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Green Cantonal Action Plan for Sarajevo

Bosnia & Herzegovina

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Abbreviations

Abbreviation	Description
BAM	Bosnia and Herzegovina Convertible Mark
BAT	Best Available Technology
BD	District of Brčko
BiH	Bosnia and Herzegovina
BIM	Building Information Modelling
BOD	Biochemical Oxygen Demand
BRT	Bus Rapid Transit
CAPEX	Capital Expenditure
CCTV	Closed-Circuit Television
CFD	Computational Fluid Dynamics
CMSR	Centre for International Cooperation and Development
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
DAMS	Digital Asset Management System
DFIs	Development Finance Institutions
DH	District Heating
DHC	District Heating Company
DHN	District Heat Network
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EE	Energy Efficiency
EEAP	Energy Efficiency Action Plan
EEP	Energy Efficiency Plan
EPR	Extended Producer Responsibility
ESCO	Energy Service Company
ESDP	European Spatial planning Perspective
ESG	Environmental, Social and Governance
EU	European Union
EUR	Euro
EV	Electric Vehicle
FBiH	Federation of Bosnia and Herzegovina
FHMI	Federal Hydro Meteorological Institute
FOPIP	Financial and Operational Performance Improvement Program
FTE	Full Time Equivalence
GCAP	Green Cantonal Action Plan
GCF	Green Climate Fund
GEFF	Green Economy Financing Facility
GrCF	Green Cities Framework
GDP	Gross Domestic Product
GHG	Greenhouse Gas(es)
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)
GPS	Global Positioning System
HOV	High-Occupancy Vehicle
HVAC	Heating, ventilation, and air conditioning
I	Investment
IBRD	International Bank for Reconstruction and Development
ICLEI	International Council for Local Environmental Initiatives
IDA	International Development Association
IDB	EBRD Indicators Database for Green City Action Plan
IFIs	International Financial Institutions
IMP	Impact Monitoring Plan
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transportation System
KEAP	Cantonal Environmental Action Plan
Kg	Kilogram
Km^2	Square Kilometres
LEAP	Local Environmental Action Plan
LEZ	Low Emission Zone
LPG	Liquefied Petroleum Gas
LRAP	Leakage Reduction Action Plan
LT	Long-Term

LTHW	Low Temperature Hot Water
M&E	Monitoring and Evaluation
MBT	Mechanical and Biological Treatment
MoFTER	Ministry of Foreign Trade and Economic Relations
MSW	Municipal Solid Waste
Mt	Mega Tonne
MT	Medium-Term
MWh	Megawatt Hour
MWt	Megawatt Thermal
n.b.	Nota Bene
NGOs	Non-Governmental Organisations
NMU	Non-Motorised User
NMT	Non-Motorised Transport
NRWRAP	Non-Revenue Water Reduction Action Plan
NO_x	Nitrogen Dioxide
OECD	Organisation for Economic Co-operation and Development
OPEX	Operating Expense
PE	Population Equivalent
PET	Polyethylene Terephthalate
PM	Particulate Matter
PMP	Progress Monitoring Plan
P	Policy
PPP	Public–Private Partnership
PRTR	Pollutant Release and Transfer Register
PSC	Public Service Contract
PSR	Pressure-State-Response
PUC	Public Utilities Commission
RANS	Reynolds-Average Navier-Stokes
RE	Renewable Energy
RES	Renewable Energy Source(s)
RS	Republika Srpska
RTPI	Real Time Passenger Information
RYG	Red, Yellow, Green

SEA	Strategic Environmental Assessment
SERDA	Sarajevo Economic Region Development Agency
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SC	Sarajevo Canton
SCFB	Framework Budget Document of Sarajevo Canton
SuDS	Sustainable Drainage Systems
SUMP	Sustainable Urban Mobility Plan
TA	Technical Assessment
TOD	Transit-Oriented Development
TV	Television
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
UWWTD	Urban Wastewater Treatment Directive
ViK	CPUC Vodovod i kanalizacija (public water company)
VOCs	Volatile Organic Compounds
WB	World Bank
WBIF	Western Balkans Investment Framework
WFD	Water Framework Directive
WHO	World Health Organisation
WWTP / WWTW	Wastewater Treatment Plant / Wastewaster Treatment Works
3D	Three-Dimensional

Executive Summary

Introduction

The Sarajevo Canton is committed to developing sustainably and this Green Cantonal Action Plan (GCAP) articulates the Canton's 'green city' vision and strategic objectives. It builds on existing plans and initiatives, such as the Cantonal Environmental Action Plan (KEAP) (2017), by applying a systematic approach to future development that takes into account a broad range of environmental issues and links these to economic and social objectives. It also contains a comprehensive set of 'green city' actions for Sarajevo Canton that address the challenges identified and can be translated into investable actions.

The objectives of developing this Sarajevo GCAP are to:

- Build on and enhance work recently completed in the development of the KEAP (2017) to address environmental challenges, including by adopting a longer-term timeframe, in alignment with the Federal Law for Environmental Protection;
- Set out clear causal linkages between the condition of environmental assets and economic and social dimensions and objectives to help the Canton to identify policies and investments that would help shape, direct and realise the Canton's policy agenda, green ideals and aspirations for sustainable development;
- Contribute towards reallocating Sarajevo's financial and personnel capacity to prioritise policy options and investments that have the potential to realise the greatest environmental benefits;
- Provide bespoke analysis, conclusions and recommendations regarding urban ventilation corridors within the Sarajevo basin;
- Enhance the potential to attract donor co-finance and support by demonstrating how a specific project fits into broader priorities and the Canton's roadmap for environmental improvement; and
- Align with key local policies and strategies.

Environmental baseline

The Green Canton baseline is presented in a separate document – the Technical Assessment Report, which forms the evidence base of the GCAP. It aims to inform policy and strategic decision-making throughout the GCAP process and provides the reference for the identification and prioritisation of challenges as well as the basis for monitoring the success of the implementation of GCAP actions. The Technical Assessment Report was preceded by the preparation of the Political Framework Report, and the information presented in these documents was utilised to identify a set of indicators to assess 'green cities' in accordance with the EBRD methodology. This Indicators Database is a collection of environmental data presented as a set of state, pressure and response indicators.

The state-pressure-response model enables the assessment of the negative impacts of human activities (pressure indicators) on environmental assets (state indicators) and identifies associated gaps in the policy framework (response indicators). Data for state of the environment indicators were collected relating to water resources, air quality, green space, mitigation of GHG (Greenhouse Gases) emissions, soils, biodiversity and ecosystems, and adaptation and resilience to natural disaster risk. Pressure indicators were populated with data collected for transport, industry, energy, buildings, land use, water and solid waste sectors. Pressure indicators are benchmarked according to presence and degree of implementation. Data for response indicators, measures that seek to improve the Canton's environment, were largely qualitative and derived from an analysis of the policy context of the GCAP, presented in the Political Framework Report.

The database was populated by compiling existing data from the Canton Administration and other relevant local organisations to develop the Green Canton baseline. The database features established international benchmarks in terms of three categories of state indicator, i) quality of environmental assets (air, water, soils), ii) availability of resources (water, green space, biodiversity and ecosystems) and iii) mitigating GHG emissions and adapting to risks deriving from climate change.

An analysis of the baseline, including of the key causal relationships between indicators, which involved technical and stakeholder-based prioritisation, resulted in the identification of priority environmental challenges, while maximising the economic and social co-benefits and considering its context (population size, socio-economic structure and geographical and climate characteristics).

Priority environmental challenges

The priority environmental challenges for Sarajevo Canton, listed in order of priority, are as follows:

1. **Air quality** - air pollution in Sarajevo Canton is at least moderately high throughout the year but trends indicate that it is worsening, with high and increasing concentrations of pollutants in the winter. Concentrations of air pollutants are highest in the urban area of the Canton. The regular exceedance of daily limits for air pollutants resulted in a **Study of Urban Ventilation Corridors and Impacts of High-Rise Buildings** being prepared as part of the GCAP development process[1]. Air pollution emissions are largely associated with citizens' relatively high reliance on fossil fuelled private road transport, which is exacerbated by the Canton's aging car fleet and low engine standards, high production of heat energy from fossil fuels in buildings, with renewable energy only comprising a small share of total energy generation, and polluting industries;
2. **Water resources** - water quality is relatively poor due to relatively high levels of Biochemical Oxygen Demand (BOD) in water bodies. This has been attributed to factors including insufficient sewage infrastructure in the Canton, the consequences of which include the direct discharge of wastewater from residential, commercial and industrial buildings into water bodies without treatment. Rainwater sewerage is not completely separated from municipal wastewater sewerage. There is also pressure on water resources due to high amount of non-revenue water, with unsatisfactory implementation and enforcement of plans, limited investments in repairs and maintenance of water supply infrastructure. A decision on protection of water from springs has yet to be adopted, and water protection zones are threatened by construction;
3. **Soils** - soil monitoring systems are not sufficiently developed in the Canton, which restricts the potential for related analysis. This is in itself a challenge that needs to be addressed, with other concerns including the low proportion of municipal solid waste that is sorted, recycled and composted, relatively high solid waste generation, lack of treatment for landfill leachate, and slippage of soil due to landslides, erosion, construction etc.;
4. **Green spaces** - Sarajevo Canton comprises a number of rural and natural areas, but the amount of green space within urban areas is very limited and unevenly distributed. This has resulted in regulatory limits regarding the building / green space ratio being exceeded in certain zones. Pressures on green space that need to be addressed include illegal construction, urbanisation and urban sprawl;
5. **Mitigation of GHG emissions** - GHG emissions in the Canton are relatively low but increasing due to levels of development, making their management a priority. Associated issues that need to be addressed have strong overlap with those in relation to local air quality. They include the high modal share of private vehicles, together with high average vehicle age, high percentage of diesel vehicles and low engine standards of the vehicle fleet, and the high reliance of the transport, residential and industry sectors on fossil fuels. Opportunities exist to enhance the energy efficiency and reduce the GHG intensity of all sectors of the economy, but these are not being capitalised upon;
6. **Biodiversity and ecosystems** - related monitoring is limited but it is known that biodiversity and natural ecosystems are being compromised by activities in all sectors. Pressures that appear to be having the most negative impact include the Canton's relatively high population density, urban sprawl, inadequate regulation of urban development, and lack of protection of natural areas; and
7. **Adaptation and resilience to natural disaster risk** - the resilience of transport, energy, water and drainage infrastructure to climate change and other natural disasters needs to be improved. Citizens also need to be better prepared for related disasters. A number of pressures are increasing related risk, notably illegal construction, which is triggering landslides (almost 900 landslides were registered in 2017), and shortcomings in the policy and planning framework.

[1] The main objectives of this study, which is summarised in this GCAP but also the subject of a separate report, were to: analyse potential impact on the air flow and quality across the Sarajevo basin by creating new wind ventilation corridors; locate areas / corridors where construction of high-rise buildings should be restricted to improve the air flow and quality throughout the basin, and; conduct a study of existing air flows and pollution levels across the basin using GIS, meteorological data, and computational modelling. Computational Fluid Dynamics (CFD) modelling was employed to predict airflow through the Sarajevo valley and between buildings.

Sarajevo Canton GCAP vision and strategic objectives

The Sarajevo Canton GCAP vision, which reflects the challenges summarised above as well as broader sustainable development aspirations, is as follows:

"Sarajevo Canton will have cleaner, greener, affordable and smarter transport, buildings and industries. It will be served by efficient and high-quality water and wastewater infrastructure, efficient district heating, with improved waste and pollution control management. The Canton will be a healthy, compact, sustainable place to live and work, with good quality, accessible green spaces and biodiversity and natural values maintained or enhanced. Resilience to climate change and other natural disasters will be increased."

A vision and strategic objective were also developed for each environmental topic area, with each vision forming the framework for the strategic objectives, which in turn shaped the generation of associated policy and investment actions. Quantified mid-term targets for 2025 and long-term targets for 2030 for each strategic objective were also set to allow the monitoring of progress towards achieving the objectives. The visions and strategic objectives for each environmental topic area are listed below.

Air quality

Vision statement: *"Air quality in Sarajevo Canton will be improved with cleaner, more efficient and greener transport, heating systems, buildings and industry."*

Strategic objective: AQ01 Improve ambient air quality compliant with EU (European Union) standards.

Water resources

Vision statement: *"Sarajevo Canton will have an efficient and well-maintained drinking water supply network as well as wastewater infrastructure serving the entire population."*

Strategic objectives:

WR01 Improve efficiency of water use; and

WR02 Maintain and improve surface water and groundwater quality.

Soils

Vision statement: *"Soil quality in the Canton will be enhanced as part of improved land, waste and pollution control management."*

Strategic objective: SL01 Protect and enhance soil quality across Sarajevo Canton.

Green space

Vision statement: *"Sarajevo Canton will become renowned as a compact, sustainable place to live and work, with good quality green spaces accessible to everyone and an efficient system of land uses."*

Strategic objective: GS01 Expand and improve provision of high quality, accessible green spaces.

Mitigation of GHG emissions

Vision statement: *"Sarajevo Canton will have smart, affordable, low carbon transport, buildings and industries."*

Strategic objective: GH01 Reduce GHG emissions.

Biodiversity and ecosystems

Vision statement: *"Biodiversity and natural values will be maintained and enhanced across the Canton."*

Strategic objectives:

BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity across Sarajevo Canton; and

BE02 Reduce the impact of human activities on biodiversity.

Adaptation and resilience to natural disaster risk

Vision statement: *"Sarajevo Canton will increase its resilience to climate change and other natural disasters with improved, coordinated planning and management."*

Strategic objective: AR01 Improve resilience to climate change and other natural disasters.

GCAP actions

Short-term actions, which are activities whose implementation commences between 2021 and 2025 and some will continue beyond 2025, have been developed as vehicles to achieve the GCAP strategic objectives as well as to contribute towards wider environmental, social and economic sustainability. A long list of short-term actions was developed, and priority actions were

selected from these using a process of technical, stakeholder and political prioritisation. The result is a list of priority actions that have the potential to realise the highest environmental, economic and social benefits in the Canton. They also take into account the availability of related finance, which was determined by conducting a preliminary analysis of the Cantonal budget and a high-level assessment of potential funding options for short-term actions that require investment. These GCAP actions are listed in the table overleaf, where actions labelled as P are policies and actions labelled as I are investments (e.g. LU01 – P or TR12 – I).

GCAP actions by sector

Action reference and title	Action classification	Implementation start/ end date	Action owner
Land use (7 actions)			
Priority actions			
LU02 – I Upgrade and enhance integrated Geographic Information System (GIS) based land use information for Sarajevo Canton to facilitate effective monitoring and evaluation systems for planning and management	Improving information base, modelling	2021 – 2022	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC
LU08 – P Climate change risk assessment to future proofing	Developing policy, plan, legislation, regulations	2021 – 2024	Ministry of Communal Affairs and Infrastructure, Civil Protection of Sarajevo Canton
LU09 – P Valorisation and protection of natural areas in Sarajevo Canton	Developing policy, plan, legislation, regulations	2024 - 2026	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Institute for the Protection of the Cultural, Historical and Natural Heritage of Sarajevo
LU10 – I Establishment of green corridor along the River Miljacka and the Main Road corridor from Central Park to Hamdije Čemerlića Street	Capital investment implementation - new	2023 - 2025	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Communal PE Park
Additional actions			
LU01 – P Develop, adopt and enforce the Urban Development Strategy for Sarajevo Canton, in accordance with the Handbook of Sustainable Urban Development Strategies[2]	Developing policy, plan, legislation, regulations	2021 - 2023	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC
LU03 – P Establish land value capture mechanisms in accordance with spatial planning development measures	Developing policy, plan, legislation, regulations	2024 – 2026	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy
LU04 – P Introduce an Urban Rulebook for Sarajevo Canton which will integrate spatial and environmental aspects, conditions of land use, and building code regulations	Developing policy, plan, legislation, regulations	2023 – 2024	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC

[2] Handbook of Sustainable Urban Development Strategies: https://urban.jrc.ec.europa.eu/#/en/urbanstrategies

Action reference and title	Action classification	Implementation start/ end date	Action owner
Sustainable Transport (15 actions)			
Priority actions			
TR07 – I Enhance and expand cycling and electric scooter infrastructure	Capital investment: implementation – improving existing	2021 – 2026	Ministry of Transport
TR10 – I Expansion of the public sector fleet, and replacement with low emission vehicles	Capital investment: implementation – improving existing	2021 – 2025	Ministry of Transport
TR11 – I Upgrading of bus station and stop infrastructure, including smart technology	Capital investment: implementation – improving existing	2021 – 2030	Ministry of Transport
TR13 – I Smart and Integrated Traffic Management Solutions	Capital investment: implementation – new	2022 – 2030	Ministry of Transport
TR15 – I Reconstruction of tram tracks and purchase of new trams	Capital investment: implementation – new	2021 – 2022	Ministry of Transport
TR16 - Construction and establishment of new tram lines	Capital investment: implementation – new	2021 - 2023	Ministry of Transport, CPUC GRAS Sarajevo
Additional actions			
TR01 – I Develop Canton-wide data collection programme and transport model	Improving information base, modelling	2021 – 2023	Ministry of Transport
TR02 – P Restricted car zone policies and city centre pedestrianised zone	Developing policy, plan, legislation, regulations	2021 - 2025	Ministry of Transport
TR03 – P Develop pricing mechanisms to promote mode shift	Developing policy, plan, legislation, regulations	2021 – 2026	Ministry of Transport
TR04 – P Develop car parking rationalisation and management policies	Developing policy, plan, legislation, regulations	2021 – 2023	Ministry of Transport
TR05 – I Promotional campaigns for car sharing, walking and cycling	Awareness raising	2021 – 2022	Ministry of Transport
TR06 – I Implement city-wide pedestrian wayfinding signage network	Capital investment: implementation – improving existing	2021 – 2025	Ministry of Transport

Action reference and title	Action classification	Implementation start/ end date	Action owner
TR08 – P Develop standards and guidelines for travel planning, parking and street design	Developing policy, plan, legislation, regulations	2021 – 2022	Ministry of Transport
TR09 – I Implement infrastructure to promote public uptake of low emission vehicles	Capital investment: implementation – improving existing	2021 – 2025	Ministry of Transport
TR12 – I Implement bus network infrastructure	Capital investment: implementation – new	2022 – 2031	Ministry of Transport
TR14 – I Feasibility study for expansion of the tram system	Capital investment: feasibility, planning, design, piloting	2022 – 2026	Ministry of Transport
Water (12 actions)			
Priority actions			
WR01 – P Establish an integrated water supply digital asset customer management system and implement non-revenue water reduction action plan	Developing policy, plan, legislation, regulations	2021 - 2023	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR02 – I Establish monitoring of the cantonal water supply network for identification of leakage locations and system performance	Improving information base, modelling	2021 - 2024	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR03 – I Implement defined measures to reduce water losses - infrastructure and facilities	Capital investment: implementation – improving existing	2021 onwards	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR04 – I Reduce risks to water quality and increase connection of population to mains supply	Capital investment: implementation – improving existing	2023 - 2028	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo, Municipal Authorities
WR05 – I Establish digital asset management systems for municipal wastewater and drainage infrastructure and implement a wastewater action plan	Improving information base, modelling	2021 - 2023	Ministry of Communal Affairs and Infrastructure
WR07 – I Execute wastewater network construction: extension, refurb and new build	Capital investment: implementation – improving existing	2023 - 2026	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR08 – I Execute Wastewater Treatment Works extension adding nutrient removal capability, optimise thermal treatment and disposal of sludge	Capital investment: implementation – new	2023 - 2026	Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, CPUC ViK Sarajevo

Action reference and title	Action classification	Implementation start/ end date	Action owner
WR11 – I Strategy and program for treatment of wastewater in industry and other activities	Developing policy, plan, legislation, regulations	2022 - 2026	Ministry of Communal Affairs and Infrastructure
WR12 – I Construction of Wastewater Treatment Plant (WWTP) and sewage network in the area of municipalities Vogošća Ilijaš and Hadžići	Capital investment: implementation – new	2021 - 2027	Ministry of Communal Affairs and Infrastructure, Ministry of Economy, Municipality Vogošća, Municipality Ilijaš, Municipality Hadžići, CPUC ViK Sarajevo, PUC Vodostan Ilijaš, PUC Komunalac Hadžići
Additional actions			
WR06 – I Conduct data surveys and monitoring of wastewater, stormwater and river flows	Improving information base, modelling	2021 - 2023	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR09 – I Sustainable Drainage Systems (SuDS) construction	Capital investment: implementation – new	2022 - 2026	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
WR10 – I Study into Wastewater Treatment Works, sewerage and SuDS financing; review water company regulation and management	Capital investment: feasibility, planning, design, piloting	2021 - 2022	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo
Energy and buildings (6 actions)			
Priority actions			
EN01 – I Study to assess the potential for the widespread adoption of renewable energy technologies in Sarajevo Canton	Capital investment: feasibility, planning, design, piloting	Study: 2021 – 2022 Implementation: 2022 – 2031	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy
EN02 – P Prepare and Develop Energy Efficiency Action Plans for Sarajevo Canton for the period 2021-2023	Developing policy, plan, legislation, regulations	2021 - 2023	Ministry of Economy
EN03 – I Public Buildings Renovation Programme aimed at improving energy efficiency	Improving information base, modelling	2022 – 2032	Ministry of Economy
EN04 – I Residential Buildings Renovation Programme aimed at improving energy efficiency	Capital investment: implementation – new	2022 – 2032	Ministry of Economy, Ministry of Physical Planning, Construction and Environmental Protection, City of Sarajevo, Municipalities,

Action reference and title	Action classification	Implementation start/ end date	Action owner
			Sarajevo Economic Region Development Agency (SERDA)
EN05 – I Assessment of thermal energy resources of geothermal and groundwater / aquifers in Sarajevo	Improving information base, modelling	2021 – 2022	Ministry of Economy, Ministry of Communal Affairs and Infrastructure
EN06 – I Improvement and extension of district heating system in Sarajevo Canton – priority investment portfolio	Capital investment: implementation – improving existing	2021 – 2026	Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy
Industry (3 actions)			
Priority actions			
IN02 – P Raise capacities of the Canton industry to implement energy and resource efficiency, and cleaner production measures	Training, capacity building	2021 - 2023	Ministry of Economy
Additional actions			
IN03 – P Develop strategy to support transition from linear to circular economy	Developing policy, plan, legislation, regulations	2022 - 2023	Ministry of Economy
IN05 – P Develop standards and regulations to reduce emissions of pollutants from food service sector (restaurants, bakeries etc.)	Developing policy, plan, legislation, regulations	2021 - 2022	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy
Sustainable waste management (6 actions)			
Priority actions			
SW01 – I Implementation of a separate collection system for recyclable waste	Capital investment: implementation – improving existing	2021 – 2022	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Communal Affairs and Infrastructure
SW02 – I Development of waste treatment infrastructure	Capital investment: implementation – new	2021 – 2027	Ministry of Physical Planning, Construction and Environmental Protection
SW04 – I Collection and treatment of leachate within RCUO Smiljevići	Capital investment: implementation – improving existing	2021 – 2027	Ministry of Communal Affairs and Infrastructure, Cantonal Communal Solid Waste Management Utility CPUC Rad

Action reference and title	Action classification	Implementation start/ end date	Action owner
SW06 – I Remediation of illegal landfills and strengthening of inspection at registered locations	Capital investment: implementation – improving existing	2019 – ongoing	Ministry of Communal Affairs and Infrastructure, Cantonal Communal Solid Waste Management Utility CPUC Rad
SW07 – P Development of a new tariff model for waste management services	Developing policy, plan, legislation, regulations	2023 – 2024	Ministry of Communal Affairs and Infrastructure
SW08 – P Development of animal waste management system	Developing policy, plan, legislation, regulations	2021 – 2023	Ministry of Economy, Ministry of Communal Affairs and Infrastructure

Implementation cost estimates

The cost of implementing the priority actions was estimated by local and international technical experts and a financial assessment of available sources of finance was conducted. The cost estimates are summarised by sector in the table following.

Next steps

The development of the GCAP will serve to update the KEAP. The updated version of the KEAP will have specific elements from the GCAP as well as other elements that are required by the Law on Environmental Protection. The Sarajevo Canton will carry out the adoption of the updated KEAP and the GCAP. The implementation of both KEAP and GCAP would be harmonised and monitored by the Ministry of Physical Planning, Construction and Environmental Protection.

The GCAP implementation is due to begin in early 2020 when monitoring and evaluation of the implementation of GCAP actions and of their impacts will also commence. The ability to monitor and evaluate the impact of the GCAP in the short-term will depend on early planning, led by an official with the highest possible level of authority, and will result in a credible monitoring and evaluation regime being operational within a couple of years. This will enable opportunities for improvement, along with any necessary corrective measures that might be needed, to be identified. It will also enable GCAP challenges, objectives, actions and targets to be periodically revisited and if necessary refined.

GCAP priority actions: CAPEX and OPEX costs by sector (EUR and BAM)

Sector	Total CAPEX (EUR)	Total CAPEX (BAM)	Annual OPEX (EUR)	Annual OPEX (BAM)
Land use	3,175,000	6,209,760	134,000	262,081
Sustainable transport	112,100,000	219,248,543	9,530,000	18,639,060
Water resource	281,989,000	551,522,545	8,662,450	16,942,279
Energy and buildings	172,550,000	337,478,467	5,590,000	10,933,090
Industries	40,000	78,233	0	0
Sustainable waste management	56,950,000	111,384,519	4,310,000	8,429,627
Total	626,804,000	1,225,922,067	28,226,450	55,206,137

***Note:** The CAPEX and OPEX should be treated as preliminary indicative estimates appropriate at this stage. These are not detailed cost estimates, owing to the need for actions to be elaborated, and the legal and regulatory investment framework reviewed in more depth, before more detailed cost estimates can be generated.

A conversion rate of 1.95583 has been used to convert costs in EUR to BAM.[3]

[3] This is the exchange rate for December 2020 as stated by InforEuro, which provides the EC's official monthly accounting rates for the Euro. Available from https://ec.europa.eu/budget/graphs/inforeuro.html.

1. Introduction

This chapter summarises the background to this Sarajevo Green Cantonal Action Plan (GCAP), its purpose, the delivery team and stakeholder contributions. A final section outlines the structure of this document.

1.1. Background of the plan

Cities are the location of a large proportion of negative environmental impacts, such as pollution and pressure on natural resources, and can also be particularly vulnerable to climate change and natural disasters. The European Bank for Reconstruction and Development's (EBRD) GCAP methodology provides a holistic and systematic approach that cities can adopt to identifying environmental priorities, setting a strategic vision and objectives, and forming a set of policies and investments to help cities move forward.

The Sarajevo Canton is committed to developing in a sustainable way and adopted the Cantonal Environmental Action Plan (KEAP) in 2017 to determine how the Canton should plan to protect its natural resources and align with the Federal Law on Environmental Protection. This has only been partially implemented, but given the scale of the challenges facing Sarajevo, which are being exacerbated by urbanisation and development pressures, this GCAP, a strategic planning document covering the whole Canton, was developed with a broader scope and to increase momentum for positive change. The main challenges to address include: poor air quality, which is negatively affected by emissions from traffic, industry and housing; lack of comprehensive solid waste management; poor water quality and monitoring; and inadequate land use and land management, resulting in a risk of landslides, erosion, and land contamination.

The GCAP methodology, developed under the EBRD's Green Cities Programme[4], addresses the increasing need for a systematic approach to urban development that covers a broad range of environmental issues and links these to economic and social objectives. It also provides a transparent means to develop a comprehensive set of sustainable solutions that address the challenges identified and can be translated into investable projects and policy. The clear link to delivery of wider co-benefits can help to persuade decision-makers about the value of implementing these actions and unlock the required finance. The development and roll-out of the GCAP approach reflects the critical importance of environmental objectives to the EBRD's strategies and operations, the growing importance of the urban environmental agenda to the EBRD, and the acknowledgement of the increasingly decentralised nature of green or sustainable city actions.

1.2. Purpose of the plan

This Sarajevo GCAP articulates the Canton's sustainable development vision and strategic objectives. It also sets out a list of green actions that, if implemented, would help shape, direct and realise the Canton's policy agenda, green ideals and aspirations for sustainable future proofing development.

The approach taken by this GCAP to address environmental challenges and opportunities that face Sarajevo Canton has followed the EBRD Methodology developed by the Organisation for Economic Co-operation and Development (OECD) and the International Council for Local Environmental Initiatives (ICLEI).

The objectives of developing this Sarajevo GCAP are to:

- Build on and enhance work recently completed in development of the KEAP to address environmental challenges, following EBRD's methodology and with a longer-term timeframe, in alignment with Federal Law;
- Set out clear causal linkages between the condition of environmental assets and economic and social dimensions and objectives to help the Canton to identify policies and actions to be addressed under a 'Green City' approach;
- Provide input to optimise the allocation of Sarajevo's financial and personnel capacity to those issues with the greatest environmental benefits – prioritisation of policy options and investments;
- Provide bespoke analysis in terms of urban ventilation corridors within the Sarajevo basin as well as conclusions and recommendations on next steps;

[4] OECD and ICLEI (2016) Green Cities Programme Methodology. Available at http://www.ebrd.com/documents/technical-cooporation/green-city-action-plan-in-tirana.pdf.

- Enhance the potential to attract donor co-finance and support when it is clear how a specific project fits into the broader priorities and roadmap for environmental improvement in the Canton; and
- Ensure that the GCAP aligns with key local policies and strategies.

1.3. GCAP team

The EBRD, under the EBRD Green City Action Plan Framework, has worked in collaboration with the Sarajevo Canton to develop this GCAP, funded by the Government of Japan (by the People of Japan). The development of the GCAP has been led by the Sarajevo Canton with the support of a team of both local and international consultants from Atkins (a member of the SNC Lavalin group), HCL Consulting and LDK in close collaboration with the EBRD. The roles and responsibilities of the Sarajevo Canton representatives, consultant team members and EBRD representatives are summarised in Appendix A.

