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RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.

RESCCUE TOOLKIT

Main author/s: D. Pacheco, M. Velasco Affiliation: Cetaqua, Aquatec Date: 28th September 2020









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MAIN AUTHOR:	David Pacheco (Cetaqua)
CONTRIBUTOR(S):	Marc Velasco (Aquatec)
INTERNAL REVIEWER:	Eduardo Martinez (Cetaqua)
EXTERNAL REVIEWER:	Angel Villanueva (Aquatec)

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Changes with respect to the DoA

This document was included in the amendment AMD-700174-30 approved in April 2020 as the production of the RESCCUE Toolkit was planned as one of the key dissemination and exploitation actions of the RESCCUE project for the last months of the project

1. Dissemination and uptake Public

2. Short Summary of results (<250 words)

Throughout the project's lifetime, RESCCUE has placed much effort on dissemination tasks, aiming at allowing general and specialised audiences to access information about the project progress and its outcomes, as well as promoting the widest application of the RESCCUE outcomes in other cities.

In this regard, RESCCUE has developed the <u>RESCCUE toolkit</u>, an interactive space where the main project's results are gathered, along with a set of guidelines outlining the steps to be taken to make your city resilient. In this platform, all the tools, datasets and methodologies developed within RESCCUE can be found, sorted by topic and by the three case studies: Barcelona, Lisbon and Bristol.

Along with the Toolkit platform itself, the deliverable D7.9 outlines the main features and characteristics of the platform.

The structure of the deliverable is organized in the following sections:

- 1. Introduction
- 2. Objectives
- 3. Identification of project results
- 4. RESCCUE Toolkit platform

3. Evidence of accomplishment

- RESCCUE Toolkit platform (<u>www.toolkit.resccue.eu</u>)
- This report



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1 Introduction

This document is developed as part of RESCCUE (RESilience to cope with Climate Change in Urban arEas - a multisectorial approach focusing on water) project, which has received funding from the European Union's Horizon 2020 Research and Innovation program, under the Grant Agreement number 700174.

This deliverable corresponds to the RESCCUE Toolkit, an interactive space where the main project's results are gathered, along with a set of guidelines outlining the steps to be taken to make your city resilient. In this platform, you all the tools, datasets and methodologies developed within RESCCUE can be found, sorted by topic and by the three case studies: Barcelona, Lisbon and Bristol. This platform will remain available **5 years after the project ends**, as well as the RESCCUE project webpage.

2 Objectives

The RESCCUE Toolkit is one of the key final materials aimed at fostering the replication of the project results in other cities.

This platform has been produced to accomplish the following objectives:

- Allow both general and specialised public to access information about the project outcomes, ensuring a successful dissemination of project achievements and results to all relevant stakeholders.
- Promote and encourage the widest possible application of project methodologies and outcomes beyond the lifetime of the project, by developing an Exploitation Plan
- Ensure that the Intellectual Property Rights of the consortium are properly protected

Besides, the RESCCUE guidelines are included in the RESCCUE toolkit. In this sense, the main objectives of the RESCCUE guidelines are:

- Summarise the RESCCUE approach, development and results in an easy-tounderstand and appealing way.
- Explain how to use RESCCUE outputs to improve your city's resilience.
- Offer expert contact info

3 Identification of project results

In this section, the process of identification of project results to be included in the RESCCUE Toolkit is outlined. Using the table of exploitable results included in the D7.7 Dissemination and Exploitation Plan and the D8.5 Data Management Plan as the starting point, each WP leader selected the most relevant results that should be included in the RESCCUE Toolkit.



In order to upload these results properly to the platform, they were sorted by city, topic (WP), described using less than 100 words and tagged as:

- Dataset
- Methodology
- Publication
- Tabulated results
- Tool
- Tool and dataset
- Assessment results Maps in image format

The complete table of results that have been included in the RESCCUE Toolkit can be found below:

Result	BCN	LIS	BRI	Туре	Торіс	Description (60-100 words)
Climatic change scenarios of extreme events	x	x	x	Dataset	Climate change & extreme events scenarios	This dataset offers detailed information at a local scale about the future changes in the frequency and intensity of a wide variety of extreme variables due to climate change. The main variables analysed are: temperature-related events (heat waves, maximum temperature, tropical night, warm day, etc.), extreme rainfall, or storm surge, among others. The information provided follows the RCP 4.5 and 8.5, and is divided into three time periods: 2011- 2040, 2041-2070 and 2071-2100. Thanks to the methodology implemented in RESCCUE, the use of quality-tested weather observations allows the replicability of these results into any other location
Flood hazard assessment in Barcelona, Lisbon, Bristol	x	x	x	Dataset	Strategic urban services modelling	The outputs of the hydrodynamic model (flood extension, flood depths and velocities) were used to generate flood hazard maps for pedestrian and vehicles according to experimental hazard criteria. Simulations were performed for different return periods related to current and future scenarios (including Business as usual and Adaptation scenarios) obtaining a specific hazard map for each case.

