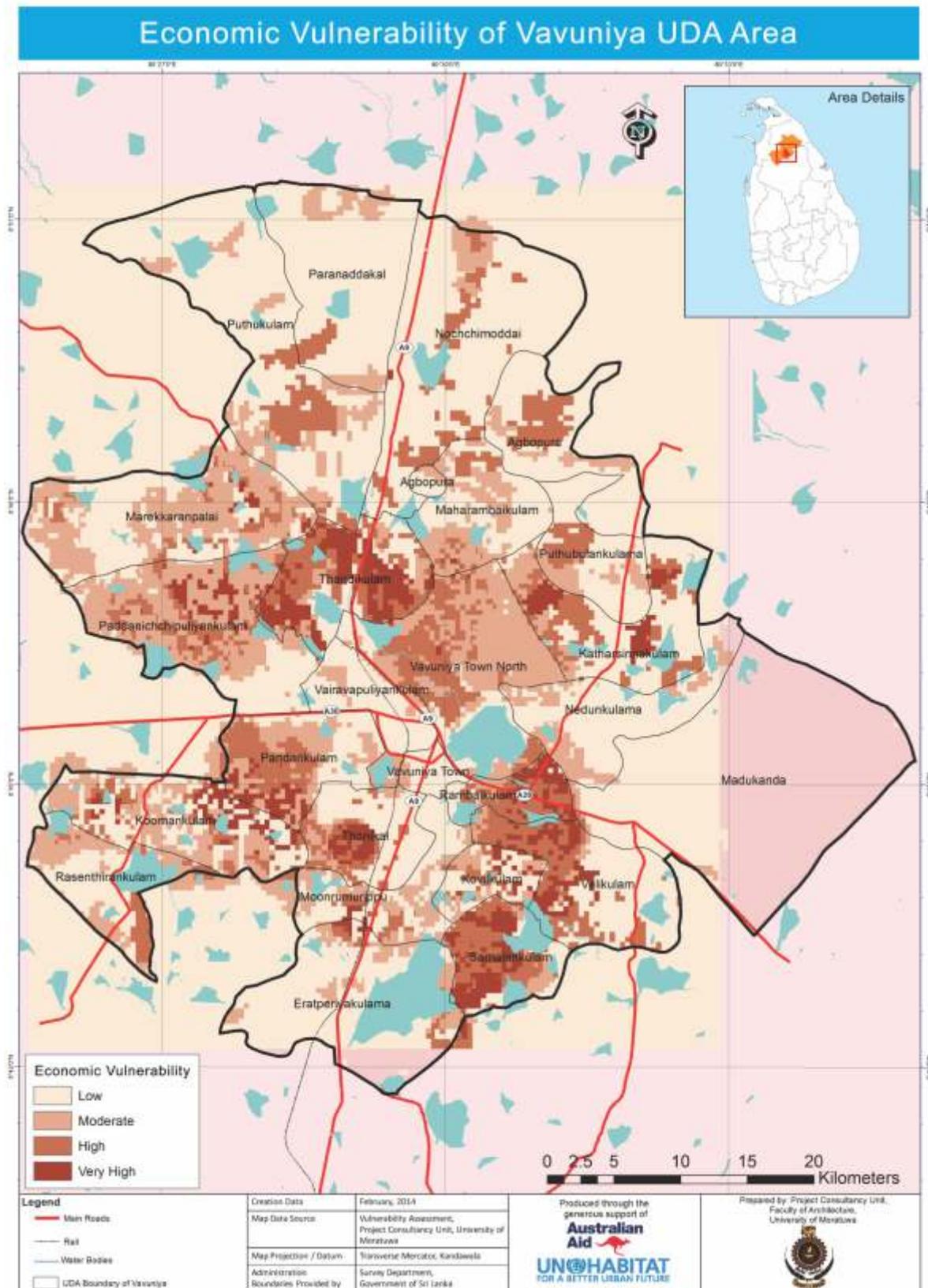


Figure 21: Economic Vulnerability

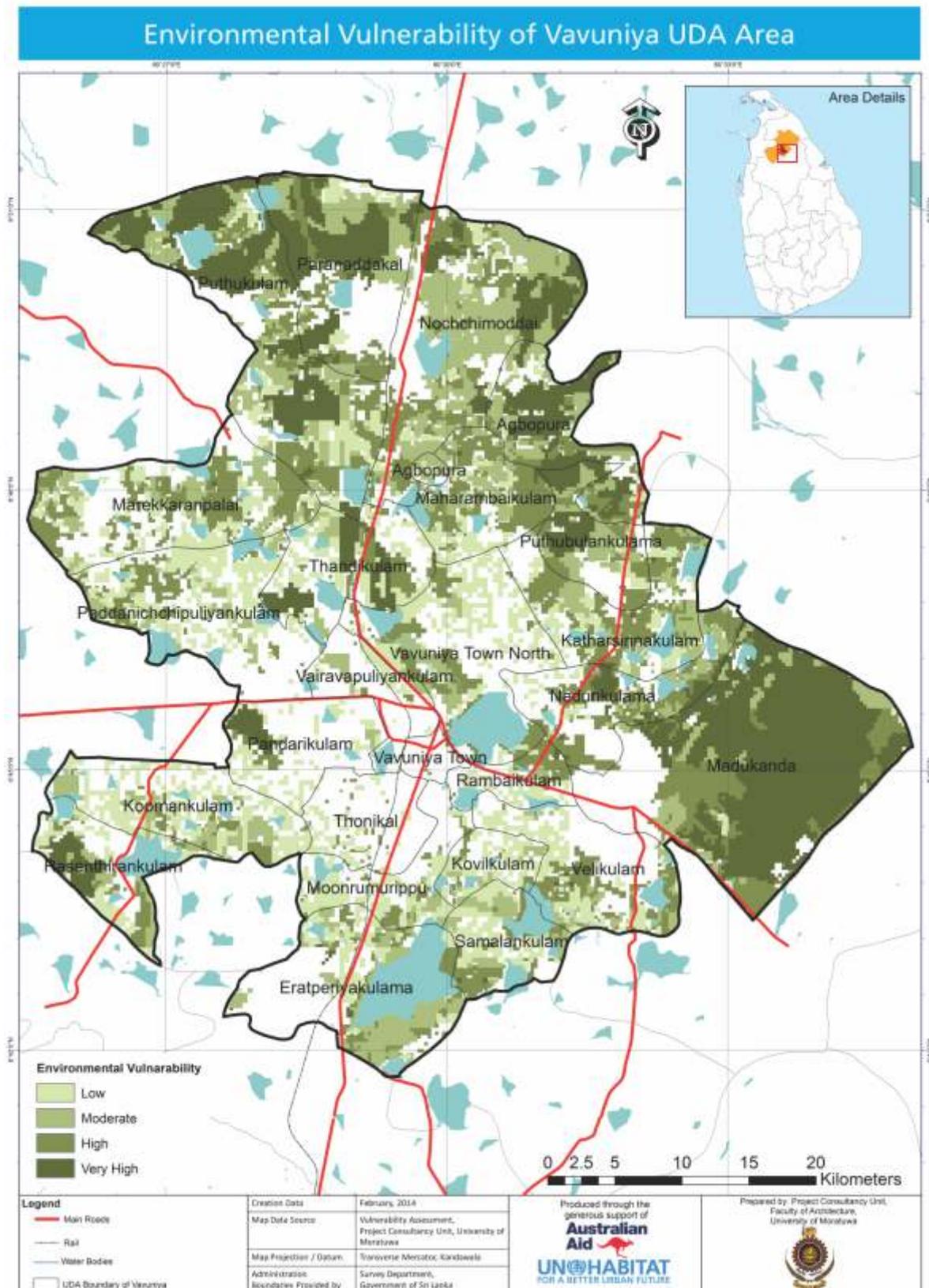


Figure 22: Environmental Vulnerability

3.5 Capacity Assessment

Standard, yet specific indicators have been established in *A Framework for Social Adaptation to Climate Change: Sustaining Tropical Coastal Communities and*

Industries,¹⁵ for capacity assessments. These indicators assisted in forming the set of indicators used to evaluate the capacity of the project area, which are provided in Table 7.

Factor	Indicator
Economically active population	Percentage of population comes under the 14-60 age group category
Access to financial subsidies	Percentage of families receiving Samurdhi
Educated population	Passed G.C.E O/L, G.C.E. A/L, Degree or Higher
Secure employment	Percentage of population involved in government, defence, education and private sector employment
Access to safe drinking water facilities	Percentage of houses with access to safe drinking water
Access to proper sanitary facilities	Percentage of houses with access to proper sanitary facilities
Access to health facilities	Service area of the Health Centres
Access to electricity	Percentage of houses with access to electricity
Permanent houses	Percentage of permanent houses

Table 7: Capacity Assessment Factors and Indicators

The capacity assessment was conducted at the Grama Niladhari Division (GND) level, as that is the smallest dataset available in the Project Area. Community knowledge and information were collected to analyse some capacity assessment factors. Several questions were asked of the community regarding the availability of disaster mitigation measures, early warning systems, evacuation places or paths and insurance. The project team has verified the recognized measures through the field visits, DMC District Disaster Preparedness and Response Plans and secondary data reports.

Figure 23: Capacity Analysis Summary illustrates what support mechanisms are available to the community. The community indicated that early warning systems for common hazards are not properly functioning or not available. The community, however, is rich with traditional and local knowledge about disasters, and the availability of the disaster preparedness plan is considered a plus point.



GN officers identifying evacuation places and paths

15 IUCN, A Framework for Social Adaptation to Climate Change. Available from: <https://portals.iucn.org/library/efiles/documents/2010-022.pdf> (accessed on 5 August 2014)

Hazard	Early warning system	Evacuation place and path	Traditional and local knowledge	Plan and funds for disaster risk reduction	Insurance policies for disasters	Building construction standards and other standards	Basic infrastructure and preventive infrastructure	Supportive organisations and communities
Flood	N/A	O	O	O	O	O	O	O
Drought	N/A	N	O	N	N	O	N	N
Strong Winds	N/A	N/A	O	O	O	N	O	O
O – Operating Normally								
N – Not Operating								
N/A – Not Available								

Figure 23: Capacity Analysis Summary

People who have more economic strength with permanent income sources, insurance schemes and financial subsidies, have a greater ability to cope with disasters because of the resources they have access to. People with indigenous knowledge about disasters also have a greater ability to face disasters with minimum losses than those who do not. Access to safe basic infrastructure such as water and sanitary facilities can minimize the secondary effects of disasters. Similarly, a community that has access to such resources normally has a higher capacity to prepare, face, cope, respond and finally, to recover from disasters.

3.6 Risk Mapping

The risk maps were prepared by superimposing the hazard and vulnerability maps. In this assessment, the hazard and vulnerability maps, each comprising four levels of classification – very high, high, medium and low – were prepared. To superimpose the maps, it is necessary to establish the risk levels criteria. A high level of hazard superimposed on high, medium or low levels

of vulnerability (or vice versa) is classified as a very high level of risk. A high level of hazard with a medium level of vulnerability is also rated as a high level of risk. Finally, a low level of hazard with low-level vulnerability is rated as a low level of risk. If either the hazard or vulnerability is very low, then risk is considered to be very low. This analysis has been performed for flood, drought and strong winds and the results are illustrated in Figure 24: Composite Flood Risk Map, Figure 25: Composite Drought Risk Map and Figure 26: Composite Strong Wind Risk Map. The areas highlighted in each of these maps are vulnerable to hazards and should be the focus for future DRR interventions. There is a very high flood risk in the area in between Vavuniya Town, Vairavapuliyankulam, Pandarikulam and Thonikal. Reducing the risk of drought is a common need across most of the project area. The composite drought risk map identifies the potential risk attached to the whole area regardless of social, economic and environmental contexts. Compared to flood and drought, the risk from strong winds is lower and prevalent across the whole area.