Press conference held during launch event of Sarajevo Green Cantonal Plan

1.4. Stakeholder contribution to the formation of the plan

By committing to the production of a holistic and effective GCAP, the Canton has committed to the involvement of key stakeholders and partners. In addition to the GCAP team members, more than 100 individuals from 71 institutions and organisations were involved in developing this GCAP, taking part in a series of workshops, focus group discussions and consultations on key GCAP deliverables.

A stakeholder mapping exercise was used as the basis for identifying key individuals and stakeholder groups. The main groups of stakeholders can be summarised as follows:

- State level ministries and agencies (three bodies engaged);
- Federal entity level ministries, institutions, agencies and public companies (11);
- Cantonal level ministries, institutions and agencies (15);
- Utility and service providers (public and private) (12);
- Municipalities (10); and
- Non-governmental organisations (NGOs), international organisations and academia (20).

GCAP stakeholder workshop

A full list of stakeholders engaged is presented in Appendix B.

The quality of stakeholder engagement was monitored and assessed throughout the GCAP process via dialogue with the GCAP work team. Specially developed proformas were distributed at stakeholder events to gain written feedback from participants at all workshops. Additional comments were also received through subsequent online communication by email. These inputs were duly registered in workshop/meeting notes and reports on stakeholder comments.

Table 1-1 lists all formal stakeholder engagement events that were conducted during GCAP development. These were supplemented by regular informal discussions between the local consulting team, Canton Administration representatives and other stakeholders throughout the GCAP process.

Table 1-1 - List of formal stakeholder engagement meetings and workshops

Date	Engagement Type	Title
November 2018	Canton Administration meeting	Inception meeting
February 2019	Stakeholder workshop	Formal Kick-Off Meeting
April 2019	Stakeholder workshop	Environmental challenges and Technical Assessment Workshop
June 2019	Stakeholder workshop	Green Canton Visions, Strategic Objectives and Actions Workshop
August – September 2019	Canton Administration inter-ministerial meetings	Meetings with Cantonal Ministries to review and agree policy options and investments
October 2019	Stakeholder workshop	Capacity Building Workshop on Urban Ventilation Corridors Study and implications of the micro-climate for the urban environment
November 2020	Cantonal workshop	Capacity Building Workshop 2 on Monitoring and Evaluation
December 2020	Cantonal workshop	Capacity Building Workshop 3 on Funding and Financing Options

1.5. Structure of this GCAP

The rest of this document is structured as follows:

Chapter 2 sets out the approach and methodology used to develop the GCAP, and primary outcomes.

Chapter 3 provides an overview of the institutional structure and the socio-economic and environmental characteristics of Bosnia and Herzegovina (BiH) and the Sarajevo Canton (SC) as well as an overview of the budget and finances of SC. The chapter also presents existing plans, strategies and policies and summarises the results of the technical assessment and stakeholder prioritisation used to identify priority environmental challenges.

Chapter 4 provides a summary of the modelling study that explores the impact of high-rise buildings on air flow and air quality across the Sarajevo basin in relation to wind ventilation corridors and provides recommendations and next steps based on the modelling analysis.

Chapter 5 sets out an overarching vision for the plan, visions for each sector, strategic objectives, recommended targets and actions for the urban sectors of land use, transport, energy and buildings, water, industry and solid waste, as well as adaptation and resilience actions that are not limited to a specific sector.

Chapter 6 describes the approach that will be followed to measure the effectiveness of the GCAP in relation both to actions taken and outcomes achieved. It also outlines governance arrangements for managing and evaluating the implementation of the plan and its impact.

Chapter 7 summarises CAPEX and OPEX costs as well as potential funding options for each of the GCAP actions.

Chapter 8 sets out the next steps, responsibilities and timeline for implementation of GCAP actions.

The report is supported by a series of appendices including: **Appendix A,** which lists the GCAP core team members; **Appendix B**, a list of stakeholders involved in GCAP development; **Appendix C**, which contains an overview of the administration of SC; **Appendix D**, State – Pressure – Response indicators and linkage; **Appendix E**, additional actions (non-prioritised actions) and **Appendix F** Monitoring and Evaluation Plan (Excel).

2. Green Cantonal Action Plan Methodology

This chapter sets out the GCAP methodology and programme, provides an overview of the approach, a detailed task methodology, key milestones and deliverables.

2.1. Overview of the methodology

The Green Cantonal Action Plan (GCAP) defines the long-term Green Canton vision – within a timeframe of 10 years and strategic objectives. It focuses on the priority environmental dimensions, using relevant indicators and time-related targets. The GCAP develops a set of short-term actions designed to achieve the GCAP vision, objectives and targets.

For the Sarajevo Canton GCAP process, the consultant team applied the GCAP methodology that has been developed by EBRD together with OECD and ICLEI. The development of the GCAP is based on the key principles of comprehensively evidence-based technical analysis, stakeholder participation and engagement, and political buy-in to the green agenda.

The EBRD's Green Cities Programme Methodology defines a **Green City** as a city "which shows high environmental performance relative to established benchmarks in terms of i) quality of environmental assets (air, water, land/soil and biodiversity), ii) efficient use of resources (water, energy, land and materials[5]) and iii) mitigating and adapting to risks deriving from climate change, while maximising the economic and social co-benefits and considering its context (population size, socio-economic structure and geographical and climate characteristics).

The GCAP process consists of the four main steps listed in Figure 2-1. It is an iterative process that requires periodic review and the consequent updating of the strategic framework to reflect the Green City actions' implementation progress as well as other relevant national, regional or local developments.

Figure 2-1 - Green Cantonal Action Plan process overview - steps

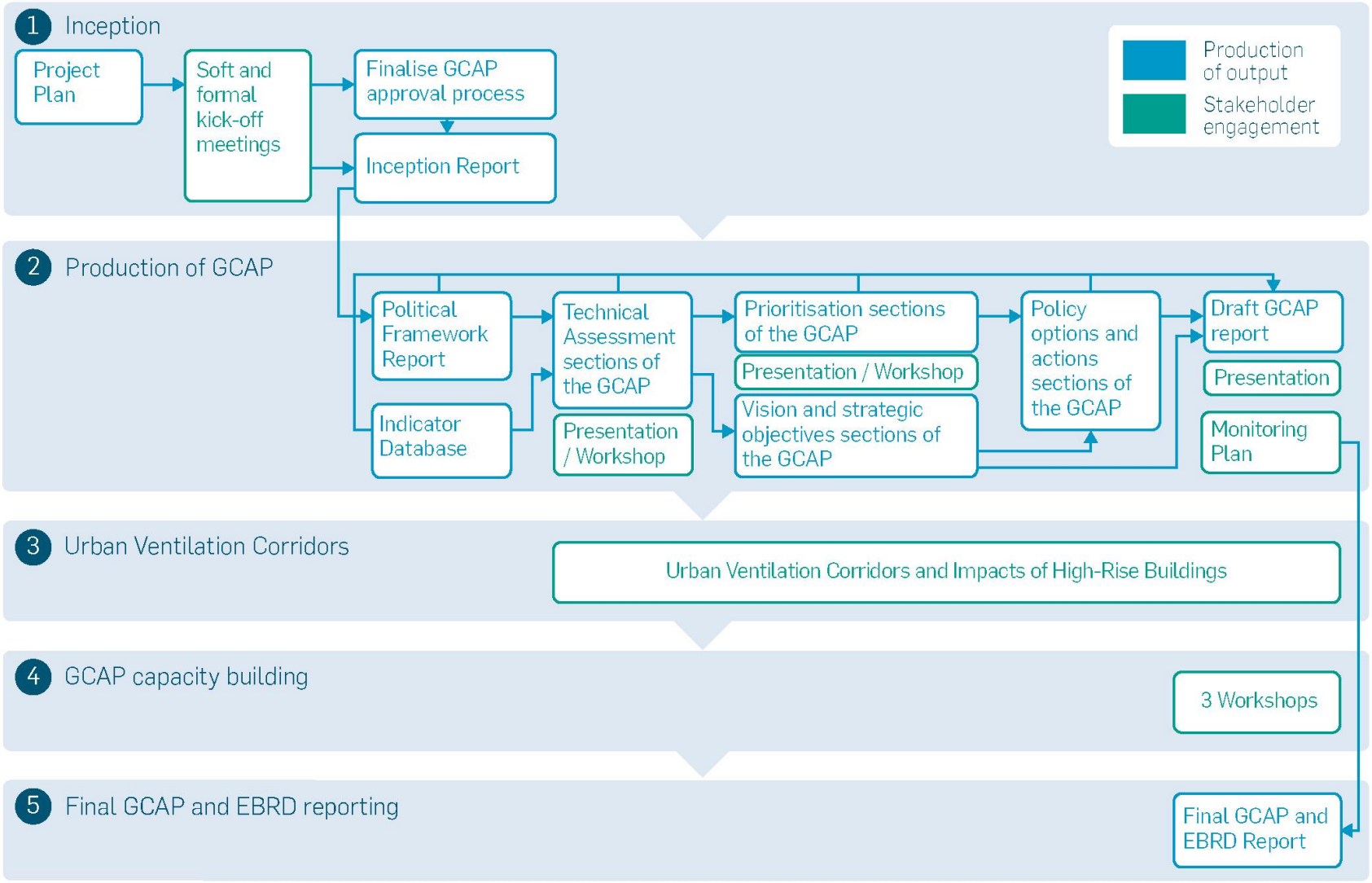
Source: Based on OECD and ICLEI (2016), op. cit.

These methodological tasks have been tailored to consider the local conditions and understanding of the Sarajevo Canton including the political framework of relevant local, sub-national, national and international policies and planning documents. The development of the GCAP was highly participatory and transparent to enhance understanding of local social, cultural and historical challenges and community needs, allow for the participatory identification of priority environmental challenges, and ensure that urban issues were addressed systematically to achieve environmental performance. The consultant team worked with the Sarajevo Canton and stakeholders to prioritise actions that would have maximum impact and be ready to attract donor co-financing and facilitated capacity development.

Figure 2-2 below provides an overview of the tasks comprising the GCAP development process (Steps 1 and 2 in Figure 2-1), delineating the sequential dependencies (blue arrows) between them. It is an integrated, multi-sector process whereby the Canton's environmental challenges are periodically identified, prioritised and addressed through short-term actions such as targeted investments and services, regulations and other relevant policy instruments, which sit in a structural framework of visions, long-term strategic objectives with corresponding mid-term targets.

[5] "Materials" in this context refers to the substance or matter of which objects are composed. Efficient use of materials involves minimisation of the consumption, incorporation, or waste of raw materials.

Figure 2-2 - GCAP development process and tasks



Source: Based on OECD and ICLEI (2016), op. cit

2.2. GCAP development tasks

2.2.1. Project inception

During the inception period, the consultant team confirmed the steps to follow for systematically preparing the GCAP for Sarajevo Canton. A Project Plan was established which confirmed the goals and objectives, methodology, roles and responsibilities, timelines and deliverables, and channels of communication. A stakeholder mapping exercise was also carried out and prepared a list of key stakeholders to be engaged at different steps of the process.

An introductory kick-off meeting took place on 13th November 2018 where the consultants discussed with the Canton leadership and the GCAP working team the methodology and approach; programme; staff roles and responsibilities; communication and data requirements. Special attention was given to the harmonisation of the GCAP and KEAP.

A formal launch and introduction to the GCAP process was held in February 2019 by the Premier, the Minister of Environment and the Ambassador of Japan to BiH. More than 100 stakeholders attended representing State organisations, Federal institutions, Cantonal ministries, agencies and institutions, utility companies and operators, Non-Governmental Organisations (NGOs) and academia.

2.2.2. GCAP approval process and harmonization with KEAP

An approval process was defined in cooperation with legal experts and the Deputy Minister for Environmental Protection to ensure the GCAP is formally adopted as a Cantonal plan aligned with the Federal Law that can be embedded within the Canton budget.

2.2.3. Political framework

A Political Framework Report was developed summarising analysis of the institutional context together with the GCAP political framework of relevant existing regulations, plans, and policies at the international, state, federal, cantonal and municipal level. The Report also contains the analysis of compliance between the goal of creating a Green Canton and the objectives of existing plans and policies.

2.2.4. Indicators database

The Indicators Database is a collection of environmental data presented as a set of state, pressure and response indicators. The state-pressure-response model enables the assessment of the negative impacts of human activities (pressure indicators) on environmental assets (state indicators) and identifies associated gaps in the policy framework (response indicators). The consultant team compiled existing data from the Canton Administration and other relevant local organisations to populate the database and develop the Green Canton baseline.

2.2.5. Green Canton baseline

The Green Canton baseline is the evidence base of the GCAP. It aims to inform policy and strategic decision-making throughout the GCAP process and provides the reference for the identification and prioritisation of challenges as well as the monitoring of the success of the implementation of GCAP actions. It was informed by an analysis of the political framework and by development of the Indicators Database.

2.2.6. Technical assessment and prioritisation of environmental challenges

The Indicators Database, in the context of the findings of the political framework analysis, was used as the basis for identifying and prioritising Green Cantonal challenges, which were presented in a Technical Assessment Report.

A summary of the findings was presented to Canton officials and other key stakeholders at the workshop on 12th April 2019. Stakeholders' comments were collected during and after the workshop including the prioritisation of the environmental challenges. These comments were considered and incorporated into the Technical Assessment Report.

2.2.7. Vision and strategic objectives

A visioning workshop was conducted with local stakeholders as part of the workshop on prioritisation (on 11th June 2019). The key stakeholders were invited to seek consensus and establish ownership over the visions and prioritisation of strategic objectives.

2.2.8. GCAP actions

A set of draft policy and investment actions were developed by applying an integrated approach to achieve the GCAP vision and strategies, focusing on key environmental outcomes. During June - September 2019, key Canton Administration stakeholders were consulted on actions identified.

2.2.9. Monitoring and evaluation

A Monitoring Plan was prepared, as part of the GCAP, to equip the Canton to evaluate progress towards achieving the targets and objectives and the effectiveness of GCAP actions.

2.2.10. GCAP finalisation and presentation

The draft GCAP was reviewed by the Canton and EBRD as well as presented and issued for public consultation. The plan was then revised and finalised to be approved by the Cantonal Assembly, with contents including:

- Green Canton vision and strategic objectives;
- Environmental challenges and their socio-economic impacts;
- Priority challenges and key measures to address them;
- Policy option and actions for implementation; and
- Stakeholder meeting using GCAP presentation.

2.2.11. Capacity building sessions

Three capacity building sessions are part of the delivery of the GCAP process. One session was held in October 2019 and two are held in November 2020.The workshops are designed for relevant government officials. The experts deliver the content through a combination of worked examples and best practice guidance, with break-out sessions for participants. The workshop themes are: 1) urban ventilation corridors and impacts of high-rise buildings, 2) Green Canton funding and financing (including climate finance), 3) data collection, monitoring and evaluation reporting.

2.2.12. Urban ventilation corridors study

The Sarajevo Canton GCAP also included development of a modelling study to explore the impact on air flow and air quality across the Sarajevo basin in relation to wind ventilation corridors, and implications for construction of high-rise buildings. The modelling was carried out at different scales to understand air flow and effects on air quality. The study included recommendations and next steps based on the modelling analysis. The results of the study are documented in a separate GCAP report.

2.3. Technical assessment methodology

The Green Canton baseline was developed based on a standard set of indicators in the Indicators Database provided by the EBRD for use on all GCAP projects, comprising:

- ***State indicators*** covering quality and availability of environmental assets such as water resources, air quality, soils, green space, biodiversity and ecosystems as well as mitigation of GHG (Greenhouse Gas) and adaptation and resilience to natural disasters;
- ***Pressure indicators*** are the sources of pressure and adverse impacts on the environment from human activity and the environmental performance of the Canton; and
- ***Response indicators*** are actions to reduce pollution or consumption of resources or investment in environmental protection. This category is mostly qualitative and builds on the findings of the Political Framework Report**.**

Data collected to populate the GCAP Indicators Database are pre-evaluated using a red, yellow, green (RYG) traffic light system based on standardised benchmarking values. Benchmarking of indicator values according to this traffic light system allows systematic comparison of performance (in terms of environmental outcomes) across the indicators set, referenced to international benchmark values, where “green” = high performance, “yellow” = medium performance and “red” = low performance.

In the case of the state and pressure indicators, benchmark values vary for each indicator and typically comprise numerical value ranges for each RYG categorisation. For response indicators, the focus is on identifying both the presence or absence of policies and the quality of those policies, using the RYG categorisations defined as shown in Table 2-1.

Table 2-1 - Benchmark flags and criteria for response indicators

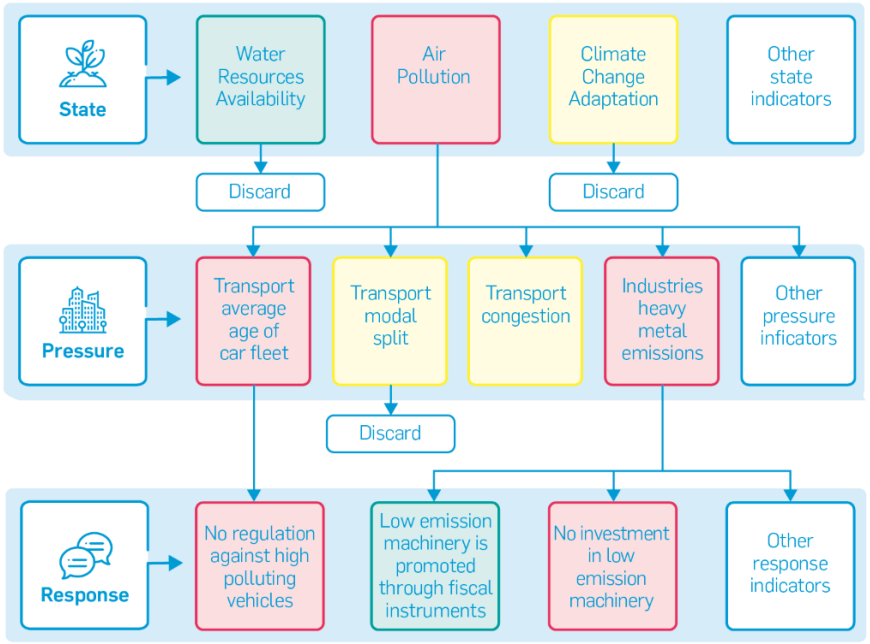
Benchmark flag	Criterion
Red	Not existing
Yellow	Existing, but implementation challenges have been observed, and/or existing policies are not sufficient to solve the issue at stake
Green	Existing and well implemented, and there is no significant need to further expand this type of response

The Technical Assessment process involves identifying priority environmental challenges using the Indicators Database by analysing linkages between indicators of different types. The results are recorded in a Green Canton 'problem tree' linking "red" / "yellow" flagged state, pressure and response indicators and setting out key causal relationships as shown in Figure 2-3. This approach is prescribed in the standard EBRD GCAP methodology.

The indicators benchmarked as "red" or "yellow" form the basis for identifying priority environmental challenges, using a problem tree approach. This ensures a focus on the most pressing environmental challenges.

The initial list of challenges identified using analysis of the Indicator Database was developed and refined with the input of local knowledge and expertise by representatives of the Canton Administration and other stakeholders via workshops and meetings. Stakeholders had the chance to rank environmental challenges in order of priority on feedback proformas as well as provide comments and feedback during a question and answer session and a focus group workshop format featuring local and international sector experts, practitioners and academic researchers. The identified environmental challenges formed the baseline for development of the GCAP vision, strategic objectives and actions which are outlined below.

Figure 2-3 - Problem tree approach for environmental challenges prioritisation



Source: Based on OECD and ICLEI (2016), op. cit.

2.4. Development of GCAP actions

The GCAP actions were developed using a systematic, evidence-based and participatory approach, which helped to ensure that the GCAP actions developed were grounded in a holistic view of the Canton.

Firstly, an overarching vision was developed for the GCAP as well as visions and strategic objectives for each environmental topic through to 2030 as shown in Figure 2-4. Strategic objectives are high-level and long-term environmental goals that need to be achieved in order to realise the GCAP's visions.

The GCAP presents quantified mid-term targets for 2025 and long-term targets for 2030 for each strategic objective. The targets allow monitoring of progress towards achieving the strategic objectives. Targets are developed by setting an

indicator value of the red- and yellow-marked State, Pressure and Response indicators that identified the priority environmental challenges at an improved and achievable level as well as referencing targets from the KEAP and other relevant policy, plans and strategies for the Canton.

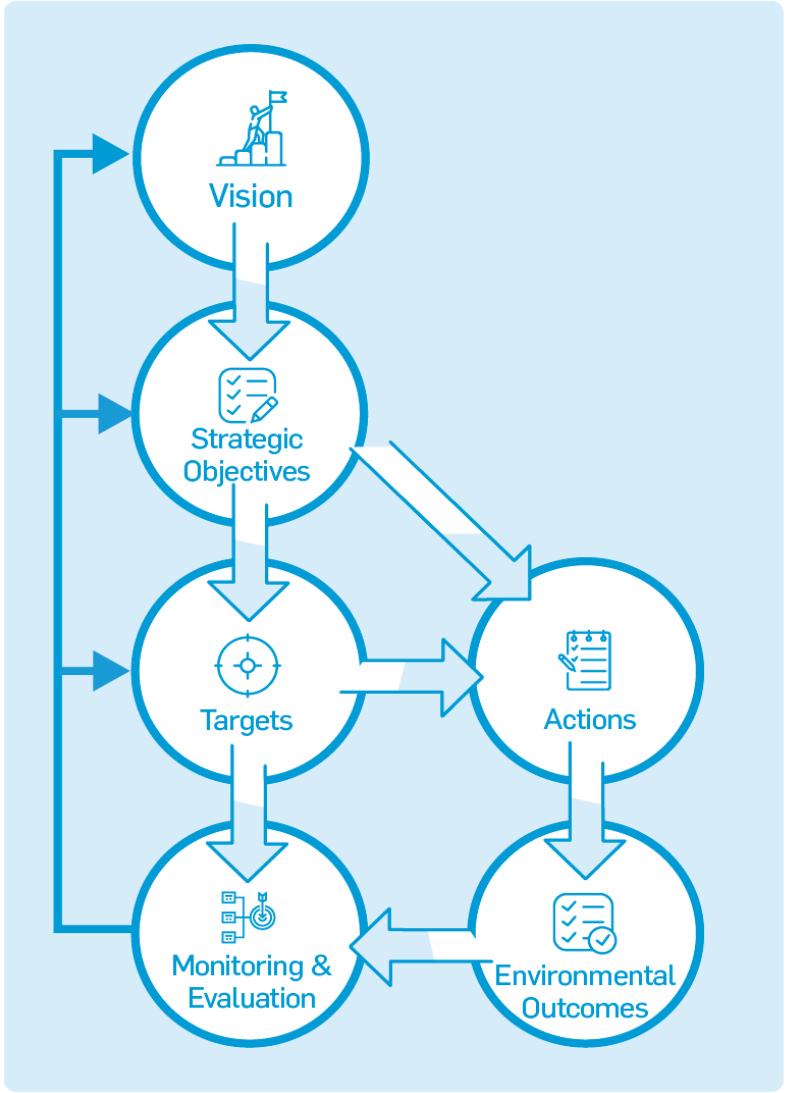
Finally, short-term actions are suggested activities starting to be implemented between 2021 and 2026. Actions are the vehicle to achieve the GCAP strategic objectives. Actions were developed by local and international sector experts taking into account environmental as well as socio-economic sustainability.

Initially a long list of short-term actions was developed, from which priority actions have been identified. This prioritisation is a three-step process, introduced below, and is aimed at focusing on actions with the highest environmental, economic and social benefits while also considering budgetary constraints.

2.4.1. Technical, stakeholder and political prioritisation

The prioritisation of short-term actions consists of three steps: technical assessment, stakeholder prioritisation and political prioritisation.

Figure 2-4 - Overview of process to develop GCAP actions



Technical assessment

Each action was scored from 0 to 3 (zero being no impact/linkage, 1 being low impact, 2 medium impact and 3 being high impact) according to their contribution to filters reflecting the three key dimensions of sustainability: environment, economy and society.

- The environmental filters comprised the GCAP strategic objectives. The evaluated impact of actions on strategic objectives was assessed. This allowed an understanding of how actions address multiple environmental objectives.
- Economic filters covered the categories of economic return for the investor, economic growth, employment and economic inclusion.
- Social filters covered the categories of public health, access to services, safety and gender equality.

Stakeholder prioritisation

At the stakeholder workshop in June 2019, the set of actions was ranked and discussed by Canton stakeholders. The stakeholders had the opportunity to rank and prioritise the actions for each sector through proformas. Following this workshop, the set of actions was revised and updated to incorporate stakeholder feedback. Inter-ministerial meetings with Canton Administration representatives were held during September 2019 where the participants provided further comments and feedback during and after the meetings. The set of actions was then further revised and updated.

Political prioritisation

The results of both the technical and stakeholder prioritisation were presented to representatives of the Cantonal Ministries in December 2019 by email correspondence, who ranked the actions as low, medium or high priority. This prioritisation was also supported and signed off by the Premier of Sarajevo Canton.

Based on the three steps of prioritisation, 32 actions were chosen as priority actions. The political prioritisation is the final step of prioritisation, following the stakeholder ranking and the technical assessment. All Cantonal Ministries/Institutes responsible for implementing GCAP actions were involved in this prioritisation exercise. Each Ministry ranked actions of the sector(s) for which they have responsibility as High/Medium/Low priority by taking into consideration technical and stakeholder prioritisation scores. The result of this exercise from the final prioritisation of actions, is that all actions scored high are put forward as 'priority actions' and medium and low priority actions are taken as 'additional actions'. Additional actions are described in Appendix D.

2.4.2. GCAP approval process

The complete GCAP is to be presented to Cantonal Assembly and Administration in November 2020. Once the GCAP has been adopted by the Assembly, the Canton Administration will use it as basis for the elaboration of the Canton annual budgets, mid-term and long-term development plans.

2.4.3. Green Canton implementation

After the GCAP's approval, the Canton Administration will commence with the implementation of the GCAP which is set for a period of 12 to 36 months. During this time the GCAP is operationalised. To facilitate smooth implementation of the GCAP in Step 3 as highlighted in Figure 2-1, the GCAP document contains clear guidance on action targets, monitoring mechanisms and accountable action owners and stakeholders.

For the implementation of individual actions further analysis on funding needs and options as well as savings and revenues will be conducted, and funding sources will be identified and pursued. Actions that are implemented will be monitored with respect to the mid-term targets defined. Further detail on the monitoring framework that will guide this process is provided in Chapter 6.

2.4.4. Green Canton reporting

Green Canton reporting looks at evaluating the success of the GCAP process as well as formulating lessons learned. The reporting on the implementation of the GCAP is harmonised with the reporting on the implementation of the KEAP for SC. Based on the GCAP monitoring throughout implementation, the Canton Administration assesses what has been achieved for the state of the environment in SC and informs the public and relevant stakeholders. Rather than being the final stage of the GCAP process, this is the beginning of reconsidering state, pressure and response indicators, readdressing and potentially refining the GCAP challenges and developing further GCAP actions.

3. Green canton baseline

This chapter provides an overview of the institutional framework and the socio-economic and environmental characteristics of Bosnia and Herzegovina and Sarajevo Canton, as well as an overview of the budget and finances of Sarajevo Canton. The chapter also presents a summary of the Sarajevo Canton political framework. Priority environmental challenges are presented at the end of the chapter.

3.1. Overview of institutional framework

3.1.1. Bosnia and Herzegovina

Bosnia and Herzegovina's constitutional setup[6] is the result of the Dayton Accords, drawn up by the international community in 1995. BiH is a democracy comprised of the two entities, Federation of Bosnia and Herzegovina (FBiH) and the Republika Srpska (RS), and the District of Brčko (BD). Both FBiH and RS have their own executive and legislature.

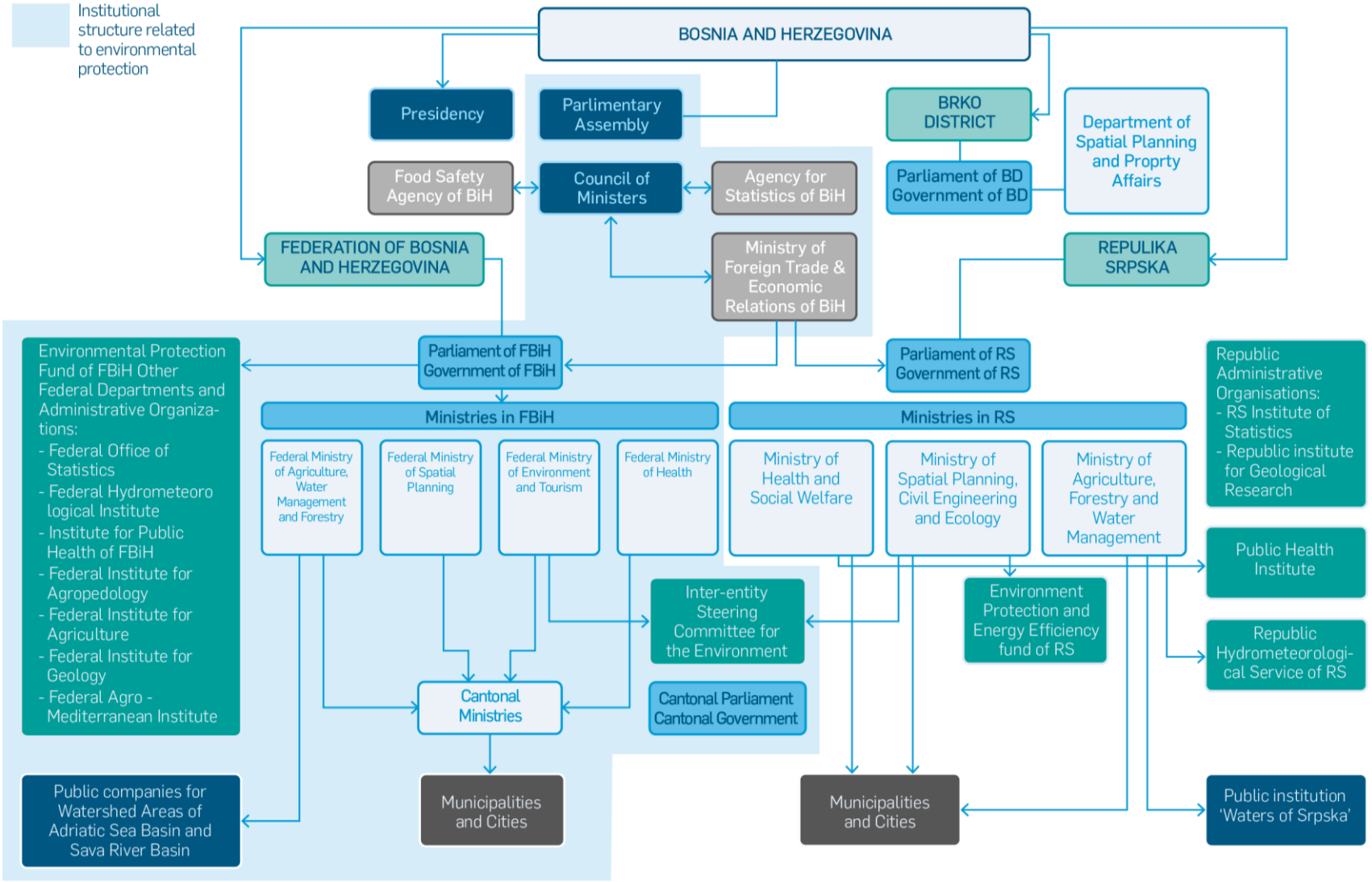
Figure 3-1 provides an overview of the institutional structure in the field of environmental protection in BiH and indicates the institutional arrangement from the state-level to the entity-level and municipality-level.