Table 1 List of results included in the RESCCUE Toolkit



Integrated flooding – traffic simulations in Barcelona	X			Dataset	Strategic urban services modelling	According to the integrated flooding- traffic model in Barcelona, flood hazard maps were obtained by GIS spatial analysis of the flooded road links (with specific rules applied in relation to traffic speed reductions) and by flow depths provided by 1D/2D hydrodynamic model. Moreover, the dataset is built on the results of TranscCAD modelling software that, on the basis of pre- calculated hazard maps, was used to simulate the flood economic impacts due to traffic disruption. Simulations were carried out for current and future scenarios (including Business as usual and Adaptation scenarios).
Integrated flooding – traffic simulations in Bristol			X	Dataset	Strategic urban services modelling	This dataset is built on utilising flood hazard data coupled with road network information as a means of modifying speed limit parameters of inundated roads within a micro-scale traffic model. For the Bristol case study the Open Source traffic modelling software SUMO (Simulating Urban Mobility) tool was applied (https://sumo.dlr.de/docs/). For comparative analysis, simulations under various flooded conditions are compared against dry weather conditions.
Sea level rise impact model	x	х	х	Dataset	Strategic urban services modelling	Critical infrastructures and services potentially exposed to sea level rise for the horizon of 2100 have been represented by exposure maps for RCPs 4.5 and 8.5 scenarios.
Assessment of marine model impacts	x	x	x	Dataset	Strategic urban services modelling	Integrated urban drainage – marine model provided temporal and spatial evolution of pollution in receiving bathing water. Dataset is built with time series of rainfall, CSO discharges and pollution in representative points of bathing water during the characteristic bathing season of the year 2009.
Flood intangible damage assessment in Barcelona	x			Dataset	Impact assessment & cascading effects	Hazard maps were also combined with vulnerability maps to provide flood risk maps for pedestrian and vehicles. Risk maps were obtained for different return periods related to current and future scenarios (including Business as usual and Adaptation scenarios).
Flood tangible damage assessment in Barcelona and Bristol	x			Dataset	Impact assessment & cascading effects	Hydrodynamic outputs (flood depths) were used to feed the flood direct damage model. This model, based on this information, detailed land use maps and tailored flood depth damage curves, provided economic risk maps for different return periods related to current and future scenarios (including Business as usual and Adaptation scenarios).



Integrated flooding – electrical simulations in Barcelona and Bristol	х		х	Assessment results Maps in image format	Impact assessment & cascading effects	Hazard and risk maps were generated from the integrated flooding-electrical simulations in Barcelona and Bristol cities. The Maps indicates the locations with hazard potential, level of risk, and the estimated cost quantification of these risks for different return periods and scenarios provided in the flooding models.
Integrated flooding – electrical simulations Bristol			x	Tabulated results	Impact assessment & cascading effects	Tabulated global results generated from the integrated flooding-electrical simulations in Barcelona and Bristol cities. This provides additional information about hazard potential, level of risk, and the estimated cost quantification of these risks for different return periods and scenarios provided in the flooding models.
Impact quantification indices in the electrical network	X	X	x	Publication	Impact assessment & cascading effects	GIS-based methodology designed for the assessment of electrical substations and distribution centres in case of extreme flooding events and extensible to other climate extreme events such as earthquakes, heat waves, and extreme windstorms if electric poles are also included into the assessment. This methodology has been thoroughly explained in "Electrical Grid Risk Assessment Against Flooding in Barcelona and Bristol Cities" paper.
Flood Risk Assessment tool for electrical assets	x		x	Tool	Impact assessment & cascading effects	This tool seeks to help with the strategic planning and future operational decisions oriented to prevent possible problems caused by extreme flooding events in the electrical network through the risk assessment and major risk identification on electrical assets, the estimation of associated costs and reliability indices. The tool has been developed on the open-source GIS platform QGIS, building on FEMA fragility curves and the methodology presented in "Electrical Grid Risk Assessment Against Flooding in Barcelona and Bristol Cities" paper.
Flood direct damage assessments	x	x	x	Dataset	Impact assessment & cascading effects	The Direct Damage Assessment data for the Bristol case study is derived via the analysing water depths that are in contact with buildings to estimate the damages based on the building use and the associated depth-damage relationship. The functions for Bristol are obtained from the Multi-colour Manual (MCM). The MCM contains information derived from historical insurance data that relates damage estimates to properties based on surrounding flood depth and said properties land use