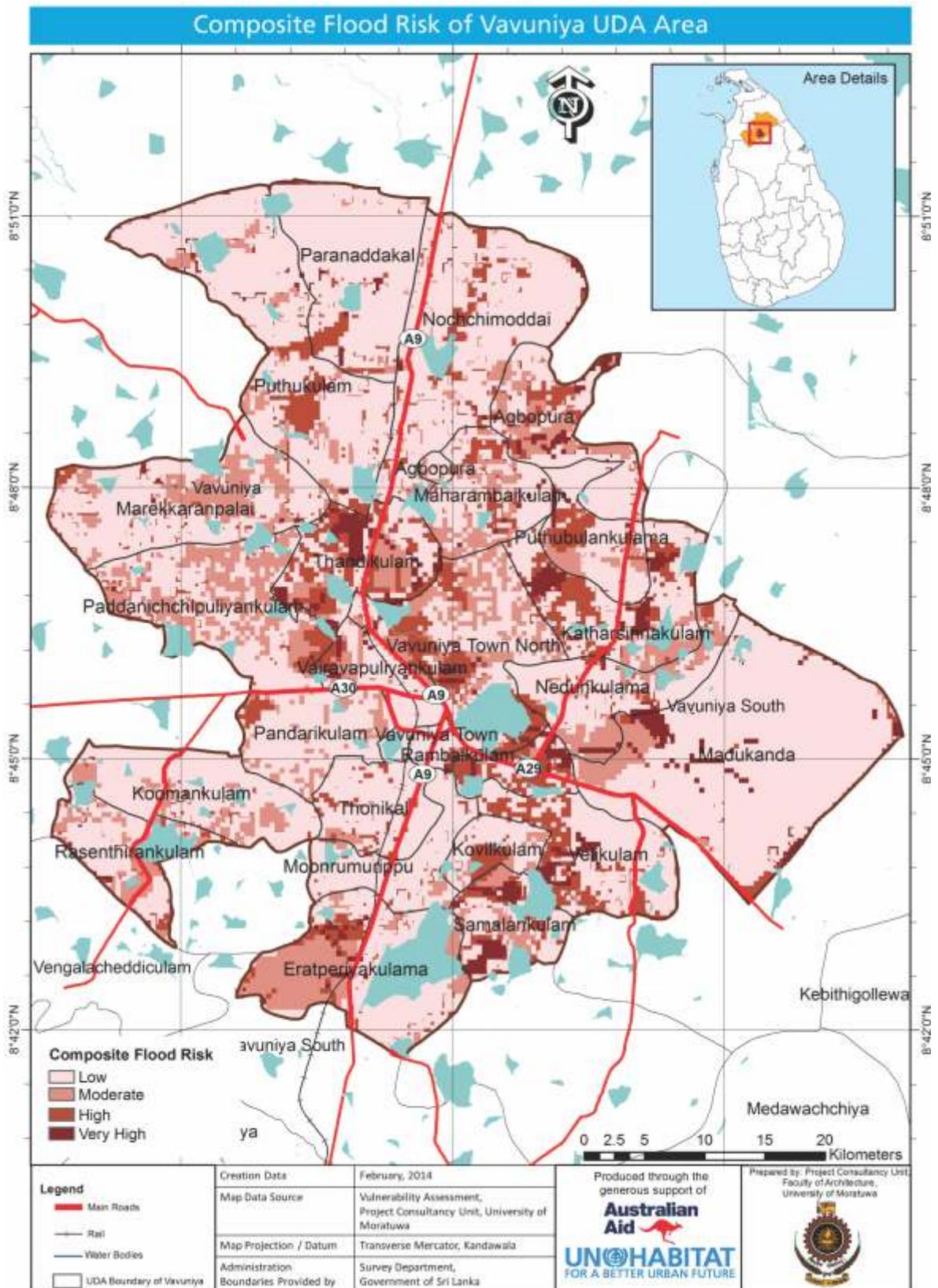


Figure 24: Composite Flood Risk Map

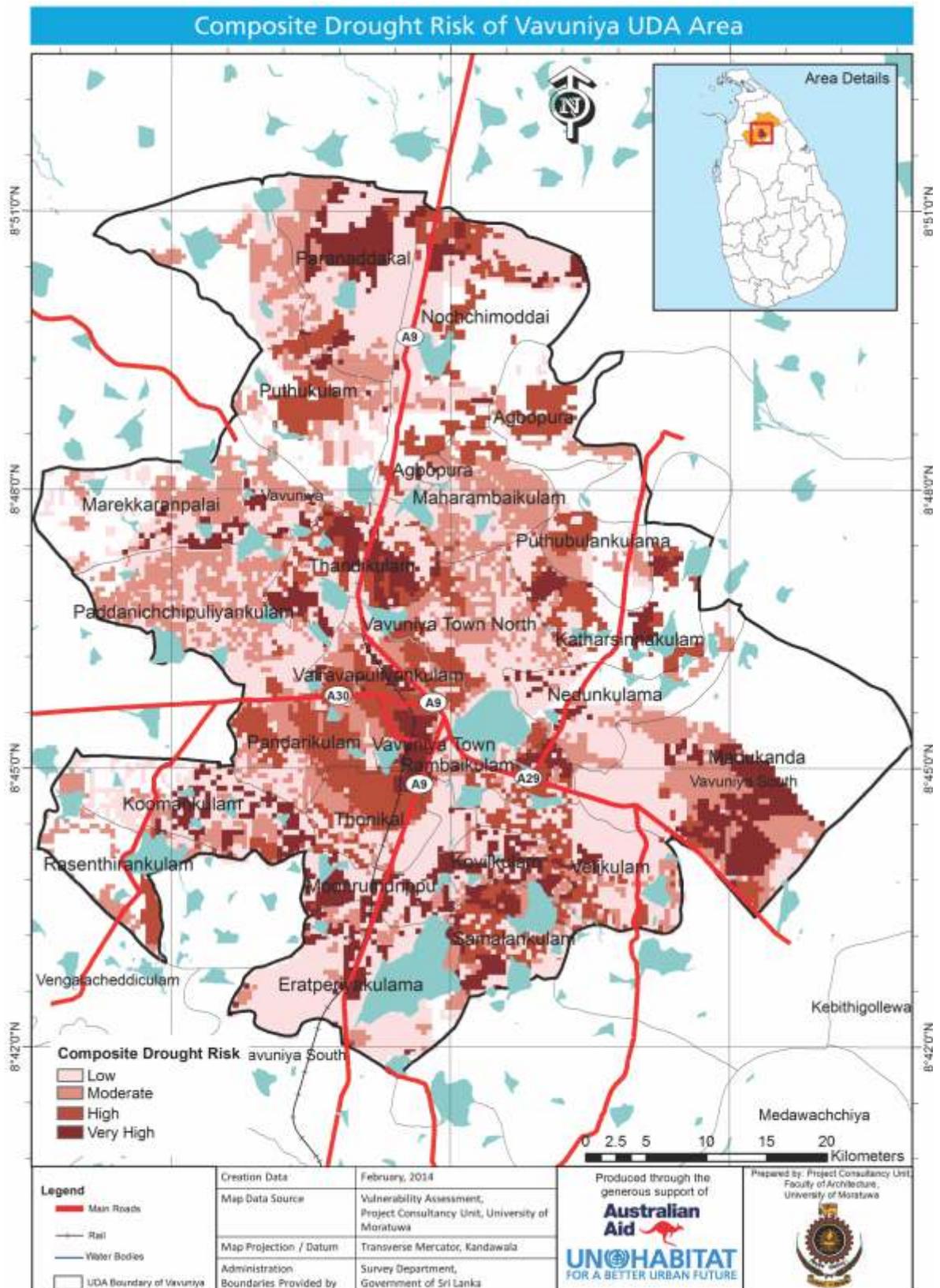


Figure 25: Composite Drought Risk Map

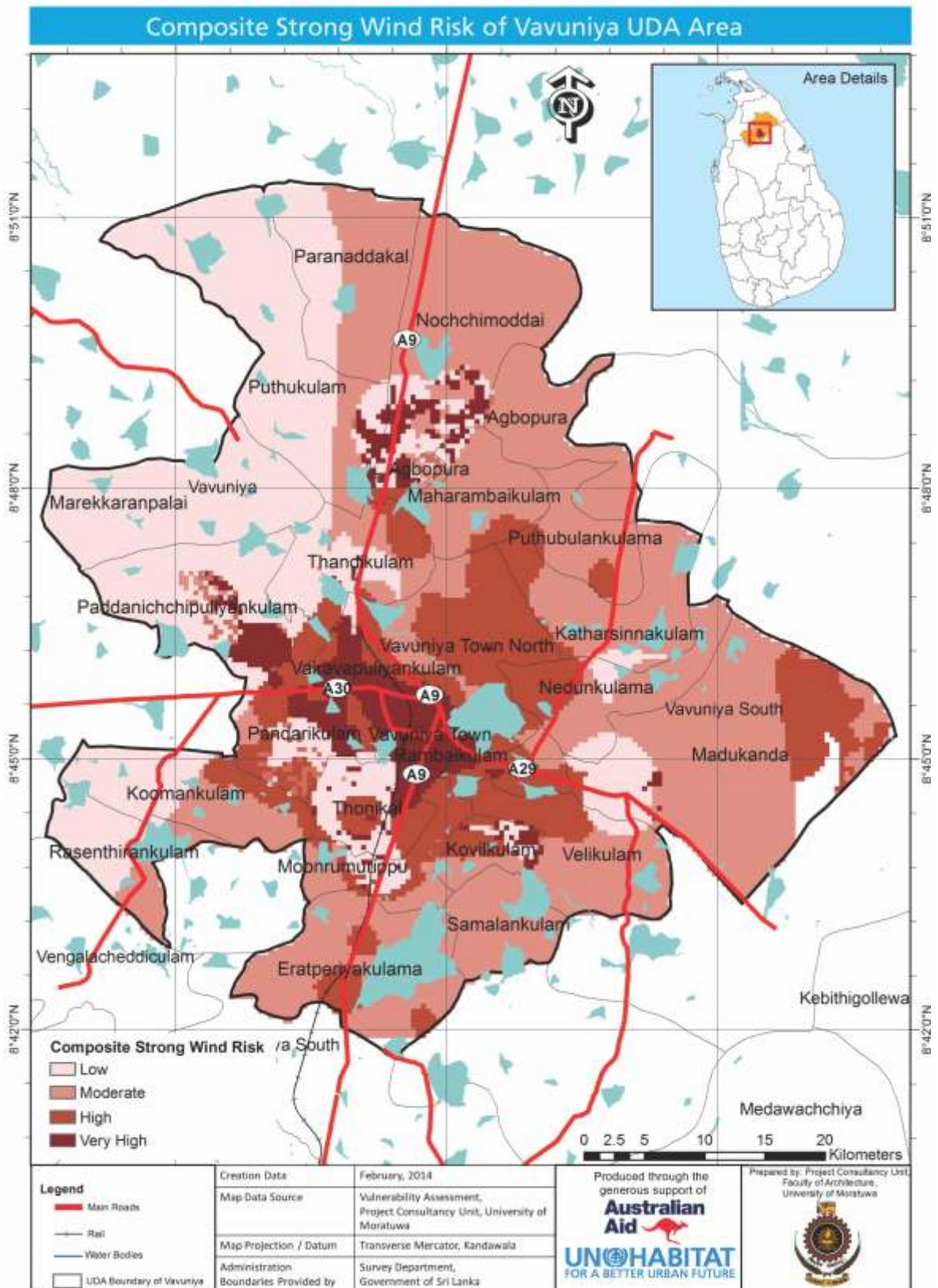


Figure 26: Composite Strong Wind Risk Map

3.7 Multiple Hazards and Very High Risk Locations

The multiple risk areas are locations that are affected by, and also have the potential to be affected by, more than one hazard. The multiple risks considered are flood, drought and strong winds and the map was produced by overlapping these three composite risk maps. Risk levels were classified as low, moderate, high and very high. This assessment gives equal importance to the three hazards when forming the multiple risk map.

Ten very high-risk zones were identified and are listed in Table 8, which also includes the hazards affecting each

location. The project team visited each of these areas. They were also the focus of the workshop on the validation of hazard and risk maps and the identification of strategies and action projects which was conducted with GN officers, local political leaders, council members, community leaders, representatives from the identified risk areas, government officials, and NGOs representatives. Figure 27: Multiple Hazards and Risk Zones Map identifies the high-risk locations where DRR planning solutions should be focused, including the ten high-risk zones. The high multiple risks occur across Vavuniya Town, Vavuniya Town North, Rambaikulam, Thandikulam, Kovilkulam and Samalankulam. Low risk areas are located at Koomankulam, Rajendrankulam, Maharambaikulam and Madukanda.



Stakeholder workshop and field visits

Risk Zone	Area	Hazard Type
1	Vavuniya Town North Areas: Vavuniya Kulam tank surrounding, Poonthoddam	Floods and droughts
2	Pattaichchu, Puliyankulam, Pandarikulam,	Floods and droughts
3	Thirunavatkulam	Floods and droughts
4	Rambikulam	Flood
5	Kovilkulam surrounding, Kovilputhukulam, Velikulam	Floods and droughts
6	Samalankulam	Droughts
7	Kaththarsinnakulam	Floods and droughts
8	Maharambaikulam and Rambavettikulam	Droughts
9	Paranaddakal	Droughts
10	Nochchimoddai	Droughts

Table 8: Ten Risk Zones

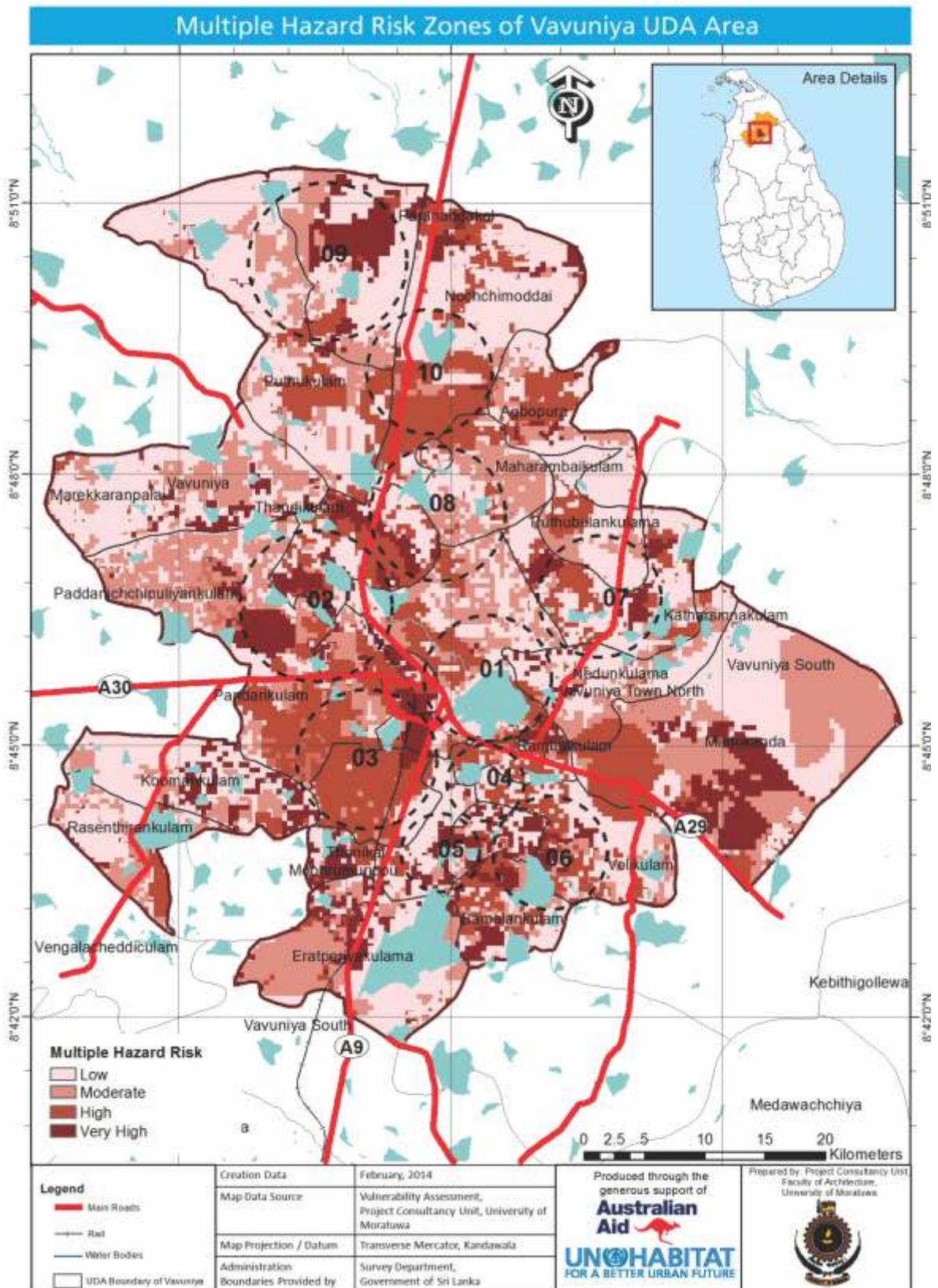


Figure 27: Multiple Hazards and Risk Zones Map

3.8 Weather Forecasting

Significant variations of weather patterns can contribute to hazards becoming disasters. Weather forecasting is therefore crucial in ensuring Vavuniya is a disaster resilient city. The rainfall, temperature, wind speed and other climatic data records from the Vavuniya township were analysed to assist in tracing changes in patterns and predicting future scenarios. The time series analysis method was used for the analysis of the records.

Forecasting Temperature

The mean monthly temperature data was subject to time series analysis. Records were available from 1958-1988 and 1992-2013. The highest temperature recorded was 37.3°C in 1983 and the lowest was 14.4°C in 1993. The higher temperatures are recorded from March through to September – the period when there is generally less rainfall. A significant variation in temperature was not observed during the time frame analysed however a very slight increase has been detected. The result shows an increase in mean monthly temperature of 0.0002°C. Further analysis of the trend was done using a multiplicative model that has a very strong correlation between actual and forecast values, thereby showing that the forecast values of the temperature pattern were very similar to the actual temperature pattern.

Forecasting Rainfall

The Project Area experiences heavy rainfall during the northeast monsoonal season with the rainfall generally increasing each year from August through to December. From January, the rainfall pattern generally begins to ease again. June and July experience the lowest levels of rainfall. A pattern of high rainfall was observed approximately every ten years – 1963, 1972, 1983, 1993, 1998, 2007 and 2012. The rainfall data was analysed (from 1958-2013) and a time series analysis was completed. A pattern can be identified which shows a slight increase in rainfall of 0.0248mm per month on average. Further analysis for accuracy was again done using a multiplicative model which generally confirmed the results of the time series analysis. In 2010 – a year that Vavuniya received 1,459mm of rain, 95,686 people were affected by flood in the Vavuniya DSD alone. High rainfall results in flooding which disrupts the lives and routines of many people in the Project Area, illustrating the importance of forecasting.

Forecasting Wind

The average monthly wind speed data for 15 years (1997-2012) was used for the time series analysis. Analysis revealed that the highest wind speeds were recorded during June and July, with a highest speed of

24.4km/h. Strong winds were recorded in 2006, 2008 and 2012 with the 2012 winds affecting 6,303 people and causing the greatest damage. A great deal of variability in the wind speed and direction was observed. A slight increase in monthly average wind speed during the study period was observed. The results indicate that the average wind speed in Vavuniya is increasing on a monthly basis by 0.0046km/h. Further analysis was done using the multiplicative model which did identify a positive correlation between the actual and forecast values however variations were common.

Temperature, rainfall and wind all contribute to the hazards that occur throughout the Vavuniya Project Area. Drought affected 72,564 people throughout Vavuniya District in 2010 and 30,974 in 2012, as well as affecting crops and drinking water. The region does not experience extremely high temperatures, however the generally high temperature, the generally constant wind and lack of rainfall can lead to drought. Forecasts will be useful in identifying weather patterns in the coming years and ensuring preparedness measures are in place.

3.9 SWOT Analysis

The SWOT analysis assists in decision-making, physical planning, controlling procedures, participation and organisation. The SWOT analysis provides a background to the Strategic Directions in Chapter 4 as it is a bridge between the present situation (“where are we now?”) and the future (“where we want to be after a defined time using available resources”).

The results of the SWOT are presented in the following subsections which have been grouped under the themes: Physical Setting, Physical Infrastructure, Natural Environment, Society and Economy.

3.9.1 Physical Setting

The physical setting relates to the location of the city and its setting within the region.

Strengths

- High level of connectivity through different modes of transportation;
- Vavuniya is a first order city and acts as the gateway to the Northern Province; and
- Vavuniya city has good accessibility through the A9 road which links the centre to northern part of the country.

Weaknesses

- The location requires comprehensive and well maintained irrigation systems that are currently lacking.

Opportunities

- Implementation of new infrastructure developments, especially housing.

Threats

- An increase in population density in the urban area has resulted in haphazard development;
- There is a sharp difference in land values between the centre of Vavuniya where land is serviced by utilities with easy access to infrastructure compared to the other areas;
- Increasing densities and demand for land for residential and commercial activities, especially in fragile areas;
- Low level of awareness of rules and regulations as well as the services of responsible authorities;
- Unauthorized and improper reclamations done without considering land reclamation regulations, leading to haphazard development and exacerbating as flood issues; and
- The participation of local stakeholders in the development planning process is low.

3.9.2 Physical Infrastructure

Physical infrastructure relates to services and provision of infrastructure within the city.

Strengths

- Well-developed road network that links the surrounding areas; and
- Rail connections to the north and south.

Weaknesses

- Poor drainage network and stormwater management;
- Poor operations and maintenance of existing tanks;
- Lack of proper drainage lines and absence of drainage from some inundation areas; and
- Lack of road design that considers contours and elevation which results in flooding cutting of access during floods.

Opportunities

- Regional linkages.

Threats

- Illegal settlements and catchment areas; and
- Illegal and improper construction of buildings.

3.9.3 Natural Environment

The natural environment relates to the natural setting within the project area and surroundings.

Strengths

- The topographic features are suitable for the agriculture of the area;
- The catchment area includes two main rivers (Paranki Aru and Pali Aru) and many tributaries;
- There are many small, medium and large scale tanks; and
- The soil is suitable for agriculture.

Weaknesses

- In the months of June, July and August the temperature can average at 36°C;
- Some areas have a shortage of drinking water;
- Annual rainfall varies from 1000mm – 1500mm and the area experiences heavy rains from October to December, causing flash floods and annual floods; and
- The difference in seasonal flow of the two main rivers flowing across the city.

Opportunities

- Preservation of natural areas by programmes, regulations and through authorities; and
- Conservation and restoration projects, including financial assistance from NGOs.

Threats

- Pollution of water bodies by the public market waste and other commercial waste.

3.9.4 Society and Environment

Society and environment relates to the people who live in, use and visit the city and Project Area.