In accordance with the Constitution of FBiH, environmental issues are under the joint jurisdiction of FBiH and the Cantons. At FBiH level, regulations on all environmental components are adopted, and Cantons are required to harmonise their regulations with FBiH regulations. This results in inadequate policies and enforcement mechanisms (administrative, inspection mechanisms) across the two levels.

In the last 10 to 15 years, considerable progress was made in reforming the environment sector. For instance, several new plans and strategies have been developed covering environmental protection and waste management, notably the Cantonal Environmental Action Plan (KEAP) in 2017.

[6] Information in this section is drawn from *State of the Environment Report of Bosnia and Herzegovina 2012*, Bosnia and Herzegovina Ministry of Foreign Trade and Economic Relations, 2013; *Bosnia and Herzegovina country briefing - The European environment - state and outlook 2015*, European Environment Agency, 2015;and *Third National Communication and Second Biennial Update Report on Greenhouse Gas Emissions under the United Nations Framework Convention on Climate Change*, United Nations Development Programme, 2016.

Figure 3-1 - Overview of institutional structure in the field of environmental protection in Bosnia and Herzegovina



Source: adapted from *State of the Environment Report of Bosnia and Herzegovina 2012*, Bosnia and Herzegovina Ministry of Foreign Trade and Economic Relations, June 2013. The area shaded in red indicates the key institutional focus for the Sarajevo GCAP. Available from: http://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/library/environment_energy/state-of-environment-report.html.

3.1.2. Sarajevo Canton

The executive authority of the Canton is held by the Premier / Prime Minister and the Cantonal Government. The Government of Sarajevo Canton is comprised of 12 Ministries, as set out in Appendix B. Each Ministry oversees a number of sectors, some of which have further administrative subdivisions such as inspectorates, directorates and units.

Beyond the Ministries, the Cantonal administration also includes the Prime Minister's Cabinet, the Expert Service to the Cantonal Government, the Press Service, the Protocol Service, the Common Affairs Service, the Office for the Fight Against Corruption and Quality Management and the Legislative Office[7].

The overall organisation of the Cantonal administration is defined by the Cantonal law in line with the Constitution of Sarajevo Canton and the principles of administration organisation[8].

The **Canton's responsibilities** are defined by the Constitution of the FBiH and Constitution of Sarajevo Canton. Within its responsibilities in terms of environment and urban development, the Canton is responsible for (i) definition of housing policy, including adoption of regulations related to decoration and building of housing units; (ii) definition of policy related to regulation and ensuring public services; (iii) enactment of regulations on use of local land; and (iv) creation of assumptions for optimal development of economy that is appropriate to an urban environment. Together with the Federation, independently or with the Federal authorities, the Canton is also responsible for the following: (i) human environment protection policy; (ii) communication and transport; (iii) natural resource use; and (iv) energy.

3.2. Canton budget and finance

The preparation and adoption of the budget in SC is carried out in accordance with the Law on Budget in FBiH ("Official Gazette of the FBiH", No. 102/13, 09/14, 13/14, 08/15, 91/15, 102/15 and 104/16). The Cantonal Ministry of Finance prepares a Budget Execution Report for the preceding year, which is submitted to the Government by 25th April. It is mandatory for the Government to submit the Budget Execution Report to the Assembly of Sarajevo Canton within six months of the end of the fiscal year to which the report refers.

The budget of SC for the previous three years (2017 - 2019) is presented in Table 3-1. A high-level and preliminary analysis of the Cantonal Budget, which has not been grounded in an in-depth assessment of the current legal and regulatory framework applicable to investments in SC, indicates that financing of significant parts of the GCAP, the costs of which are summarised in Chapter 7, should be possible.

Revenues - Current revenues represent the sum of tax and non-tax revenues. Based on the 2019 budget, as adjusted in June 2019, tax and non-tax revenues comprised 76% and 19% of total revenues respectively. Income from indirect taxes represents the most significant group of tax revenues in SC. A total of BAM 463,724,000 of indirect tax revenues is forecast to be collected in 2019, or 47% of total generated revenues and receipts. Non-tax revenues represent different types of fees and penalties. The largest revenue item is typically tax revenue (BAM 757 million in 2019), while the second largest item is non-tax revenue (BAM 189 million), out of which the largest amount relates to taxes and fees, income from private businesses and unplanned payments (BAM 178 million).

Current transfers and donations mainly relate to the resources of the Ministry of Labour, Social Policy, Displaced Persons and Refugees, which were obtained through a transfer from the Federal level of government and are intended for the protection of civil victims of war.

The water usage fee is included in the category of tax revenues, which are distributed to the SC in accordance with Article 177 of the Federal Law on Water (Official Gazette of the FBiH No. 70/06) equivalent to the amount of BAM 6,254,251 corresponding to 45% (general and special water fee, Articles 169 and 170), as per 2019 information. The water usage fee together with revenue from the lease of public water resources from the category on surface water II are allocated to the competent cantonal ministries for financing projects in the field of water management. As stated in Article 178, paragraph 2 these funds could be used to co-finance the construction and maintenance of water facilities under Article 14 of the FBiH Law on Water. These funds could potentially be used to co-finance the implementation of water related actions as defined in this GCAP.

Capital receipts consist of receivables from the sale of fixed assets and receipts from the sale of commodity reserves.

[7] Government of the Sarajevo Canton. Available from http://vlada.ks.gov.ba/.

[8] The Law on Organization and Jurisdiction of Administrative Bodies and Administrative Organizations of the Sarajevo Canton ("Official Gazette of SC" no. 2/12, 41/12 and 8/15).

Received payments represent payments received from lending resources to individuals and non-profit organisations, while loans are received domestic loans for capital projects.

Expenditures - Operating expenditure consists of: (i) salaries, fees and contributions, (ii) material and service expenses, and (iii) current transfers.

Generally, the highest expenditures relate to salaries and contributions, which is forecast to amount to BAM 466 million in 2019. Current transfers are also high and are mostly related to current transfers to individuals (BAM 82 million), non-profit organizations (BAM 49 million) and subsidies to public companies (BAM 61 million). Capital transfers and expenditures are mostly to non-profit organizations (BAM 50 million) and to public companies (BAM 45 million).

Borrowings - these relate to resources borrowed to individuals and non-profit organizations.

Net acquisition of non-financial assets - Expenditure for the acquisition of non-financial equipment (fixed assets) is mainly related to the reconstruction and maintenance (BAM 48 million) and procurement (BAM 33 million). The budget deficit is mostly the result of increased expenditures from the acquisition of non-financial assets.

Net financing - The income from domestic borrowing for capital projects mostly relates to the Cantonal Ministry of Transport (BAM 29.3 million) and Ministry of Education (BAM 6.8 million).

Canton reports are characterized by an accumulated deficit dating back to previous periods (for example, in 2015, the accumulated deficit amounted to BAM 73.6 million), and the initial period can be traced at the time of the last economic crisis.

Budget deficit - The accumulated deficit for 2017 should be reduced to BAM 72.9 million and covers the accumulated deficit of the Institute for Construction of the Canton of Sarajevo and the transfer of the balance of the deposit account of the Municipal Court in Sarajevo (BAM 64,000). Canton reports reflect an accumulated deficit dating back to previous periods and initially to the time of the last economic crisis. The surplus for 2019 (BAM 3,100 thousand) is mostly expected owing to inflows from net financing (since the Budget deficit in the amount of BAM 27.9 million is evidenced for 2019).

Table 3-1 - Sarajevo Canton financial situation, 2017 – 2019 (figures in 000s, BAM)

	Description	2017	2018	2018	2019	2019	Index I	Index II
		Execution 2017	Budget changes 2018 (June 2018)	Execution 2018 *(report not adopted)*	Budget 2019	Budget changes 2019 (June 2019)[9]	Execution 2018 / budget 2018	Execution 2018 / execution 2017
Item	**Income**	**726,875**	**811,076**	**799,846**	**892,372**	**993,673**	**98.62%**	**110.04%**
1.1.	Tax revenue	626,306	671,283	699,089	715,207	757,387	**104.14%**	**111.62%**
	Income tax on individuals and companies	*112,655*	*120,246*	*125,923*	*128,182*	*129,805*	**104.72%**	**111.78%**
	Tax on wages and labour	*444*	*375*	*356*	*365*	*365*	**94.93%**	**80.18%**
	Property tax	*9,738*	*10,550*	*10,286*	*12,326*	*12,326*	**97.50%**	**105.63%**
	Domestic Goods and Services Tax (arrears)	*128*	*96*	*253*	*303*	*303*	**263.54%**	**197.66%**
	Income tax revenue	*130,724*	*135,519*	*144,826*	*144,313*	*150,799*	**106.87%**	**110.79%**
	Income from indirect taxes	*372,555*	*404,422*	*417,445*	*429,654*	*463,724*	**103.22%**	**112.05%**
	Other taxes (arrears)	*62*	*73*	*63*	*64*	*64*	**86.30%**	**101.61%**
1.2.	Non-tax revenues	81,557	118,277	80,479	142,125	189,596	**68.04%**	**98.68%**
1.3.	Current transfers and donations	15,602	15,908	14,858	27,651	32,534	**93.40%**	**95.23%**
1.4.	Capital transfers	2,370	5,247	4,518	6,389	12,535	**86.11%**	**190.63%**
1.5.	Revenue from arrears	284	360	154	248	248	**42.78%**	**54.23%**
1.6.	Revenues from internal transactions	756		685	752	1,373		**90.61%**
2.	**Expenses**	**668,040**	**731,013**	**684,554**	**842,260**	**909,644**	**93.64%**	**102.47%**
2.1.	Expenses	586,512	607,057	617,547	743,079	791,617	**101.73%**	**105.29%**
2.2.	Capital transfers and expenditures	77,051	118,808	63,419	94,226	113,672	**53.38%**	**82.31%**
2.3.	Interest expense	4,477	5,147	3,587	4,955	4,355	**69.69%**	**80.12%**
3	**Current balance (1-2)**	**58,835**	**80,062**	**115,293**	**50,112**	**84,028**	**144.00%**	**195.96%**
4	Proceeds from the sale of non-financial assets	300	2,086	710	300	368	**34.04%**	**236.67%**
5	Expenditure on the acquisition of non-financial assets	33,250	74,835	40,945	65,884	112,347	**54.71%**	**123.14%**

[9] In session held on June 24, 2019, the Sarajevo Canton Assembly adopted amendments to the budget of the Canton of Sarajevo for 2019. At the same session, the Sarajevo Canton Assembly did not adopt the 2018 Budget Execution Report.

	Description	2017	2018	2018	2019	2019	Index I	Index II
		Execution 2017	Budget changes 2018 (June 2018)	Execution 2018 *(report not adopted)*	Budget 2019	Budget changes 2019 (June 2019)[9]	Execution 2018 / budget 2018	Execution 2018 / execution 2017
6	NET acquisition of non-financial assets (4-5)	**-32,950**	**-72,487**	**-40,285**	**-65,584**	**-111,979**	**55.58%**	**122.26%**
7	**Total surplus/ deficit (3 + 6)**	**25,885**	**7,314**	**75,008**	**-15,472**	**-27,950**	**1025.54%**	**289.77%**
8	**Receipts from financial assets and borrowings**	**17,799**	**38,518**	**4,995**	**49,089**	**61,712**	**12.97%**	**28.06%**
8.1.	*Receipts from financial assets*	*2,892*	*3,488*	*3,169*	*3,393*	*4,151*	**90.85%**	**109.58%**
8.2.	*Proceeds from domestic borrowing for capital projects*	*14,907*	*35,029*	*1,826*	*45,696*	*57,561*	**5.21%**	**12.25%**
9	**Expenditure on financial assets and debt repayment**	**38,979**	**40,832**	**39,505**	**31,218**	**30,662**	**96.75%**	**101.35%**
9.1.	*Expenditure on financial assets and debt repayment*	*1,282*	*3,410*	*3,100*	*2,420*	*1,420*	**90.91%**	**241.81%**
9.2.	*Debt repayment expenditure*	*37,697*	*37,422*	*36,405*	*28,798*	*29,242*	**97.28%**	**96.57%**
10.	**Net financing (8-9)**	**-21,180**	**-2,313**	**-34,510**	**17,872**	**31,050**	**1492.00%**	**162.94%**
11.	**Total financial result* (7 + 10)**	**4,705**	**5,000**	**40,545**	**2,400**	**3,100**	**810.90%**	**861.74%**
	Surplus of transferred unspent funds from direct borrowing from previous years (domestic loans)		22					

* These funds will be used to cover part of the accumulated deficit made in the previous year.

Source: Documentation available on the official website of the Sarajevo Canton and the document “Budget Execution for the period from 01/01/2018 to 31/12/2018,” which was not adopted for the implementation for 2018 by the Sarajevo Canton Assembly, the body responsible for adoption.

3.3. Economic, social and environmental conditions

3.3.1. Socio-economic conditions

3.3.1.1. Bosnia and Herzegovina[10]

The population of BiH is 3,791,622 according to the Census 2013, of which 2,371,603 (63%) reside in the FBiH. BiH has an ageing population. Fertility rates are low and the unemployment rate of the working age population is 27.2%, which could have negative implications for future economic stability. Despite a decrease in total population, the concentration of the population living in urban areas and along their transport corridors continues to increase. This increasing urban sprawl and high rates of poverty are also contributing towards environmental degradation.

Total GDP (Gross Domestic Product) in BiH was BAM 25,734 million (BAM 6,709 per capita) in 2012. Processing industries are prevalent in BiH, producing 78.3% of the total value of industrial product sales (2011). In 2012, 21% of GDP was dominated by industry. The industrial sector in BiH is characterised by low productivity and weak competition. This is partly a consequence of the effects and after-effects of war and partly due to previous economic development models adopted, which were based on natural resource exploitation.

Compared to the total area of agricultural land in BiH, arable areas are decreasing, while the area of unused and uncultivated land has increased by between 45 and 49% compared to total arable land (2012). Agriculture is characterised by small and fragmented estates, inadequate equipment on estates and poor use of agricultural inputs. Forests are a very significant natural resource in BiH and 80% of forests (2.18 million hectares) are state-owned. Forest cover extends to 50% of total BiH land cover and is roughly equally distributed between the FBiH and the RS.

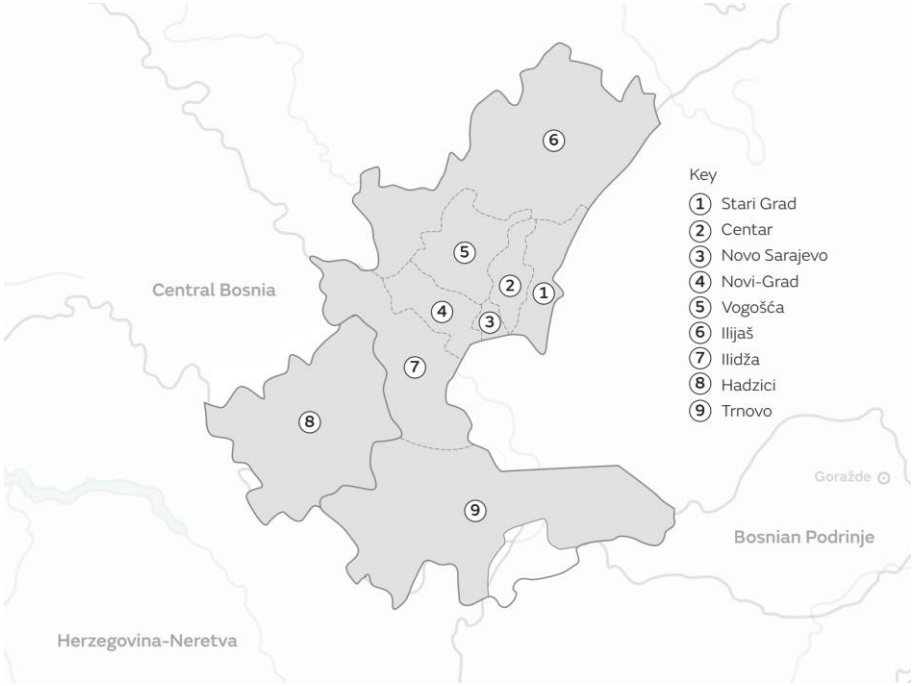
3.3.1.2. Sarajevo Canton

Figure 3-2 shows the location of SC within the FBiH and the 10 municipalities within the Canton.

The Sarajevo Canton[11] is one of the 10 cantons of FBiH, occupying an area of 1,277,30 km^2, which represents around 5% of the land area of FBiH. The Canton had 418,542 inhabitants in 2017, giving a population density of 327.7 persons/km^2.

The total GDP of SC in 2017 was BAM 15,974 million (Sarajevo Canton Development Report for 2017). Of a working age population of 288,056 in 2017, 66.4% were employed, which represents an increase of 0.5% compared to the previous year. The proportion of unemployed was 33.6%, 4.1% lower than in 2016.

Figure 3-2 - Administrative boundaries of Sarajevo Canton and its municipalities



Source: Office for Sarajevo Canton Planning Development

[10] Information in this section is drawn from *State of the Environment Report of Bosnia and Herzegovina 2012*, Bosnia and Herzegovina Ministry of Foreign Trade and Economic Relations, 2013; and *Third National Communication and Second Biennial Update Report on Greenhouse Gas Emissions under the United Nations Framework Convention on Climate Change*, United Nations Development Programme, 2016.

[11] Information in this section is drawn from the Development Strategy of Sarajevo Canton to 2020.

3.3.2. Environmental context and public infrastructure

3.3.2.1. Bosnia and Herzegovina

Air quality in BiH is generally poor owing to industrial activities and road traffic. Industrial process emissions have decreased while road traffic related emissions have increased. Due to specific climate conditions and temperature inversions, air pollution is particularly pronounced in the winter months in larger urban areas in BiH.

BiH has substantial water resources but an unequal temporal and spatial distribution of total water quantities. Surface water quality is generally good considering the content of oxygen in water. However, risk assessment based on surface water monitoring estimated that the highest risk was in the Bosna River Basin[12]. Soil degradation is increasing, and rapid urbanisation, industrialisation and changes to commercial development have resulted in land use changes and the loss of agricultural land. The main characteristics of soils in BiH are: low content of humus and fertilizer nutrients; soils are generally shallow, and; approximately 14% of the territory contains excess water. Acidic soils occupy more than a third of the land in BiH.

BiH has high biodiversity characterised by a high degree of endemic and relict forms of living organisms. More than 5,000 species and sub-species of vascular plants, more than 100 species of fish, and over 320 species of birds and other components of biological diversity have been identified in BiH.

The major modes of transport in BiH are road and rail. Passenger transport is mainly conducted by road while a significant part of freight transport is conducted by rail. Water transport is poorly developed. Air transport is also insufficiently developed, even though progress is being achieved slowly. Motorised road vehicles are one of the main air polluters in major urban centres, with a motor vehicle stock made up largely of older vehicles, which greatly contributes towards poor air quality.

58% of the population is covered by public water supply services. Losses in the water supply network are estimated to be between 30% and 50%. It is estimated that only 33% of the population is connected to public sewage systems. Some municipalities in the FBiH and one in the RS have operational wastewater treatment plants while the rest is directly discharged into water bodies.

The energy sector is one of the key sectors of the BiH economy. Main domestic energy sources are coal and hydro-power, while natural gas and oil are imported. Between 1995 and 2008, energy consumption increased annually by an average of 3.14%. Energy consumption from renewable sources, mostly biomass and hydro-energy, was 9.59% of the total energy consumption in 2008. Geothermal sources in BiH have not been explored sufficiently yet and estimated possible total installed capacity of geothermal sources at 44 locations is 9.25 MWt for heating purposes only, or 90.2 MWt of geothermal energy for heating, recreational and spa purposes. Due to overall low productivity and energy consumption, as well as low energy production and consumption per capita, BiH remains a relatively small GHG emitter with a total of 24.14 MWt CO_2e in 2005.

Solid waste is generally one of the most significant environmental issues in BiH. Since 2003, municipal waste generated in BiH has been constantly increasing. In 2010, it amounted to 332 kg per capita per year. The level of service coverage is 68%. From the total amount of municipal waste, less than 5% of waste is recycled while 95% of municipal waste is disposed of at the regional landfill. However, due to limited disposal capacities and low public awareness of adequate waste management, there is a significant number of illegal dumpsites. A major proportion of hazardous production waste and other special categories of waste is exported.

3.3.2.2. Sarajevo Canton

Air quality in SC is negatively affected by emissions from industry, housing and traffic. Particulate Matter (PM) is very high during winter. Acid precipitation occurs during the whole year, with the highest level during the winter. The Cantonal Air Emissions Register has recorded increments of air emissions of about 25% between 2010 and 2013 and reveals that recorded emissions are within permitted thresholds. However, not all operators / industries are reporting their emissions. Additionally, data regarding the type and quantity of energy sources used are not available.

[12] Plan upravljanja vodama za vodno područje rijeke Save u FBiH (2016.−2021).

Analysis shows that drinking water from the central water supply system is of good quality and is consumed directly after disinfection is performed at the well or in distribution reservoirs. However, water samples from local sources are not always of good quality. Decisions on the protection of springs are not implemented in accordance with the Official Gazette of FBiH 88/12[13] related to the conditions for protection of springs used for public water supply. Currently, not all water springs in the Canton are protected, and usually sanitary protection zones are not respected in terms of the activities undertaken within these zones, e.g. agriculture. The quantity of water in the public water supply system in summer months is sometimes insufficient to cover demand. Quality and quantity of affected groundwater sources included in the water supply system are regularly monitored.

Surface water in SC is polluted mainly with municipal wastewater that is not captured from the existing public sewerage system to the wastewater treatment plant. Results of the analysis show increased concentrations of organic pollutants and some heavy metals.

Land, mainly agricultural and forest land, is under constant negative anthropogenic influence and physical losses are experienced due to the continuous increase in urban population, illegal construction activities and illegal forest cutting. In hilly areas, construction of tourism developments and weekend resorts has been conducted without proper planning. Monitoring systems are not sufficiently developed and there are no exact data about physical land losses or soil quality. As a result of inadequate management, land in SC is at a relatively high risk of landslides and erosion.

Concerning biodiversity and ecosystems in SC, 22 habitat types from the Habitat Directive are registered in the territory of the Canton and forests make up 53% of the Canton area. These are under constant stress from human activities and the changing of habitats and land uses. An inventory of flora, fauna and fungi is not available. There are five protected areas within the borders of the Canton covering 2.3% of the whole territory. There is an initiative to increase this percentage by protecting parts of Bjelasnica and Igman mountains. Work has also been initiated related to the preparation of an expert valorisation of the natural areas of Misoča and Čemerska planina, in order to assess the required protection of these areas. Protected areas are managed by a Cantonal Public Institution for Protected Natural Areas.

Sarajevo Canton is the hub of the main roads and highways connecting the south and north of the country (A1, M18, M17), and east and west (M5). With 11 kilometres of bypass, it directly connects these routes, relieving inner-city traffic. The Canton has a plan to increase the number of bypasses and reduce the transit transport to a minimum. There are several bus routes from the Sarajevo bus station to the other larger cities of BiH. Rail also connects the north and south through Sarajevo (Sarajevo-Ploče, Sarajevo-Šamac). There are 19 railway stations in the Canton, which presents an opportunity for a successful suburban transport network. There are local lines to Zenica, and a fast line to Banja Luka, Mostar and Doboj, from where it is possible to change for the Doboj-Tuzla train.

Most suburban and urban public transport in SC is provided by the private company Centrotrans and the public company GRAS. GRAS is also the owner of the tram and trolleybus network of the City of Sarajevo, which forms the core

[13] Decision on protection of mountain drinking water sources in Sarajevsko polje (Official Gazette of the City of Sarajevo, 2/1987), Decision on protection of mountain drinking water sources of the Sarajevo water supply system and part of the open flow of the Mošćanica river, Decision on protection of Perački vrelo and open flow interventions Vogošća River, Vogošća Municipal Assembly, no. 01-022-5 / 89 dated 15 February 1989.

of public transport provision in the City. There are six tramlines, six trolley bus lines, 55 bus lines, 44 minibus lines and one funicular line in SC. Overall, there are 112 lines of public and suburban transportation with a total length of 2,267.28 kilometres. In addition, the Trebević cable car has been reconstructed and successfully reduces car transportation to the protected area of Trebević. However, the frequency of bus and railway transport provision is insufficient and must be improved in order to reduce car transport. Tramlines must be reconstructed, and new trams, buses and trolleys procured. Most of the existing vehicle stock was donated from elsewhere in support of the rehabilitation of Sarajevo after the war (1992-1996).

The Canton's water supply network is old, with high water losses in the system. Illegal connections pose additional problems. Four water supply systems are managed by public utilities owned by the Canton and municipalities. There are also local water supply systems that are not under the jurisdiction of utility companies. According to official statistics, 98% of the inhabitants of the SC are connected to water supply systems. Total water losses in the central water supply the system in 2015 amounted to 74.8%, as noted in the KEAP.

About 78% of the population in the urban area of the SC is served by a sewerage connection but this varies for each municipality. For example, in Ilijaš municipality 80% of inhabitants are served, while in Hadzici municipality only 40% of inhabitants are served. In the suburban municipality Trnovo, the population in urban area are served, while a sewerage system in its mountain settlements is currently under construction.

Some sections of the sewage network are over 100 years old. The main sewage network is separate to the stormwater network, although parts of the main sewer passing through the city centre are designed to be able to receive stormwater as well. The remaining parts of the network are mixed sewers. The City of Sarajevo has one central Wastewater Treatment Plant (WWTP), located in Butile, with a capacity of 600,000 PE[14]. Households that are not connected to the sewerage system have their own septic tanks or discharge sewerage directly to open watercourses.

Municipal waste from the Canton (all nine municipalities) is disposed of at the Regional Centre for Waste Management Smiljevići (RCUO Smiljevići) located at Buća Potok, municipality of Novi Grad Sarajevo in the Adema Buće Street No. 422 in Sarajevo, with an area of about 94.5 ha, including a buffer zone. Taking into account the non-functionality of the landfill gas collection and leachate treatment system, the issue of meeting sanitary standards within the RCUO still needs to be addressed. A plan has now been completed for expansion of the landfill with a new disposal area of 15,000 m^2, which also applied to the expansion of capacity of the sorting plant and installation of a new weighbridge.

The coverage rate of the Sarajevo Canton with waste collection and transport is approximately 95%. These services in the four urban municipalities are offered to all inhabitants, whereas the coverage of the service in suburban areas is somewhat lower. The lower coverage is due to weekend houses or private houses in more isolated areas not satisfying the technical preconditions for waste collection. However, these house owners are able to dispose their waste in the nearest public waste containers. In some municipalities, there are locations with insufficient container capacities, some others are not covered by

[14] Population Equivalent: pollution load (BOD) of household sewage produced by one person during 24 hours.

regular collection and transportation, and some do not have adequate access for municipal waste trucks.

Different waste streams, including animal waste from butcheries, are mixed with the communal waste. The Canton also has problems with illegal dumping sites.

Overall recycling activities in SC are at a very low level. Infrastructure to support recycling is insufficient and public awareness about recycling is poor. There are no adequate local stations for separate waste collection nor recycling yards. However, there is some infrastructure for separate waste collection. Work is currently underway on the construction of a recycling yard in the municipality of Ilijaš. Biological treatment of waste is not carried out.

The production and distribution systems of heat energy in SC can be divided into three groups according to source and means of distribution. These are:

- District Heating System (DH) through public and private companies dealing with the distribution of heat energy: CPUC Toplane Sarajevo, BAGS Energotehnika d.d. Vogošća and UNIS Energetika d.o.o. – Sarajevo. Currently the primary fuel in the district heating system of Sarajevo Canton is natural gas. Given that the district heating system covers mostly multi-apartment residential buildings, this mode of heating has a significant share in three urban municipalities (Novi Grad, Novo Sarajevo and Centar);
- Individual boiler rooms owned and managed by a building owner and producing heat from natural gas, electricity, liquid and solid fuels. A significant number of public institutions and buildings as well as commercial facilities are heated in this way. This group also includes a number of newly built residential buildings with higher heat consumption; and
- Furnaces or boilers using gas, coal, fuel wood, pellets and electricity. This group includes individual homes as well as some multi-apartment residential buildings.