						classification. The dataset herein presented outlines the aggregated damages to flooded buildings based on their exposure to flood waters and their respective depth-damage curves.
Assessment of city resilience in Barcelona	X			Publication	Holistic resilience assessment & management	This video presents the main steps of RESCCUE methodology application in Lisbon Research Site. From the identification of resilience-related goals, key stakeholders to engage and critical services and infrastructures to include in the analysis; to the study of interdependencies and consequent cascade effects triggered by a climate- related disruptive even, in the case, rainfall induced floods. In Lisbon, 19 services from 7 sectors were considered, including 146 infrastructures. Data collection was performed through a set of 13 meetings, at the service operational level, and 5 local workshops, at strategic and steering levels, involving all the key stakeholders.
Tool and database for the selection of adaptation strategies	x	x	x	Tool and dataset	Resilience & adaptation strategies for the market uptake	A prioritization methodology has been developed to rank the proposed climate adaptation measures. This methodology will assist to decision makers to select the most efficient measures in terms of both their costs and the degree of risk reduction that they can guarantee. Besides, the methodology has been integrated into a web-based platform that will assist the decision makers to conduct the process of prioritization. The platform includes an extensive database of adaptation measures gathered by the different project partners based on their experience in the three cities that act as case studies in the project (Barcelona, Bristol and Lisbon)
Framework for cities resilience assessment	x	x	x	Methodology	Water- focused city resilience roadmap	RESCCUE RAF is a framework that provides a structured system for urban resilience assessment to climate change, considering four dimensions: organisational integrating top-down governance relations and urban population involvement; spatial referring to urban space and environment; functional regarding strategic services' resilience and physical looking at infrastructures' resilience. It is objective- driven enabling to assess the development level of city resilience,



						considering strategic services and interdependencies contributions to city resilience. Services included are water supply, wastewater, storm water and waste management, electrical energy and mobility. Its main purpose is to support decision in the development of resilience action plans and assess progress.
Framework for the Resilience Action Plan	x	x	x	Methodology	Water- focused city resilience roadmap	It is an approach that provides a planning process by defining the main steps to follow to develop resilience action plans, It includes the information needed to produce an action plan for enhancing resilience of any city, based on the work already existing in the city, the definition of climatic scenarios, characterization of the context and hazards, risk and resilience assessment and development of strategies to be implemented to improve resilience.
RESCCUE Assessment Framework tool for application	X	X	x	Tool	Water- focused city resilience roadmap	RESCCUE RAF-APP is a tool to facilitate undertaking a structured urban resilience assessment to climate change providing easy visualization of results through graphical representation. The tool enables assessing the development level of city resilience, considering strategic services and interdependencies contributions to city resilience. Services included are water supply, wastewater, storm water and waste management, energy distribution and mobility. It also supports to assess resilience development level of the service. This allows identifying the main strengths and weaknesses in the city and services. Its main purpose is to support decision in the development of resilience action plans and assess progress.
Resilience Action Plan of Barcelona	х			Publication	Water- focused city resilience roadmap	It is a document containing the resilience action plan for each city defining the roadmap for resilience enhancement, to climate change with focus on water. It
Resilience Action Plan of Bristol			x	Publication	Water- focused city resilience roadmap	includes the information on the work already existing in the city, definition of climatic scenarios, characterization of the context, and hazards, risk and resilience
Resilience Action Plan of Lisbon		x		Publication	Water- focused city resilience roadmap	assessment, description and implementation planning of strategies to be implemented to improve resilience. It is a thematic plan that can contribute to the city's global resilience plan and it was built based on RESCCUE's template and guidelines and on the results obtained,



						using the tools and approaches developed in RESCCUE.
RAP templates & guidelines	x	x	x	Publication	Water- focused city resilience roadmap	These documents support the development by any city of their resilience action plans. A template with guidance to write a Resilience Action Plan (RAP) is provided, regarding climate change, with focus on the water cycle. The city may complete or adapt the template suggestions to fit better its own context and expectations for this document.



4 RESCCUE Toolkit platform

4.1 Features

The main features allowed in the RESCCUE Toolkit platform are:

- Navigate through the RESCCUE results and guidelines
- Find out all the results developed within the project
- Sort results by topic or city
- Learn more about each case study
- Access all the databases, tools, methodologies and templates
- Access the RESCCUE maps on the Clarity portal and interact with them
- Access other results from the project: scientific publications, deliverables, etc

4.2 Structure

The RESCCUE Toolkit is structured following the scheme below:



Figure 1 Structure of the RESCCUE Toolkit platform



4.2.1 Homepage

The homepage of the RESCCUE Toolkit aims to present the RESCCUE project by offering the following items:

- Brief description of the RESCCUE project
- Link to the RESCCUE website
- Link to the RESCCUE e-book
- Link to the RESCCUE video

RESCCUE Toolkit	TOPICS CITIES OTHER RESULTS ALL TOOLS
Resilience to cope with climate change in urban areas The RESCCUE project aims to help urban areas around the world to become more resilient to climate change, improving their capability to anticipate, prepare for, respond to and recover from significant multihazard threats, with minimum damage.	
Got interested?	