Strengths

- Strong cultural and historical background of the area;
- Traditional knowledge about adaptation to disasters and management of disasters is strong;
- Willingness of the people to move to safer places at times of danger;
- Supportive and good participation of the people for public programmes in the area; and
- Is a UDA declared urban area.

Weaknesses

- Disaster risk reduction is not mainstreamed in development plans;
- Lack of sufficient disaster preparedness at the community level;

- Inadequate natural and human resources at all levels;
- Lack of integration with local, regional and national level disaster risk reduction institutions like DMC, NBRO, UDA, VUC and a lack of specific legislation on disaster risk management;
- Lack of financial support and technical inputs;
- Inadequate evacuation paths and evacuation centres; and
- Problems with maintenance and care of equipment.

Opportunities

- Programmes to repair the damaged tanks with the contribution of farmer organisation and agrarian services;
- Encourage government and non-government organisations to prioritise flood risk reduction projects;
- Enhance volunteerism and the capacity to establish partnerships and improving inter-agency coordination;
- Learn from good practices implemented elsewhere in Sri Lanka and overseas in the field of DRR including information and communications technology advances and the availability of disaster risk management tools and approaches;
- Support from international and national agencies, including UN-Habitat, that are interested in working in the city.

Threats

- The lack of public and industry awareness about building regulations and guidelines;
- Citizens have little awareness about the services of responsible authorities;

- Unauthorised land reclamations;
- Low levels of participation of local stakeholders in the development planning process;
- Illegal settlements in catchment areas;
- Illegal and improper construction of buildings;
- Disconnected water resource programs such as soil conservation, water conservation, floodplain management and watershed management;
- Minimal economic diversity;
- Unwanted political interventions for the implementation and enforcement of regulations;
- Preparedness plans and programmes are introduced by people who don't live in the area;
- Policy changes at the national level interrupt the continuation of current development programmes.

The SWOT analysis provided a number of ideas for future planning. Collating the results around the themes of Physical Setting, Physical Infrastructure, Natural Environment, Society and Economy highlighted the breadth of opportunities for targeted planning interventions within the Vavuniya project area. A number of common issues also emerged which require immediate action and clearly relate to developing Vavuniya as a resilient city. These are discussed further in the Core Problem Analysis.

3.10 Core Problem Analysis

The core problem analysis brings together the key issues facing the Vavuniya Project Area in order to shape the strategic directions which are discussed in the following chapter. Table 9 identifies the main issues and their locations; this is followed by a list of key problems and key potentials that recognise the core of the problem and how it can be solved.



Irrigated paddy fields near Vavuniya Kulam

Disaster Risk Reduction and Preparedness Plan - Vavuniya

Description of the Issue	Locations
Flood during seasonal heavy rain overflows from the Mamadu Oya.	<ul style="list-style-type: none"> • Puliya-divayalweli; • Settlements near Nochchimodai; • Peyaadikulankulam; • Manikarampaikulam village; and • Marakkarampanai.
Lack of proper drainage lines.	<ul style="list-style-type: none"> • Maharampaikulam; • G.T.M.S. and surrounding area; • Thasnagar; and • Rajendrakulam.
Demolishing, destroying of filling tanks.	<ul style="list-style-type: none"> • Thirunavatkulam.
Floods due to the reduced capacity of tanks.	<ul style="list-style-type: none"> • Goodshed Road; • Amman Kovil Road; • Veppankulam 6th and 7th Lanes; • Kumankulam, Kanthapuram; • Paarthankooddam; • Nagar Iluppaikulam; • Paddanichoor 1st and 2nd Lanes; • Thampanaikula Road; and • Thaskooddam.
Damaged sluice gates of tanks.	<ul style="list-style-type: none"> • Mannar Road; • 2nd Mannar Road; and • Mullipulavu.
Settlements in low land.	<ul style="list-style-type: none"> • Maharampaikulam; and • G.T.M.S. and surrounding area.
Illegal settlements in catchment areas and illegal or improper construction of buildings.	<ul style="list-style-type: none"> • Thonikal Road, Katkuli; • Near to Gnavaivarav Kovil, 2nd Cross Street; • Poonthottam Road, Kudiyiruppu; • Poonthottam School Road; • Poonthottam, Maharampaikulam Road; and • Sri Nagar (Vavuniya North).
Lack of surface and ground water due to low rainfall.	<ul style="list-style-type: none"> • Settlements near Nochchimodai; • Peyaadikulankulam; and • Kuddinagar.
Deforestation.	<ul style="list-style-type: none"> • Thonikal.
Over extraction of water from tube wells.	<ul style="list-style-type: none"> • Saampalthottam.
Lack of re-planting.	<ul style="list-style-type: none"> • Saampalthottam; and • Paalamaikkal, Nelumkulam.
Difficulties with groundwater extraction.	<ul style="list-style-type: none"> • Marakarampanai; • Vinayakapuram.
Wasting tank water.	<ul style="list-style-type: none"> • Periyarkulam.
Lack of proper maintenance of tanks and other water bodies.	<ul style="list-style-type: none"> • Maharambaikulam; • Karupanichankulam; and • Paalaikallu.

Description of the Issue	Locations
Invasive plants spreading over tank surfaces (<i>Salfenia</i>).	<ul style="list-style-type: none"> • Mathavuvaithakulam.
Failures from inappropriate constructions in strong wind.	<ul style="list-style-type: none"> • Marakarampanai; and • Manippuram.
Lack of protection walls and large trees too act as wind barriers.	<ul style="list-style-type: none"> • Kallikulam; and • Aachipuram.
Lightening causes harm in rainy seasons at open lands	<ul style="list-style-type: none"> • Srirampuram; and • Kovilkulam.

Table 9: Common hazards and locations

Risks can arise from many different situations – from changing demographics, to changing economic conditions or competition for scarce resources. The key problems in the Vavuniya Project Area are listed below.

Key Problems

- Poor maintenance of tanks, canals and other water bodies;
- Increasing population and construction on fragile environmentally sensitive areas;
- Lack of proper planning and building guidelines to shape development;
- Lack of planning and building enforcement measures, especially for conservation sites, redevelopment activities and settlement plans;
- Lack of awareness about disasters, their causes, mitigation measures and possible consequences;
- Lack of integration between stakeholders, decision making bodies and community; and
- Lack of financial capacities and funding sources to implement DRR actions.

The key potentials refers to the opportunities that exist within the Vavuniya project area and these are listed below.

Key Potentials

- Availability of natural water resources, tanks and an irrigation system;
- Large areas of vacant land with minimal risk of hazards for future development;
- The risks are largely seasonal;
- Demand for the economic services that Vavuniya offers;
- Community and government officers' attitudes towards the conservation and restoration of natural resources;
- Upcoming conservation and restoration projects, and financial assistance from NGOs; and
- Improve leadership and commitment at local level.

The key problems and key potentials offer Vavuniya the opportunity to work towards a disaster resilient future.



Dredging of Vavuniya Kulam

3.11 Conclusion

This chapter has provided the key results from the hazards, vulnerability, risk and capacity assessments that were undertaken and validated through community workshops. This information was then integrated with the baseline research to identify risk levels, and this process culminated with the multiple hazards composite risk map for the Vavuniya Project Area, which identified ten very high-risk zones.

The weather forecasting, SWOT analysis and the core problem analysis assisted in identifying future patterns, issues and themes to shape a response that builds on the strengths already present in the Project Area. The objective is to make Vavuniya a resilient town.

The strategic directions were identified thereafter and these are discussed in further detail in Chapter 4.



Strategic Directions



Strategic Directions

The baseline study, hazard, vulnerability, risk and capacity assessments, SWOT and Core Problem Analysis all provide a solid and valuable foundation for formulating the city's vision and disaster resilient strategies. They all include substantial input from stakeholders including the public, as well as community groups, city employees and council members. Vavuniya has potential for future development; this, however, must be managed in a planned way, ensuring that resilience and risk reduction are driving principles. The Vavuniya Urban Council has to develop two important tools to manage hazards: Disaster resilience strategies and strategic urban planning incorporating DRR. Place-based planning will shape the future of Vavuniya by concentrating on making places people centred, with urban character, instead of focusing only on land use and infrastructure development.

Five strategic directions have been developed for the Vavuniya Project Area:

1. Enhancing infrastructure to minimise the risk of floods;
2. Using land-use planning to minimise the risk of disasters and to protect natural resources and enhance drought risk reduction techniques;
3. Sharing and participating in community actions to improve resilience through social empowerment;
4. Planning for recovery and enabling economic opportunities; and
5. DRR through continuous assessment, evaluation and monitoring.

This Plan was prepared based on the following concepts:

- Hazards and risks have been identified and considered in the planning process. This includes local and site-specific assessments of risks;
- Development activities should be located in areas with little or no likelihood of hazards thereby

avoiding or minimising the risk. Development activities includes transport and utility infrastructure as well as residential and other buildings;

- Development should be permitted in hazardous areas only when there are no alternative and reasonable sites available which meet the objectives of proper planning and sustainable development. These developments must adhere to special design regulations to mitigate their risk;
- Only selected land uses should be allowed in hazardous areas;
- A precautionary approach should be applied to reflect uncertainties in hazard datasets, risk assessment techniques and the difficulty in predicting future climate scenarios. Development should be designed with careful consideration of future changes including climate change and flood risk so that future occupants are not subject to unacceptable risks.

The strategic directions cannot be implemented by the local authority or other relevant institutions alone; they must work collaboratively, and ensure community participation to develop the sustainability of the DRR initiatives in the city.

4.1 Strategic Directions

The five strategic directions improve environmental, social and economic conditions, by strengthening the community, involving local technical officials and introducing development initiatives. This section outlines the rationale, strategies and actions behind each Strategic Direction. Further details on selected actions projects are provided in Chapter 5, Action Projects.



GPS training for local officials

4.1.1 Strategic Direction 1: Enhance infrastructure to minimise the risk of floods

This strategic direction has been developed to initially focus on water management however it can be broadened in the future to respond to other issues. Table 10 outlines the rationale, strategies and projects under this strategic direction.

Rationale	Strategy	Projects
Improving construction, operations and maintenance practices will reduce flooding caused by infrastructure failure and poor design. Reducing the flood risk needs to be citywide including settlements, commercial premises, agricultural land and public spaces. Currently many city buildings as well as roads are vulnerable to disasters.	Flood mitigation and protection of vulnerable public spaces.	<ol style="list-style-type: none"> 1. Reduce run-off and mitigate flooding at Poonthoddam; 2. Restore the spill canal and two culverts between Vavuniya Kulam and Periyakulam; 3. Landscape and improve the natural environment of Vavuniya Kulam along Horowpathana Road; 4. Rehabilitate the main wastewater canal; 5. Establish a wetland park; 6. Drainage master plan for Vavuniya to rehabilitate drainage network; 7. Improve the seasonal water retention pond at Thirunavatkulam; 8. Restore Mamadu Oya bank at 40ft bridge, Nochchimodai; 9. Restore tanks and the cascade irrigation system; and 10. Encourage drip irrigation and rainwater harvesting tanks.

Table 10: Strategic Direction 1 – Rationale, Strategies and Projects

4.1.2 Strategic Direction 2: Using land use planning to minimise the risk of disasters, protect natural resources and enhance drought risk reduction techniques

This strategic direction has been designed to highlight the importance of land-use planning. Strategic land-use planning can assist in protecting natural resources and providing sustainable DRR measures. Table 11 outlines the rationale, strategies and projects under this strategic direction.

Rationale	Strategy	Projects
The strategic management of land and natural resources will provide a strong base for developing strategies to minimise drought impact and enhance water conservation in Vavuniya.	Greening the city.	<ol style="list-style-type: none"> 1. Land use management and the restoration of tanks; 2. Multipurpose greenbelts throughout the city; and 3. Flood and drought resistant green home model.

Table 11: Strategic Direction 2 – Rationale, Strategies and Action Projects

4.1.3 Strategic Direction 3: Sharing and participating in community actions to improve resilience through social empowerment

Social empowerment programmes can be developed to respond to a wide range of needs to enhance the capacity of communities. Table 12 outlines the rationale, strategies and projects under this strategic direction.

Rationale	Strategy	Projects
Sharing and learning from previous experiences, including capitalising on local and indigenous knowledge can assist in improving responses to future hazards. Providing opportunities for participation in planning assists in creating a resilient society. This strategic direction empowers society with information, knowledge and access to networks and resources. Ensuring an understanding of risks and mitigation measures will help build resilience.	Empower society and provide capacity development and knowledge sharing opportunities; and Establish participatory social networks	<ol style="list-style-type: none"> 1. Conducting community awareness programmes on DRR and preparedness; 2. Educating school children; 3. Implementing GIS training programmes for local officials; 4. Forming Community Based Disaster Risk Management Committee in high risk zones; 5. Forming youth response and post-recovery teams; and 6. Establishing a drought forecasting and early warning communication network.

Table 12: Strategic Direction 3 – Rationale, Strategies and Action Projects

4.1.4 Strategic Direction 4: Planning for recovery and enabling economic opportunities

Ensuring recovery includes financial stimuli to enable communities to quickly rebuild will minimise the post-disaster trauma. Table 13 outlines the rationale, strategies and projects under this strategic direction.

Rationale	Strategy	Projects
Maximising the capacities of vulnerable communities by empowering their economic abilities will enhance recovery post disaster: economic stability is needed for quick and full recovery. Local organisations that can react immediately will assist their communities to respond. Dependence on agriculture for livelihoods increases the vulnerability where destruction or inundation can create both economic and food shortages.	Ensuring financial security during and following disasters, and protecting livelihoods to enhance recovery.	<ol style="list-style-type: none"> 1. Develop a cooperative disaster recovery donation system through VUC; 2. Establish a local level community DRR fund; 3. Establish an insurance scheme, with a reputable firm and cooperative bank; and 4. Provide incentives for DRR initiatives and efforts.

Table 13: Strategic Direction 4 - Strategies and Action Projects

4.1.5 Strategic Direction 5: DRR through continuous assessment, evaluation and monitoring

A critical element of improving DRR plans and strategies is the assessment, evaluation and monitoring to ensure they are addressing the needs and improving resilience of the community in the Project Area. Table 14 outlines the rationale, strategies and projects under this strategic direction.

Rationale	Strategy	Projects
Monitoring and evaluation will assist in enabling VUC to set and meet DRR targets. Following a DRR Plan will strengthen VUC's ability to develop and track progress through specific and measurable indicators that manage risk and achieve widespread consensus for engaging in and compliance with DRR measures.	Monitoring and evaluation.	1. Introduce assessment, evaluation and monitoring processes.

Table 14: Strategic Direction 5 – Strategies and Action Projects

Applying these strategies and projects will reduce the vulnerability of the Project Area to natural hazards. They capitalise on the strengths of the project and encourage participation in DRR by all stakeholders in the project area. This will increase the success of this disaster resilient city development plan.



Improving leadership qualities of local community to strengthen resilience

4.2 Conclusion

The strategic directions that have been identified all assist in linking and strengthening DRR in the Vavuniya Project Area. They also support the priorities and tasks that are identified in the HFA and are designed to assist each city become more resilient (refer to Annexure A: Linking the Strategic Directions to the HFA). Promoting an integrated economic, social, psychological, physical

and environmental approach in all aspects of the DSD operations, such as infrastructure, governance, disaster risk management and social services will assist in reducing the impact of hazards and will enable communities to prepare, prevent and respond to hazards.



Action Projects



Action Projects

The action projects detailed in this section are considered priorities and are derived from the strategic directions identified in the previous chapter. All action projects respond to a need identified and many relate to

the areas that have been identified as very high risk in the assessment phase. Table 15 links the strategic directions and detailed action projects provided in this chapter.

Strategic Directions	Action Project Details Provided in this Chapter
1. Improving infrastructure to minimise the risk of floods.	<ul style="list-style-type: none"> ● Reduce run-off and mitigate flooding at Poonthoddam; ● Restore spill canal and two culverts between Vavuniya Kulam and Periyakulam; ● Landscape and improve the natural environment of Vavuniya Kulam along Horowpathana Road; ● Rehabilitate wastewater purification tanks; ● Rehabilitate the main wastewater canal; ● Establish a wetland park ● Implement a drainage master plan; ● Improve the seasonal water retention pond at Thirunavatkulam; ● Restore Mamadu Oya bank at 40ft bridge, Nochchimoddai; ● Restore tanks and the cascade irrigation system; and ● Investigate drip irrigation and rainwater harvesting tanks.
2. Using land-use planning to minimise the risk of disasters and to protect natural resources and enhance drought risk reduction techniques.	<ul style="list-style-type: none"> ● Hold community awareness programmes on DRR and preparedness; ● Arrange GIS training programmes for local officers; ● Arrange DRR awareness programmes for school children; ● Form Community Based Disaster Risk Management Committees in high risk zones; ● Form youth and post recovery teams; and ● Establish an early warning centre with a strong communication system with those involved in the agricultural sector at the local level.
3. Sharing and participating in community actions and improving resilience through social empowerment.	<ul style="list-style-type: none"> ● Hold community awareness programmes on DRR and preparedness; ● Arrange GIS training programmes for local officers; ● Arrange DRR awareness programmes for school children; ● Form Community Based Disaster Risk Management Committees in high risk zones; ● Form youth and post recovery teams; and ● Establish an early warning centre with a strong communication system with those involved in the agricultural sector at the local level.
4. Planning for recovery and enabling economic opportunities.	<ul style="list-style-type: none"> ● Develop a cooperative disaster recovery donation system through VUC; ● Establish a local level community DRR fund; ● Establish an insurance scheme, with a reputable firm and cooperative bank; and ● Provide incentives for DRR initiatives and efforts.
5. DRR through continuous assessment, evaluation and monitoring.	<ul style="list-style-type: none"> ● Introduce assessment, evaluation and monitoring processes.