Natural gas accounts for 53.2% (of which 29.7% is gas consumption in the DH system) in the Cantonal energy balance. The remaining energy balance is accounted for by firewood (17.5%), coal lignite (13.05%), coal (7.7%), electricity (6.0%), fuel oil (1.6%) and pellets / briquettes (0.95%).

3.4. Policy framework

International, European, national, federal, cantonal and municipal level policies, plans, strategies, legislation and regulations have been reviewed in order to understand the GCAP policy context. This section provides an overview of the hierarchy of policies, plans, strategies and legislation that relate to the Sarajevo GCAP.

3.4.1. Federation of Bosnia and Herzegovina

Figure 3-4 provides an overview of the relationship between policies, plans, strategies, legal acts and bylaws of the FBiH and SC. Figure 3-7 highlights areas where FBiH or SC have exclusive responsibility to regulate certain sectors.

Figure 3-7 - Areas where FBiH or Sarajevo Canton have exclusive responsibility to regulate certain sectors

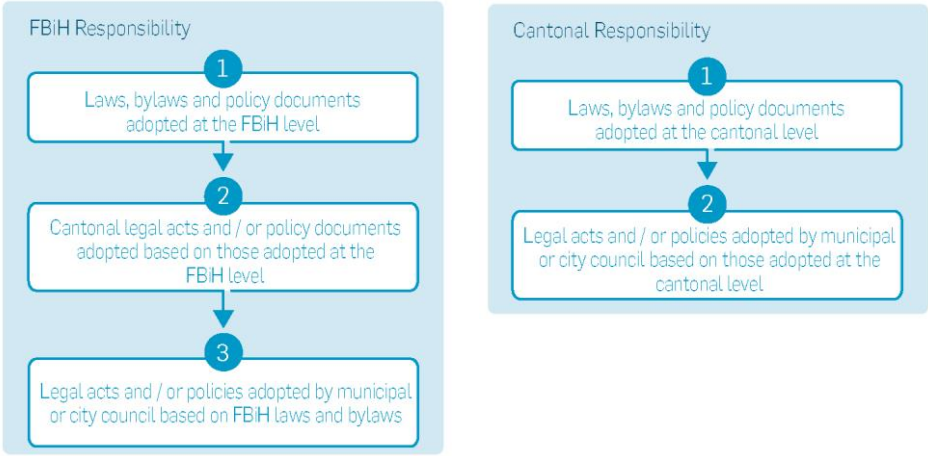
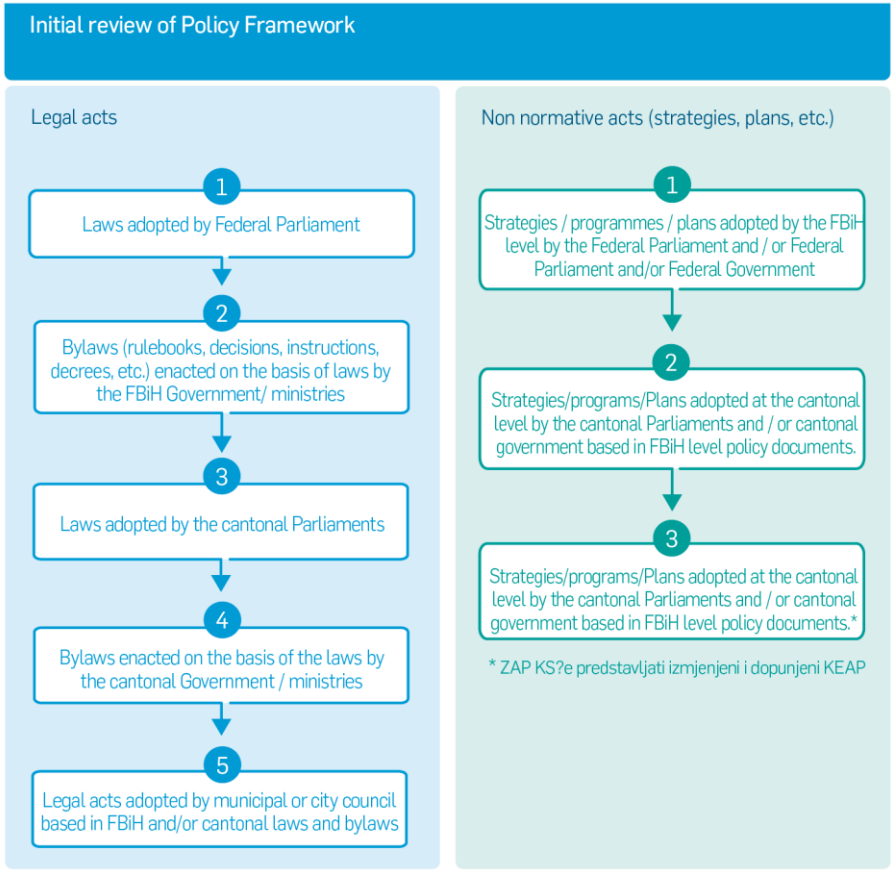


Figure 3-4 - Overview of relationship between policies, plans, strategies, legal acts and bylaws – FBiH and Sarajevo Canton



Inter-sectoral coordination during preparation of legislation and strategic documents / plans is still an area of weakness in FBiH. Consequently, environmental issues are not sufficiently addressed within other legislation or strategic documents / plans.

Sectoral laws often require adoption of strategic and other public policy documents (such as plans and programmes). Laws stipulate responsibility for their adoption and implementation, outline their content and similar. Although strategic documents are not legal documents, the laws strictly stipulate that strategic documents must be harmonised. The principle of harmonisation is emphasised in specific sectors where responsibilities are shared, such as, for example, traffic and energy.

3.4.2. Cantonal and municipal policy context

The Constitution of FBiH stipulates that environmental policies are a shared responsibility between the Federal government and the Cantons as federal units within the FBiH. Thus, both FBiH and the Cantons enact laws and bylaws in this sector. For certain sectors of relevance to environmental protection, FBiH (for example energy policy) or Cantons (e.g. utility / communal services and local land use) have exclusive responsibility. Additionally, at the lower level of these government layers in FBiH, there are local governments who also have certain responsibilities according to the law regulating local self-government and sectoral rules and regulations.

However, with regard to the level of competence of local self-government units within SC, it is necessary to emphasize that the competencies of some municipalities in the areas of waste management, utilization of space and natural resources are inadequately regulated. For these aspects, the municipalities do not have the same jurisdiction as other municipalities elsewhere in FBiH as these competencies are centralized at Canton level instead, and operationally implemented through the established Cantonal public enterprises. The Canton adopts and enforces policies.

Laws adopted by the Federal Parliament are at the top of the hierarchical pyramid of legal norms. As and when provided for by the laws, the Federal Government and ministries enact secondary regulations for implementation (different bylaws such as decisions, decrees, rulebooks, etc.), that elaborate in more detail certain technical norms with the aim of effective practical enactment of laws and principles set therein.

In those sectors where responsibilities are shared between FBiH and the Cantons, laws adopted at the Federal level delineate areas of responsibility between different levels of governance, i.e. between FBiH level, Cantonal level and local self-government units (municipalities and cities). There are also Cantonal laws which elaborate further provisions of Federal laws. In these cases, Cantonal legal acts must be harmonised with laws and bylaws adopted at the FBiH level.

Laws often require adoption of strategic and other public policy documents, such as plans and programmes. Laws stipulate who is responsible for their adoption and implementation, outline their content and similar. Although

strategic documents are not legally binding, the laws strictly order that strategic documents must be harmonised, meaning that local strategic documents must be harmonised with Cantonal documents, and Cantonal documents must be harmonised with those at the FBiH level.

A typical example of this is the provisions of the FBiH Law on Environmental Protection (which foresee the adoption of the Federal Environmental Protection Strategy) and the Cantonal Environmental Protection Plan, which aligns with the FBiH Strategy. This principle is also re-emphasised in other specific sectors where responsibilities are shared.

3.5. Priority environmental challenges

The environmental challenges have been identified by using the State-Pressure-Response model as described in section 2.3.

Data for state indicators were collected relating to water resources, air quality, green space, mitigation of GHG emissions, soils, biodiversity and ecosystems, and adaptation and resilience to natural disaster risk. Pressure indicators were populated with data collected for transport, industry, energy, buildings, land use, water and solid waste sectors. Data for response indicators, measures that seek to improve the Canton's environment, were largely qualitative and derived from the Political Framework Report.

A series of problem trees representing identified causal linkages between state, pressures and response indicators were used to inform the identification of environmental challenges in Sarajevo whilst also taking into account socio-economic impacts (shown indicatively in Figure 2-3. A process of technical and stakeholder-based prioritisation was then conducted. The EBRD GCAP methodology stipulates that prioritisation of environmental challenges comprises the following steps:

- **Technical analysis** - identification of priority environmental challenges based on the assessment of GCAP Indicators Database;
- **Stakeholder-based prioritisation** - evaluation of the relative priority, or ranking, of environmental challenges by GCAP stakeholders via structured discussion in a workshop setting; and
- **Political assessment** - formal review and assessment by the Canton Administration of the results of the first two steps.

This prioritisation exercise identified priority environmental challenges in SC for each of the GCAP environmental topics which are listed in order of priority below:

- Air quality;
- Water resources;
- Soils;
- Green spaces;
- Mitigation of GHG emissions;
- Biodiversity and ecosystems; and
- Adaptation and resilience to natural disaster risk.

The following sections outline the results of the analysis of the indicators and identified priority challenges per environmental topic. The set of key state, pressure and response indicators contributing to specific challenges are summarised in Table 5-2 by environmental topic.

3.5.1. Air quality

Air pollution is the highest priority challenge in the Canton. Air quality indicator values appear to be within the benchmark "yellow" thresholds, but with trends of increasing values, especially for SO_2, NO_x and PM_{10} indicators. Air in Sarajevo Canton is moderately polluted when values are averaged over the year. However, air pollution is much higher in wintertime than the rest of the year due to temperature inversion effects and the increased burning of solid fuels for heating. Concentrations of pollutants such as PM_{10} are also generally extremely high in winter. Analysis of individual records reveals that pollutant concentrations are the highest in the urban area of the Canton.

The response indicators regarding transport and energy are mostly benchmarked as "red" and "yellow" due to implementation challenges in these sectors as well as the fact that existing policies might not be sufficient to resolve the issues at stake. The priority environmental challenges with regard to air quality, in order of priority, were identified as:

- Increased use of fossil fuels, wood and other non-renewable options as energy sources for heating and cooking;
- Canton is highly reliant on fossil fuelled private road transport, with aging car fleet and low engine standards;
- Traffic congestion;
- Lack of road lanes exclusively dedicated to public transit and poor quality / inefficient public transport;
- Polluting industries;

- Infrastructure for Non-Motorised Transport (NMT) is partly provided (such as cycle lanes, pedestrian paths and bike parking);
- Low proportion of clean renewable energy as a share of total energy consumption;
- Relatively low levels of District Heating Network (DHN) connection;
- Connections to DHNs that are old, use solid fuels or heavy oils which means that DHN need to be reconstructed, improved and modernised (such as the boiler room of the company BAGS in Vogošća).
- High electrical and heat energy consumption in buildings; and
- Other key challenges highlighted by stakeholders, including illegal construction, poor enforcement of existing regulations, open burning of waste and lack/decrease of green spaces.

3.5.2. Water resources

The deterioration in the quality of water bodies in Sarajevo is reflected in the high level of Biochemical Oxygen Demand (BOD). The low water quality in rivers in SC is directly linked to insufficient sewage infrastructure although the Canton has had a wastewater treatment plant in Butile since 1982, as well as a second wastewater treatment plant at Trnovo. The issue of the use of treatment services between the two plants has not been resolved and also affects the wastewater tariff, which currently does not include treatment costs. Sewerage infrastructure is not adequately developed, sludge is not properly treated and some residential buildings are not connected to a main sewage collector, so significant quantities of wastewater are directly discharged to surface water bodies without treatment. A similar situation is experienced with regard to industries, where waste is sometimes disposed in non-sanitary ways, e.g. directly into water bodies. Improvements are also needed in connecting services between the Butile and Trnovo WWTPs, which also affects the tariff for wastewater disposal.

Priority environmental challenges with regard to water resources were identified, in order of priority, as:

- The sewerage network is not completely separating rainwater from wastewater, does not cover all areas of the Canton; and part of the network is outdated.
- Part of the sewerage network is not connected to the main collector to the treatment plant, so that wastewater is discharged without treatment.
- Additionally, about 20%[15] of households discharge to septic tanks or directly into water bodies;
- Wastewater from industry is partially treated. There are many polluting industries and lack of inspection and regulatory control;
- The tariff structure includes only the price of drainage but not wastewater treatment;
- The water supply network in the Canton is partly obsolete, with a high level of non-revenue water, and very low level of implementation of plans and investments in repairs and maintenance of water supply infrastructure;
- Analysis shows that the water from the central water supply system is of good quality and should be used immediately after disinfection at the

15 https://mpz.ks.gov.ba/sites/mpz.ks.gov.ba/files/kantonalni_plan_zastite_okolisa_kantona_sarajevo_verzija_za_web1.pdf.

source or in distribution tanks. However, water samples from local sources are not always correct. Water sources in Sarajevo Canton are not legally protected[16]. The water springs are endangered by urbanisation, illegal construction, as well as deforestation;

- There are two wastewater treatment plants in the Canton, Butile and Trnovo, which have not resolved the issue of final sludge disposal. The leachate treatment plant of the Smiljevići waste management centre is currently out of order; and
- Other challenges prioritised by stakeholders including inadequate protection of water bodies, irregular riverbed cleaning, lack of enforcement of existing regulations and inadequate monitoring of permits and stricter controls.
- The efficiency of water consumption in industry and households is questionable.

3.5.3. Soils

Existing data are limited to two indicators: cadmium concentration, benchmarked as "yellow" based on 2016 monitoring results from location of water supply source Vrelo Bosne; and mercury concentration, which was benchmarked as "green". Data on the number of contaminated sites were not available, which hampered the analysis and development of conclusions. Soil monitoring systems are not sufficiently developed, as highlighted by initial stakeholder feedback, limiting the availability of data on soil quality.

A number of solid waste management pressure indicators were identified as having potential links with soil quality. However, data gaps made it difficult to correlate soil state indicators with other related transport and energy pressure and response indicators that may have negative impacts on soil quality.

The priority environmental challenges with regard to soils were identified, in order of priority, as:

- Very low proportion of municipal solid waste that is sorted, recycled and composted;
- Solid waste generation and material consumption;
- Lack of treatment for landfill leachate;
- Industrial wastewater and waste not properly disposed/treated;
- Lack of monitoring systems on land/soil quality including surveys of contaminated land in old industrial sites that are changing use to housing;
- Adoption of policies in this field is under the jurisdiction of the Federation of BiH;
- Individual studies on limited soil surfaces show the presence of harmful substances in soil; and
- Other challenges highlighted by stakeholders, including inappropriate waste disposal and illegal dumping, lack of charges/fines for inappropriate solid waste separation, ineffective inspection control and the relocation of industry from the city centre.

3.5.4. Green space

[16] Decision on protection of mountain drinking water sources in Sarajevsko polje (Official Gazette of the City of Sarajevo, 2/1987), Decision on protection of mountain drinking water sources of the Sarajevo water supply system and part of the open flow of the Mošćanica river, Decision on protection of Perački vrelo and open flow interventions Vogošća River, Vogošća Municipal Assembly, no. 01-022-5 / 89 dated 15 February 1989.

The most urbanised area of Sarajevo Canton stretches along the valleys of the rivers Miljacka, Željeznica and Bosna, and is surrounded by mountains that have high significant natural value. If the entire Canton is taken into account in the calculation of the percentage of green areas, then the forests and forest lands of the surrounding mountains would also be included in the calculation. However, if only the part of the Canton under the urban plan is taken into account, then this value is significantly lower and indicates a lack of green areas. The urban area has very limited green open spaces, which are unevenly distributed and therefore not accessible by all residents, and there is a low percentage of non-built up areas. There is lack of data on the rate of growth of the built-up area. However, the building/land ratio within the urban area exceeds regulatory limits in certain zones. Accelerated expansion of residential buildings as a result of urbanisation is not aligned with delivery of infrastructure.

The priority environmental challenges with regard to green spaces were identified, in order of priority, as:

- Illegal construction;
- Population density, urban sprawl and lack of non-built up areas;
- The provision of green areas in SC is limited, and not evenly distributed. Those that exist are not equally accessible to all citizens;
- Littering on green open spaces; and
- Limited spaces for recreation.

3.5.5. Mitigation of GHG

State indicators regarding GHG emissions, covering housing, transport and industries, have been benchmarked as “green” for Sarajevo Canton. However, pressure and response indicators have pointed to adverse impacts that can potentially exacerbate GHG emissions, together with policy gaps addressing climate change mitigation including energy efficiency.

Although current levels of GHG emissions appear relatively low, in order to control their growth priority environmental challenges with regard to the mitigation of GHGs were identified, in order of priority, as:

- High proportion of fossil fuelled private vehicles, high average age of the vehicle fleet, and low engine standards (Euro 4);
- Traffic congestion;
- Lack of road lanes exclusively dedicated to public transit, poor quality public transport;
- High use of fossil fuels for heating/cooling and cooking in residential and non-residential buildings;
- Low share of renewable energy as a share of total energy consumption;
- Infrastructure for NMT is partly provided (such as cycle lanes, pedestrian paths and bike parking);
- Lack of composting, recycling, waste-to-energy; and
- Locally produced materials are not used for construction.

3.5.6. Biodiversity and ecosystems

The majority of species are located outside of the urban areas of SC. The total area occupied by the protected areas of the Canton is about 2.3%. Green areas cover less than 2% of the area within urban limits. However, the analysis of this challenge area has been hampered due to the lack of monitoring data on the change in abundance or decline of species. This data limitation makes evaluation of potential impacts of different sectors, such as industry, waste

management, transport and energy, on biodiversity and ecosystems problematic.

The priority environmental challenges with regard to biodiversity and ecosystems were identified, in order of priority, as:

- Population density, urban sprawl and lack of non-built up areas;
- Inadequate regulation of urban development;
- Green areas in urban parts are limited and fragmented, and there are no urban corridors; as such, they are insufficient for increasing urban biodiversity;
- Aquatic ecosystems in the Canton are endangered by untreated wastewater;
- Low provision of green areas within urban areas in SC;
- Lack of treatment of industrial wastewater and inadequate policy responses in relation to industrial emissions;
- Inadequate municipal solid waste disposal;
- Lack of biodiversity maps and inventory of flora/fauna/fungi and identification of habitat types in an appropriate database;
- Lack of monitoring of preservation and protection of dendroid valuable species;
- Littering on green open spaces could put pressure on biodiversity;
- Under resourced capacity for protected areas management and planning; and
- Other challenges highlighted by stakeholders, including invasive species, inadequate protection of karst areas (Bjelašnica-Igman), and lack of planning which takes into consideration impact of existing and planned high-rise buildings on urban ventilation corridors.

3.5.7. Adaptation and resilience to natural disaster risks

Adaptation issues mainly relate to the level of resilience of transport, energy, water and drainage infrastructure to natural disasters. Values for associated indicators in relation to this area are limited, as data providing a fuller picture of potential damage to main infrastructure, industrial facilities and agricultural areas that could pose a socio-economic risk are lacking. However, citizens are aware of natural disasters, but are not well prepared to act in case of a disaster.

State indicators regarding natural disasters have been benchmarked as “yellow”, highlighting the effects of landslides due to illegal construction on unsuitable land and dwellings damaged by intense floods in the last 10 years. Landslides and floods are the most frequent natural disasters. In the period from 2014 to 2018, floods were caused by watercourses of category I (rivers) and category II (tributaries and small rivers).[17] Almost 900 landslides were registered in 2017, and therefore the relevant authorities have been investing in the rehabilitation of areas affected by landslides, with the Institute for Construction of CS performing operational work..

The priority environmental challenges with regard to adaptation and resilience to natural disaster risk were identified, in order of priority, as:

- Illegal construction exacerbating the risk of landslides;
- Inadequate policy responses in relation to resilience to disasters;
- Construction and improvement of flood protection infrastructure should be continued;
- The sewage system is not completely separate from the stormwater system, so extreme rainfall leads to overflow from the sewage system (of combined sewage and stormwater);
- An increase in temperatures during summer increases the risk of forest fires;
- Lack of resilient infrastructure – drainage facilities, electricity network, public transport and water supply; and
- Other challenges identified by stakeholders, including lack of plans to support rural development, renewable energy resource potential not fully exploited, and no regular riverbed cleaning conducted as a measure to reduce flood risk.

[17] Preliminary Flood Risk Assessment, 2013.

4. Urban ventilation corridors study modelling

4.1. Study background and objectives

The Study of Urban Ventilation Corridors and Impacts of High-Rise Buildings has been prepared as part of the Sarajevo GCAP, and the full report is provided as a separate deliverable. This study was also used to inform Land Use actions in section 5.4.

One of the most urgent problems in Sarajevo is poor air quality exceeding daily limit values of air pollutants such as PM (particulate matter) , especially during the winter, owing to a combination of terrain configuration (orography), meteorological/weather conditions as well as emissions from district heating, vehicles and industry. A good urban wind environment is important in accelerating the spread of pollutant turbulence and increasing the urban environmental capacity. However, increased levels of urbanisation and the construction of tall buildings along major ventilation routes raises concerns that these physical barriers will block the flow and reduce the positive effects of ventilation. As such, preserving corridors of natural airflow has become extremely important.

In line with this, the main objectives of the Study were:

- To analyse potential impact on the air flow and quality across the Sarajevo basin by creating new wind ventilation corridors;
- To locate areas/corridors where construction of high-rise buildings should be restricted to improve the air flow and quality throughout the basin; and
- To conduct a study of existing wind flows and pollution level across the basin using GIS, meteorological data, and a model to predict air flow between buildings. Computational Fluid Dynamics (CFD) was employed to compute airflow through the Sarajevo valley.

4.2. Methodology and modelling of corridors

The Study used the CFD method with a time-dependent Reynolds-Average Navier-Stokes (RANS) turbulence modelling approach. Two scenarios were considered, one in which air flow in Sarajevo valley was due to typical wind and another where air flow was only due to buoyancy force generated by temperature difference, to investigate if the same corridors appear in both scenarios. The terrain roughness was represented by the porosity model that considers different surface characteristics. Seven terrain zones were defined (high-rise building area, medium-rise building area, low-height private houses, forest, grass fields and parks, rivers and roads) on which different values of porosity coefficient, temperature and pollution emission were assigned.

Three different computational models of terrain were used:

Meso-scale computation identifies the main air corridors through Sarajevo valley and analyses the correlation between air corridors and levels of pollution in urban areas of Sarajevo. The computational domain covers a region of 15 km x 13 km x 1.5 km, and contains the whole valley including surrounding mountains. The domain is oriented along East-West and North-South directions (see Figure 4-1 and Figure 4-2).

Figure 4-1 - Surface of computational domain colour-coded by terrain altitude

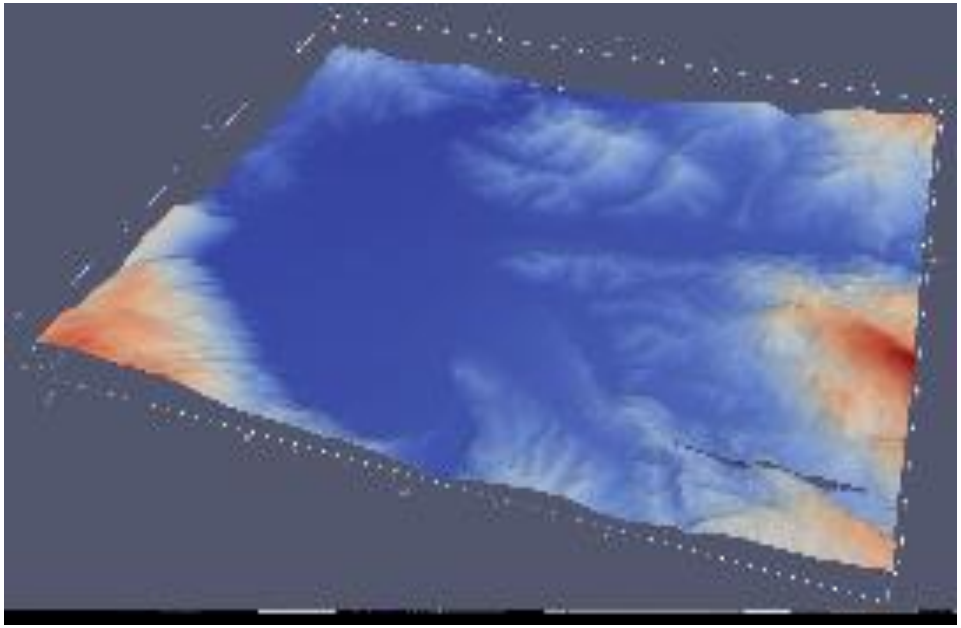
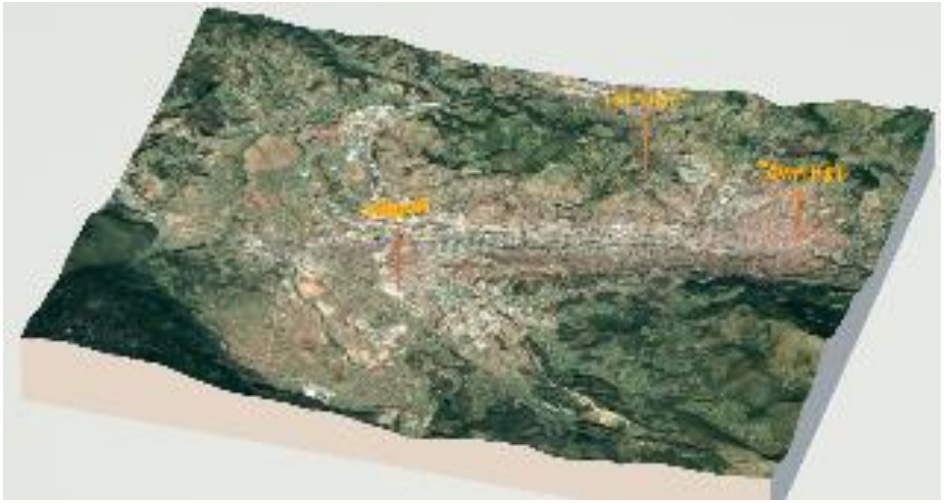


Figure 4-2 - Satellite picture of model terrain

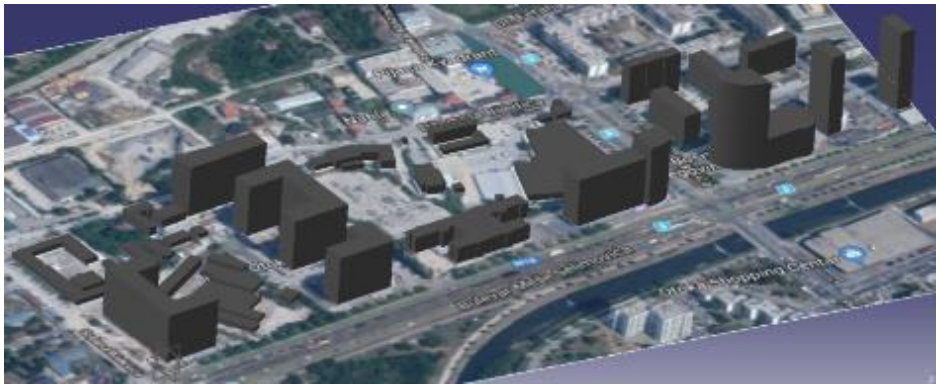


Local-scale computation was performed to determine details of the main air corridors, as well as to estimate the influence of tall buildings on corridor size and strength. Direct 3D modelling of buildings also enables the identification of high pollution regions, determined by the presence of flow separations caused by buildings or natural obstacles. The computational domain covers a region of 6 km x 1.8 km x 1 km and includes most of the urban region of the city of Sarajevo (the old city and administrative centre in Marijin Dvor) as shown in Figure 4-3 - . The computation is performed for the most frequent wind direction (ESE, 120^{o}) and reference wind magnitude of 1.8 m/s.

Figure 4-3 - Satellite picture of region included in computational domain with modelled objects on the ground

Micro-scale computation was performed to assess the influence of building heights on the pollution level. The computational results are used to investigate the efficiency of pollution cleaning by the incoming low-pollution wind and its correlation to buildings' density and heights. The domain contains a Sarajevo neighbourhood with a computational mesh resolution of 2 to 3 metres as shown in Figure 4-3.

Figure 4-4 - Current objects at Nova Otoka district



4.3. Key findings and conclusions

Through the methodology outlined, the computations of wind in Sarajevo's valley identified two main air ventilation corridors, which are named by their topographical features – Miljacka and Main Road. Both air corridors are roughly oriented along East-West direction. In addition to these two main

corridors, several further local air corridors were identified. These local corridors are comparatively smaller but can play an important role in supplying fresh air into the city.

The air corridor Miljacka is determined by the Miljacka river channel. It stretches from the East where Miljacka enters the city (the location of Bentbaša) until the meandering of the river starts in Sarajevo's Field at the location of Halilovici. The corridor width varies due to different proximities of buildings along the Miljacka channel, from the maximum width of around 110 metres at the location of Dolac Malta to around 60 metres at the segment Vijećnica-Skenderija. The wind intensity along the corridor also varies both in time and space, influenced by the complex interaction of air flow and the objects in the corridor's vicinity.