	Resilient cities facing climate change encode
WATCH VIDEO	READ E-BOOK

Figure 2 Homepage of the RESCCUE Toolkit platform

4.2.2 Topics

All the tools & results included in the RESCCUE toolkit are sorted by topic. These topics match the 6 technical work packages (WP) of the RESCCUE project:





Figure 3 Section "Topics" in the RESCCUE Toolkit homepage

Each topic is presented in a single page including:

- Link to the topic guidelines
- Link to the topic tools & results
- Link to other topics
- Guidelines (see below)
 - Expert contact info
- Tools & results









Figure 5 List of topic experts and expert contact info



Figure 6 Example of tools and results of topic "Strategic urban services modelling experts"

4.2.2.1 Guidelines

Over the last year of the project, one of the materials designed and produced to approach those goals was a set of guidelines that synthesise the key outputs, providing the end-users with relevant information to face climate change. These guidelines create a road map to on how to apply the RESCCUE tools and methodologies in different cities:

#1 How to... use climate scenarios for analysing climate-related impacts in cities

The creation of climate change scenarios, according to different climate variables, facilitates the implementation of adaptation measures as well as reduces the level of uncertainly.

#2 How to... analyse the behaviour of critical urban services under climate pressures



Testing different methodologies in order to develop multiple hazard assessment for strategic urban services and infrastructure, providing deep knowledge about the behavior of urban services under extreme climate conditions.

#3 How to... estimate direct, indirect and subsequent cascading impacts from climate driven hazards

Within RESCCUE, the potential impacts on critical infrastructures and services as a result of climate driven hazards were selected to be assessed in the cities of Barcelona, Bristol and Lisbon for both current and future climate scenarios.

#4 How to... globally analyse, diagnose and manage urban resilience with a holistic approach

With a holistic resilience approach, the city vulnerabilities can be identified, together with its critical infrastructures and key relationships among critical services, allowing to understand the existing interdependences.

#5 How to... effectively prioritise adaptation strategies to enhance urban resilience

Cities must adapt to increasing climate impacts, by setting an adaptation strategy based on the context, on its resources and necessities, of each city.

#6 How to... develop and implement a Resilience Action Plan (RAP) in your city

Water-related risks may be aggravated by climate change and eventually condition the correct functioning of the city. The Resilience Action Plan finds the best responses for those gaps.

4.2.3 Cities

In the home page, a menu to select the 3 cities appears to navigate to the page of each city:



Figure 7 Section "Cities" in the RESCCUE Toolkit homepage

Each city is featured in a single page, including the following items:

• Description of the city and the case study



- Link to read more on the RESCCUE website
- List of tools and results related to the city



Tools & Results

RAP TEM	RAP TEMPLATES & GUIDELINES	+	RESILIENCE ACTION PLAN OF BARCELONA	+	RESCCUE ASSESSMENT FRAMEWORK TOOL FOR APPLICATION	+
Water-focu	sed city resilience roadmap		Water-focused city resilience roadmap		and the second Hold Science and Hold Science	

Figure 8 Page about Barcelona case study

4.2.4 Other results

In this section, a brief description of the RESCCUE deliverables, maps and scientific publications can be found, as well as a link to each material (on the RESCCUE website).

Other results



Figure 9 "Other results" section on the RESCCUE Toolkit



4.2.5 All tools

In this section, all the main tools and results are featured. Two filters (topic & city) allow the users to sort these tools and results and navigate through them.



Figure 10 "All tools" section on RESCCUE Toolkit

4.3 Monitoring and impact measurement

In order to track the effectiveness of the RESCCUE Toolkit, two indicators have been established:

- Number of visits to the website (Google Analytics): The main indicator of the effectiveness of the RESCCUE Toolkit is the number of users that visit the platform. This will serve to measure the visibility of the RESCCUE results. Over 1.000 visits are expected for the first year after the project ends.
- Number of contacts received through the RESCCUE guidelines: Another key indicator of the effectiveness of the RESCCUE Toolkit is the number of people contacting the RESCCUE partners through the contact info offered within the RESCCUE guidelines of each topic. **5 contacts are expected** during the first year after the project ends.