Table 15: Priority Action Projects under each Strategic Direction

Action projects where local capacity already exists, and which can quickly demonstrate visible results should be pursued. This will motivate stakeholders and create awareness on the importance of DRR in the Project Area. The priority action projects have also been selected in consultation with core stakeholders including the general public, the responsible officers from different authorities and local government leaders.

All projects aim to reduce risk and vulnerability, as well as provide ways to adapt to the hazard faced. Projects were prioritised to focus on the very high and high-risk zones that were identified in Chapter 3. The frequency of the occurrence of hazards and their level of magnitude was also taken into account when selecting areas and action projects. The action projects consider the shifting risks associated with climate change and ensure that the mitigation measures do not move the risk or increase vulnerability to climate change over medium or long term time frames.

These strategic action projects provide direction for urban managers at all levels, and from different organisations operating within the Project Area. They will facilitate DRR measures that will contribute to

sustainable development through inclusive growth. They will also build the adaptive capacities of communities, increase the resilience of vulnerable sectors and optimise disaster mitigation opportunities. Thus the effects of hazards will be minimised and people's ability to prepare, respond and quickly return to normalcy following any event will be improved.

All projects proposed require comprehensive research into the cost-benefits, as well as the environmental and social impacts and specialist design to ensure the anticipated benefits are delivered.

5.1 Implementation of Action Projects

The implementation of the projects will be an ongoing matter and require collaboration between a number of agencies. A draft of the processes that are required to be undertaken to implement all projects, including the responsible agencies is provided in Table 16: Generic Implementation Methodology for Action Projects. A detailed assessment process, including a cost benefit analysis, is required prior to implementing any of the proposed projects.



Construction of the culvert along irrigation channel of Vavuniya Kulam, July 2014

Phase	Detailed Design	Identify Resources	Construction	Management and Maintenance	Monitoring and Evaluation
Activities	Detailed site investigation. Prepare detailed drawings and structural designs. Estimate budget. Determine cost effective solutions.	Identify stakeholders, donors and funding sources. Investigate public private partnerships. Build commitment of community and identify inputs.	Obtain approvals, site preparation, excavation and construction activities. Landscaping and re-planting especially on slopes to prevent erosion.	Ensure financial support from government agencies (especially Irrigation Department, Agrarian Department), for maintenance. Improve awareness on landscaping methods and identifying suitable vegetation. Maintain new infrastructure.	Evaluate impacts. Monitor the maintenance. Identify and undertake repairs and modifications as required.
Responsible Agencies	DRR unit of VUC, DMC, UDA, RDA, Irrigation Department, Irrigation, Research Institute and consultants.	Local DRM team, VUC, DMC, funding agency.	VUC, Irrigation Department, UDA, RDA, construction agency.	VUC, DRR technical working group.	VUC DRR unit, DMC, Irrigation Department.

Table 16: Generic Implementation Methodology for Action Projects

5.2 Action Projects to improve infrastructure to minimise the risk of floods

This section provides details on the eleven action projects that will support this strategy:

1. Reduce run-off and mitigate flooding at Poonthoddam;
2. Restore the spill canal and two culverts between Vavuniya Kulam and Periyakulam;
3. Landscape and improve the natural environment of Vavuniya Kulam along Horowpathana Road;
4. Rehabilitate the main wastewater canal;
5. Establish a wetland park;
6. Drainage master plan for Vavuniya to rehabilitate drainage network;
7. Improve the seasonal water retention pond at Thirunavatkulam;
8. Restore Mamadu Oya bank at 40ft bridge, Nochchimodai;
9. Restore tanks and the cascade irrigation system; and
10. Encourage drip irrigation and rainwater harvesting tanks.

Each of the projects is discussed in detail below.

5.2.1 Reduce run-off and mitigate flooding at Poonthoddam

Poonthoddam village and the area surrounding the Vavuniya Tank was identified as a very high risk zone in the multi-hazard map (see Figure 30: Multiple Hazards and Risk Zones Map). The area is inundated annually during heavy rains between October and December and the main road to the Poonthoddam village is impassable. Sedimentation and a reduced capacity of the Vavuniya Tank, lack of management of spill-over canals and an unplanned drainage network has contributed to the problem. The velocity of the water is too great for the design of the bridge, canal and culverts so water overflows into the surrounding area (Poonthottam Road, Poonthottam Bridge, Poonthottam Junction, surrounding paddy land in Vavuniya town and Sandasola, Periyakulam, Periyakulam Road and Thammanasola). Flooding can affect more than 500 families.

This action project involves:

1. Constructing a flood embankment combined with floodwall;
2. Reconstruction of the bridge at the Poonthoddam Junction;
3. Developing a rainwater detention pond at Poonthoddam Junction; and

4. Restoration of the spill canal and two culverts between Vavuniya Kulam and Periyakulam.

A location map for each of these project elements is provided at Figure 28.

A flood embankment including a floodwall is a common method of protecting low-lying areas against flooding. The proposed wall will act as a temporary flood defence to protect nearby houses, businesses and public places against flooding. Reconstructing of the bridge will involve elevating the road so it is higher than the high flood level of 5m. This would allow water to naturally flow from the tank without hitting any barriers. It is proposed to reconstruct the start of the spill canal at Poonthoddam Junction as a rainwater detention yard. This will enable the area to absorb a greater amount of excess water from the tank. A gabion wall will increase the capacity further to direct the water flow to the spill canal. The proposed detention yard is designed to collect then slowly release water at a controlled rate so that downstream areas such as Sandasolai and Periyakulam are not flooded or eroded. This practice also significantly improves the water quality as the plants act as natural filters. The whole concept is illustrated in Figure 29 (cross section) and Figure 30 (aerial image).

This project is anticipated to cost between five to nine million rupees, it is a high priority level and the responsible agencies for implementation will be the DMC, the Irrigation Department, the VUC, the RDA and the UDA. It is anticipated that this project will take eight months to complete.



Poonthoddam Junction spillway during floods

The Poonthoddam Junction area



Flood wall and Spillway of Vavuniya Kulam in the dry season



Existing irrigation canal



Spillway at Poonthoddam Junction

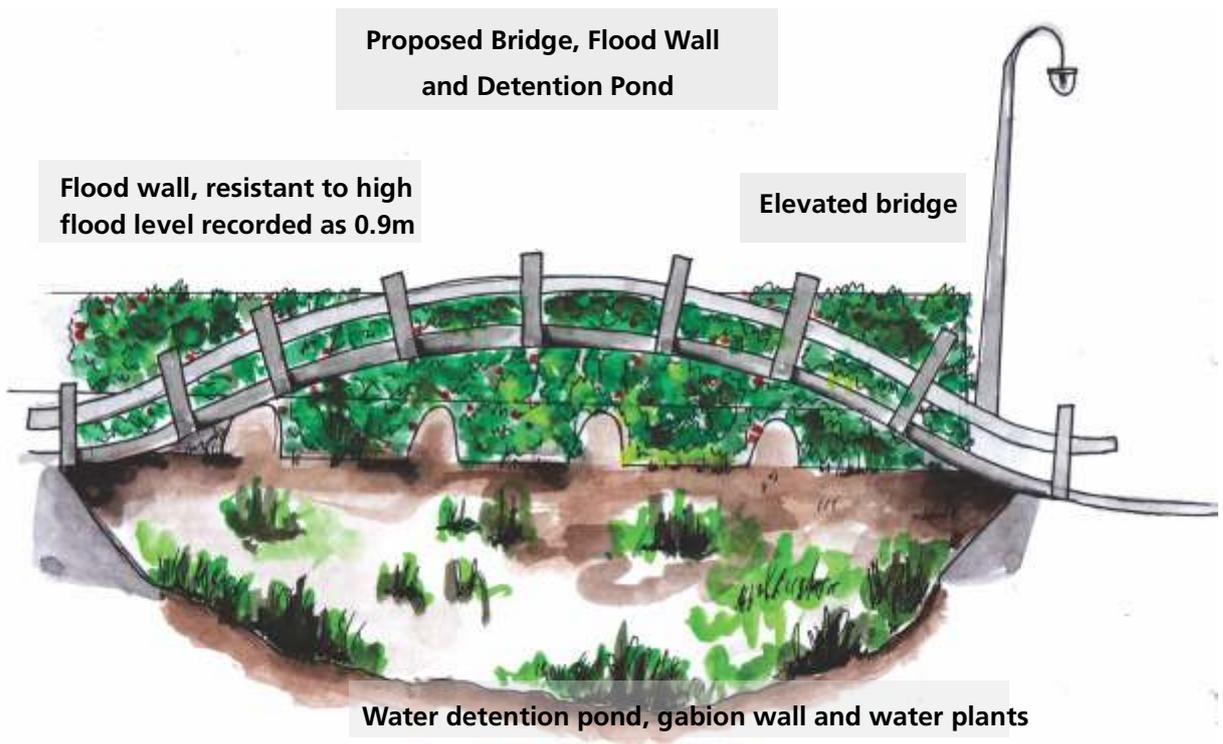


Figure 29: Flood wall, Bridge and Water Detention Yard – cross section

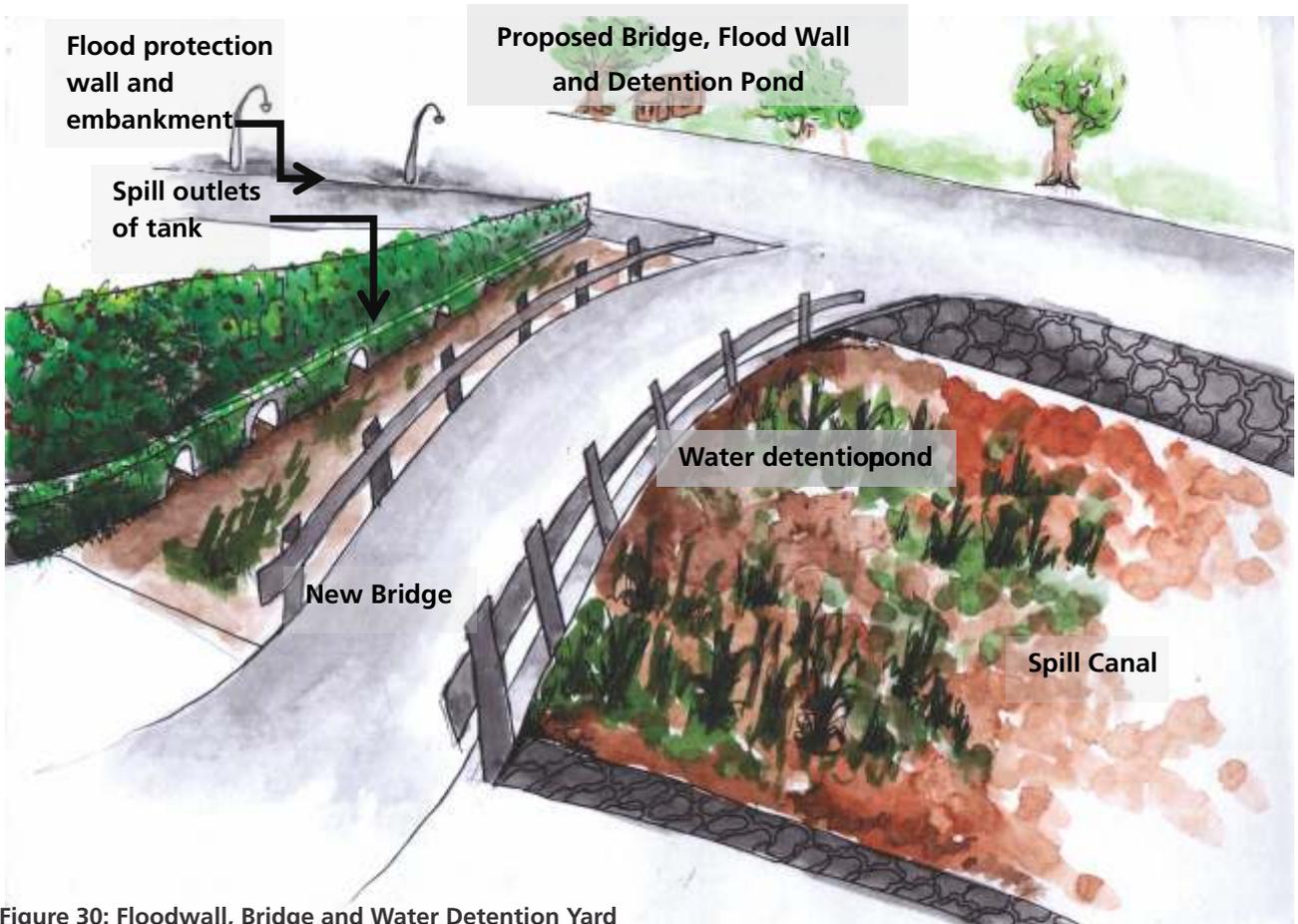


Figure 30: Floodwall, Bridge and Water Detention Yard

5.2.2 Restore spill canal and two culverts between Vavuniya Kulam and Periyakulam

Restoring the spill canal and reconstructing two culverts will continue the project outlined above to ensure that floodwater from Vavuniya Kulam travels to Periyakulam without interruption. The canal will be widened and excavated. A gabion wall and guiding stones will provide further support. The current situation is illustrated in

Figure 31: Existing Spill canal and Culverts. Schematic impression of the proposed design is provided in Figures 32 and 33. This design will improve the surrounding environment by providing a walking path, a cycle path and space for passive recreation. The culverts will be redesigned as per the image at Figure 34. This project is currently being implemented under this Disaster Resilient City Development Strategies for Sri Lanka Project funded by UN-Habitat and the Australian Government.