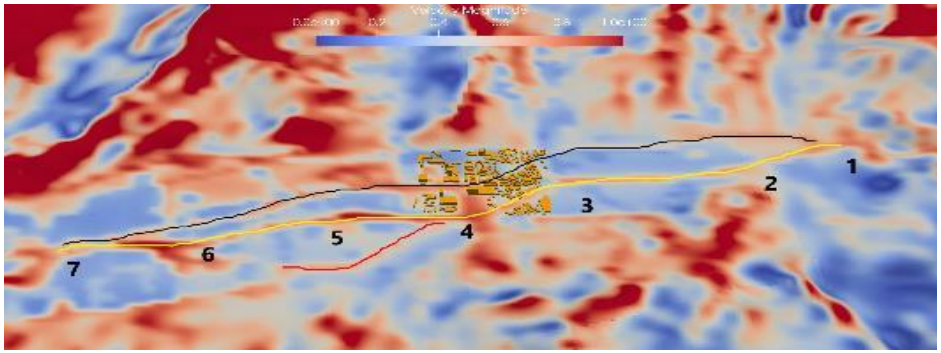
The air corridor Main Road is formed along the main road that connects the eastern and western parts of the city. The corridor stretches from Marijin Dvor in the East and ends at the location of Stupska Petlja in the West. The width of the corridor is almost constant, at around 50 metres. The air flow is more intense along Miljacka air corridor due to several reasons (as illustrated in Figure 4-5), including an undisturbed supply of air at the Vijećnica location, the wider Miljacka corridor and the presence of less high-rise buildings on the left edge of the Miljacka corridor compared to Main Road.

Apart from these two main corridors secondary or additional air corridors were identified. These are significantly shorter than the main corridors but can play an important role in supplying fresh air into the city. These corridors are the South Longitudinal corridor (which coincides with the South Longitudinal road defined by the following streets: Zagrebačka, Grbavička and Zvornička, North Longitudinal road), Alipašina Street (which sits within the Green Belt), Ante Babića Street and Ive Andrića Street (in Alipašino Polje district).

The presence of high-rise buildings in the corridor's vicinity is reducing wind permeability, thereby inhibiting the supply of fresh air to the corridors. In addition, the recirculation zones in the wakes of buildings slow down air flow if the wakes penetrate the corridors. For this reason, it is important to protect existing routes by which the air is supplied to the corridors, as well as to prevent the negative influence of new buildings on the air flow.

Based on the empirical formula for the recirculation length proposed by Hertwig et al. (2018), it is estimated that a building height of 20 metres would not produce a negative impact on air flow through the corridors. Accordingly, it is proposed to restrict building height to 20 metres in the region of a 200 metres wide belt from either side of the two air corridors, in order to ensure that new buildings will not produce recirculation zones long enough to interact with the corridor air flow.

Figure 4-5 - Air corridors visible in velocity magnitude field from meso-scale computation with reference velocity 1.8 m/s



Legend: Black – Corridor Main Road, Yellow – Corridor Miljacka, Red – Corridor Zagrebačka ulica.

Primary and secondary ventilation corridors are identified as shown in Figure 4-6:

a) Primary ventilation corridors include:

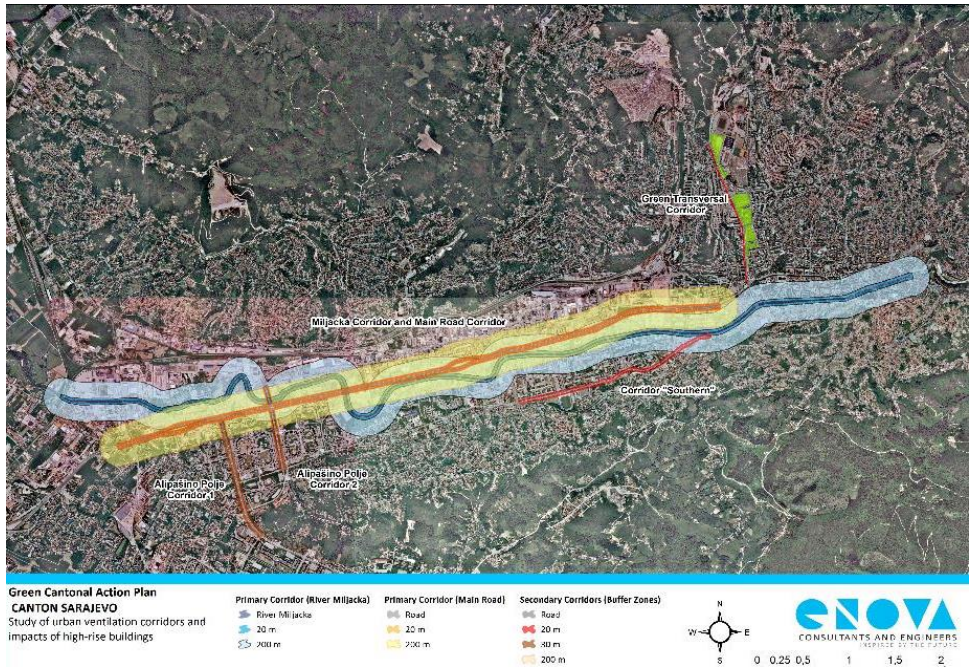
- Miljacka Corridor is defined by the route of the Miljacka River. It stretches from the east where the Miljacka enters the city (Bentbaša) to the Miljacka River in Halilovici;
- Main Road Corridor is formed along the length of the main road connecting the eastern and western parts of the city. The corridor extends from Marijin Dvor to the east to Stupske Petlje to the west.

b) Secondary ventilation corridors include:

- Corridor "Southern" coincides with the "Southern longitudinal" or is defined by the streets of Zagrebačka, Grbavička and Zvornička;
- Green Transversal Corridor extends along Alipašina Street from Koševo and Zetra to Skenderija;
- Alipašino Polje Corridor 1 extends along Ante Babic Street in Alipašino Polje;

- Alipašino Polje Corridor 2 extends along Ivo Andric Street in Alipašino Polje.

Figure 4-6 - Primary and secondary ventilation corridors



4.4. Recommendations and next steps

It has been demonstrated and documented that certain areas of Sarajevo's urban area have been affected by the uncontrolled increase in density, particularly tall buildings. In such context, urban natural ventilation is one of the most effective ways of tackling localised pollution and, potentially, the Urban Heat Island effect. Wind corridors provide such fundamental function of cleansing and refreshing air but, in certain instances, the corridors have been fragmented and eroded by developments. For the benefit of citizens and business alike identification, protection and improvement of the wind corridors is a priority action that has been recommended here.

To implement this, all experts and government stakeholders should contribute and be involved to create a holistic approach to comprehensive urban planning and design (for streets, parks, buildings and other urban areas) that considers improvements which will enable better air circulation and reduced air pollution as fundamental criteria of success.

Future urban development in Sarajevo must incorporate an environmental dimension to achieve sustainability in urban planning. As the Study demonstrates, on-site air quality can be negatively impacted by changing building layout disposition, orientation and heights. Therefore, it is important to assess the impact of new construction using complex modelling (CFD or wind tunnel) to support the design of a sustainable and healthy urban environment.

Several measures are recommended to protect air ventilation corridors in Sarajevo basin. The protection measures on primary ventilation corridors are:

- Prevention of construction of new buildings in the 20m zone from the bank of the river Miljacka, i.e. the edge of the Main Road, on each side of the corridor;
- Building height limitation up to 20 metres (which is about 6 levels) in the 200m zone on each side of the primary ventilation corridors;
- Application of technical guidelines for spatial development and design of structures with the aim of improving the air flow.

The protection measures on secondary air corridor are:

- Prevention of construction along the Alipašina Street-Skenderija corridor in the 20m zone on the right side of the road. Construction prohibition on park areas on the left side of the road;
- Prevention of construction of new buildings at 20m on each side of the Southern Corridor or the southern longitudinal road connecting the streets: Zagrebačka, Grbavička and Zvornička;
- Prevention of construction of new buildings on the surface of 30m on each side of the ventilation corridors Alipašino 1 and Alipašino 2, i.e. Ante Babić and Ivo Andrić streets;
- Kozija ćuprija – Bentbaša;
- Northern side of Main Road corridor:
  - Veliki park – Mali Park-Hastahana,
  - Greening city yards of Dolina, Fra Anđela Zvizdovića and Kralja Tvrtka Streets;
  - Greening squares along Franca Lehara Street;

- Preservation and upgrading of existing park areas between Kalemova and Kranjčevićeva Streets;
- Greening the University Campus from Halida Kajtaza street to Hamdije Čemerlića Street;
- Revitalisation and greening of the square in front of the train station and the BH Post building; and
- Preservation of existing park areas and greening of squares in the area bounded by the streets of Zmaja od Bosne and the railway station on one side, and Ložionicka and Hamdija Čemerlic streets on the other side.

In order to improve the ventilation characteristics of Sarajevo Canton and to mitigate the Urban Heat Island effect, green corridors should be established by extending to and upgrading existing green spaces as shown in Figure 4-7 and Figure 4-8.

Figure 4-7 - Green corridor along the main road

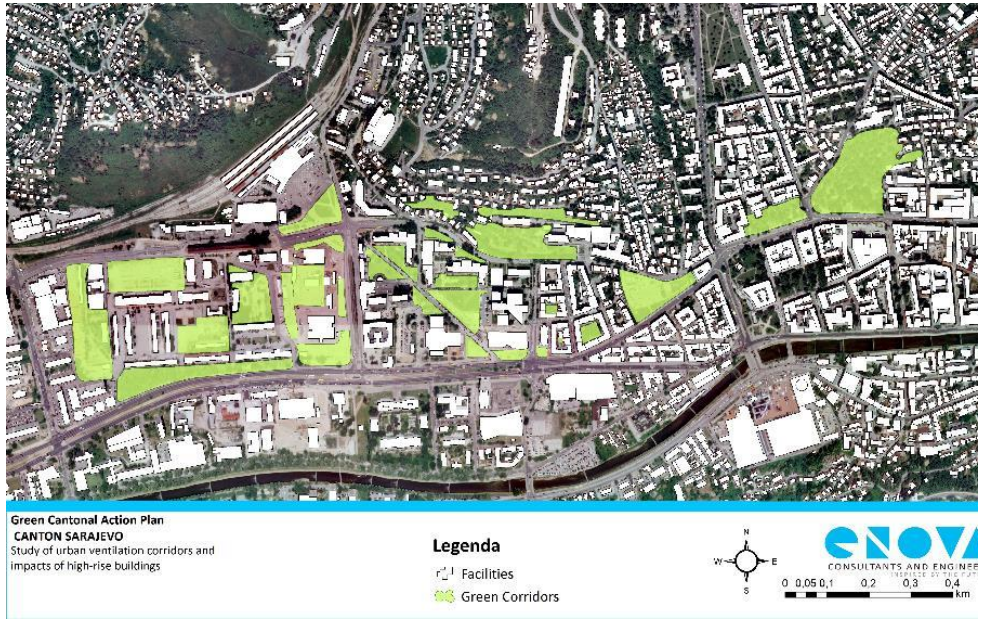


Figure 4-8 - Boundaries of the green corridor Kozija Ćuprija Bentbaša

The measures above shall be applied when adopting new spatial planning documents, as well as for amendments of existing ones.

When designing regulatory plans that are within the area of the ventilation corridors, a Strategic Environmental Assessment should be required including airflow analysis based on numerical simulations.

An Urban Climatic Map shall be created for SC which should collect and analyse relevant data on meteorology, topography and land use. Air ventilation corridors for dominant wind direction should be determined by the Urban Climatic Map and specify protection measures.

It is also recommended to develop tall buildings technical design guidelines outlining appropriate buildings layout, massing, form and localised solutions based on CFD analysis. These are to guide the design in assessing and approving new regulatory plans and buildings of a scale such that will affect their local context.

5. Green Cantonal Action Plan

5.1. GCAP vision and strategic objectives

The Canton-wide vision statement takes into consideration the identified green challenges and blends this with the broader aspiration of how the Canton wants to develop in the future, shaping the green ideals and aspirations. The vision statement takes into consideration the wider policy agenda identified with the political framework reporting, as well as feedback from Canton officials and stakeholders at GCAP workshops. This will help to create ownership and backing for the Green Cantonal Action Plan.

The overarching vision statement for the GCAP is presented below:

Sarajevo GCAP vision statement

"Sarajevo Canton will have cleaner, greener, affordable and smarter transport, buildings and industries. It will be served by efficient and high-quality water and wastewater infrastructure, efficient district heating, with improved waste and pollution control management. The Canton will be a healthy, compact, sustainable place to live and work, with good quality, accessible green spaces and biodiversity and natural values maintained or enhanced. Resilience to climate change and other natural disasters will be increased".

Based on the identification and prioritisation of environmental topic challenges, a series of environmental topic visions have been developed. The topic visions present a qualitative output of the desire to meet the environmental challenges, identified through the technical assessment report and through stakeholder-based prioritisation. They also form the framework for developing strategic objectives which in turn shape the generation of policy options and actions. A set of proposed mid-term (2025) and long-term (2030) targets are presented for each strategic objective.

The vision statements for each of the prioritised environmental topic areas are presented in Table 5-1, where they are aligned with Green Canton topic challenges. A single vision is presented for each topic area and strategic objectives are also presented. A total of nine strategic objectives have been generated.

Table 5-1 - Prioritised environmental topic visions and strategic objectives, policy gaps and action priority areas

<table>
<tr><th>Environmental Topic</th><th>Priority environmental challenges</th><th>Vision, strategic objectives, targets</th><th>Policy gap(s) / issue(s)</th><th>Action priority sectors</th></tr>
<tr><td>1. Air quality</td><td>• Air quality in Sarajevo Canton is generally poor and this is exacerbated during winter months.
• Key pressures include fossil fuelled private road transport, lack of public and NMT infrastructure, aged car fleet, high production of heating from fossil fuels for residential buildings and industries, increase use of fossil fuels/non-renewable options as energy sources for cooking in individual households, and small share of population with access to district heating/cooling.
• Increased use of fossil fuels and non-renewable options as energy sources for heating and cooking in individual households.
• Some industry types such as quarries, construction and wood processing are also contributing to particulate matter concentrations.
• Outdated boiler houses and obsolete fossil fuel boilers in use in district heating networks that are exacerbating poor air quality in Sarajevo Canton.</td><td><u>Air quality vision statement:</u>
“Air quality in Sarajevo Canton will be improved with cleaner and greener transport, buildings and industry”
Strategic objective: AQ01 Improve ambient air quality compliant with EU standards
<table><tr><th>Indicator</th><th>Baseline [18]</th><th>MT Target</th><th>LT Target</th></tr><tr><td>Average annual concentration of PM_{10}</td><td>48 µg/m^3 (2017)</td><td>40 µg/m^3</td><td>30 µg/m^3</td></tr><tr><td>Average annual concentration of SO_2</td><td>22 µg/m^3 (2017)</td><td>20 µg/m^3</td><td>< 20 µg/m^3</td></tr><tr><td>Share of trips by private motorised transport</td><td>N/A</td><td>50%</td><td>30%</td></tr><tr><td>Share of passenger vehicles run by electricity or gas</td><td>2% (2017)</td><td>3%</td><td>5%</td></tr><tr><td>Consumption of energy from fossil fuels for heating in residential buildings</td><td>101 KWh/m^2 (2018)</td><td>96 KWh/m^2</td><td><96 KWh/m^2</td></tr><tr><td>Consumption of energy from fossil fuels for heating in non-residential buildings</td><td>147 KWh/m^2 (2017)</td><td>137 KWh/m^2</td><td>127 KWh/m^2</td></tr><tr><td>Share of population with access to district heating</td><td>23% (2015)</td><td>30%</td><td>50%</td></tr><tr><td>Fossil fuel combustion in industry</td><td>N/A</td><td>< 2.2MJ/USD</td><td>1.4MJ/USD</td></tr></table></td><td>• Absence of smart and sustainable transport strategy for the Canton.
• There are no measures to remove / scrap / ban old vehicles, which emit greater amounts of pollutants, compared to newer vehicles.
• Lack of integration of transport planning with land use planning.
• Lack of incentives for cleaner production.
• Lack of measures to discourage use of private car and encourage NMT.
• Absence of cleaner energy development plan for heating, lighting and cooking.
• Lack of energy efficiency policies and measures for buildings and industries.
• Investing in energy efficiency measures in DHN including reconstruction, new technologies, energy efficiency.</td><td>• Transport: fossil fuelled road transport.
• Transport: lack of provision for NMU movement.
• Buildings energy: fossil energy consumption.
• Industry: air emissions and energy efficiency.
• Land use – urban fabric and land use pattern in relation to transport routes.
• DHN: clean energy, air emissions and energy efficiency.</td></tr>
<tr><td>2. Water resources</td><td>• The amount of non-revenue water is extremely high and poor implementation of plans and investment in repair and maintenance of water supply infrastructure.
• Sewerage network coverage is limited, with around 20% of households discharging to septic tanks or directly into water bodies.
• Sewerage network is a combined system.
• Although there is centralised wastewater treatment provision, only a portion of wastewater is treated. Part of the Canton cannot be connected to existing plants, so wastewater is discharged into rivers. Smaller local facilities are needed to serve those areas where it is not possible to connect to the central wastewater treatment plant.
• Final treatment of sludge remains unresolved.
• Better connection is needed between WWTP at Butile and Trnovo. Water quality in KS rivers is monitored at 37 monitoring sites. Analyses show deterioration in the water quality of rivers within the Canton.
• Decision on protection of water spring areas has not been adopted; the water protection</td><td><u>Water resources vision statement:</u>
“Sarajevo Canton will have an efficient and well-maintained drinking water supply network as well as wastewater infrastructure serving the entire population”
Strategic Objective: WR01 Improve efficiency of water use
<table><tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr><tr><td>Share of non-revenue water</td><td>75% (2015)</td><td>55%</td><td>35%</td></tr><tr><td>Industrial water consumption as percent of total urban water consumption</td><td>21% (2016)</td><td>17%</td><td>19%</td></tr></table>Strategic Objective: WR02 Maintain and improve surface water and groundwater quality
<table><tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr><tr><td>Biochemical oxygen demand in rivers</td><td>2.47 mg / L (2017)</td><td>2 mg / L</td><td>< 2 mg / L</td></tr><tr><td>Percentage of industrial wastewater that is treated according to applicable national standards</td><td>N/A</td><td>50%</td><td>60%</td></tr></table></td><td>• Insufficient and inappropriate wastewater management of all types of wastewater source (households, industry, landfill leachate, agriculture).
• Lack of regulated metering and billing for drinking water.
• Inappropriate sanitation tariff structure; wastewater treatment collection costs are included but not wastewater treatment costs.
• Under resourced capacity to tackle wastewater issues, and inefficient collaboration between institutions at all levels.
• Lack of measures for treatment of wastewater sludge, e.g. consideration of waste to energy options.
• Water springs are not legally protected.</td><td>• Wastewater: wastewater collection and treatment.
• Water: potable supply network.</td></tr>
</table>

[18] Baseline corresponds to the latest data available as per Indicators Database.

<table>
<tr><th>Environmental Topic</th><th>Priority environmental challenges</th><th colspan="4">Vision, strategic objectives, targets</th><th>Policy gap(s) / issue(s)</th><th>Action priority sectors</th></tr>
<tr><td></td><td>zone is endangered by construction and illegal deforestation. Inefficient use of water in households and industry.
• Leachate treatment plant in the landfill is not currently operating.</td><td colspan="4"></td><td></td><td></td></tr>
<tr><td>3. Soils</td><td>• Although there is no system for soil quality monitoring, there are records of higher concentration of pollutants in soil in several locations.
• Legal and policy response instruments to adequately manage soil and protect/enhance its quality are under Federal jurisdiction, the Canton can only adopt and implement such instruments.
• Unknown industrial impact on soils quality.
• Leachate treatment plant in the landfill is not operating.
• Limited capacity of infrastructure facilities to separate and collect waste.
• Limited capacity of infrastructure facilities for sorting and recycling. The existing sorting plant is used to separate paper and plastic.
• Insufficient awareness and education campaigns on how and what to recycle.
• Presence of illegal dumping, cleaning programme has started.
• Issues with animal waste arising from slaughterhouses, butchers, and food industry.</td><td colspan="4"><u>Soils vision statement:</u>
“Soil quality in the Canton will be enhanced as part of improved land, waste and pollution control management”
Strategic objective: SL01 Protect and enhance soil quality across Sarajevo Canton
Indicator | Baseline | MT Target | LT Target
Total solid waste generation per capita | 450 kg/year (2016) | 370 kg/year | 300 kg/year
Percentage of Municipal Solid Waste (MSW) which is disposed of in open dumps or bodies of water or is burnt | 5% (2017) | 3% | 1%
Proportion of MSW that is sorted and recycled | Less than 1% (2017) | 11% | 21%
Share of industrial waste recycled as a share of total industrial waste produced | N/A | 50% | 80%</td><td>• Lack of land / soil quality monitoring system and regulations.
• Insufficient level of policy responses in relation to soil quality.
• Uncontrolled conversion of agriculture land to construction land.
• Lack of circular economy policies and measures including awareness campaigns on recycling and composting.</td><td>• Land use: adoption of soil quality and use regulations, monitoring and urban planning.
• Solid waste: MSW (Municipal Solid Waste) and industrial solid waste collection and disposal, integration of circular economy principles.
• Water: discharge of untreated wastewater.
• Solid waste: waste disposal and treatment of landfill leachate.
• Solid waste: collection and disposal.</td></tr>
<tr><td>4. Green space</td><td>• Although Sarajevo Canton overall seems very green as it includes rural areas and four protected natural areas, the provision of green public areas in Sarajevo Canton is relatively poor.
• Relatively low provision of green areas within the built-up area. Sarajevo Canton has very limited green areas within urban areas, not evenly distributed and not easily accessible by all citizens. Densely populated areas have very limited green areas and recreational zones.
• Lack of monitoring of growth of built-up area and share of green spaces.
• Illegal construction is jeopardising green space.
• Littering on green open spaces and other natural areas.</td><td colspan="4"><u>Green space vision statement:</u>
“Sarajevo Canton will become renowned as a compact, sustainable place to live and work, with good quality green spaces accessible to everyone and an efficient system of land uses”
Strategic objective: GS01 Expand and improve provision of high quality, accessible green spaces
Indicator | Baseline | MT Target | LT Target
Open green space area ratio per 100,000 inhabitants | 9 m^2/capita (2016) | 10 m^2/capita | >10 m^2/capita
Share of green space areas within urban limits | 2% (2016) | 20% | 38%
Population density on urban land | 1,580 residents/km^2 (2014) | 4,000 residents/km^2 | > 4,000 residents/km^2</td><td>• Lack of regulation and control of urban development as a result of the Canton’s new Urban Plan not being adopted yet.
• Poor implementation of existing Spatial Planning regulations/legislation.
• Lack of harmonisation of institutional and legal frameworks.</td><td>• Land use: urban planning and green infrastructure provision.
• Water: surface and ground water quality.
• Industry: emissions to water, air and land.</td></tr>
</table>

<table>
<tr><th>Environmental Topic</th><th>Priority environmental challenges</th><th>Vision, strategic objectives, targets</th><th>Policy gap(s) / issue(s)</th><th>Action priority sectors</th></tr>
<tr><td>5. Mitigation of GHG emissions</td><td>• Although current levels of GHG emissions appear relatively low, the high proportion of fossil fuelled vehicles, high average age of the vehicle fleet, high use of fossil fuels for heating and cooking, low fuel standards, lack of provision of cycling/pedestrian infrastructure, low share of RES, and lack of composting, recycling, waste-to-energy facilities together indicate that potential increases in GHG emissions represent a challenge for the Canton that needs to be addressed.</td><td>
<u>Mitigation of GHG emissions vision statement:</u>
“Sarajevo Canton will have smart, affordable, low carbon transport, buildings and industries”
Strategic objective: GH01 Reduce GHG emissions
<table>
<tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr>
<tr><td>Annual CO_2 equivalent emissions per capita</td><td>4.27 t/yr/capita (2013)</td><td>4 t/yr/capita</td><td><4 t/yr/capita</td></tr>
<tr><td>Share of trips by private motorised transport</td><td>N/A</td><td>50%</td><td>30%</td></tr>
<tr><td>Share of passenger vehicles run by electricity or gas</td><td>2% (2017)</td><td>3%</td><td>5%</td></tr>
<tr><td>Consumption of energy from fossil fuels for heating in residential buildings</td><td>101 KWh/m^2 (2018)</td><td>96 KWh/m^2</td><td><96 KWh/m^2</td></tr>
<tr><td>Consumption of energy from fossil fuels for heating in non-residential buildings</td><td>147 KWh/m^2(2017)</td><td>137 KWh/m^2</td><td>127 KWh/m^2</td></tr>
<tr><td>Fossil fuel combustion in industry</td><td>N/A</td><td>< 2.2MJ/USD</td><td>1.4MJ/USD</td></tr>
<tr><td>Proportion of total energy derived from RES as a share of total city energy consumption</td><td>15% (2017)</td><td>20%</td><td>> 20%</td></tr>
<tr><td>Share of industrial energy consumption from renewable energy</td><td>N/A</td><td>5%</td><td>10%</td></tr>
</table>
</td><td>• Insufficient policies and measures to address climate change pressure.
• Lack of policies/investment on low carbon transport and renewable energy technologies.
• Lack of energy efficiency and retrofitting programmes in buildings and industries.
• Lack of financial mechanisms and regulation to fine polluters.
• Existing policies and measures are insufficient to address current and future challenges.</td><td>• Transport: fossil fuelled road transport.
• Transport: lack of provision for non-motorised user (NMU) movement.
• Buildings, industry, energy: fossil energy consumption.</td></tr>
<tr><td>6. Biodiversity and ecosystems</td><td>• The Canton has five protected natural areas, but other areas identified of high natural value are not properly protected.
• Biodiversity within protected areas is researched and monitored.
• Construction activities are jeopardising areas of high natural value that are not protected.
• Unknown state of aquatic ecosystems.
• For the Canton area there is currently no overall biodiversity map and inventory of flora, fauna, fungi and identification of habitat types with an appropriate database.
• Lack of monitoring of preservation and protection of dendroid valuable species.
• Littering on natural areas could put pressure on biodiversity.</td><td>
<u>Biodiversity and ecosystems vision statement:</u>
“Biodiversity and natural values will be maintained and enhanced across the Canton”
Strategic objective: BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity across Sarajevo Canton
<table>
<tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr>
<tr><td>Proportion of protected areas</td><td>N/A</td><td>10%</td><td>15%</td></tr>
<tr><td>Abundance of all bird species, annual change</td><td>N/A</td><td>0% decline</td><td>0% decline</td></tr>
<tr><td>Share of green space areas within urban limits</td><td>2% (2016)</td><td>20%</td><td>38%</td></tr>
</table>
Strategic objective: BE02 Reduce the impact of human activities on biodiversity
<table>
<tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr>
<tr><td>Average annual concentration of SO_2</td><td>22 µg/m^3 (2017)</td><td>20 µg/m3</td><td>< 20 µg/m3</td></tr>
<tr><td>Biochemical oxygen demand in rivers</td><td>2.47 mg / L (2017)</td><td>2 mg / L</td><td>< 2 mg / L</td></tr>
<tr><td>Percentage of MSW which is disposed of in open dumps or bodies of water or is burnt</td><td>5% (2017)</td><td>3%</td><td>1%</td></tr>
</table>
</td><td>• Under resourced capacity for protected areas management and planning.
• Lack of monitoring of preservation and protection of dendroid valuable species.
• Insufficient systems for monitoring of biodiversity.
• Uncontrolled littering on green open spaces could put pressure on biodiversity.
• Insufficient Implementation and regulation of the City of Sarajevo’s Urban Plan.
• Insufficient enforcement to undertake SEA when compulsory for plans</td><td>• Land use: urban planning and green infrastructure provision.
• Water: surface and ground water quality.
• Industry: emissions to water, air and land.
• Solid waste: collection and disposal.</td></tr>
</table>

<table>
<tr><th>Environmental Topic</th><th>Priority environmental challenges</th><th>Vision, strategic objectives, targets</th><th>Policy gap(s) / issue(s)</th><th>Action priority sectors</th></tr>
<tr>
<td>7. Adaptation and resilience to natural disaster risks</td>
<td>• During high rainfall events, the drainage system infrastructure is insufficient which causes floods. Most of the Canton is not significantly vulnerable to floods, and the appropriate infrastructure for flood protection is under regular improvement and construction. From 2014 to 2018, floods were caused by watercourses of category I (rivers) and category II (tributaries and small rivers).
• The phenomenon of landslides is a very significant issue, mainly caused by human activities instead of natural causes Number of forest fires is relatively low but this can increase if extreme temperatures arise. The forest fire protection system needs to be upgraded.
• Lack of resilient infrastructure to tackle future climate change.</td>
<td>
<u>Adaptation and resilience to natural disaster risks vision statement:</u>
“Sarajevo Canton will increase its resilience to climate change and other natural disasters with improved, coordinated planning and management”
Strategic objective: AR01 Improve resilience to climate change and other natural disasters
<table>
<tr><th>Indicator</th><th>Baseline</th><th>MT Target</th><th>LT Target</th></tr>
<tr><td>Percentage of public infrastructure at risk</td><td>20% (2015)</td><td>15%</td><td>10%</td></tr>
<tr><td>Percentage of households at risk</td><td>40% (2015)</td><td>25%</td><td>10%</td></tr>
<tr><td>Efficiency of transport emergency systems in case of disaster</td><td>N/A</td><td>Emergency transport systems are able to run normally in case of disaster</td><td>Emergency transport systems are able to run normally in case of disaster</td></tr>
<tr><td>Share of green space areas within urban limits</td><td>2% (2016)</td><td>20%</td><td>38%</td></tr>
</table>
</td>
<td>• Absence of policies and measures to address climate change.
• Absence of climate resilience and adaptation strategy and action plans.
• Limited systems to assess vulnerability and risk.
• Lack of awareness campaign on disaster risk management.</td>
<td>• Establishment of a public institution to drive action climate change resilience and adaptation, build adaptive capacity and raise awareness.
• Active membership of resilient city networks and initiatives.
• Quantitative assessment of climate change risk to the city.
• Mainstreaming of climate change resilience and adaptation into urban policy, planning, design and procurement.
• Identifying and securing funds for climate change adaptation.
• Land use: incentivising investment in green and blue infrastructure; Sustainable Drainage Systems (SuDS) and flood risk management; construction related land degradation.</td>
</tr>
</table>

5.2. Addressing environmental challenges

Action priority sectors set the broad direction for addressing environmental challenges through policies and investments within urban sectors. The table above acts as a map to show how environmental challenges captured under the topics of air quality, water resources, green space, mitigation of GHG emissions, soils, biodiversity and ecosystems and adaptation and resilience are addressed via a variety of identified action priority areas across the sectors of land-use, transport, water, energy and buildings, industry and solid waste. This information is used to guide the development of GCAP actions presented in the sections below. The priority action areas presented in Table 5-2 align with the corresponding column in Table 5-1. In the following sections short-term actions are presented for each of the sectors.