Existing culverts are insufficient during heavy rains



Existing canal

Figure 31: Existing Spill Canal and Culverts

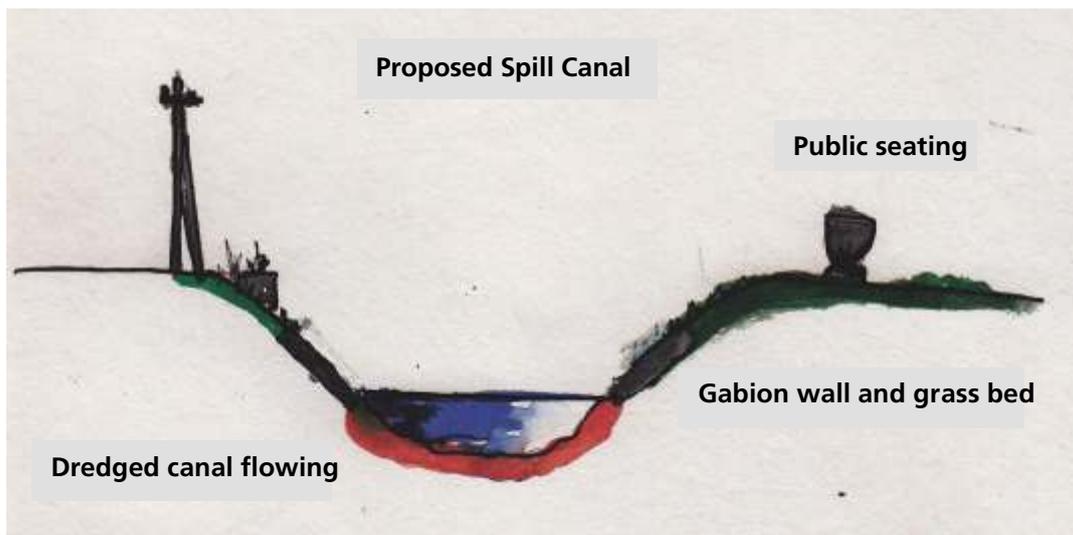


Figure 32: Restored Spill Canal – cross section

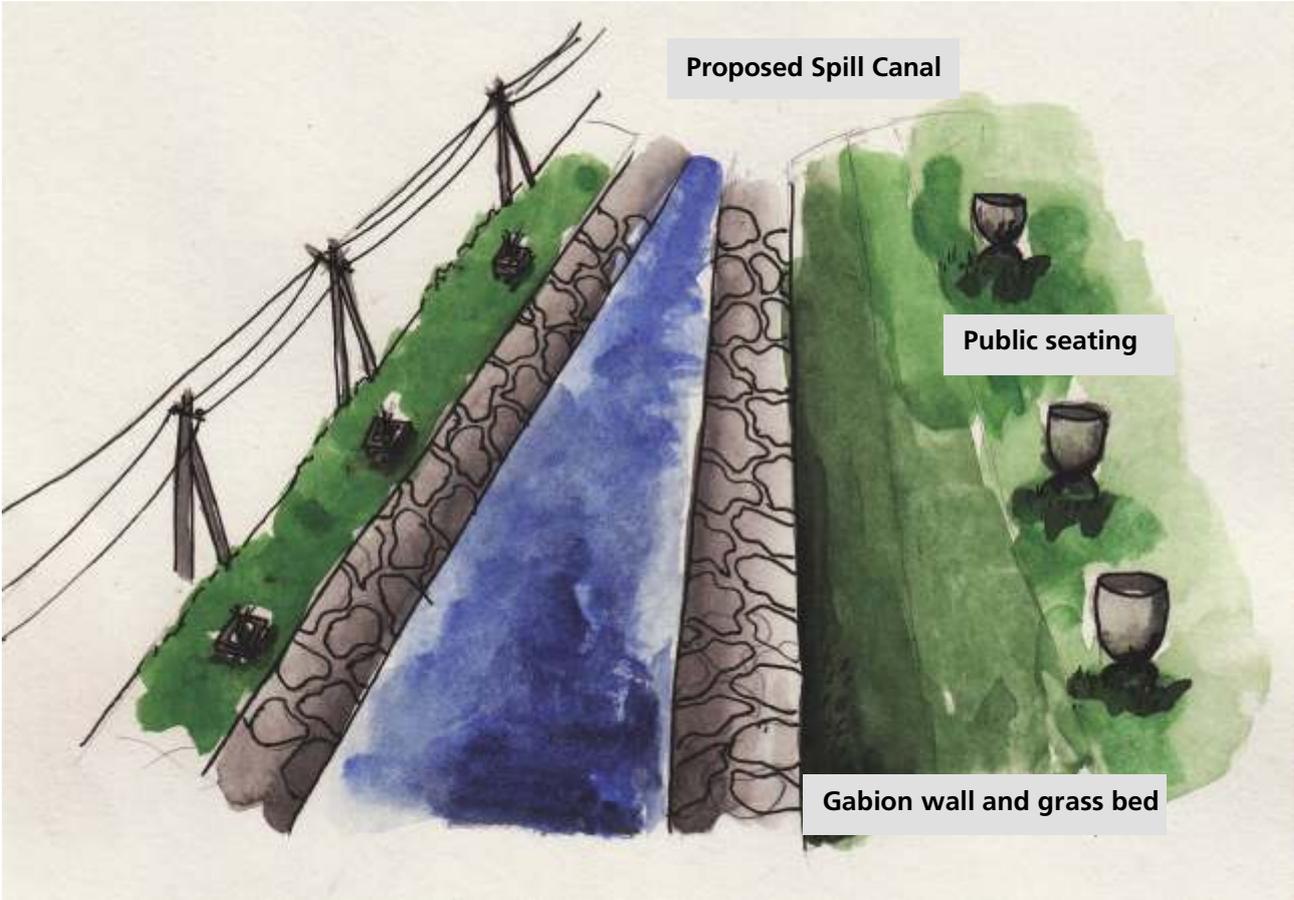


Figure 33: Restored Spill Canal - aerial view

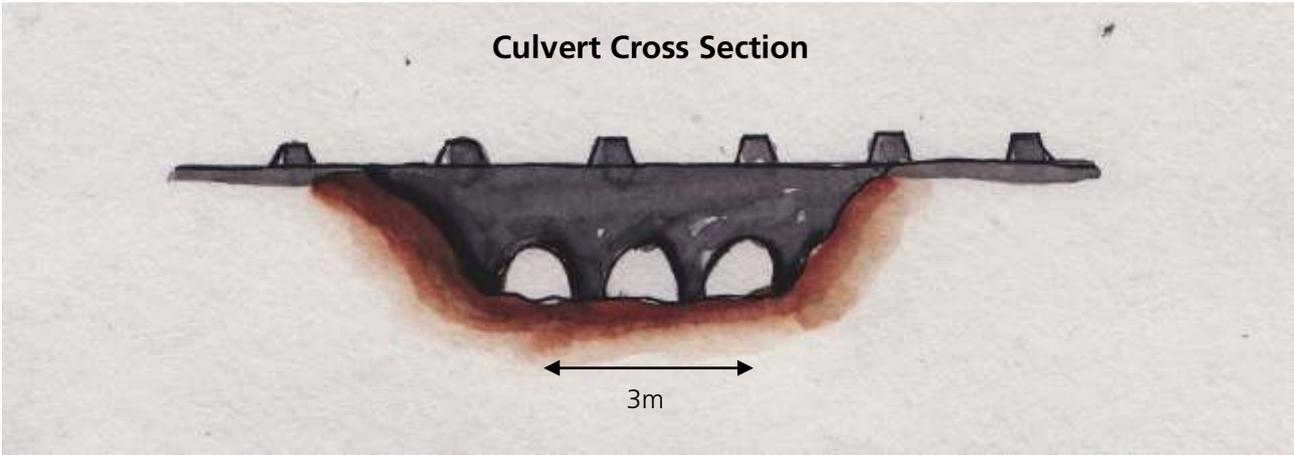


Figure 34: Proposed Culvert engineered to the requirements of the site

5.2.3 Landscape and improve the natural environment of Vavuniya Kulam

This series of action projects will improve the natural environment of Vavuniya Kulam, with a focus on Horowpathana Road, which is the most visible area of the Kulam. The proposal will mitigate hazards by improving the area's resilience to flood and will

simultaneously improve the area's environmental setting. Figure 35 provides a location map of the context within Vavuniya as well as the locations of the different project elements.

This project is anticipated to cost between three to six months and is of moderate importance. The project will be implemented by the VUC, the RDA, the UDA and the CEA. The duration is anticipated to be five months.



Abandoned wastewater tanks in Vavuniya Kulam

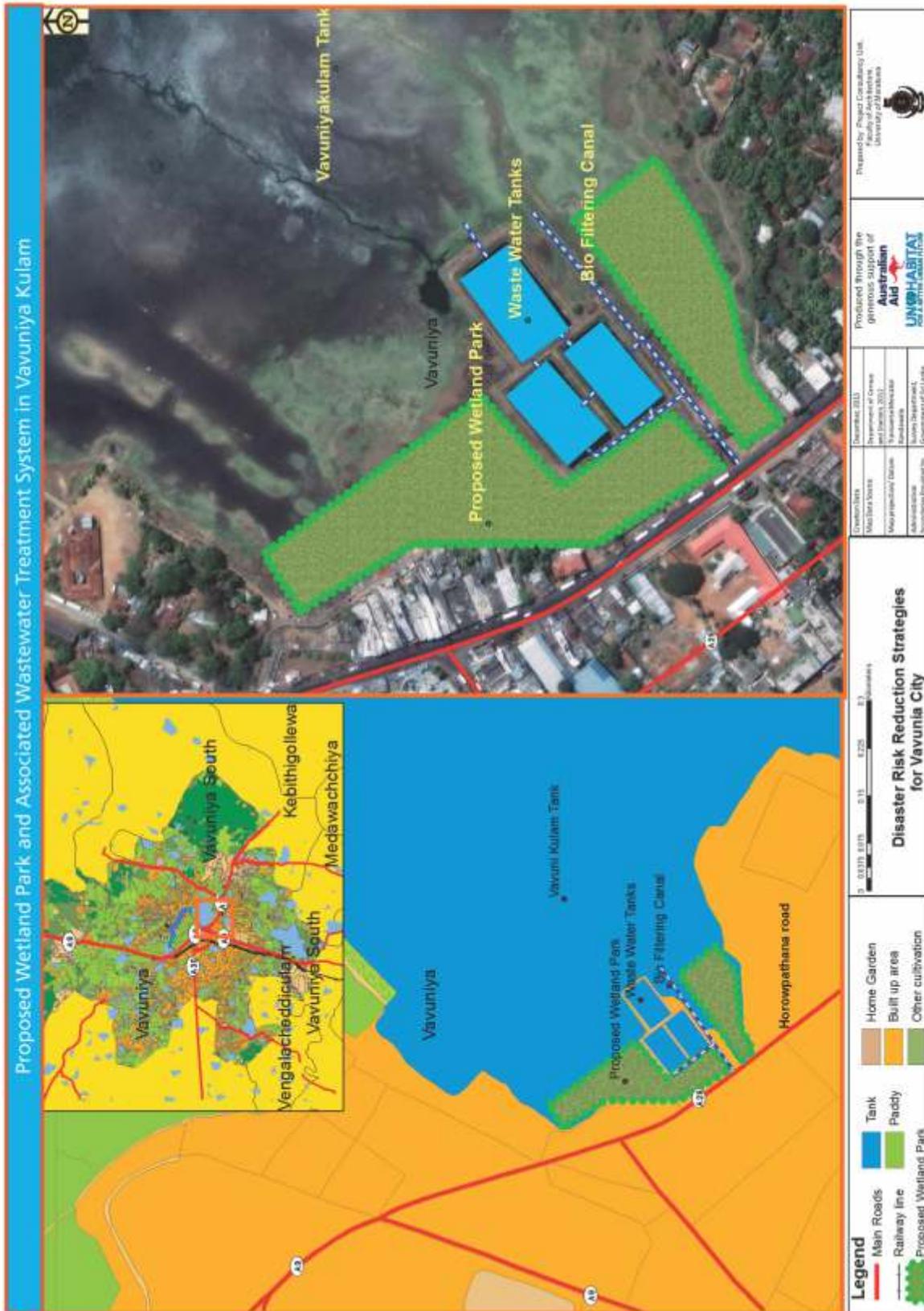


Figure 35: Location map for Proposed Wetland Park and Wastewater Treatment System

Several issues have been identified at the site and are listed below, and images below show the current situation.

- The capacity of Vavuniya Kulam has reduced because of siltation;
- The water in the Kulam has been polluted by wastewater that comes from the town through the main drainage canal, which now links directly to the



A drain linking to a wastewater tank in Vavuniya Kulam

- tank. There are three wastewater filtering tanks on the site, however, because of the elevation the city wastewater does not flow through the filtering system; and
- The capacity of the wastewater filtering tanks has reduced due to underutilisation and they were sited so they cannot hold the expected water volume.



Wastewater drain blocked with solid waste

Figure 41: The Current Wastewater Situation

The action project includes three elements:

- Rehabilitate wastewater purification tanks;
- Rehabilitate the main wastewater canal; and
- Establish a Wetland Park.

5.2.4 Rehabilitate wastewater purification tanks

There are currently three wastewater-filtering tanks on-site that do not function well. This project will rectify this situation by:

- Redirecting the water flow through inter-related canals through the wastewater tank, paying attention to elevation;
- Excavating wastewater tanks, removing sediment and restructuring the layout;
- Protecting tank bunds with gabion walls;
- Including a biological (vegetation) filtering system and promoting aeration and flow within the tanks.

Wastewater purification tanks are planned systems designed and constructed to utilise natural processes to assist wastewater treatment. They are designed to take advantage of many of the same processes that occur in natural wetlands. Horizontal sub-surface flow tanks are proposed to provide a high rate of removal of pollutants. Ammonia nitrification acts as a primary treatment by removing suspended particles of soil. Biological wastewater purification tanks may be combined in order to achieve higher treatment effects. Wastewater that

comes from the city passes slowly through the filtration medium (canals and tank beds planted with appropriate vegetation and lined with an impermeable layer), until it reaches the outlet at the Vavuniya tank. Contact with air and sunlight also provide cleansing opportunities. This system will assist in improving the poor water quality in Vavuniya Kulam as well as improving the eco-systems and bio-diversity of the area. There is a proposal to repair the wastewater purification system by UNOPS so close coordination will be required.

5.2.5 Rehabilitate the main wastewater canal

It is proposed that the main wastewater canal from Vavuniya, and the sub-canals that it links to should be rehabilitated. This includes:

- Dredging and removing sediments;
- Concrete lining for the main drainage canal, and a gravel lining for the sub-canals; and
- Incorporating biophysical filtration traps.

Canals that are lined prevent erosion and are most cost effective over a longer period of time than unlined canals. Precast cement concrete slabs for the side slopes and *in-situ* concrete for the bed are the common types of lining used for canals. The main canal will direct the wastewater to the proposed wastewater purification tanks through sub-canals that have a gravel base. This will enable biological filters with organic earth gravels to

do preliminary treatment on the wastewater. The concrete lining of the main canal is currently being implemented under this Disaster Resilient City Development Strategies for Sri Lanka Project funded by the Australian Government.

Three types of filtration traps will be placed along the canals and the first type of trap will remove solid particles such as plastic and rubbish. The second type of trap will remove oil and other liquid waste. The third type of trap will ensure that any remaining solid waste is removed. The main canal requires cleaning valves to separate the solid waste. A microbiological process will convert some organic waste to methane however other solid waste will have to be manually removed. Once the water has passed through the physical filters, it will reach a biological filter (porous stones containing aerobic bacteria) where will be oxygenized and purified. The water that reaches Vavuniya Kulam will be of an improved quality which will improve the health of the tank and ecosystem.

5.2.6 Establish a wetland park

As ecosystems serve as protective buffers against natural hazards it is proposed to develop the area adjacent to the water purification tanks as a wetland park. This area is currently used as an unofficial area for dumping waste. The proposed wetland park will increase the resilience of the city and enhance the natural environment by acting as a purifying sponge for stormwater. The Horowpathana Road area lacks footpaths, so the construction of semi-permeable footpaths will provide a pleasant place for people to walk. Wetlands are able to store additional water, which will minimize the effect of floods, as well as act as biological filters for polluted storm water. Shrubs and trees prevent bank erosion by securing the soils. During the dry season, wetlands can play an important role in protecting the tank catchment. Proper landscape management and provision of appropriate facilities will ensure the wetland park is a safe and welcoming environment for citizens.

Figure 36 provides a layout plan illustrating how all the improvements described in this section will work together.

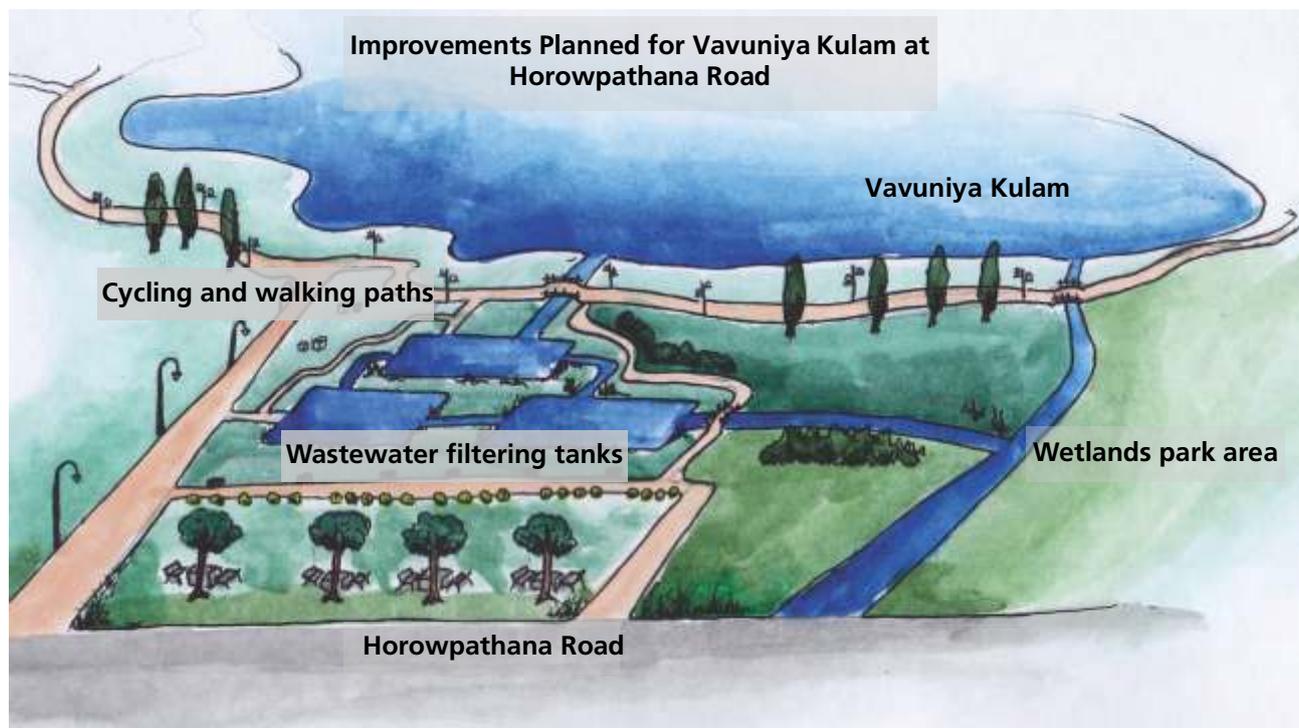


Figure 36: Layout Plan of Improvements to Vavuniya Kulam off Horowpathana Road

5.2.7 Implement a drainage master plan

Vavuniya is regularly affected by floods. This includes both flash floods and longer-term inundation, caused by rainwater combined with the soil types, flat topography and some poorly engineered and aging infrastructure.

This also results in water stagnating and being unable to disperse from an area for long periods of time. The areas at very high risk of floods include: Pandarikulam, Navalar Road, Nochchimoddai, Thirunavatkulam (1st, 2nd, 3rd, 4th, 5th lanes, Sivan Kovil Road and Sandasolai), Nawagama, Irattperiyakulam, Moonrumurippu,

Madavaitukulam housing scheme and Tekkawatta. These areas are frequently flooded and also have a high social vulnerability.

The existing drainage system in the Project Area consists of open drains that are used for domestic wastewater as well as the stormwater. This gets directed to canals that discharge to tanks. Roads also act as drains in the monsoon season when drains are at capacity. Wastewater from houses, unauthorized low-income settlements, markets, commercial and government institutions all discharge into tanks. The overall condition of most of the drainage is not satisfactory with regards to structural stability and sizes of drains. Poor management of the current drainage system is also a problem. Roadside canals in the VUC area are frequently blocked and maintenance is lacking. Comprehensive cleaning and de-silting is required.