Table 5-2 - Key linkages between environmental topics and policy / action priority areas

Environmental topic / Priority Area	1 Air quality	2 Water resources	3 Green space	4 Mitigation of GHG emissions	5 Soils	6 Biodiversity and ecosystems	7 Adaptation and resilience
Land use	*Spatial planning and urban design*	*Spatial planning Green Infrastructure*	*Spatial planning Green infrastructure*	*Spatial planning Future proofing*	*Spatial planning*	*Spatial planning Green infrastructure*	*Thermal comfort Spatial planning Future proofing including disaster risk management*
Transport	*Fossil fuelled vehicles NMU provision Modal shift*			*Fossil fuelled vehicles NMU provision Modal shift*			*Future proofing including disaster risk management*
Water		*Wastewater Potable water*	*Surface water quality Ground water quality*			*Wastewater Potable water*	*Water resource efficiency*
Energy and buildings	*Fossil energy consumption*			*Fossil energy consumption*			*Thermal comfort Energy resource efficiency*
Industry	*Air emissions Energy efficiency*	*Water emissions Water resource efficiency*	*Emissions to water, air and land*	*Air emissions*	*Water and land emissions*	*Air, water and land emissions*	*Water resource efficiency Future proofing*
Solid waste		*Collection Disposal and treatment*	*Collection Disposal and treatment*	*Disposal*	*Collection Disposal and treatment*	*Disposal and treatment*	

5.3. Short-term actions

This section presents a suite of 49 GCAP Actions. The actions have been prioritised using the three-step prioritisation process outlined in Chapter 2, including a technical assessment of environmental, economic and social benefits, a stakeholder prioritisation as well as a political prioritisation.

The GCAP Actions are the primary vehicle for Sarajevo's Green Canton transformation. Responding directly to the strategic objectives, they contribute to the achievement of mid and long-term targets. The GCAP Actions were developed specifically for Sarajevo Canton based on interactive consultation with the Sarajevo Canton Administration and other local stakeholders. While strategic objectives are in relation to environmental topics, the actions are developed in relation to sectors covering:

- Land use;
- Transport;
- Water;
- Buildings, energy;
- Industry; and
- Solid waste.

Actions within this GCAP are broadly categorised into investment actions or policy actions. The GCAP actions also have a more specific categorisation as presented opposite.

Table 5-3 - Action classifications

	Improving information base, modelling: monitoring and analysis of information on the state of the environment in Sarajevo Canton as well as the city's urban sectors.
	Developing policy, plan, legislation, regulations: prerequisite framework to guide urban governance in the city's green transformation including standards, guidelines and regulations as well as legislation, which will be implemented by Sarajevo Canton Administration.
	Capital investment: feasibility, planning, design, piloting: detailed studies including initial designs of GCAP Actions as well as preliminary phases of piloting which will provide front end feasibility and planning, to assess in further detail the viability of subsequent/follow on actions and will act as a lead into major capital investment.
	Capital investment: implementation – improving existing: actions which involve direct investment in existing infrastructure, assets (for example, rolling stock) and technologies (for example, web applications). This includes upgrading of infrastructure as applicable.
	Capital investment: implementation – new: actions which involve direct investment in new infrastructure, assets (for example, new wastewater treatment plant) and technologies (for example, web applications).
	Awareness raising: public awareness initiatives which include public information campaigns, community projects and engagement with local businesses to deliver local improvements to the environment.
	Training, capacity building: Capacity building initiatives relate to actions which enable the City Administration and other formal actors to improve access to information, to build skills and knowledge and to improve decision making and management processes.

The structure of each sub-section in this chapter is detailed below.

Firstly, short-term actions are presented in tabular format, in relation to the GCAP framework, identifying their contribution to strategic objectives This is visualised according to the colour coding presented in Table 5-4. Key information on each action is stated, including implementation timeframe, cost estimates and action owner. Priority actions are clearly indicated and are grouped at the top of each table, followed by the additional actions.

Table 5-4 - Colour coding of the performance of actions against strategic objectives

High performance against strategic objective	Medium performance against strategic objective	Low performance against strategic objective	No performance against strategic objective
3	2	1	0

Secondly, a programme is presented for each sector indicating the action programme sequencing, as well as linkages between actions. The sector programmes focus on the GCAP's short-term implementation phase from 2020 to 2025 as this is the first phase of the GCAP cycle.

Thirdly, detailed action proformas for each action are presented. Each action proforma contains the following information:

- Sector, action reference number; and indication if the action is smart,
- Action title;
- Action description;
- Action benefits: focus on socio-economic benefits which were identified in the technical assessment stage of the action prioritisation process outlined in Chapter 2;
- Current baseline: listing which key state and pressure indicators from the indicator database the respective action links to, along with whether each is currently benchmarked 'red,' 'amber' or 'green.' Indicators listed only include those which have been presented in the technical assessment report and outlined in Appendix D also features an overview of the indicator codes;
- Performance against strategic objectives: listing all strategic objectives an action is linked to and indicating the extend of the action contribution towards the achievement of each connected strategic objective using the colour coding presented in Table 5-4;
- Action CAPEX and OPEX in Euro (EUR) and Bosnian Convertible Mark (BAM)[19]; and
- Action implementation start and end year.

[19] A conversion rate of 1.95583 has been used to convert costs in EUR to BAM.

5.4. Land use

5.4.1. Key challenges and gaps

The Sarajevo Canton (SC) is comprised of nine municipalities of which four form the core of Sarajevo. The municipalities of Centar, Novi Grad, Novo Sarajevo and Stari Grad are considered the City of Sarajevo, while Vogosca and Ilidza have a more suburban character. Ilijaš, Trnovo and Hadžići are satellite settlements, mainly for people commuting to the core. Trnovo has a relatively small number of inhabitants and is focused on tourism, sports and recreation (Bjelašnica and Igman mountains are within the territory of this municipality). About 70% of the SC's population live within the urban municipalities.

The average population density of the built-up area of the Canton is 1,580 residents / km^2, which is regulated by spatial planning legislation, the urban plan, detailed spatial plans and planning regulations, but nevertheless benchmarked as "red". The average commuting distance and time is 2.8 km within the City of Sarajevo (municipalities of Stari Grad, Centar, Novo Sarajevo and Novi Grad) and 9.6 km for the remaining Cantonal municipalities (Vogosca, Ilidza, Hadzici, Ilijas and Trnovo). The average commuting time is 10 to 15 minutes within the City of Sarajevo and more than 30 minutes for the remaining municipalities (based on 2003 data).

Although SC seems very green as it includes rural areas and four protected natural areas, the provision of green public areas in SC is relatively poor, especially in urban areas where green areas are relatively limited and also not easily accessible to all citizens. The provision of green areas is therefore insufficient and the network of green and blue infrastructure that exists is disconnected. Other opportunities to improve green spaces include addressing the fact that littering on green open spaces is not penalised.

There is a lack of information regarding the growth of built-up areas, which is not subject to robust data collection or monitoring. This is exacerbated by factors including illegal construction that takes place in the SC and a lack of planning guidance, tools and related capacity. Consequences include sporadic land-use development, which combined with the illegal construction has contributed towards urban sprawl and landslides.

5.4.2. Current initiatives

The SC already has numerous key policy documents, plans and strategies at the Federal, Cantonal and city/municipal level that guide the land use sector in the SC and have been taken into account in developing GCAP actions and in relation to proposals for their implementation. These are:

- Federal development strategy 2010-2020;
- Sarajevo Canton Spatial Plan for the period 2003 - 2023;
- Phase "A" Sarajevo Canton Spatial Plan Amendments for the period 2003 - 2023;
- Phase "B" Sarajevo Canton Spatial Plan Amendments for the period 2003 - 2023;
- Development Strategy of Sarajevo Canton until 2020 and Development Strategy of Sarajevo Canton until 2020- Implementation Action Plan 2018 - 2020;
- Environmental Protection Plan for Sarajevo Canton for the period 2017 - 2022 (KEAP);
- Urban Plan for Sarajevo Urban Area for the period 1986 - 2015 (in the process of being updated).
- Development Strategy for City of Sarajevo 2022;
- Regulation Plans/Urban Projects for urban area of Sarajevo;
- Development strategies for nine municipalities in SC, and;
- Local Environmental Action Plans (LEAPs) for 9 municipalities in SC.

5.4.3. Short-term actions

Seven land use actions were developed for the SC in the GCAP process; four actions were prioritised. These actions are featured in Table 5-5 alongside the owner of each action, their estimated cost, timeline for implementation and contribution towards strategic objectives.

The land use actions collectively contribute towards achieving all strategic objectives, but the strongest correlation is with the green space and biodiversity and ecosystems objectives. The actions address the challenges summarised above, with one of the first action to be implemented focusing on increasing the evidence base about existing land use in the SC. It will upgrade and enhance an integrated GIS regarding land use in the SC, which will

include a digital inventory of fauna and fungi. It will also be used to establish a monitoring and evaluation system for land use outcomes, which will provide information regarding any gain or loss of biodiversity, impacts from human activities and urban development, deforestation and afforestation rates.

The other five actions will also strengthen the SC's spatial planning framework. These measures include the development, adoption and implementation of the four urban plans in the area of SC which include the Urban Plan for the City of Sarajevo, , the Urban Plan for the Urban Area of Hadžići, the Urban Plan for the Urban Area of Ilijaš and the Urban Plan for the Urban Area of Trnovo. These updates will ensure that core sustainability principles are adopted and will include sectoral strategies for the provision of good quality green public areas, green and blue infrastructure and public realm. These plans will promote standards for green infrastructure, which will be complemented by those developed under other priority actions such as the introduction of environmental and building code regulations and guidelines, which will align with EU requirements.

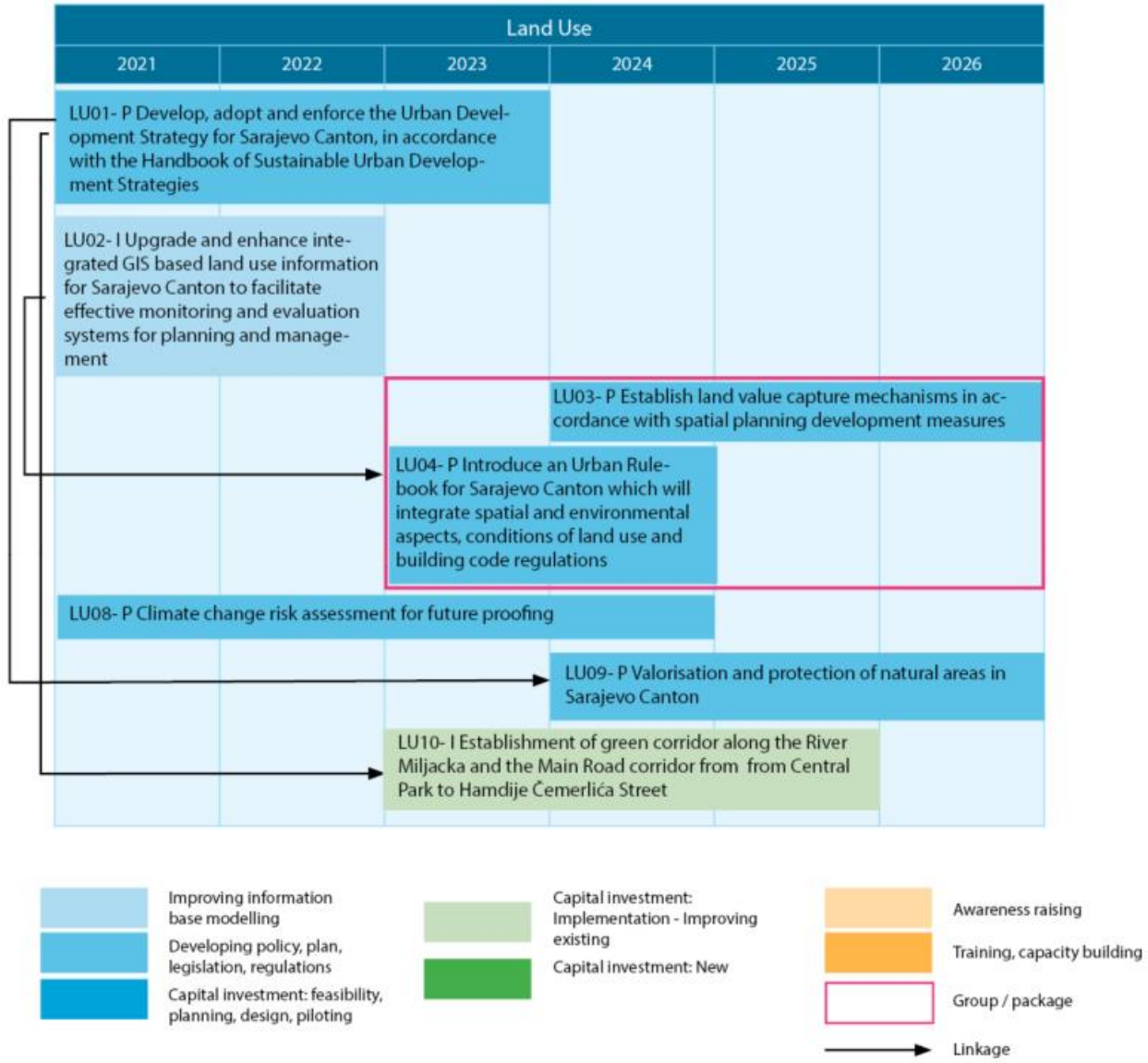
Other short-term actions have also been developed to address urban sprawl and illegal construction, including the establishment of fiscal instruments to disincentivise urban sprawl and illegal construction, notably the introduction of land value capture mechanisms.

In response to concerns regarding climate and natural disaster vulnerability, the SC has developed a risk and vulnerability assessment based on historical climate data and another priority action ('climate change risk assessment to future proofing') is to update this vulnerability assessment. This action extends to conducting feasibility studies for the upgrade of infrastructure that is identified as not being future proofed, and to developing guidelines to help identify and manage future risks posed by climate change, extreme weather and other environmental emergencies. The last two actions are related to, development of a sustainable management plan for areas of outstanding natural value in SC and development of green corridors along Milijacka River and main roads, to protect and enhance SC's landscape, habitat, flora and fauna and to provide green areas within the urban fabric. More widely, any climate change risk assessment to future proofing will require multi-disciplinary collaboration to address all infrastructure sectors.

Table 5-5 - Land use actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Policy Option / Action Owner	CAPEX (EUR / BAM)	OPEX (Annual) (EUR / BAM)	Timeline	Smart Action	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
LU02 – I	Upgrade and enhance integrated Geographic Information System (GIS) based land use for Sarajevo Canton to facilitate effective monitoring and evaluation systems for planning and management	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC	EUR 1,000,000 BAM 1,955,830	EUR 18,000 BAM 35,205	2021 – 2022	Y	1	1	1	2	1	1	2	1	1
LU08 – P	Climate change risk assessment to future proofing	Ministry of Communal Affairs and Infrastructure, Civil Protection of Sarajevo Canton, Ministry of Physical Planning, Construction and Environmental Protection	EUR 1,225,000 BAM 2,395,892	EUR 1,000 BAM 1,956	2021 – 2024		0	1	2	1	3	0	2	2	3
LU09 – P	Valorisation and protection of natural areas of SC	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Institute for the Protection of the Cultural, Historical and Natural Heritage of Sarajevo	EUR 450,000 BAM 880,124	EUR 65,000 BAM 127,129	2024 – 2026		1	0	1	1	3	0	3	3	1
LU10 – I	Establishment of green corridor along the River Miljacka and the Main Road corridor from Central Park to Hamdije Čemerlića Street	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Communal PE Park	EUR 500,000 BAM 977,915	EUR 50,000 BAM 97,792	2023 – 2025		3	0	0	0	3	0	2	2	2
Additional actions															
LU01 – P	Develop, adopt and enforce the Sarajevo Canton Long-Term Urban Development Strategy until 2040, in accordance with the Handbook of Sustainable Urban Development Strategies	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC	EUR 600,000 BAM 1,173,498	EUR 0 BAM 0	2021 – 2023	Y	2	1	2	2	2	2	3	2	2
LU03 – P	Establish land value capture mechanisms in accordance with spatial planning development measures	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy	EUR 100,000 BAM 195,583	EUR 0 BAM 0	2024 – 2026		0	0	0	1	0	0	0	0	1
LU04 – P	Introduce an Urban Rulebook for Sarajevo Canton which will integrate spatial and environmental aspects, conditions of land use, and building code regulations	Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC	EUR 1500,000 BAM 293,375	EUR 1,500 BAM 2,934	2023 – 2024		2	1	2	2	2	2	2	2	3

Figure 5-1 - Land use sector actions programme



Land Use LU02 - I	Smart

Upgrade and enhance integrated GIS based land use information for Sarajevo Canton to facilitate effective monitoring and evaluation systems for planning and management

Description

The legal basis for this action is Article 78 of the Decree on “uniform methodology for creating spatial planning documentation” (Official Gazette of FBiH no. 63/04 and 50/07). Geographic Information System (GIS) are mandatory in FBiH for the purpose of creating a database and to compare data to neighbouring states. The framework for this policy is Strategic Measure 5.2.3. Monitoring of development indicators in SC is aligned with EU policy and the Development Strategy of Sarajevo Canton until 2020 (2016).

There is a lack of integrated GIS based land use information for SC that considers cadastral information, land register, biodiversity and ecosystems, heritage assets, environmental and natural features, building/planning permissions, utility infrastructure, community assets, transport infrastructure, etc. This negatively affects inter-sectoral coordination and land use procedures. There is also a lack of a register and monitoring system of protected areas, biodiversity, endemic species, impacts of urban development on flora and fauna, number of visitors, accommodation capacities, status of flora and fauna in SC, and also a lack of a register of green public areas in the Canton.

The idea is to create a single database in GIS for the entire Sarajevo Canton, including all cantonal institutions involved in spatial planning processes and cantonal municipalities. A user-friendly GIS database should comprise a number of layers with different spatial information content. The system should consist of land use types, land ownership (private, public, community), green infrastructure, transport, utilities, hydrology, contaminated land sites, community and public facilities, protected ecological sites, biodiversity hotspots, heritage buildings, historic conservation areas, forests, fertile/agricultural areas, topography (contours), areas prone to landslides, floods, etc. The GIS system will facilitate high quality monitoring of basic climate elements and help define climate trends. The digitisation process and development of the GIS could be a common activity of the Canton Administration departments in cooperation with universities, statutory bodies, utility companies and NGOs. After development, the GIS could later be made available online for public accessibility, which will help citizens and potential developers to identify development constraints and opportunities early.

This GIS database should also include a digital inventory system of flora, fauna and fungi, including identification of habitat types, natural protected areas and green open spaces with the aim to monitor the status of biodiversity (gain or loss), impacts from human activities and urban development, deforestation and afforestation rates. The database should include information about visitors, capacity and occupancy rates of facilities within natural protected areas and natural parks within SC.

GIS should be upgraded to establish systems of monitoring and evaluation of land use outcomes (spatial planning documentation preparation, drafting and implementation; inspection activities) available for all spatial planning stakeholders to encourage intersectoral coordination. All stakeholders should be involved in capacity building.

A register of land use outcomes monitoring, and evaluation systems, can be created in order to be able to follow land use policies’ implementation and to encourage intersectoral coordination and continuous improvement of land use policies.

Preconditions will be created for more transparent urban planning; data will be available to the general public. After its establishment and implementation, the registry in GIS should made be available to the public.

Benefits

- Facilitate better cooperation among institutions and provide an integrated database on land use, utilities and transport infrastructure, natural environment and historic assets as well as on planning documentation and procedures.

- Once data have been digitised, they can be used for many purposes, be processed very quickly and can be used by multiple users at once. It will become an effective holistic tool for urban planning in the Canton, facilitating evaluation and monitoring, research activities and analysis as selected layers can be overlain and help with analysis of urban development features, multi-criteria analysis or reveal unexpected correlations.
- This system will be more accessible to more users, allowing for easier search and orientation, and could allow for greater cost savings for the Canton Administration.
- An integrated GIS based land use system will also enhance and facilitate effective monitoring and evaluation.
- A unified register and monitoring system of biodiversity, protected areas and green public areas in Sarajevo Canton will provide information on the status of endemic and endangered species, pressures from human activities, as well as impacts of urban development on flora and fauna, and will facilitate integrated land use planning and enhance biodiversity and environmental protection.
- Regular updates and control of data will allow closer monitoring of urban-technical conditions, such as construction coefficients and share of green spaces.
- Opportunities for increased employment.
- Improved public health, access to services and public safety through more cohesive planning and application of integrated spatial data.

Current Baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1, 9.2)

Pressure: land use (33, 33.3, 34), transport (11.2, 11.4, 11.5, 11.6)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR01 Improve efficiency of water use	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	2
GS01 Expand and improve provision of high quality, accessible green spaces	1
GH01 Reduce GHG emissions	1
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity across Sarajevo Canton	2
BE02 Reduce the impact of human activities on biodiversity	1
AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021 – 2022
EUR 1,000,000 BAM 1,995,830	EUR 18,000 BAM 35,205	Cantonal budget, IFI and donors	

Notes on cost estimates: The estimated CAPEX includes the development of a GIS strategy based on data collection for multiple sectors, creation of online database and web portal, training sessions, and creation of inventory of biodiversity to facilitate effective monitoring and evaluation. Existing digital databases will be used and updated to the new geoportal. The CAPEX excludes GIS software license and computers for nine municipalities as it is assumed the Canton Administration has already obtained necessary licenses, permits and computers. The OPEX is required for IT services, maintenance, labour, and regular data updates for effective continued operation.

Owner Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC	**Stakeholders** Cantonal Institute for Construction, Cantonal Institute for Cultural and Natural Heritage, Canton public institution for protected areas, CPUC Park (Canton Public Communal Enterprise "Park"), JKP Komunalac Hadzici, JKP Trnovo, SC Direction for roads, CPUC Vodovod I kanalizacija, CPUC Rad, CPUC Sarajevogas, JP Elektroprivreda BIH, nine municipalities within SC

Land Use LU08 - P
Climate change risk assessment for future proofing
Description The Canton has been looking at flooding issues and investing in flood defence infrastructure. Future proofing should cover all infrastructure sectors – transport, energy, waste, water and sanitation and community infrastructure. There is a lack of contingency or emergency management plans in case of an emergency or disaster in SC for certain sectors. Currently, due to uncontrolled urban sprawl, infrastructure delivery is not coordinated with construction in Sarajevo Canton (SC), which increases the risk from natural disasters, as well as endangering human health and quality of life. Future proofing cities takes into account resilience to natural disasters and extreme weather, risk management of uncontrolled urban sprawl, as well as adaptability to required changes in structure and / or operations of infrastructure, including urban heat island effects. Future proofing cities principles and actions should be mainstreamed in spatial planning documentation and infrastructure delivery. The SC Spatial Plan should be amended to enable effective delivery of future proofed infrastructure to help achieve a more resilient Canton. The SC has developed a risk and vulnerability assessment based on historical climate data. However, the risk and vulnerability assessment need to be updated to include climate change projections and future risk to identify areas and assets at significant risk of hazards, vulnerabilities and capacity to cope under uncertain conditions such as extreme weather, natural disaster, environmental emergencies, uncontrolled urban sprawl etc. This multi-sectoral risk assessment should involve engineers, scientists, planners, economists and environmentalists to discuss in an integrated way what the potential risks are, what / where the vulnerabilities are, and what measures are needed to effectively respond to and manage the identified risks / vulnerabilities. The assessment should also identify potential funding sources for climate action and future proofed infrastructure; incentivise investment in green and blue infrastructure, SuDS and flood risk management; control construction potentially contributing to land degradation, etc. It is recommended that Sarajevo Canton take up an active membership of resilient city networks and initiatives. The multi-sectoral risk assessment will identify infrastructure that is not future proofed. Feasibility studies should be undertaken to upgrade this infrastructure to ensure it addresses future climate change. Pilot projects are recommended to showcase the benefits of addressing climate change risk. Similarly, guidelines should be developed for policy makers and local authorities to help identify and manage future risks from climate change, extreme weather, environmental emergencies, etc. when delivering infrastructure, developing planning and management tools or developing procurement documents. Development of awareness campaigns is recommended for the general public to understand the implications of climate change, and what to do in case of a disaster and/or an emergency.
Benefits • The framework for this policy is the Sarajevo Canton Spatial Plan for the period 2003 – 2023 (Sarajevo Canton Official Gazette no. 26/06, 4/11, 22/17). • Climate change will have serious impacts on the canton and the municipalities. Future proofing and resilience and resilience is essential to urban policy and a smart investment. Achieving a future proofed canton will help to alleviate floods, landslides and general risk from natural disaster / emergency, as well as protect biodiversity, ecosystems and natural areas. Many cities / regions are already beginning to build resilience in response to emerging threats associated with climate change. The strategies they are adopting often lead to win-win outcomes, making them healthier, more attractive places to live, do business and visit. • The cost of delivering future proofed infrastructure could initially be seen as very high and probably unaffordable for the Canton. But these costs are likely to be lower than the costs of retrofit and recovering after a disaster. • Long term economic benefits through growth, returns, employment and inclusion.

- Social benefits including improved access to services, safety and gender equality.

Current baseline

State: water (2), soils (4.1b), green spaces (6 , 6.1), mitigation of GHG emissions (8 , 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1, 9.2)

Pressure: land use (33, 33.3, 34), water (28), transport (13.1), energy (24)

Environmental performance (alignment with GCAP objectives)

WR01 Improve efficiency of water use	1
WR02 Maintain and improve surface water and groundwater quality	2
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	3
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity	2
BE02 Reduce the impact of human activities on biodiversity	2
AR01 Improve resilience to climate change and other natural disasters	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021 -2024
EUR 1,225,000 BAM 2,395,892	EUR 1,000 BAM 1,956	Cantonal budget, IFI and donors	

Notes on cost estimates: The total EUR 1,225,000 CAPEX for future proofing is comprised of three sub sections of EUR 600,000 to update multi-sectoral risk assessment and management to consider climate change and future risks, EUR 375,000 feasibility studies to upgrade infrastructure (assuming five feasibility studies at 75,000 EUR delivered by local consultants), EUR 150,000 to develop guidelines and EUR 100,000 for awareness campaigns. The OPEX is required for enforcement of guidelines and sensitisation campaigns if necessary.

Owner	**Stakeholders**
Ministry of Communal Affairs and Infrastructure, Civil Protection of Sarajevo Canton	Sarajevo Canton Administration, Municipalities

Land Use LU09 - P

Valorisation and protection of natural areas of SC

Description

The legal framework for this measure is the Spatial Plan of the Canton of Sarajevo for the period 2003-2023 (Official Gazette of the Canton of Sarajevo, No. 26/06, 4/11, 22/17), which identifies areas with special features, and the obligation to draw up planning documentation for development of these areas.

Sarajevo Canton has a rich and valuable natural heritage that is continuously explored and recorded, either separately or for the purpose of targeted spatial planning documentation, with a view to its more effective and expedient protection and conservation.

Natural heritage consists of natural landscapes and natural values as parts of nature of special scientific, educational, cultural and environmental, protective, recreational and other social significance, which enjoy special protection as goods of public interest.

For several natural areas, up-to-date evaluation was carried out in order to determine an adequate category, and to adopt a legal act declaring the area protected. The areas of Skakavac (valorisation of natural values made in 2000), Bentbasa (1999), Bijambare (2001), Vrelo Bosne (2005), Trebević (2014) have been classified as areas of distinctive natural beauty which have restricted uses and controls and therefore there are more adequate for protection.

The valorisation of the area of Igman and Bjelasnica (1998/1999) with a nominated II value category (national park) did not result in an act of protection, but the adoption of the Decision on the designation of Igman, Bjelasnica, Treskavica and Rakitnica Canyon (Visocica) as an area of special features and of importance for Federation of BiH. By the end of 2020, the process of valorisation and adoption of the Law on Designation of Protected Areas under the UNDP project will be completed.

The Spatial Plan of Sarajevo Canton identifies the following areas of significant natural characteristics that need to be valorised and protected:

- The natural area Bjelašnica, Rakitinica, Visočica and Treskavica, of national importance, with an area of 14,180 ha, lying within the municipalities of Hadžići and Trnovo.
- The natural area Bjelašnica and Igman, of importance for Sarajevo Canton, with an area of 19,233 ha, lying within the municipalities of Hadžići, Trnovo and Ilidža. It covers the northern part of Bjelašnica and Igman to the borders of the urban area and the protected area of Vrelo Bosne.
- The natural area Ozren, with an area of7,166 ha, lying within the municipalities of Ilijaš, Stari Grad, Centar and Vogošća.
- Skakavac natural monument, an area of 1,430 ha. Protected under the Law on the Proclamation of the wider area of Skakavac waterfall as a natural monument (Official Gazette of the Sarajevo Canton, No. 10/02 and 11/10), within the Spatial Plan of the Special Area of Natural Heritage "Skakavac Waterfall", and the Official Gazette of Sarajevo Canton no. 32/09 and Management Plan - Official Gazette of Sarajevo Canton no. 18/11.
- Natural monument Vrelo Bosne, with an area 631 ha. Protected under the Law on Proclamation of Natural Monuments "Vrelo Bosne" Official Gazette of Sarajevo Canton ", No. 16/06, (36/09 and 06/10 - Consolidated text) and Management Plan -" Official Gazette of Sarajevo Canton ", No. 25/07.

- The natural area of Zvijezda, with an area of 2,580 ha, which covers part of the mountain of the same name in the neighbouring canton. It covers the northern part of the Nisica plateau.
- Protected landscape of Bijambare, with an area of 497 ha. Protected under the Law on Proclamation of Protected Landscape Bijambare (newspaper of the Canton of Sarajevo, No. 21/02 and 36/09 (06/10 - Consolidated text)), and the Spatial Plan of the Area of Special Features Protected Landscape Bijambare (Official Gazette of the Canton of Sarajevo, No. 23/09 and Management Plan -Official Gazette of Sarajevo Canton , No. 35/08).
- Natural area Debelo Brdo, with an area of 1,824 ha.
- Protected landscape Trebevic, with an area of 400 ha. Protected under Law on the Proclamation of the Protected Landscape Trebević (Official Gazette of Sarajevo Canton, No. 15/14, Official Gazette of Sarajevo Canton, No. 23/17).
- Natural area of Jahorina, with an area of 1,478 ha.
- Natural area of Bentbaš, with an area of 160 ha. The natural ensemble of Bentbaš was declared a Protected Landscape in 2017 (Official Gazette of Sarajevo CantonNo. 31/17).
- Natural area Podlipnik, with an area of 1,327 ha.
- Natural area Čemerska planina, with an area of 1,674 ha.

It is therefore necessary to develop the spatial plans of areas of special features. These plans should follow the results of an audit and evaluation of natural areas, the laws on protection of ecological areas, and preparation of wider planning documentation for:

- Natural Monument: Vrelo Bosne.
- Natural areas: Bjelašnica and Igman, Cemerska planina, Podlipnik, Debelo brdo, Ozren, Zvijezda, Jahorina, Misoča, Bentbaša.

Additionally, a number of specific natural value areas were recorded, of which 22 were geomorphological, 25 hydrological, 2 dendrological and 12 parks and alleys.

The cantonal institution responsible for the protection of cultural, historical and natural heritage, should review and assess the plans for these natural areas within four years of the adoption of the Amendments to the Plan. This should take into account their natural and other values, determine the necessary treatment and measures, and the respective protection regime. The result of this valorisation and protection study should also assess the possibility of declaring certain areas as protected thanks to its special ecological and natural values.

- For each area designated as an area of special natural values, an expert explanation for the proclamation of protection is prepared in accordance with the Federal Law on Natural Protection, which represents the basis for the preparation and adoption of regulations. After the enactment and proclamation of the law, a management plan and a spatial plan for the areas of special natural features will be adopted

Benefits

Increasing the percentage of protected areas, preserving biodiversity, raising the quality of life, developing ecosystem services.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6 , 6.1), mitigation of GHG emissions (8 , 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9 , 9.1, 9.2)
Pressure: land use (33, 34),

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	3
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	3
BE02 Reduce the impact of human activities on biodiversity	3

	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2024-2026
EUR 450,000 BAM 880,124	EUR 65,000 BAM 127,129	Cantonal budget, IFI and donors	

Notes on cost estimates: The total EUR 450,000 CAPEX for valorisation and protection, based in EUR 50,000 per area of outstanding natural values for set of three documents, there are nine areas of outstanding natural value within the SC. The OPEX is required to employ full time six park rangers and/or guides for specific events.

Owner	**Stakeholders**
Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Institute for the Protection of the Cultural, Historical and Natural Heritage of Sarajevo	Public enterprise for protected areas, Development Planning Institute of SC, municipalities etc.

Land Use LU10 - I

Establishment of green corridor along the River Miljacka and the Main Road corridor from Central Park to Hamdije Čemerlića Street

Description

Urban greenery comprises all the green areas within the urban fabric which have come to form part of said fabric on account of a projected transformation of the space, and in turn this greenery (largely consisting of parks and gardens), along with the natural and agricultural areas, forms the green infrastructure .The presence of flora and fauna in the city provides many benefits to its inhabitants. Beside habitat and biological quality, the green corridors can improve the environmental quality by improving acoustic comfort, climate comfort and air quality

Problems such as air pollution, noise and temperature are mitigated by the effect of vegetation in urban areas, as well as the fact that these corridors promote mobility by soft ways such are bicycle lines and/or walking corridors. If adequately designed, green corridors can improve urban ventilation, allowing for cooler air from outside to penetrate into the more densely built areas, and thus reducing the urban heat island effect.

Two main ventilation corridors are identified by the Study on Ventilation Corridors and Impact of Highrise Buildings. River Miljacka and the Main Road Corridors. The Ventilation Corridor “Main Road” is formed along the main road connecting the eastern and western parts of the city. The corridor extends from Marijin Dvor to the east and ends at the Stupske Petlje location to the west. The green corridor will be built along the right side of Main Road Corridor by upgrading and connecting an existing green areas and parks. The green corridor will cover:

- Right side of the corridor Main Road, from Veliki Park - Mali Park-Hastahana Park, greening of the city yards along the streets Dolina, Fra Angel Zvizdovic and King Tvrtko and revitalisation of the green area of the University Campus from Halid Kajtaz Street to Hamdija Čemerlić Street, i.e. the area between the Northern Longitudinal and the Main Road..
- Revitalisation and greening of the square in front of the train station and the BH Post building.
- Preservation of existing park areas and greening of squares in the area bounded by the streets of Zmaja from Bosnia and Kolodvorska on the one hand, and Lozionicka and Hamdija Čemerlić on the other.
- These areas may also coincide with areas where new sewer interceptors need to be built and may be designed as active runoff and stormwater management features by the incorporation of SuDs systems.

Benefits

New green public spaces and public realm will provide a benefit to residents and visitors. New green infrastructure and corridors will provide positive environmental and ecological benefits in line with the GCAP. Best practices should be promoted in the creation of open space standards and urban planning.

Establishing a network of green spaces with good quality public realm easily accessible by all and connected with SC mountains and protected natural areas will not only benefit biodiversity and wildlife but also human wellbeing and better public health. Inclusion.

Current baseline

State: air quality (1.1, 1.2), water (2), green spaces (6 , 6.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9 , 9.1, 9.2)
Pressure: land use (33, 34),

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	3
GS01 Expand and improve provision of high quality, accessible green spaces	3
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity	2
BE02 Reduce the impact of human activities on biodiversity	2
AR01 Improve resilience to climate change and other natural disasters	2

CAPEX	OPEX	Potential funding options	Start/end year 2023-2025
EUR 500,000 BAM 977,915	EUR 50,000 BAM 97,792	Cantonal budget, IFI and donors	
Notes on cost estimates: The estimated CAPEX of EUR 500,000 is for the establishment of a green corridor to cover planting and construction activities, and project documentation. The OPEX is estimated at 10% of CAPEX at EUR 50,000 required for upkeep and maintenance of the corridors and green spaces.			
Owner Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Communal PE Park		**Stakeholders** Cantonal Agency for Protection of Cultural-Historical and Natural Values, Agency for Planning of Development for SC, Public Enterprise for Protected Areas, Municipalities, Local Communities.	

5.5. Sustainable transport

5.5.1. Key challenges and gaps

Air quality problems are directly linked to several populated pressure indicators, including those related to transport and energy. The average age of the vehicle fleet is 16 years, the proportion of diesel cars is 50%, and the engine standard for imported vehicles is Euro 4. Thus, all three indicators are benchmarked as “red”. According to available statistics, the share of the total passenger car fleet powered by electric, hybrid, fuel cell or LPG/CNG fuelled engines is about 2%. Thus, this indicator is benchmarked as “yellow”. The motorisation rate in SC is 0.34 and the average number of vehicles per household is 0.7, resulting in both indicators being benchmarked as “yellow”. Although significant progress has been made in recent years on cycle path construction, the total length (6.8 km per 100,000 population) is still below the “green” benchmark of 25 kms.

The need to manage private car use is reflected in the average travel speed on primary thoroughfares during peak hours. This is currently below 30 km/hour, which has resulted in the associated indicator being benchmarked as “yellow”.

A key challenge in reducing the negative environmental impact of the transport sector is the inadequacy of public transport provision in SC. The provision of bus and rail services is insufficient and with only 6 kms of road dedicated exclusively to public transport per 100,000 population the associated indicator is benchmarked as “red”. Public transport service provision will need to be enhanced to reduce the high modal share of the car in SC, particularly in sub-urban areas although the same limitations apply to public transport in urban areas. In order to enhance provision tramlines, need to be reconstructed and new trams, buses and trolleys need to be procured. Most public transport vehicles have been donated to Sarajevo as part of rehabilitation after the war (1992 to 1996), and these now need to be replaced with more modern and higher quality vehicles.

Insufficient public transport provision is a consequence of poor management and obsolete fleet and associated infrastructure. The extension and improvement of public transport has been scoped and planned, including as part of the traffic study for SC, but it has not been accompanied by the investment needed for implementation.

The KEAP foresees the preparation of project technical documentation for the reconstruction of the tram line in the Canton and for the reconstruction of the trolleybus infrastructure on the Sarajevo-Vogosca line. Tenders for the construction of a tram line from Ilidza to Hrasnica and for the reconstruction of the tram line from Ilidza to Marijin Dvor were published in October 2018. However, activities relating to the construction and reconstruction of the aforementioned tram and trolleybus infrastructure have not yet started. In April 2019, the Ministry for Transport of Sarajevo Canton acquired seven used trolleybuses to be used by the public company GRAS in order to improve capacity. Additional new trolleybuses and minibuses are planned to be acquired over the next several months. These activities are in line with planned activities in the KEAP on the renewal of the fleet for public transport. No significant activities have, however, been planned to promote the use of public transport. In terms of the promotion of NMT there is a plan to extend cycle paths and a few activities have been implemented by NGOs, including a small-scale pilot project for a bike sharing scheme.

The KEAP identified the need to establish a Traffic Control and Regulation Centre, including the introduction of Intelligent Transportation System (ITS) technology, smart traffic congestion and automatic control of traffic lights in Sarajevo Canton. However, these activities have not yet been implemented.

In terms of the energy efficiency of vehicles, in 2016 the BiH Council of Ministers stipulated that vehicles meeting Euro 4 standard may be imported because energy efficient vehicles are not incentivised. This would have a negative impact on air quality and GHG emissions from the transport sector, which this GCAP seeks to reduce.

There are no policies for public transport emergency management nor regarding the climate and wider natural disaster resilience of public transport; thus the related response indicator is benchmarked as “red”.

5.5.2. Current initiatives

There are numerous transport sector initiatives in the SC with several having been introduced above. A key additional initiative is the Sustainable Urban Mobility Plan (SUMP) developed by the South East Europe Change Net

Foundation and funded by GIZ[20]. A SUMP is a plan that contributes towards the development of a sustainable urban transport system and specifically has the aim of improving accessibility across an urban area (and its hinterland) by providing high-quality and sustainable transport. The SUMP focuses on the transport sector but also considers other policy areas and the roles of different levels of government.

There are therefore strong synergies between the SUMP and the transport sector GCAP actions, such as provision and improvement of NMT facilities (alignment with TR07), establishment of low-emission public transport fleet and upgrade of public transport infrastructure (TR10 and TR11), smart traffic management centre (TR13), awareness campaigns (TR05), data collection on transport modes and monitoring of emissions (TR01), development of design guidelines (TR08), reconstruction of tram tracks (TR15) and restricted car zone areas and pedestrian areas (TR12). There are also synergies with land use sector GCAP actions, including integrated land use and planning regulations with transport mobility (LU01 and LU04), disaster risk management (LU08), and greening city parks and squares (LU10).

5.5.3. Short-term actions

Sixteen transport sector GCAP actions were developed and six were prioritised. These are listed in Table 5-6 They will all contribute towards improving air quality and controlling SC's GHG emissions.

The actions include to enhance understanding about the SC's transport sector, specifically by developing a Canton-wide data collection programme and transport model. This can be used to underpin and inform all other transport sector actions, which comprise an integrated package of complementary infrastructure, policy and planning measures that are collectively designed to reduce the high modal share of the private car and to reduce the per passenger energy and emissions intensity of all modes of transport. They aim to do so by increasing the relative attractiveness and viability of walking, cycling and public transport and by increasing the energy efficiency and emissions reduction of all modes.

GCAP actions include policy measures to pedestrianise areas of the city centre (and by doing so to restrict access by car). They also include fiscal actions, specifically developing pricing mechanisms to promote modal shift, including the introduction of a city centre congestion charging zone and low emission zone. Another policy action is to develop car parking management policies to manage car parking supply across the SC. The effectiveness of these measures will be enhanced by information measures, such as introducing promotional campaigns regarding the potential for, and benefits of, car sharing, walking and cycling, including cycle rental facilities in SC.

There is the potential to improve the planning framework for the transport sector, and an action to develop standards and guidelines for travel planning, parking and street design has been developed to contribute towards this process.

The other actions are all focused on either constructing new or improving existing infrastructure. They include two actions that will improve pedestrian and cycling infrastructure in the SC. These relate to the introduction of a city-wide pedestrian wayfinding signage network and dedicated cycle infrastructure, including parking and priority lanes. In terms of public transport, actions have been developed to upgrade bus stop infrastructure (including by providing real time information systems at bus stations and stops and by introducing park and ride facilities in the Canton) and improving the bus network infrastructure by introducing dedicated bus priority lanes and Bus Rapid Transit (BRT) routes. The availability and quality of public transport across the SC will also be improved by reconstructing tram tracks and developing new tracks, an action that will be informed by a feasibility study that will be conducted to explore opportunities for expanding the tram system.

In order to reduce the carbon intensity of the Canton's transport network, public sector vehicle fleets will be replaced with electric vehicles and electric vehicle charging infrastructure will be introduced to promote increased uptake of low emission vehicles by the public. The two related infrastructure actions will both contain policy elements to guide, incentivise and sustain this shift.

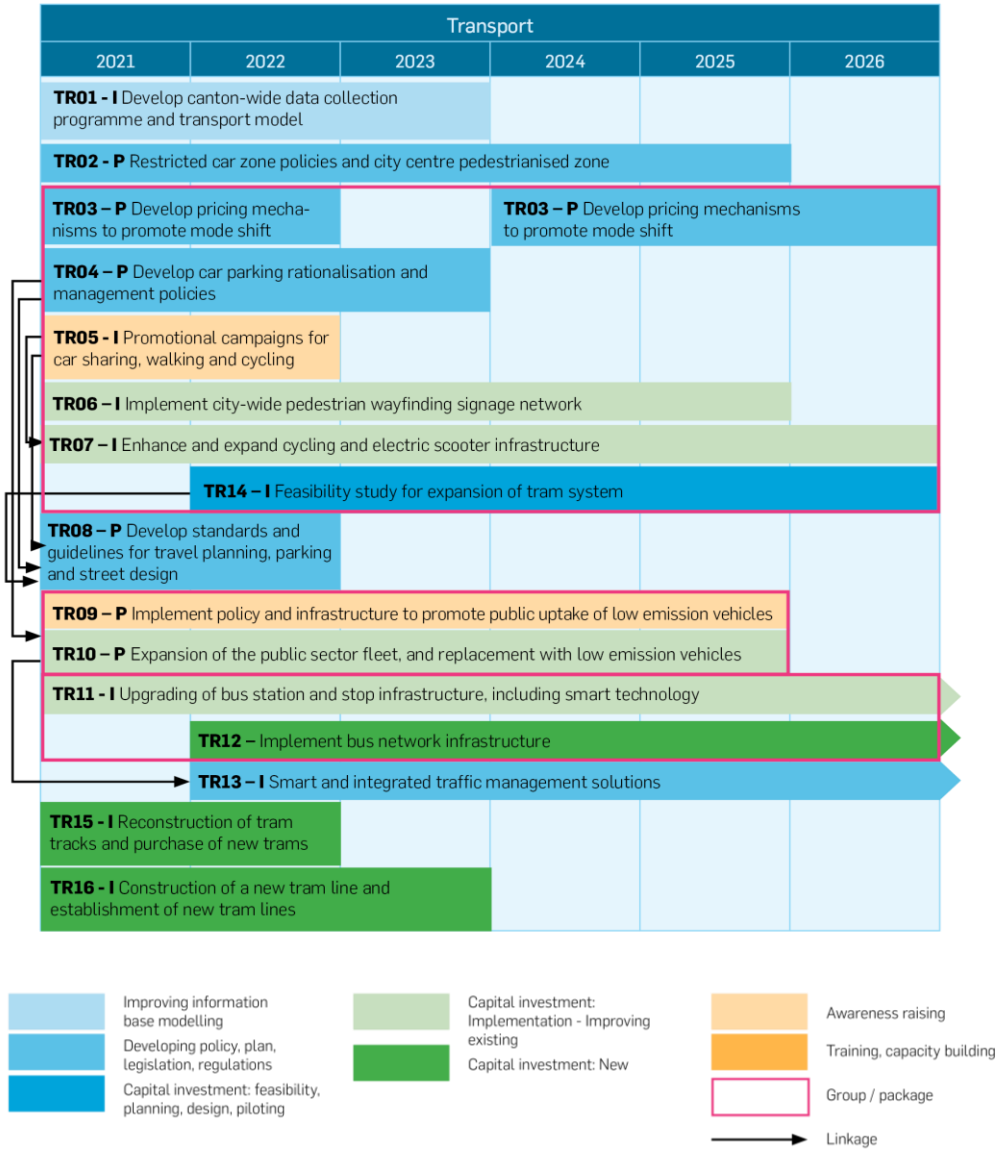
The last infrastructure measure relates to the improvement of the transport network as a whole. The action is to introduce smart and integrated traffic management solutions, which will include the establishment of a signalling system and control centre and High Occupancy Vehicle (HOV) lanes.

[20] Sustainable Urban Mobility Plan is available at https://ms.ks.gov.ba/sites/ms.ks.gov.ba/files/SUMP.pdf

Table 5-6 - Sustainable transport actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Policy Option / Action Owner	CAPEX	OPEX (Annual)	Timeline	Smart actions	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
TR07 - I	Enhance and expand cycling and electric scooter infrastructure	Ministry of Transport	EUR 5,300,000 BAM 10,365,899	EUR 265,000 BAM 518,295	2021 - 2026	Y	3	0	1	1	2	3	1	1	1
TR10 - P	Expansion of the public sector fleet, and replacement with low emission vehicles	Ministry of Transport	EUR 20,300,000 BAM 39,703,349	EUR 1,015,000 BAM 1,985,167	2021 - 2022 2022 - 2025	Y	3	0	0	0	0	3	0	0	0
TR11 - I	Upgrading of bus station and stop infrastructure, including smart technology	Ministry of Transport	EUR 8,000,000 BAM 15,646,640	EUR 400,000 BAM 782,332	Phase 1: 2021 - 2025 Phase 2: 2026 – 2030 2022 - 2025	Y	1	0	0	0	0	1	0	0	0
TR13 - I	Smart and Integrated Traffic Management Solutions	Ministry of Transport	EUR 3,500,000 BAM 6,845,405	EUR 350,000 BAM 684,541	2025 - 2030 2022 - 2023	Y	2	0	0	0	0	2	0	0	0
TR15 - I	Reconstruction of tram tracks and purchase of new trams	Ministry of Transport	EUR 50,000,000 BAM 97,791,500	EUR 5,000,000 BAM 9,779,150	2021 - 2022	Y	3	0	0	0	0	3	0	0	0
TR16 - I	Construction and establishment of new tram lines	Ministry of Transport, CPUC GRAS Sarajevo	EUR 25,000,000 BAM 48,895,750	EUR 2,500,000 BAM 4,889,575	2021-2023		3	0	0	0	0	3	0	0	0
Additional actions															
TR01 - I	Develop Canton-wide data collection programme and transport model	Ministry of Transport	EUR 3,200,000 BAM 6,258,656	EUR 120,000 BAM 234,700	2021 - 2023	Y	1	0	0	0	0	1	0	0	0
TR02 - P	Restricted car zone policies and city centre pedestrianised zone	Ministry of Transport	EUR 2,125,000 BAM 4,156,139	EUR 105,000 BAM 205,362	2021 - 2023 2021 - 2025		3	0	1	1	1	2	0	1	0
TR03 - P	Develop pricing mechanisms to promote mode shift	Ministry of Transport	EUR 10,500,000 BAM 20,536,215	EUR 2,005,000 BAM 3,921,439	2024 - 2026 2021 - 2022	Y	3	0	1	1	1	2	1	1	1
TR04 - P	Develop car parking rationalisation and management policies	Ministry of Transport	EUR 375,000 BAM 733,436	EUR 10,000 BAM 19,558	2021 - 2023	Y	2	0	1	1	1	2	1	1	0
TR05 - I	Promotional campaigns for car sharing, walking and cycling	Ministry of Transport	EUR 300,000 BAM 586,749	EUR 15,000 BAM 29,337	2021 - 2022		2	0	1	1	1	2	1	1	0
TR06 – I	Implement city-wide pedestrian wayfinding signage network	Ministry of Transport	EUR 400,000 BAM 782,332	EUR 20,000 BAM 39,117	2021 - 2025		3	0	1	2	3	3	1	2	2
TR08 - P	Develop standards and guidelines for travel planning, parking and street design	Ministry of Transport	EUR 500,000 BAM 977,915	EUR 30,000 BAM 58,675	2021 - 2022		1	0	1	1	2	1	1	1	1
TR09 - I	Implement infrastructure to promote public uptake of low emission vehicles	Ministry of Transport	EUR 2,700,000 BAM 5,280,741	EUR 135,000 BAM 264,037	2021 – 2022 2022 – 2025	Y	3	0	0	0	0	3	0	0	0
TR12 - I	Implement bus network infrastructure	Ministry of Transport	EUR 54,500,000 BAM 106,592,735	EUR 2,725,000 BAM 5,329,637	2022 - 2026 2026 - 2031		1	0	0	0	0	1	0	0	0
TR14 - I	Feasibility study for expansion of the tram system	Ministry of Transport	EUR 500,000 BAM 977,915	EUR 0 BAM 0	2022 - 2026	Y	2	0	0	0	0	2	0	0	0

Figure 5-2 - Sustainable transport actions programme



Transport TR07 - I	Smart

Enhance and expand cycling and electric scooter infrastructure

Description

Canton-wide cycleways

To encourage increased uptake of cycling and electric scooters (e-scooters) in Sarajevo, this proposal is to implement cycleways, kerb segregated where possible, to promote cycling and e-scooters throughout the Canton. Increasing the current cycling rate can have clear benefits for air quality, GHG emissions reduction and wider socio-economic benefits, including improved health and reduced congestion. Ensuring safety is paramount to encouraging cycling and e-scooters in urban areas. As such, the design of the cycle lanes should consider user experience, existing mix of traffic, safety, visibility and integration with key land uses. The routes would need to interface with critical sites such as the city centre bus station, train station, city centre attractions and workplace locations. This would build on existing cycle infrastructure projects at Wilson's promenade, Miljacka coastline on Grbavica and the shores of Mak Dizdara. The action proposes an additional 100 km of cycle lanes to be implemented throughout the Canton. A feasibility study should support this action, which is required to better understand current usage and demand for cycling and e-scooters across the Canton, which will help to identify key areas to invest in new or upgraded infrastructure. By the end of 2022, it is suggested that 50% of cycleways (50km) are implemented within the Canton.

Canton-wide cycle parking

An improved city-wide network of cycle routes needs to be supported by the installation of new cycle and scooter parking infrastructure. In line with international good practice, cycle/scooter facilities should be planned, designed and installed to ensure they are fit for purpose. This can include, amongst other things, that they are visible; accessible; safe and secure; durable; available and covered. New areas for cycle/scooter parking need to be located adjacent to the main cycle route network. In terms of parking space numbers, this is generally determined through local standards or regulations, as there is a significant variety in the number of spaces which can be provided within cities. For Sarajevo city, it is proposed that 50 cycle parking spaces are provided per kilometre of cycle route, which equates to approximately 5,000 additional cycle parking spaces in the city. This excludes any spaces which are privately installed, such as businesses, universities. By the end of 2022, it is suggested that 50% of cycle parking (2,500 spaces) is implemented within the Canton.

Supporting measures relating to bike hire are noted in the "Action plan for the reduction of particulate matter in the air in the Sarajevo Canton", which proposes the promotion of cycling through bike sharing whereby members of a club can hire a bicycle and return it to a predefined location. A feasibility study should support this action, which is required to better understand current usage and demand for cycling across the Canton, which will help to identify key areas to invest in new or upgraded infrastructure.

Benefits

- Promotes cycling and e-scooters.
- Improved overall city streetscape and infrastructure furniture.
- Reduced GHG emissions
- Opportunities for improved economic inclusion and employment
- Social benefits to public health, access to services and gender equality

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1)

Pressure: transport (11, 11.1, 11.2, 11.3, 11.5, 12, 12.1)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	3
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	2
GH01 Reduce GHG emissions	3
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
BE02 Reduce the impact of human activities on biodiversity	1
AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2026
EUR 5,300,000 BAM 10,365,899	EUR 265,000 BAM 518,295	Cantonal budget, IFI and donors, Private sector,	

Notes on cost estimate The CAPEX covers a feasibility study to understand and develop requirements and the creation of EUR 5,000,000 Canton-wide cycleways. It assumes a cycle lane cost of EUR 50,000 per kilometre (non-segregated) for up to 100km of cycle lanes based on the size of the city, with greater costs for segregation. The EUR 300,000 CAPEX for cycle parking is based on a cost of EUR 60 per stand with up to 5,000 stands could be provided, subject to projected cycle demand. Capital costs per metre of cycle lane and per cycle stand are aligned with amounts put forward for other regional plans, and assume minimal existing infrastructure as a baseline across the Canton. OPEX set for EUR 250,000 Canton-wide cycleways and EUR 15,000 Canton-wide cycle parking. Cycling infrastructure assumed to be 5% of CAPEX cost for repair and maintenance of assets based on design life of cycling infrastructure which has a design life of 15 years.

Owner	**Stakeholders**
Ministry of Transport	Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, citizens, Development Planning Institute of SC

Transport TR10 - I	Smart

Expansion of the public sector fleet, and replacement with low emission vehicles

Description

Renewal of the city vehicle fleet to electric vehicles

There is a drive and desire within Sarajevo to promote a shift from traditional gasoline powered vehicles to alternative, cleaner fuel sources, such as hybrid and electric. The promotion and use of cleaner alternatives are mentioned in the "Action plan for the reduction of particulate matter in the air in the Sarajevo Canton" but the actions are high level and not defined in detail. To drive forward and promote active take up of low emission vehicles, preferably electric by the general public and Canton commuters, it is proposed that the Canton Administration and other Canton stakeholders including public authorities, look to replace a proportion of their existing gasoline-based vehicle fleets with low emission vehicles, preferably electric vehicles (EV). Depending on the total size of the Canton vehicle fleet, it is proposed that up to 50 vehicles are replaced with electric alternatives.

Low / zero emission public transport services policy

The diesel fuelled bus fleet represents the primary source of PM_{10} and $PM_{2.5}$ emissions in Sarajevo. The policy is to set a regulatory framework to replace the existing diesel fuelled bus fleet with more fuel-efficient low emission vehicles, including hybrid biodiesel; biogas CNG (Compressed Natural Gas); electric; LPG (Liquified Petroleum Gas); and hydrogen. Alternative fuels are used in bus fleets throughout the continent and options exist for retrofitting of the existing fleet. The policy will, however, have a high cost-implication on the operators. To incentivise this change, the Canton Administration may need to subsidise part of the cost, and a phased approach to fleet renewal is recommended. Firstly, all new bus fleet vehicles purchased will be low emission (minimum Euro 6), while the existing fleet will be progressively replaced over 10 years. Supporting measures to ensure public sensitisation and stakeholder buy-in are crucial to adoption, while a review of best-practice in similar cities is needed to ensure that the implementation period, procurement agreements and technologies chosen are appropriate for Sarajevo.

Benefits

- Promotes a higher rate of uptake of low emission/electric vehicles.
- Encourages the use of alternative/new technologies.
- Canton Administration and stakeholder level promotion of low emission vehicles.
- Supports a change in public perception and attitudes towards low emission technology.
- Minor opportunities for economic returns, growth and employment.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	3
Pressure: transport (11.1, (10, 10.1, 10.2, 10.3)	GH01 Reduce GHG emissions	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year**
EUR 20,300,000	EUR 1,015,000		

BAM 39,703,349	BAM 1,985,167	Cantonal budget, IFI and donors	City fleet to low emission vehicles: 2022 – 2025 Low emission public transport policy: 2021 – 2022
Notes on cost estimate The CAPEX for the low emission city fleet and the public transport policy assumes a 12-month consultancy study, including marketing, at EUR 300,000. The CAPEX for the renewal of the city vehicle fleet to electric vehicles is EUR 20,000,000, which assumes a per vehicle cost of EUR 400,000. The OPEX cost assumes 5% of the total CAPEX cost.			
Owner Ministry of Transport		**Stakeholders** Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Citizens, Development Planning Institute of SC, Local businesses	

Transport TR11 - I	Smart

Upgrading of bus station and stop infrastructure, including smart technology

Description

Upgrading of bus stop infrastructure

The bus network and quality of the supporting bus stop infrastructure has a critical contribution in enhancing the overall public transport infrastructure quality in the Canton, which should support increasing public transport take up and promoting better overall accessibility to vital local amenities. Well-planned, designed and maintained bus stops promote inclusive bus services, so reducing social isolation, increasing the number of users of these services.

Any new/upgraded bus stop infrastructure in Sarajevo Canton should be planned and designed in accordance with international good practice, which should consider as a minimum security and lighting, posts and flags, surface markings, passenger shelters and seating, utilities, information provision, drainage, pedestrian footways, height and type of kerb, waiting areas and approach and exit pathways. The planning and design of bus stops will need to be based on a framework of street/road types, where different layouts of bus stops are implemented depending on the classification of road. The action proposes the upgrading of 600 bus stops. The upgrading of bus stop infrastructure provides revenue opportunities including advertising.

Provision of real time passenger information systems at bus station and stops

Real time passenger information is an automated system for supplying users of public transport with information about the nature and state of a public transport service, through visual, voice or other media. The system uses real time information, derived from automatic vehicle location systems, which changes continuously because of actual events and is typically used during the course of a journey: primarily, how close the bus service is running to time and when it is due at a bus stop. Real time information is an advance on schedule-only information, which recognises the fact that public transport services do not always operate exactly according to the published timetable. In terms of information provision, this can be presented to passengers in different ways, including mobile phone applications, platform and bus stops electronic signage and automated public address systems. The action proposes the implementation of Real Time Passenger Information (RTPI) at 200 bus stops.