A drainage master plan is proposed to reduce and minimise the impacts of flood. Initially the drainage master plan will focus on the VUC area because of the density of the population and this is also where a number of key infrastructure facilities are located. The drainage master plan will:

- Improve natural water bodies and the stormwater drainage system;
- Suggest measures to restrict human activities which disturb the drainage network;
- Conserve and protect water retention areas;
- Increase the volume of tanks and provide for tank restoration; and
- Develop a proper drainage network that initially focuses on the UC area, which will then expand in stages to comprehensively serve the whole DSD.

The drainage master plan will provide a comprehensive and strategic plan to be followed when implementing drainage projects in the VUC area. Three phases are proposed for the master plan:

Phase 1

- Comprehensive drainage survey to establish drainage inventory (for example, location, nature and materials of existing drainage lines); and
- Identify critical areas that require drainage systems.

Phase 2

- Evaluate the condition of existing drainage facilities and recommend future use.

Phase 3

- Modify the existing drainage system to be capable of handling monsoonal floods;
- Design a new drainage plan based on hydraulic models; and
- Incorporate best management practices, road layout and design.

Specific examples highlighting the need for the drainage master plan are listed below.

The Nochchimoddai tank has no excess water drainage system resulting in overflowing from seasonal rains flooding the houses and crops of 20 families. A drain designed for overflow will assist in lowering the risk that these families face.

A well-designed drainage system using proper material in appropriate places is required to connect Paththiniyarkulam and Makulankulam.

In Thekkawatta, the settlements near the low-lying rail reservation are frequently inundated by flood as the drainage path has been blocked by construction. A contour drainage system with a flood retention canal should be constructed as this will also reduce stagnant water. Illegal settlements along the rail reservation could be relocated to an appropriate site in the Paranadakal area.

Water flowing between Kovilkulam and Kovilputhukkulam also lacks a proper drainage path which contributes to flooding.

The floods caused by water from Rambaikulam flowing to Vavuniya Kulam will be managed by the construction of a canal, the removal of sediments and cleaning the water inlet to increase the capacity and flow. The canal project is currently being implemented under this Disaster Resilient City Development Strategies for Sri Lanka Project funded by the Australian Government.

Expanding the spill over canals of the Nawagama community hall area (Eraperiyakulam) is also proposed to overcome flooding in that area. Figure 37 provides a map of locations that experience drainage problems and Table 16 provides the road locations to match the map.

This project is anticipated to cost between 12-15 million rupees and is of great importance. It should be implemented by the NWSDB, the VUC, the RDA and the UDA. It is anticipated to take up to two years.

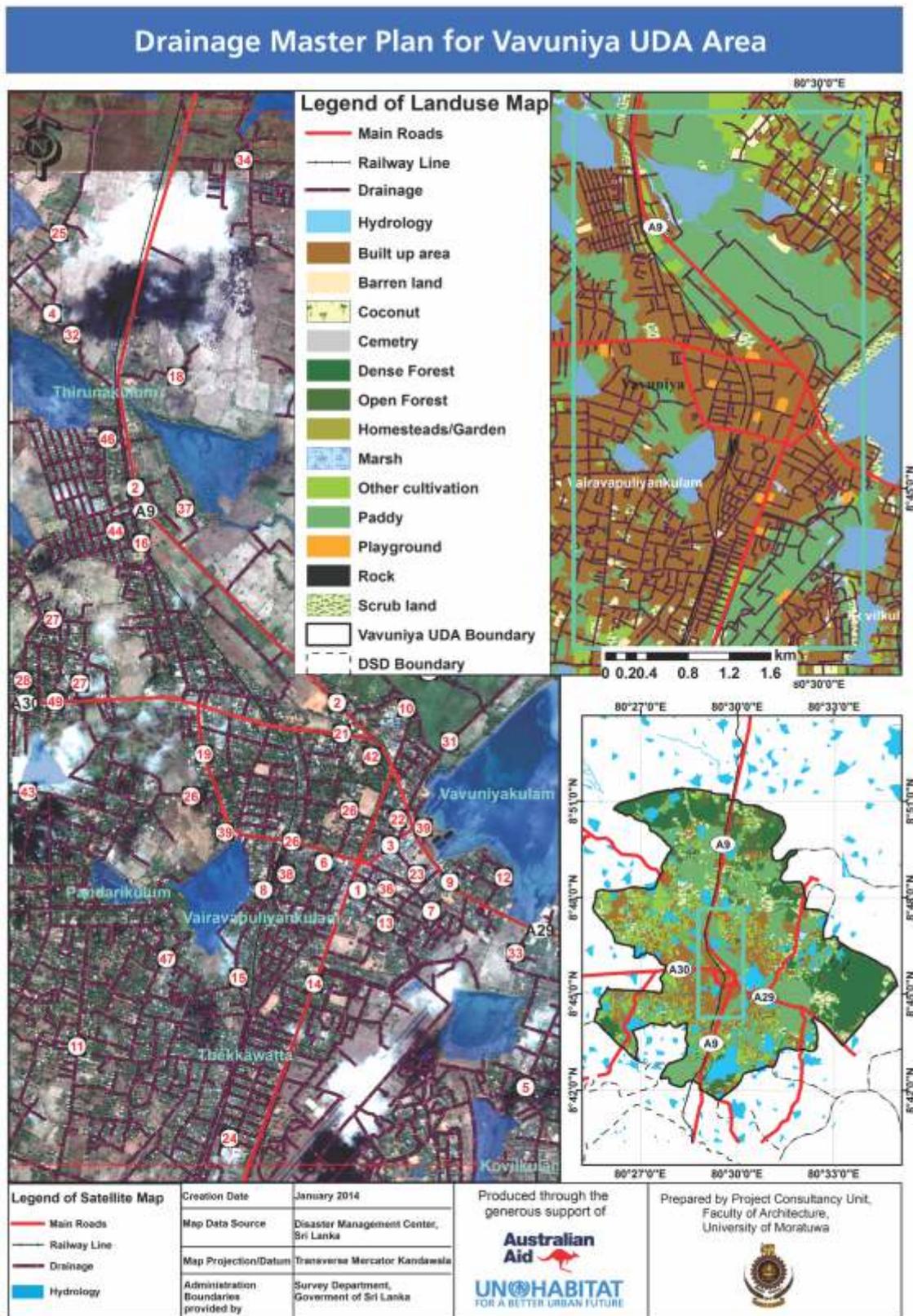


Figure 37: Drainage Master Plan for Vavuniya UDA Area

No	Road Name	No	Road Name
1	3rd Cross Street	26	Pandarikulam Rd
2	A9 Rd	27	Pattakadu Rd
3	Bazaar Rd	28	Pattanisoor Rd
4	Camp Lane	29	Periyarkulam Rd
5	Chinna Puthukulam Rd	30	Police Station Rd
6	Circular Rd	31	Poonthottam Rd
7	Convent School Lane	32	Puthukulam Rd
8	Goodshed Rd	33	Rampaikulam Rd
9	Horowpothana Rd	34	Santhasoolai Rd
10	Hospital circular Rd	35	School Lane
11	Irratperiyar Kulam Rd	36	Second Cross Street
12	Joseph Vas Lane	37	Soya Lane
13	Kandasamy Kovil Rd	38	Station Rd
14	Kandy Rd	39	Tank Road
15	Katkuli Rd	40	Thampanaisoolai Rd
16	Kidachuri Rd	41	Thandikulam Rd
17	Kokkuveli Rd	42	Tharmalingam Lane
18	Kulakattu Rd	43	Thavasikulam Rd
19	Kurumankadu Rd	44	Thirunavatkulam 1st Lane
20	Maharampaikulam Rd	45	Thirunavatkulam 2nd Lane
21	Mannar Road	46	Thiruvavatkulam 3rd Lane
22	Market Rd	47	Thoonikal Rd
23	Mill Rd	48	A29 Rd
24	Moonrumurippu Rd	49	A30 Rd
25	Oyaar Chinnakulam 1st Lane		

Table 17: Locations identified for Drainage Interventions

Techniques to compliment the Drainage Master Plan

It is proposed to use vegetated swales, planter boxes and permeable pavements to compliment the measures being implemented through the drainage master plan. Vegetated swales enable filtering of pollutants and the infiltration of runoff in small drainage areas. Planter boxes can be placed on impervious surfaces to capture and filter water thereby reducing runoff. Permeable pavements can be used to allow stormwater to seep into the ground; this also reduces runoff.

5.2.8 Improve the seasonal water retention pond at Thirunavatkulam

The Thirunavatkulam village area gets inundated because of the settlements constructed in the low-lying area of a tank reservation. The tank beds and water catchment areas have been filled and this contributes to both flooding and stagnant water being unable to drain. This situation affects 150 families, their houses and

paddy fields. As an immediate solution, a water retention pond with a landscaped public recreation park is proposed. A location map is provided at Figure 38.

The proposal involves creating a dry and wet pond on the site that holds water in the rainy season and can be used as a play area in the dry season. The pond will be designed to store flood water that will mitigate the risk of the settlements flooding. Figure 39 provides a sketch of the proposal.

This project could be implemented using a community based approach. This would involve awareness raising, sharing responsibilities and work, establishing a community based funding system and forming a CBO for implementation.

This project is anticipated to cost between two and four million and is of high importance. The VUC, the RDA and the CEA will be responsible for implementation. The duration is anticipated to be three to five months.



Thirunavatkulam

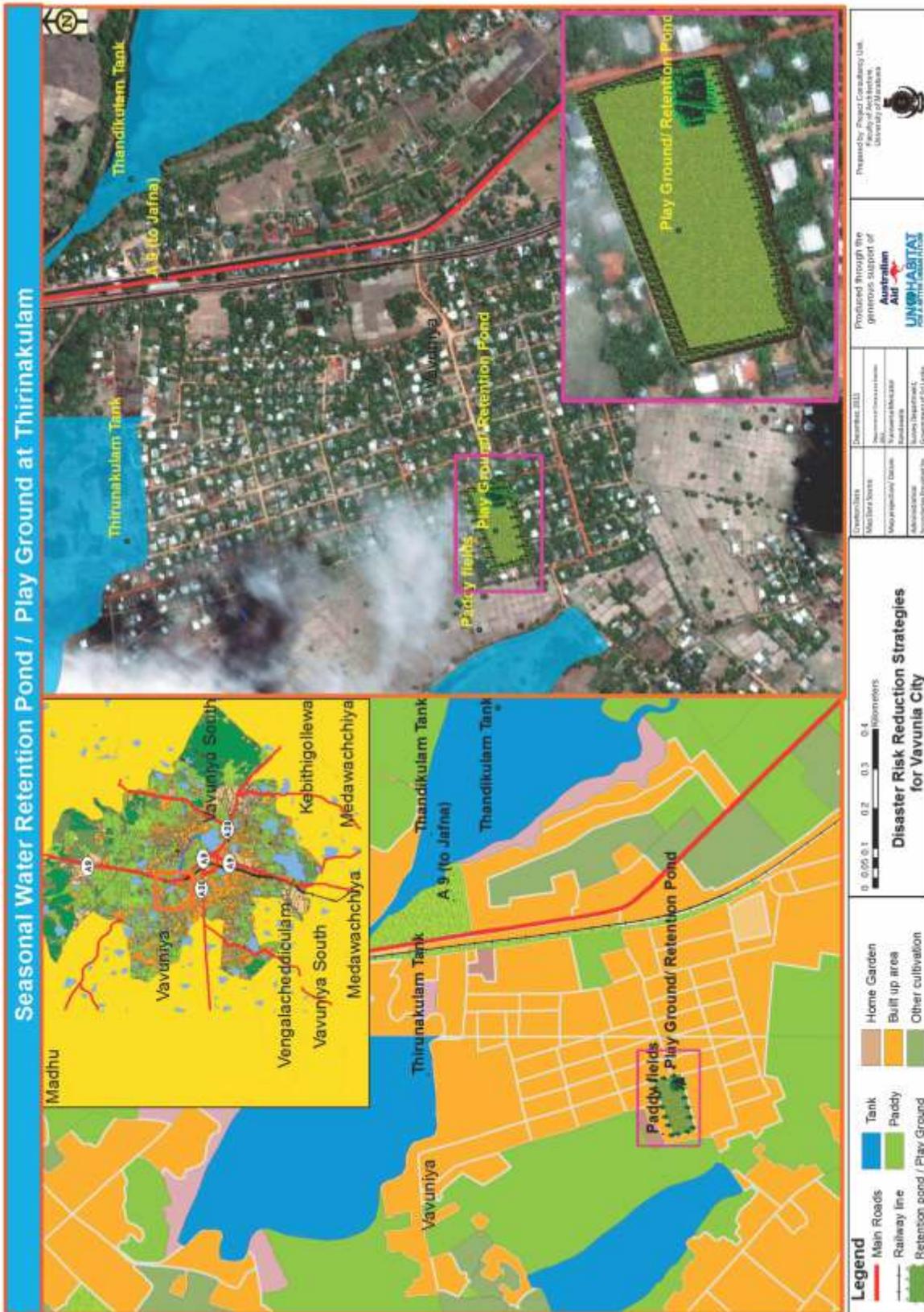


Figure 38: Proposed Water Retention Pond at Thirunavakulam



Figure 39: Retention Pond and Park

5.2.9 Restore Mamadu Oya bank at 40ft bridge, Nochchimoddai.

The Nochchimoddai GN Division experiences both floods and droughts. The Mamadu Oya is a seasonally active tributary that regularly floods the A9 at the 40ft bridge. Flooding affects the southwest area of Santhasolai village as well as Peyadikoolankulam village. Figure 40 provides a location map of the area.

The project proposed dredging and removing the sediment in the Oya followed by reconstructing the

embankment. This will need to be done in a way that allows for overflow and limits erosion. Specific design expertise should be sought when the detailed design is occurring. A sketch of the proposal is provided at Figure 41. The project should be implemented with the support of the RDA and Irrigation Department.

This project is anticipated to cost between six and nine million rupees, is of high importance and will be implemented by the NWSDB, the VUC, the RDA, the UDA and the Irrigation Department. It is anticipated to take between three to five months to complete.



40ft Bridge, A9 road

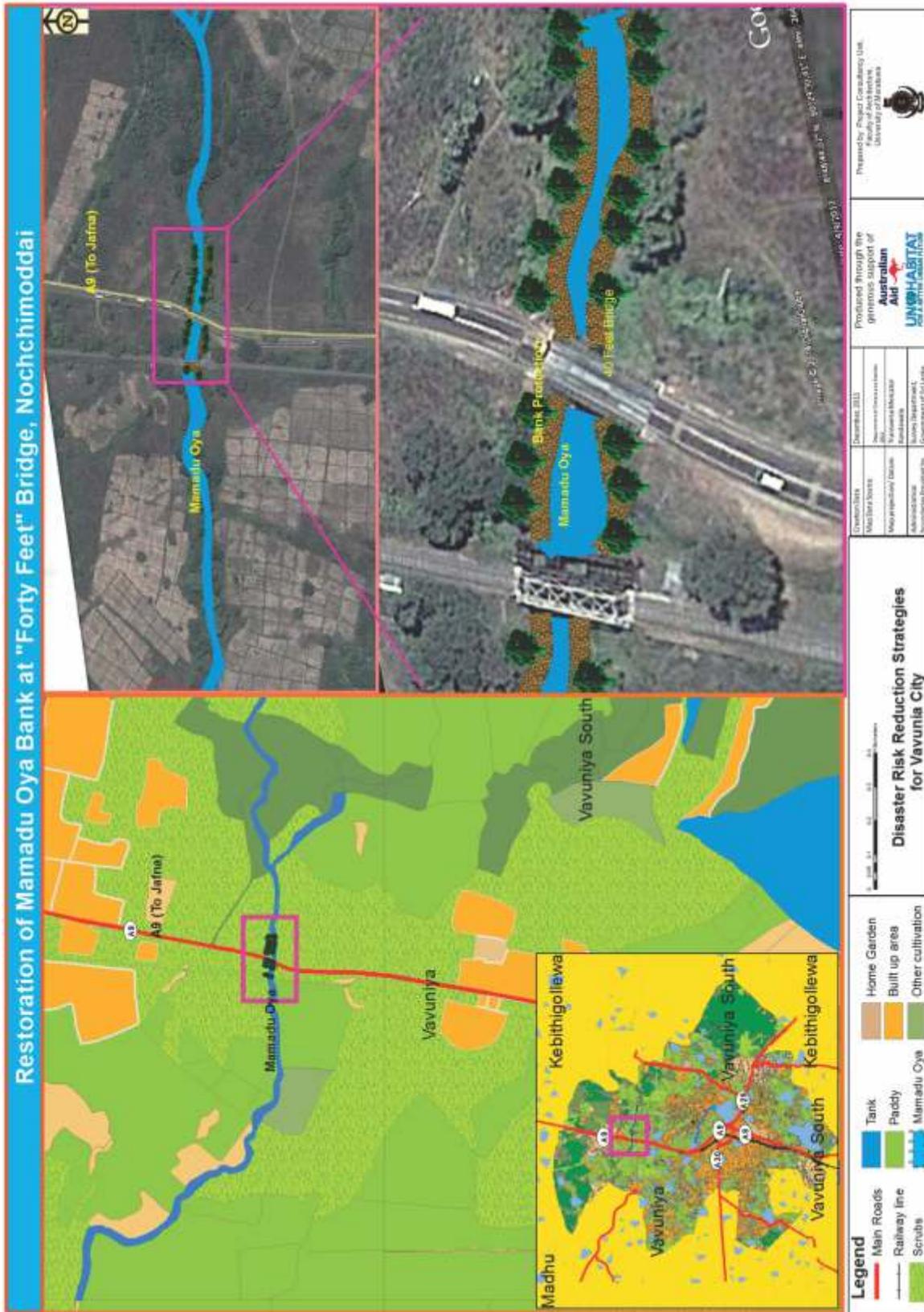


Figure 40: Location for Flood Mitigation Intervention at 40ft Bridge

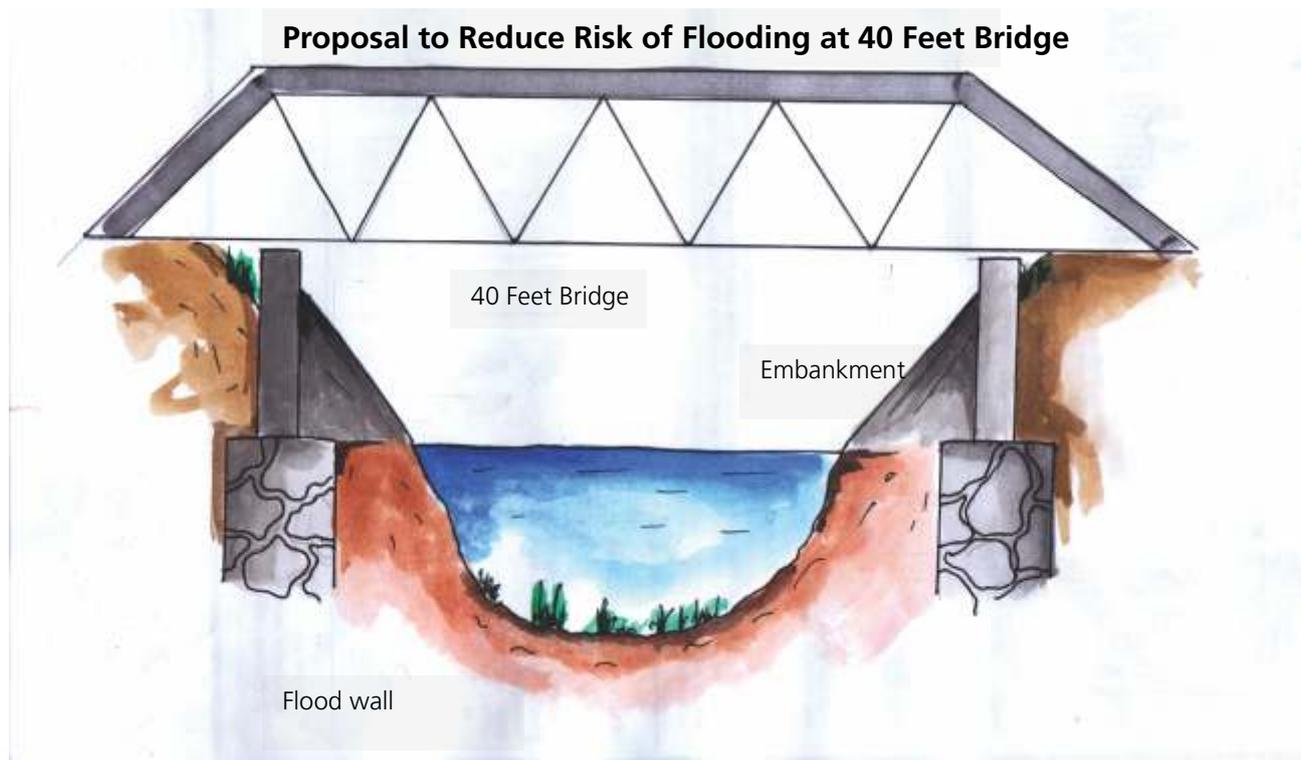


Figure 41: Proposed improvements for 40ft Bridge

5.2.10 Restore tanks and the cascade irrigation system

The tanks are an asset in the Vavuniya Project Area that have not been maintained and are now poorly functioning and sometimes contribute to flooding. Drought is a common hazard in Vavuniya and tanks are an important part of the solution for providing water

during dry periods. Tanks can provide water for housing schemes, agriculture and inland fishing so they are important economic drivers of the area. Kovilkulam, Samalankulam, Velikulam, Vavuniya Kulam, Eratperiyakulam, Peadikoolankulam and Rambaikulam are large tanks and require renovations to their cascade system.



Tanks in the Project Area - Samalankulam (left), Vairavapuliyankulam (right)

Increasing the capacity of the tanks can also provide backup for agriculture in drought seasons. This will provide a safety net for families working in the industry.

The cascade system has a long history in Sri Lanka. Implementing improvements to the cascade system will require developing sustainable regulatory mechanisms. A trial system should be developed and it is proposed to use the Vavuniya Kulam, Periyakulam, Thandikulam tank cascade system as a model to assess the water flow, water and flood reduction benefits. Figure 42 provides a map of the cascade system to be re-established. To restore this cascade system, spill canals and connections need to be identified and established. The projects at Poonthoddam and Rambikulam (see section 5.2) will restore two canals in this cascade system.

This project, which will cost between two and four million rupees per tank, is of moderate importance and should be implemented by the Irrigation Department, the VUC, the UDA and the Agrarian Services Department. It is anticipated to take between five to eight months to complete one tank.

5.2.11 Drip irrigation and rainwater harvesting tanks

The severe impacts of droughts on the agricultural industry have resulted in this project proposal which offers ways for farmers to save water. Drip irrigation waters plants at their base ensuring water is effectively delivered to the roots and not wasted on the leaves. The water drips at a very slow rate from pipes that are aligned to each plant. Drip irrigation is suitable for crops that grow in a row, like vegetables or fruits. It is also suitable for most soils however the rates will differ – for example, clay-based soils should have very slow drips whilst sandy soils can have drips that are a little faster. To

complement the drip irrigation, rainwater tanks should be utilised. These tanks can also be filled by the VUC in times of extreme drought. A traditional watering system where water is passed through canals to different villages could also be investigated.

Teaching the farming community about these techniques, the benefits and the ways they mitigate hazards will assist in ensuring they are implemented. Village level disaster management committees and farmer organisations could work together to teach their communities about the benefits and to raise funds to assist in implementing the drip irrigation and rainwater tanks. DSDs and the Department of Agrarian Services could also be approached to assist in funding these proposals.

The Land Use Management Plan (see the upcoming section 5.3) should identify areas for common rainwater harvesting tanks, as well as private rainwater harvesting tanks.

This project is expected to cost between 1.5 and 2.5 million rupees, it is of low importance. The departments responsible for implementation will be the Irrigation Department, the VUC, the UDA, the Agrarian Service Department and Farmer Organisations. The duration is anticipated to be three months.

Restoring tank banks and bunds using both grass beds and gabion walls is another element that will improve the whole system. This will help to minimise erosion, which in turn contributes to filling the tanks. Ensuring tanks have no-build zones identified around their reservations, and that these zoning regulations are implemented will further assist in enhancing the stability of the banks and protecting the integrity of the tanks (this is elaborated further in section 5.3.1 Land use management and the restoration of tanks).



Well irrigated paddy lands in Vavuniya

5.3 Action Projects Using Land Use Planning to Minimise the Risk of Disasters and to Protect Natural Resources

Land use planning can be used to minimise droughts, soil erosion and floods by establishing strategies and policies to protect sensitive land uses and provide direction to development.

This section provides details on the three action projects that will support this strategy.

1. Land use management and the restoration of tanks;
2. Multipurpose greenbelts throughout the city; and
3. Flood and drought resistant green home model.

Each of the projects is discussed in detail below.

5.3.1 Land use management and the restoration of tanks

Land uses affect water quality and can cause or contribute to flooding if not properly regulated. Encroachments in water catchment areas such as Vairavapuliyankulam, Thandikulam, Thirunavatkulam have been identified as a severe problem that needs to be managed by legal or regulative actions. Encroachments near the tank area of Mathavuvaiththakulam have also caused floods in the surrounding area. Some settlements in the Kadarsinnakkulam Division, including the paddy lands area have caused water to stagnate in low-lying areas. Both settlements and roads near the tank bund in Rajendrankulam get inundated due to encroachment and land fillings in the catchment area. To regulate settlement development in the catchment area of tanks, a land use management strategy is required.

The land use management strategy will demarcate catchments and prioritize the rehabilitation of catchments, as well as identify a plant inventory of species that are appropriate for specific conditions located within the Project Area. The demarcated zone will be to at least the high flood level, however, discretion can be used by the responsible authority: in this instance VUC in consultation with the Irrigation Department and Survey Department. This demarcation zone will target both structures and land filling. Reconstruction of boundary walls assists in demarcating zones. The boundary wall along the Horowapathana Road and Kovil Link road is being repaired under this Disaster Resilient City Development Strategies for Sri Lanka Project funded by UN-Habitat and the Australian Government.

In the case of settlements that encroach on these zones all options must be considered and any relocation should be done in accordance with the National Involuntary Resettlement Policy.

A land use management strategy is a long-term solution that requires widespread consultation that continues over the length of time involved in drafting the strategy and also continues as the strategy is reviewed and updated. It enables citizens to see a strategic future and to understand the direction the VUC has established, and the reasons why some land should not be built on. The land use management strategy will also encourage plantings around tanks that assist with soil stability and filtering water thereby preventing erosion and helping the water quality in the tanks. The land use management strategy will enable different, selected uses, such as recreation, to be encouraged in the catchment areas – see Figure 43.



Figure 43: A Land Use Management Approach to Tanks and Bunds

5.3.2 Multipurpose greenbelts throughout the city

Multipurpose greenbelts and street tree planting both provide a cooling, pleasant environment that can act as a wind barrier and also reduce the urban heat island effect. Of particular importance to Vavuniya, greenbelts can assist soil to maintain moisture and reduce erosion. Reducing erosion will be of benefit to agricultural land, as the topsoil will stay in situ, assisting the plants' growth. They can also assist in providing absorbent surfaces that enable water to seep into the soil and reduce the amount of runoff and water entering the drainage system. Greenbelts are able to reduce wind damage as thick vegetation blocks the wind and provides some protection to settlements. Finally, well-

designed greenbelts can provide pleasant environments for the citizens of VUC. Figure 44 highlights locations in the centre of Vavuniya where trees, as both greenbelts and street trees, could be planted. The UDA's Vavuniya Development Plan and the Land Use Management Strategy should both identify streets and locations for greenbelts and ensure protection measures are in place over existing large trees and greenbelts.

This project is anticipated to cost between 1.5 and 3 million rupees. It is of moderate importance and should be implemented by the VUC, CEA, UDA and Forest Department. It will take between six to twelve months to complete.



Existing green cover along the Kandy Jaffna highway

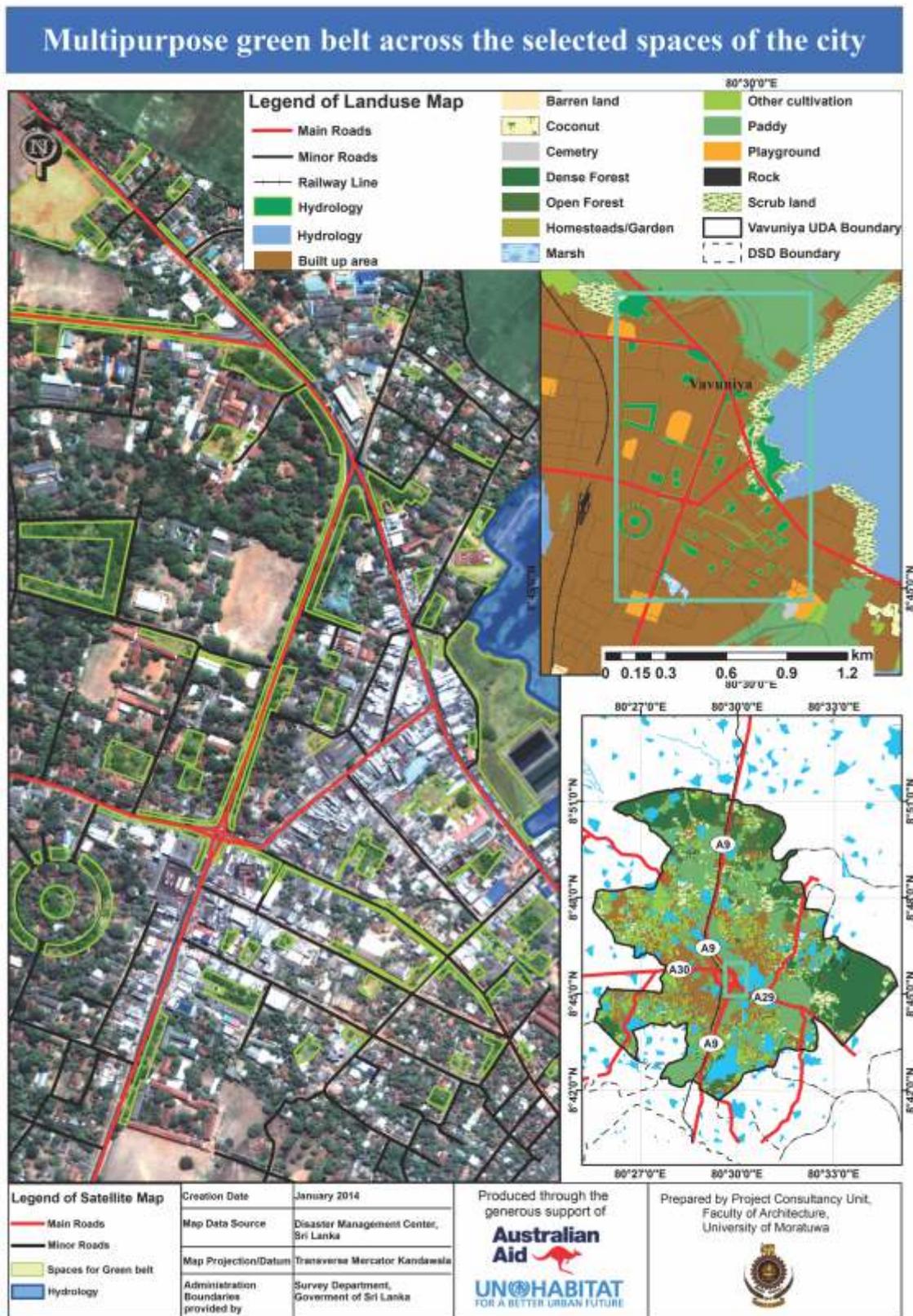


Figure 44: Locations for Multipurpose Greenbelts

5.3.3 Flood and drought resistant green home model

This project will focus on the individual house level to reduce their level of risk to both floods and droughts. This should be focused on the very high-risk areas that have been identified (see Figure 27: Multiple Hazards and Risk Zones Map). The strategies, however, could be adopted by any house in the Project Area.

The project includes practical tips for reducing risks and living in a sustainable manner, such as planting vegetation around the house. This simple act can assist in deflecting heat, reducing dust, improving the air quality, improving health and comfort levels and reducing the amount of stormwater in the monsoon period.

The model houses can include some, or all of the following techniques:

- Green roof to provide shade, remove heat, and also grow vegetables;
- Rainwater collection system attached to the house roof and used for gardening;
- Raised platform in the roofs of houses provides somewhere to keep food and important information safe during floods;
- Seed and food storage in waterproof plastic containers that are quick and easy to transport;
- Raised wells to reduce the risk of contamination and waterborne disease;
- Raised latrines to minimise the risk of groundwater contamination;
- Rain garden grown seasonally to match with water availability;
- Floating vegetable garden on rafts made of bamboo which can rise and fall with the height of flood water;
- Semi-permeable paving that encourages water to seep through to the soil and reduces reflection and heat generation;
- Growing vegetables that are drought resistant;
- Wastewater used for gardening.

Through education and especially initial successes with these strategies, their popularity will grow and encourage more citizens to try the techniques in their own houses.

The weather pattern of the area combined with proper water management practices will enable a wide diversity of horticultural practices to be implemented. Financial subsidies for tanks could be offered by VUC.

This project is anticipated to cost between 0.5 and 2 million rupees. It is of low importance and should be implemented by the VUC, the UDA and the DMC. It will be ongoing in terms of implementation.

5.4 Action Projects: Sharing and participating in community actions and improving resilience through social empowerment

Learning from experience, sharing those experiences and ensuring social networks are operating can all be effective ways of enhancing awareness and improving resilience. This section provides details on the six action projects that will support this strategy:

1. Conducting community awareness programmes on DRR and preparedness;
2. Educating school children;
3. Implementing GIS training programmes for local officials;
4. Forming Community Based Disaster Risk Management Committee in high risk zones;
5. Forming youth response and post-recovery teams; and
6. Establishing a drought forecasting and early warning communication network.

Each of the projects is discussed in detail below.

5.4.1 Community awareness programmes on DRR and preparedness

Ensuring community awareness programmes that reach the whole community, including vulnerable groups is a necessary starting point when considering who to target and how to spread messages. Establishing the messages to impart and refining the details of the messages will follow for each identified group. Participatory processes are beneficial because engaging the community will enable programmes to learn from indigenous knowledge as well as work with communities to act and understand how their actions can have implications in times of disaster. Preparedness programmes need to be clearly understood so there is no miscommunication during a hazard event. Community awareness messages need to be consistent, clear, location specific and repeated regularly to ensure actions become second nature. Warnings must be acted upon promptly however warnings must not be issued without cause for real concern about an imminent hazard.

Properly implemented community education campaigns result in increasing awareness, improving understanding, increasing acceptance and influencing behaviour change.

Women must be included in training programmes. Ensuring their knowledge and expertise in mobilising communities, and thereby reducing risks is critically important to the success of any programme. Ensuring

grassroots women's organisations, and women, have full access to information and decision-making in prevention and preparedness strategies is a core element of this project.

5.4.2 Educating school children

Educating school children is an effective way of reaching whole communities: children can act as messengers and educate their parents, families, neighbours and communities about DRR. Schoolteachers are therefore a very important element of society that needs to be targeted under this programme. Conducting a properly targeted school education programme will enable the children to understand risk and consequence.

School programme education campaigns could include:

- Awareness raising on hazards and their subsequent effects;
- Workshops on preparedness including swimming lessons, first aid and search and rescue training;
- Training programmes on emergency response and handling equipment;
- Exhibitions on disaster management, preparedness and response;
- Communication skills;
- Leadership programmes and recovery training (including psycho-social recovery);
- Participatory environmental management projects and shramadana campaigns; and
- Resilient school chains that link the DRR activities of respective schools.

5.4.3 GIS training programmes for local officials

Improving the technical ability of local officials to identify and measure risk will enable the VUC, the DMC and the UDA to understand the high risk locations, as well as the activities that are occurring in other locations that influence these risks.

GIS is a discipline devoted to the acquisition, storage, management, analysis and visualisation of spatial data. GIS gives the ability to integrate and analyse spatial and non-spatial information for mapping, planning and decision-making. This information assists government officials establish areas for development, hazard prone areas, infrastructure mapping, population and environmental sites. GIS can be used to generate maps illustrating this information. Once information is entered into a GIS system, it is a simple matter to change the data on the computer and produce an updated product.

The GIS training programme proposes to teach participants how to create a citywide spatial database

and also develop a disaster profile for the Vavuniya Project Area.

Creating a citywide spatial database for the Vavuniya Project Area is identified as one component of a GIS training programme that will target officials in the relevant fields. It is a tool that helps to make use of available data, stores that data in a usable way, and enables it to be clearly presented. A Spatial Database can be helpful in different ways at city level. Once the citywide database is established, a specific data sub-set that will be developed is the disaster profile. This will enable the Vavuniya project area to prepare and plan for disasters and ensure responses can be mapped and coordinated in a smooth manner.

The spatial database that is going to be created for the Vavuniya Project Area will include the following features:

- Land use data of the area and attributes of each and every element;
- Thematic information (for example, population density, building density);
- Information regarding infrastructure facilities (for example, water supply, drainage network, electricity lines); and
- Other information (for example, information about land ownership, flood prone areas).

The database should be regularly updated to ensure it reflects the situation on the ground, especially as land uses and other features change.

As the Vavuniya Project Area frequently faces different kinds of disaster, a disaster profile will be helpful to understand the nature and trends of disasters, and the levels of the impact on life and property. The disaster profile will include:

- Data and location maps of past disasters;
- Magnitude of the disaster (for example flood level);
- Data on life and property damage;
- Identified hazard prone areas; and
- Number of vulnerable people in hazard prone areas.

There are three steps that are important for developing a disaster profile. Firstly, the system should be designed with the help of experts. The system needs to be maintained and training can cover how to do this. Finally, the system needs to be updated and training can also cover this element.

The Training Programme can be designed to practice and develop these systems using different software packages. ArcGIS is a commercial software package; using open source software is therefore preferred. Quantum GIS (Q-GIS) is a free open source, user-friendly software package that includes almost all the features of ArcGIS.

A further option is to link this system with the web. Once it is connected, it can be developed and shared with other local authorities, as well as the public very easily.

5.4.4 Forming Community Based Disaster Risk Management Committees

Communities that are actively involved in disaster risk management are better prepared to face hazards. A formal mechanism to encourage this preparedness is establishing Community Based Disaster Risk Management Committees (CBDRMCs). This is a local organisation established for a specified small, local area. CBDRMCs should be established in all high-risk zones. They can enable communities to be well organised and to respond in a structured manner. The CBDRMC can be linked with the village level disaster management committee of the DMC. This will facilitate strong coordination and awareness of roles and responsibilities. The general steps to take when forming a CDRMC are:

1. Identify community, including different groups such as youth, elderly, vulnerable and commuters;
2. Identify leaders in the community, such as religious leaders and involve them in the risk assessment, planning and awareness process;
3. Ensure representatives from vulnerable groups are included in the CDRMC;
4. Establish criteria for membership of the CDRMC;
5. Define functions of the CDRMC;
6. Register CDRMC with the government authorities;
7. Hold meetings, petition VUC or other agencies, organise trainings to raise awareness and influence behaviour change;
8. Coordinate with other CDRMCs and VUC, DMC to ensure training is targeted and addresses local needs. Coordination will also enhance links between organisations working in DRR; and
9. Ensure equality is a core component of the CDRMC and encourage female members to be involved.

5.4.5 Forming youth response and post-recovery teams

Youth includes school students, higher education students, young professionals and young workers. Each group can make different contributions to making cities resilient. In this instance, it has been identified that there is a need for assistance with immediate response and recovery and that youth can assist in filling this gap. Different youth groups can be harnessed to promote new farming techniques, such as drip irrigation, as well as contribute to environmental conservation and tank improvement or protection projects. Youth bring energy, motivation, willingness to consider alternatives and try out new ideas.

Youth can be equipped with the knowledge and ability to provide links between communities and recovery programmes. These could include, for example, the distribution of physical relief (food, shelter, medicine) or the awareness of signs of psychosocial stress and the ability to link these needs with services that are provided by either government or non-government organisations.

5.4.6 Drought forecasting and early warning communication network

Establishing a drought forecasting centre including a community based early warning network will assist the communities, especially those involved in agriculture and livestock to plan for the future. Involving farmer organisations will ensure the system considers the needs of the end users. The system will need to ensure data collected is in a standardised format to ensure valid comparison and projections between districts. The data should be collected at regular intervals to ensure close tracking of the availability of water and that the situation on the ground is accurately reflected in the future modelling.

Mapping the hazards and anticipated severity will assist in preparedness. These maps could be prepared with assistance from the VUC, DMC and meteorology department. Ensuring support from the community will assist with the provision of data however the community will need to be trained in data collection methods.

The early warning network will have a focus on drought initially however it could be expanded to monitor rainfall and flooding.

5.5 Action Projects to Plan for Recovery and Enable Economic Opportunities

Financial security assists communities and individuals recover faster following any disaster. This section provides details on the four action projects that will support this strategy:

1. Develop a cooperative disaster recovery donation system;
2. Implement a local level community DRR fund;
3. Establish an insurance scheme; and
4. Incentives for DRR.

Each of the projects is discussed in detail below.

5.5.1 Establish a Cooperative Disaster Recovery Donation System

A cooperative disaster recovery donation system will be established under VUC to act as a contingency fund for

response and management following disasters. This will include financial donations as well as physical items (food, clothing, household items), and in-kind contributions such as labour.

A further possibility to be explored is the creation of a public-private insurance scheme that also includes the government.

The cooperative disaster recovery donation system should be managed by the VUC and will be responsible for the following:

1. Establish administrative structures and responsibilities, for disaster logistics and donations management operations;
2. Establish methods and procedures relating to donations including different categories (such as kind, type, and quantities) of donations;
3. Establish administrative procedures for accounting for donations;
4. Identify a disaster donations management team from within the VUC staff to manage disaster donations;
5. Establish methods and procedures for educating the public on where and how they can volunteer post-disaster;
6. Provide a system for distributing any donations remaining following the conclusion of the disaster recovery operations; and
7. Provide the opportunity to review and improve the established system.

5.5.2 Start a local level community DRR fund

This fund is proposed for the high-risk areas, and contributions can be sourced from a monthly membership fee from households located in the high-risk zones. The contributions can be monetary, goods or services. Charities operating in the respective areas can also be approached for funds. VUC can assist in developing the fund and connecting to other potential funding sources such as local businesses. A line of micro credit for DRR improvements to housing could be an additional feature added to the fund.

5.5.3 Investigate insurance schemes

A disaster insurance scheme will provide security to properties, livelihoods and people affected by disasters. Community savings schemes can assist community members who don't have regular salaries to contribute to the insurance fund. Links with local businesses must be enhanced to ensure they contribute to these funds. The steps involved in establishing this project are:

1. The insurance scheme should be introduced by the VUC in affiliation with a bank and a reliable insurance firm;

2. Each local household would pay a particular amount decided by the insurance firm and receive home and contents insurance if they are affected by a flood, strong wind or similar natural disaster;
3. Each local cultivation holder would pay a particular amount decided by the insurance firm and receive cultivation insurance if they were affected by a flood, strong wind, drought or similar natural disaster; and
4. The local government would manage the fund and payout where necessary, ensuring equal treatment for everybody affected.

5.5.4 Incentives for DRR Initiatives

Incentives for implementing DRR initiatives can be varied – they can range from cash to training to opportunities to attend conferences. Private companies such as CIC Agro, Hayleys, John Keels could be approached to sponsor incentives or provide credit for households and small businesses to assist them in recovery after any disaster. Training programmes such as Outbound Training can be offered for both local community leaders and local officials to help improve leadership, initiatives and trust. Scholarships and opportunities for further education both within Sri Lanka and abroad should be pursued. The DRR unit in VUC can assist in sourcing opportunities for training and advising the community and other local officials about how to apply.

5.6 Action Projects to Ensure Assessment, Evaluation and Monitoring of DRR Implementation

Continuous assessment, evaluation and monitoring of DRR Projects will enable programmes to be implemented and ensure that they are responding to the needs identified in the most appropriate way. Continually updating data will enable:

- Review of the very high hazard locations;
- Evaluation of the action projects;
- Changes to be made to the plan to reflect changes in risk level and locations; and
- Review of the governance framework around the plan.

The VUC has a very important role in the assessment, evaluation and monitoring process. Indicators will need to be developed to enable proper assessment, evaluation and monitoring. Conducting this part of this element of the whole project correctly will ensure following the plan becomes an inherent part of VUC practices.

5.7 Conclusion

The details on how the Vavuniya Project Area will move towards becoming a resilient city through specific and targeted action projects have been provided in this Chapter.

A resilient city is a place where the community has the ability to adapt to disasters and respond quickly for the betterment of society as a whole. This chapter has ensured projects are achievable and will have direct positive impacts on the citizens. Community participation in the disaster resilient city development initiatives provided some solutions for mitigating

disaster risk and developing the capacity of the community. Institutional setup and frameworks are required to capitalise on the ability of the community.

The strategies proposed will assist in enabling the Vavuniya project area to face disasters with improved resilience while the social empowerment strategies are particularly focused around enabling the community and ensuring DRR is part of their daily life. Vavuniya is at a critical stage in development, and careful, strategic choices will enable the city to flourish for future generations. Good governance and proper execution of DRR and this Plan will strengthen the development of Vavuniya as a resilient city.

6

Conclusion



Conclusion

In 2005, at the World Conference on Disaster Reduction, 168 countries adopted the Hyogo Framework for Action 2005-2015 for building the Resilience of Nations and Communities to Disasters as an ambitious programme of action to significantly reduce disaster risk.

In this context the Disaster Resilient Development Strategies for Sri Lankan Cities Project was established. The Vavuniya Disaster Risk Reduction and Preparedness Plan is an attempt to put the HFA into action.

This report firstly explains the project in the context of Sri Lanka and Vavuniya, then demonstrates the methodology and explains a resilient city. Several analyses of the Vavuniya project area, from different perspectives, to identify hazards, vulnerabilities, major constraints and potential opportunities were conducted. The HFA and stakeholder consultation shaped the assessments which were developed into the five strategic directions.

The strategic directions form the basis for the action projects. The action projects elaborate on the proposed DRR plan for the Vavuniya project area and suggest strategic actions, both structural and non-structural, to minimise disaster risk and improve the adaptive capacity to achieve a resilient, sustainable and healthy city.

These projects, when implemented will achieve a substantive reduction in disaster losses by promoting the idea of a holistic and integrated economic, social, psychological, physical and environmental approach where all aspects of the city, such as infrastructure, governance, disaster risk management and social services, are treated as inter-related and equally important. This will increase resilience and improve the current situation for the population of the Vavuniya project area.

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Annexure A: Linking the Strategic Directions to the HFA

The links between how the HFA is incorporated into the Strategic Directions and the DRR planning process that was undertaken in the Vavuniya Project Area are explained in the following table.

The 10 Essentials for Making Cities Resilient in line with Hyogo Framework for Action	Strategies and Projects Proposed in Vavuniya Project Area through this Plan
<p>Essential 1: Put in place organisation and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role in DRR and preparedness.</p>	<ul style="list-style-type: none"> ● Form community DRM groups in high-risk zones to prepare for and respond to hazards. Improve resilience by establishing a local level disaster management committee integrated with national level DRM groups. ● Form youth response and post recovery teams. ● Develop and establish a monitoring framework for the DRM committee. ● The technical working group (DMC, UDA, VUC), is to evaluate and monitor disaster risk and mitigation (DMC, UDA, UC, CDRMC), including: <ul style="list-style-type: none"> - Establishing a structured system for planning and building approvals, including a disaster management specialist; - Mandatory membership of a disaster management specialist on the building approval and on land subdivisions committees; - Develop a methodology to assess the degree of vulnerability of development sites and make provisions to introduce site specific planning regulations and guidelines; and - Establish community participatory decision-making mechanisms to issue permission for public places or buildings in vulnerable areas.
<p>Essential 2: Assign a budget for DRR and provide incentives for homeowners, low-income families, communities, businesses and public sector to invest in reducing the risks they face.</p>	<ul style="list-style-type: none"> ● Develop a cooperative disaster recovery donation system under VUC and a contingency fund for disaster management and response at local government level; and ● Establish a local level community DRR Fund.
<p>Essential 3: Maintain up-to-date data on hazards and vulnerabilities, prepare risk assessments and use these as the basis for urban development plans and decisions. Ensure that this information and the plans for the city's resilience are readily available to the public and fully discussed with them.</p>	<p>The ultimate objective of this project is to achieve Essential 3. The vulnerability, risk assessment, SWOT analysis, time series analysis and core problem analysis were completed using updated demographic, socio economic and weather data.</p> <ul style="list-style-type: none"> ● Link disaster information systems to VUC library and DRR unit; and ● Establish spatial database and conduct training on technological use.
<p>Essential 4: Invest in and maintain critical infrastructure that reduces risk such as drainage, adjusted where needed to cope with climate change.</p>	<p>DRR measures proposed through this plan include:</p> <ul style="list-style-type: none"> ● Flood protection walls for Vavuniya Kulam and Samalan Kulam; ● Reducing run-off and water filtration basins at Poonthottam junction with lifted dyke; ● A water retention pond at Thirunakulam; ● A Wetland Park at Vavuniya Kulam on Horowpathana Road; ● A drainage masterplan for Vavuniya; ● Restoration of Mamadu Oya bank at 40ft Bridge, Nochchimoddai; ● Improve resilient infrastructure with vegetated swales, planter boxes and permeable pavement; and ● Improve land use management of tank catchment and rehabilitation of irrigation system.

The 10 Essentials for Making Cities Resilient in line with Hyogo Framework for Action	Strategies and Projects Proposed in Vavuniya Project Area through this Plan
<p>Essential 5: Assess the safety of all schools and health facilities and upgrade these as necessary.</p>	<p>The location of all schools and health facilities in Vavuniya Project Area was considered as an element of vulnerability and as an element of adaptive capacity. The Plan proposes DRR awareness programmes for school children.</p>
<p>Essential 6: Apply and enforce realistic, risk compliant building regulations and land-use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible.</p>	<ul style="list-style-type: none"> ● Review existing building regulations; ● Amend existing building regulations by streamlining and filling gaps; and ● Prepare land use zoning map for disaster resilient Vavuniya in-line with identified risk zones and suitable planning and building regulations for each zone.
<p>Essential 7: Ensure education programmes and training on DRR for schools and local communities.</p>	<ul style="list-style-type: none"> ● Empower the community who are affected by disasters by enhancing their ability to respond. ● Enhance knowledge sharing on disaster resilient planning; ● Encourage knowledge sharing and training to build safe structures; and ● Train the local officers to map hazard areas and prepare a GIS based database for disaster information, include providing knowledge of GIS and other relevant software.
<p>Essential 8: Protect ecosystems and natural buffers to mitigate floods and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices.</p>	<ul style="list-style-type: none"> ● Multipurpose greenbelt proposed across selected locations in the city; ● Green public buildings and home gardening to be encouraged; ● Bank protection solutions for Vavuniya Kulam, Kovil Kulam, Samalan Kulam and Thandikulam; ● Demarcation of tank reservations and restoration of tank catchments at Vavuniya Kulam and Vairavapuliyankulam; ● Rehabilitation of abandoned tanks to improve capacity; and ● Introduce rain water horticulture system for home gardens.
<p>Essential 9: Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.</p>	<ul style="list-style-type: none"> ● Establish a disaster insurance scheme with trusted insurance firm and cooperative bank; and ● Establish incentive scheme for DRR initiatives and efforts.
<p>Essential 10: After any disaster ensure that the needs of the survivors are placed at the centre of reconstruction with support for them and their community organisations to design and help implement responses, including rebuilding homes and livelihoods.</p>	<ul style="list-style-type: none"> ● Facilitate coordination among community groups for disaster relief, capacity building and knowledge sharing by CBDRMC.