Implement park and ride facilities

Park and ride facilities are car parking areas which provide public transport connections to allow commuters and other people heading to city centres to leave their vehicles and transfer to a bus, rail system or carpool for the remainder of the journey. The vehicle is left in the parking area and retrieved when the owner returns.

Generally located on the outer edges of large cities, park and ride locations can also be integrated with other transport nodes, including rail stations, to enhance overall inter-modal connectivity. There are also opportunities to link the sites with NMT modes, such as cycle routes. They present opportunities to utilise low emission buses and connect into wider integrated ticketing solutions.

In the specific context of Sarajevo, it is proposed that two park and ride sites could be implemented initially, located in areas of the city which attract the highest number of long-distance car commuters into the city centre. They would remove private vehicle trips from arterial routes and consolidate them onto low emission bus vehicle journeys.

Benefits

- Increase in bus patronage.
- Opportunity to implement smart technology.
- Improved overall city streetscape and infrastructure furniture.
- Opportunity for improved economic returns and inclusion.

<table>
<tr><td colspan="4">• Social benefits including access to services, safety and gender equality.</td></tr>
<tr><td colspan="2">Current baseline
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1)
Pressure: transport (11, 11.1, 11.4, 12, 12.1)</td><td colspan="2">Environmental performance (alignment with GCAP objectives)
AQ01 Improve ambient air quality compliant with EU standards — 1
GH01 Reduce GHG emissions — 1</td></tr>
<tr><td>CAPEX
EUR 8,000,000
BAM 15,646,640</td><td>OPEX
EUR 400,000
BAM 782,332</td><td>Potential funding options
Cantonal budget, IFI and donors, Federal Budget</td><td>Start/end year
Bus stops and RTPI
Phase 1: 2021 - 2025
Phase 2: 2026 - 2030
Park and ride facilities
2022 - 2025</td></tr>
<tr><td colspan="4">Notes on cost estimate The EUR 8,000,000 CAPEX is based on the upgrading of bus infrastructure. Bus stop infrastructure for EUR 3,000,000. The provision of real time passenger information systems at bus station and stops for EUR 1,000,000. The implement park and ride facilities for EUR 4,000,000. The OPEX assumes upgrading of bus stop infrastructure for EUR 150,000, the provision of real time passenger information systems at bus station and stops for EUR 50,000 and park and ride facilities for EUR 200,000.</td></tr>
<tr><td colspan="2">Owner Ministry of Transport</td><td colspan="2">Stakeholders Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Other bus operators, Citizens, Development Planning Institute of SC</td></tr>
</table>

Transport TR13 - I	Smart

Smart and integrated traffic management solutions

Description

Implement corridor-based high occupancy vehicle (HOV) lanes

High Occupancy Vehicle (HOV) lanes are designed to discourage single or low occupancy car use by providing priority to vehicles with more than a minimum number of occupants (usually two or three) and to buses. They encourage car sharing or public transport use, or both, by allowing users to reduce their journey times relative to single-occupant vehicles, particularly when the general-purpose lanes are congested. This in turn reduces the number of cars on the network and this reduction in the demand for road space can reduce overall congestion, fuel consumption and have beneficial environmental impacts. In specific reference to Sarajevo Canton, candidate routes, at least as pilots, should be considered which include: A1, M5, M18, E73, R442a.

Implement city-wide traffic signal system upgrade and control centre

Adaptive traffic signalling systems can be used to minimise unnecessary green phases and allow traffic to flow more efficiently. Traffic control centres are used as centralised facilities to manage traffic flow and safety on the road network. The control centre can also be linked to the operation of traffic signals, where traffic signal timings can be adjusted to smooth overall flow and reduce queuing. The system is used to monitor congestion and manage incidents, and can also be used to inform travel media and support the city response to incidents.

In the specific context of Sarajevo Canton, there is a need to upgrade some of the traffic intersections of strategic routes to incorporate adaptive signal control technology to better manage traffic flow and queuing. This would need to be supported through the development of a traffic control centre, which would monitor traffic flows and incidents on key strategic routes and at key intersections. This action is aligned with the project 'Active Traffic Management' which the Ministry of Transport is about to tender.

Benefits

- Contributes to localised improvements in air quality.
- Reduces congestion and improves travel time reliability.
- Improvements in safety and security.
- Social benefits including public health, access to services and safety.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	2
Pressure: transport (11, 11.1, 11.2, 11.4, 12, 12.1)	GH01 Reduce GHG emissions	2

CAPEX	**OPEX**	**Potential funding options**	**Start/end year**
EUR 3,500,000 BAM 6,845,405	EUR 350,000 BAM 684,541	Cantonal budget, Federal budget	HOV lanes: 2025-2030 Signalling system and control centre: 2022-2023

Notes on cost estimate CAPEX for the HOV lanes based on EUR 100,000 per km (scheme implementation cost for signing and lining and enforcement mechanisms) for 5km on three individual approach roads totalling 15km at EUR 1,500,000 total. Plus a signalling system and control centre estimated at EUR 2,000,000. OPEX assumed at 10% of CAPEX.

Owner Ministry of Transport	**Stakeholders** Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Citizens, Development Planning Institute of SC

Transport TR15 - I			Smart
Reconstruction of tram tracks and purchase of new trams			
Description Sarajevo has an extensive network of trams, which run on a total of seven lines in the city, covering a distance of 24 km. The tram system is one of the oldest in Europe and in recent years the need for upgrading specific sections of the tram lines has become apparent. In addition, the rolling stock is also ageing and is in need of replacement. This action would involve track renovation and overhead catenaries in critical areas; renovation of substations and new substations and equipment purchase for depots. It would also require purchasing a significant volume of new and smart tram rolling stock.			
Benefits • Increase ridership in the public transport system. • Improvements in localised air quality. • Improved accessibility.			
Current baseline State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1) Pressure: transport (11, 11.1, 11.2, 11.4, 12, 12.1)		**Environmental performance** (alignment with GCAP objectives) AQ01 Improve ambient air quality compliant with EU standards GH01 Reduce GHG emissions	3 3
CAPEX EUR 50,000,000 BAM 97,791,500	**OPEX** EUR 5,000,000 BAM 9,779,150	**Potential funding options** Cantonal budget, IFI and donors, Private sector	**Start/end year** 2021-2022
Notes on cost estimate The CAPEX is based on the reconstruction of tracks at EUR 35,000,000 million and the purchasing of new trams at EUR 15,000,000. The OPEX is estimated about 10% of total Capax at EUR 5,000,000.			
Owner Ministry of Transport		**Stakeholders** Ministry of Transport, Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Citizens, Development Planning Institute of SC	

Transport TR16 - I

Construction and establishment of new tram lines

Description

Construction of the tram line Ilidža - Hrasnica

Constructing a tram line from Ilidža to Hrasnica has been justified in various development plans for Sarajevo in recent decades. The first strategic plan for this project dated back to the "Urban Plan of the City of Sarajevo 1986-2015", which safeguarded a lane to accommodate the two-track tram line, with a network supply, tram stops and a new tram turntable near the former factory complex Famos in Hrasnica.

The railway line for the tram is planned along the primary city road from Ilidža to Hrasnica between the two traffic lanes. The project will improve the quality of public transport to meet European standards, protect the natural environment, promote safety of train operators and staff, improve users experience and increase economic competitiveness.

Funding was secured in October 2019 for the extension of the tram line from Ilidža to Hrasnica and the purchase of 20 additional trams. An additional loan of EUR 35m was secured from the EBRD in February 2020 to upgrade the existing infrastructure and purchase further trams.

Benefits

- Increasing the number of passengers in the public transport system.
- Better air quality at the local level.
- Better accessibility.
- Safety of working staff and users of traffic services
- Increasing economic competitiveness.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	3
Pressure: transport (11, 11.1, 11.2, 11.4, 12, 12.1)	GH01 Reduce GHG emissions	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2023
EUR 25,000,000 BAM 48,895,750	EUR 2,500,000 BAM 4,889,575	EIB, EBRD	

Notes on cost estimate: For the construction of the tram line Ilidža - Hrasnica, complete project documentation was prepared, all property legal relations were resolved and a construction permit was obtained. The total estimated value of the works is EUR 25m..Operating costs include additional costs of hiring the company CPUC GRAS Sarajevo for the establishment of a new line and the costs of possible maintenance and it has been estimated as 10% of CAPEX

Owner	**Stakeholders**
Ministry of Transport, CPUC GRAS Sarajevo	Ministry of Transport, Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Citizens, Development Planning Institute of SC

5.6. Water

5.6.1. Key challenges and gaps

Values for indicators relating to water consumption (numbers 25 and 25.1) are at a satisfactory level and therefore benchmarked as “green”. Information from the Sarajevo Water Project – Feasibility Study Update (2016) has been used to benchmark industrial water consumption (indicator number 25.3) as "yellow".

Pressure indicator number 26 (non-revenue water) indicates the extremely inefficient use of water resources in SC. Approximately 75% of water is lost in the water supply system and this represents one of the biggest challenges regarding availability of water resources for consumers. The quantity of water in the public water supply system is sometimes insufficient to cover demand in summer months although related performance is improving. In 2018, for example, the average daily number of hours of continuous water supply was 24. Water saving / reuse is not encouraged through awareness campaigns and so this indicator is benchmarked as “red”.

Issues regarding the coverage and efficiency of the water supply network are defined in the KEAP, which has identified that related activities are being conducted including the improvement and development of infrastructure to: improve capacity; reduce losses; encourage rational and planned use, and; improve the conditions and conservation of water bodies that are used or planned to be used for the purpose of water supply. Due to these activities not being implemented, the indicator on improvement of the coverage and efficiency of water supply networks is benchmarked as “yellow”.

The metering and billing for water use is benchmarked as “yellow”. Water consumption is metered and billed by the public utility company "ViK". Some multi-apartment buildings only have one water meter installed for all apartments; hence water consumption is billed based on a calculation of total water consumption in the building divided by the number of households. Illegal connections to the water supply network, insufficient coverage and monitoring equipment are a problem.

Although pressure indicator number 27 shows a satisfactory level of wastewater treatment, the related state indicator points to there being a pressure from wastewater in rivers, as Biochemical Oxygen Demand (BOD) concentration in rivers is not satisfactory. Additionally, the value of this pressure indicator only shows the value for residential wastewater treatment while the percentage of treated commercial wastewater is unknown.

Although wastewater is treated and partially purified, wastewater infrastructure is not sufficiently developed. About 78% of the population in the urban area of Sarajevo Canton is served by a wastewater network connection and the remaining 22% dispose of communal wastewater in septic tanks or directly into watercourses. In the suburban municipality of Ilijaš 80% of inhabitants are served by the wastewater system, while in the suburban municipality of Hadzici only 40% of inhabitants are served. The municipality of Hadžići is connected to the sewage system in the urban area. But it is not adequately connected to the collector that drains the collected waste (sanitary) water to the central Butile wastewater treatment plant. In the suburban municipality of Trnovo the population in the urban area are served but the wastewater system in its mountain settlements is currently under construction. Due to terrain, the Municipality of Vogošća cannot be connected to the central Butile wastewater treatment plant and discharges its wastewater directly into open watercourses. Similarly, wastewater from some industries is disposed without treatment. Therefore, surface waters in Sarajevo Canton are polluted mainly with the municipal wastewater that is not captured in the existing public wastewater system that is connected to the wastewater treatment plant. In line with the KEAP, the municipalities of SC each budget for projects to extend the wastewater system on an annual basis but this is not currently sufficient.

The response indicator on the improvement of buildings’ access to wastewater collection and treatment systems through plans and investment is benchmarked as “yellow”. The KEAP has identified activities for the improvement and development of wastewater infrastructure with the aim of reducing pollution from municipal wastewater. Amongst proposed activities are improvements to infrastructure for wastewater collection, construction of faecal collectors in identified locations, and drainage and treatment systems. In SC wastewater is not billed; thus, the indicator on wastewater billing is benchmarked as “red”.

Another challenge is the treatment of sludge. The City of Sarajevo has one central WWTP in Butile with a capacity of 600.000 PE[21]. It was built in the 1980s and rehabilitated and modernised in 2018 but it has no technology for the final treatment of sludge. There is also a smaller wastewater treatment facility in the Municipality of Trnovo, which does not provide sludge treatment facilities either. A feasibility study regarding sludge treatment options has been conducted and shows that additional sludge could be turned into fuel for energy plants (cement and thermal power plants). The SC has applied for related funds from the European Commission but at present sludge is temporarily deposited on a temporary dump at the location of the plant.

Activities regarding pre-treatment of drinking water are regularly implemented where necessary by the public water company "ViK". In addition, monitoring of the quality of drinking water is regularly performed both by the public company "ViK" (in its laboratory) and the Cantonal Institute for Public Health. 98% of samples are in line with national standards. The indicator on drinking water pre-treatment is therefore benchmarked as "green".

In terms of the sector's resilience, according to the Cantonal Operational Plan (2012) Defence from Floods the share of dwellings affected by extreme flood in 2015 was 0.9%, and thus indicator 28 is benchmarked as "yellow". Citizens are aware of natural disaster risk but do not have well developed attitudes in relation to disaster resilience. The preliminary flood risk assessment study for watercourses of categories I (rivers) and II (tributaries and small rivers) show areas vulnerable to flood risk within the SC. The calculated summary flood index shows that the settlements of Podlugovi, Ilijaš, Breza, Ilidže, Stupa and Butmira are areas of significant flood risk caused by the rivers Stavnja, Tilava and Dobrinja (category II).

The need for the construction of new, and improvement of existing, facilities for flood protection is identified and planned within the KEAP but none have been implemented. The indicator on the development of drainage facilities is therefore benchmarked as "yellow". No activities are foreseen regarding awareness campaigns to encourage business and community resilience, and so this response indicator is benchmarked as "red."

[21] Population equivalent: pollution load (BOD) of household sewage produced by one person during 24 hours.

5.6.2. Key current initiatives

Water resources policies are the responsibility of the two Entities and BD governments, which regulate water matters through laws, regulations and standards. The BiH Ministry of Foreign Trade and Economic Relations (MoFTER) is responsible for coordinating and harmonising plans and activities from FBiH and RS in relation to water resources. The primary responsibility for water management in FBiH belongs to the Federal Ministry of Agriculture, Water Management and Forestry. In turn, the Constitution of FBiH stipulates that water resources policies are a shared responsibility between the Federal government and the Cantons as federal units within the FBiH.

There are multi-sectoral strategic documents covering water resources such as the KEAP. A number of other related documents at the Cantonal, City / municipal level expired in 2018 or before, but the water sector has been subject to reform in recent years and this is being reflected in subsequent policies and plans. These include the Cantonal Operative Plan for Flood Management (2012), the Water Management Strategy of the FBiH 2010 to 2022, and Water Management Plans for the Sava river basin and the Adriatic Sea basin. These two Water Management Plans were both prepared as drafts in 2016 for the period 2016-2021 and were adopted by the Government of FBiH in 2018[22]

The key current investments in relation to water resources in SC are:

- EBRD "Green Cities Framework (GrCF): Sarajevo Water Project" (2018) - The priority investments include (i) purchase of new metering and control equipment (individual and bulk meters, telemetry); (ii) reconstruction of the water supply network in several parts of the Canton, and; (iii) rehabilitation of pumping stations (including chlorination units);[23]
- WBIF (Western Balkans Investment Framework) project "Flood Hazard and Flood Risk Maps Project in BiH" - Infrastructure Support Programme (WYG IPF5 Consortium, April 2017-October 2019) - The expected results of the project include flood risk and flood hazard mapping of areas of significant present and future flood risk for the whole country. The methodology for flood hazard and risk mapping will be in accordance with

[22] Available from: https://fmpvs.gov.ba/wp-content/uploads/2017/Vodoprivreda/Vode-ostalo/Odluka-RBM-Sava-i-Jadransko-more.pdf.
[23] https://www.ebrd.com/work-with-us/projects/psd/grcf-sarajevo-water.html.

the EU Floods Directive (EU Parliament, 2007). In the area of the Sarajevo Canton, the scope of the project will cover nine river sections located on the following rivers: Željeznica, Bosna, Miljacka, Kasindolska rijeka, Dobrinja, Stavnja and Rečica;[24]

- Reconstruction and construction of water management infrastructure in Sarajevo Canton and reconstruction and construction of sewage infrastructure in Sarajevo Canton - Budget of Sarajevo Canton/ Ministry of Communal Affairs and Infrastructure, budget of nine municipalities;[25]
- Integrated water resource management under the Water Law – Budget of Sarajevo Canton/ Ministry of Economy of Sarajevo Canton, budget of nine municipalities; and
- Reconstruction of wastewater treatment plant in the regional waste management centre Smiljevići, budget of Sarajevo Canton/ Ministry of Physical Planning, Construction and Environment Protection.

5.6.3. Short-term actions

Twelve water resource GCAP actions were developed and nine prioritised. These are listed in Table 5-7.

The outputs of five of the actions will inform subsequent infrastructure measures, which reflects the need to develop a more in-dept understanding of the state of the sector and appropriate means of improvement. These include an action to improve monitoring and data collection from the water supply network, and a wastewater asset monitoring and data collection action. They also include the execution of related strategies and plans. These are a strategy and plans for the water supply network and customer management systems and an action to develop a wastewater strategy and conduct associated digital planning and design. A study will also be conducted into Wastewater Treatment Works (WWTW), sewage and SuDS financing, and water company regulation and management. In the short-term, an assessment of industrial wastewater will also be delivered. This will extend to related regulations and also result in the development, enactment and enforcement of appropriate regulation(s) to fill any gaps identified in the review.

The other six actions involve the construction of new or modification of existing infrastructure, with these actions also incorporating feasibility studies and/ or in-depth assessments as part of the initial phase. In line with the needs of the sector the scope of these actions is broad. They include actions to extend and refurbish the wastewater network and construct SuDS. The Wastewater Treatment Works will also be extended and a thermal sludge treatment facility constructed at the plant. Additional Wastewater Treatment Works will also be constructed to supplement the plant that exists in Butile, and it is anticipated that these will be in the vicinity of Vogošća, Ilijaš, Hadžići and Breza, with associated improvements also made to the sewage network. The other two actions both refer to programmes of improvement works to the water supply network. One to conduct work to reduce water losses from the network (through maintenance and/ or replacement of the existing water supply system), and the other to reduce risks to water quality by extending the current urban water supply network.

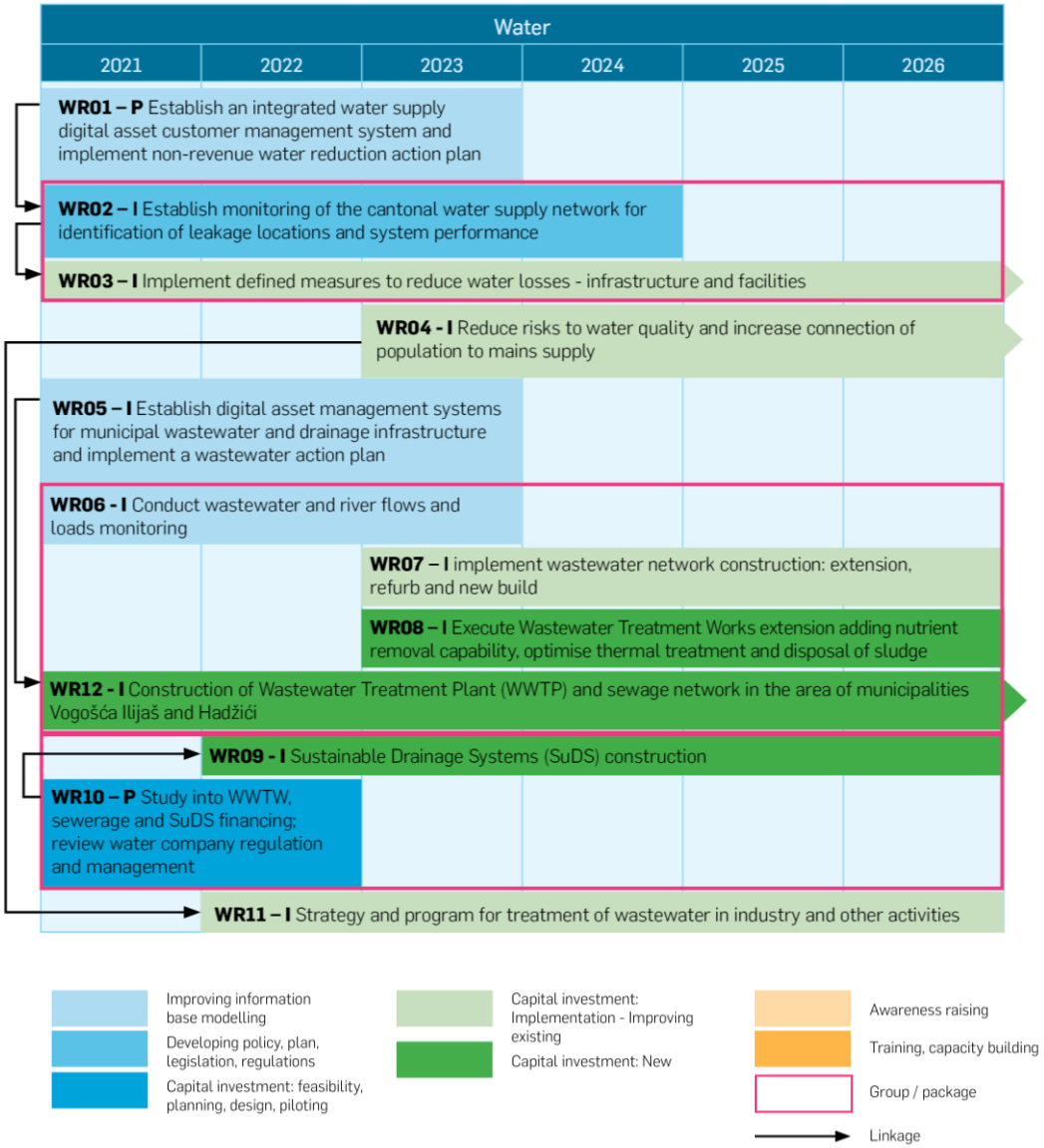
[24] www.mvteo.gov.ba/.../Projekti/Projekti.../PROJECTS.../WBIF__F....
[25] http://skupstina.ks.gov.ba/sites/skupstina.ks.gov.ba/files/izmjene_i_dopune_bks_2019.pdf; Development Planning Institute of SC - Implementation Action Plan 2019.-2021., Development Strategy of Sarajevo Canton until 2020; March 2019.

Table 5-7 - Water resources actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Policy Option / Action Owner	CAPEX	OPEX (Annual)	Timeline	Smart Action	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
WR01 - P	Establish an integrated water supply digital asset and customer management system and implement non-revenue water reduction action plan	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 550,000 BAM 1,075,705	EUR 10,000 BAM 19,558	2021 - 2023	Y	0	2	0	0	0	0	0	0	0
WR02 - I	Establish monitoring of the cantonal water supply network for identification of leakage locations and system performance.	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 400,000 BAM 782,332	EUR 8,000 BAM 15,647	2021 - 2024	Y	0	2	0	0	0	0	0	0	0
WR03 - I	Implement measures to reduce water losses - infrastructure and facilities.	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 65,000,000 BAM 127,128,950	EUR 80,000 BAM 156,466	2021 onwards	Y	0	3	0	0	0	0	0	0	0
WR04 - I	Reduce risks to water quality and increase connection of population to mains supply	Ministry of Communal Affairs and Infrastructure, Ministry of Economy o, CPUC ViK Sarajevo, Municipal Authorities	EUR 50,000,000 BAM 97,791,500	EUR 200,000 BAM 391,160	2023 - 2028		0	2	1	0	0	0	0	0	0
WR05 - I	Establish digital asset management systems for municipal wastewater and drainage infrastructure and implement a wastewater action plan	Ministry of Communal Affairs and Infrastructure	EUR 300,000 BAM 586,740	EUR 10,000 BAM 19,558	2021 - 2023	Y	0	0	3	0	0	0	1	2	0
WR07 - I	Execute wastewater network construction: extension, refurb and new build	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 50,000,000 BAM 97,791,500	EUR 1,000,000 BAM 1,955,830	2023 - 2026		1	0	3	1	1	1	1	1	1
WR08 - I	Execute Wastewater Treatment Works extension adding nutrient removal capability, optimise thermal treatment and disposal of sludge	Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, CPUC ViK Sarajevo	EUR 16,900,000 BAM 33,053,020	EUR 2,415,000 BAM 4,723,257	2023 – 2026		1	0	3	1	0	2	1	1	0
WR11 - I	Strategy and programme for treatment of wastewater in industry and other commercial activities	Ministry of Communal Affairs and Infrastructure	EUR 50,000 BAM 97,792	EUR 0 BAM 0	2022 - 2026	Y	1	0	2	0	1	0	0	1	0
WR12 - I	Construction of Wastewater Treatment Plant (WWTP) and sewage network in the area of municipalities Vogošća Ilijaš and Hadžići	Sarajevo Canton Administration and Zenica-Doboj Canton Administration, Municipality Vogošća, Municipality Ilijaš, Municipality Hadžići, CPUC ViK Sarajevo, Ministry of Communal Affairs and Infrastructure, Ministry of Economy, PUC Vodostan Ilijaš, PUC Komunalac Hadžići	EUR 98,789,000 BAM 192,803,850	EUR 4,930,000 BAM 9,640,000	2021 - 2027		1	0	3	1	0	2	1	1	0

Additional actions															
WR06 - I	Conduct data surveys and monitoring of wastewater, stormwater and river flows	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 250,000 BAM 488,958	EUR 5,000 BAM 9,779	2021 - 2023	Y	1	0	2	0	0	0	0	2	0
WR09 - I	Sustainable Drainage Systems (SuDS) construction	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 30,000,000 BAM 58,674,900	EUR 1,000,000 BAM 1,955,830	2022 - 2026		0	1	2	1	2	1	1	1	2
WR10 - I	Study into Wastewater Treatment Works, sewerage and SuDS financing; review water company regulation and management	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	EUR 150,000 BAM 293,375	EUR 0 BAM 0	2021 - 2022		0	0	2	0	0	0	0	1	0

Figure 5-3 - Water resources actions programme



Water Resources WR01 - P	Smart

Establish an integrated water supply digital asset and customer management system and implement non-revenue water reduction action plan

Description

Development of a **GIS, database and network model** is proposed to confirm asset locations and condition and enable efficiency programming of future asset maintenance activities allowing for deterioration of the water supply systems. This will provide a basis for **digital asset management system (DAMS)** and the ongoing recording of asset health.

Network planning will be integrated with supply and demand requirements for water resource, water treatment facilities capacity, distribution network and water quality. Network modelling systems may be used to better understand network performance and the consequences of investments in the assets. This will account for increasing demand due to population growth in the Sarajevo Canton; changes in water availability due to climate change; customer behaviour and degradation of the network infrastructure.

The development of a **customer management system** linked to the DAMS will assist all aspects of Non-revenue Water reduction leading to improvement of revenue collection and the ongoing financial viability of the utility company. This system will also be extended to cover customer management on behalf of wastewater assets.

The GIS system and network models, together with the survey results from WR02, will facilitate planning of measures to address leakage (where it is cost effective to do so), extend coverage to all areas of the city, manage and influence customer behaviours and assess the sustainability of the water resources through the production of a **Non-Revenue Water Reduction Action Plan (NRWRAP)**. The NRWRAP will consider projections of population, economy and climate change to provide planning scenarios and identify key risks and opportunities.

The digital systems will be used in the preparation of outline designs and in a digital procurement process for the delivery of the new and refurbished assets. It is expected than principles of Building Information Management (BIM) will be used in the design and construction of the assets and that the digital twin models produced will form the basis of the DAMS in the operational phase.

This activity, in addition to KJKP VIK Sarajevo, should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš, JKP Komunalac Hadžići.

Benefits

Improved digital asset management capability, which will enable the assessment and improvement of the resilience of the supply system to current and future levels of demand and supply availability under different scenarios of climate change and drought risk, will help to ensure that existing and future operations are environmentally and financially resilient. Can Link to SMART city systems. Economic benefits through increased returns, growth, employment and inclusion. Social benefits for public health and access to services.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: Water (5), Pressure: water (26, 25.3)	WR01 Improve efficiency of water use	2

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021 - 2023
EUR 550,000 BAM 1,075,705	EUR 10,000 BAM 19,558	Cantonal budget, IFI and donors, Federal Budget	

Notes on cost estimate CAPEX based on expert judgement, which is comprised of EUR 150,000 GIS, EUR 150,000 network modelling, EUR 50,000 LRAP undertaken by international support to a local team, EUR 150,000 for site surveys and condition assessments undertaken by a specialist subconsultant. OPEX is required for labour to update and maintain software licenses. Savings from implementing action.	
Owner Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo, KJP Vodostan Ilijaš, JKP Komunalac Hadžići	**Stakeholders** Customers, Municipalities

Water Resources WR02 - I	Smart

Establish monitoring of the cantonal water supply network for identification of leakage locations and system performance

Description

This action involves increasing the extent of real-time monitoring across the network, including district metering and conducting leakage surveys.

According to the KEAP, continuous monitoring in public water supply system does not exist at present and the coverage of measurement equipment is insufficient for a proper monitoring and management system. Therefore, long-term, smart district metering should be installed in the system to provide continuous operational data. This would be complemented with short-term surveys to identify specific leaks in the system.

With leakage estimated at 75% of the water that leaves the treatment plant (so three times the amount used by customers) the key areas for leakage reduction should be identified through a combination of the district metering and targeted surveys of the system by specialist contractors, e.g. using acoustic methods to find leaks. The results of the surveys and monitoring will allow the development of the network models to fully understand network performance and the effect of possible interventions. Customer water usage records will also be an important component for understanding the system performance.

EBRD loan 48252 Sarajevo Water Project, approved 2017[26], is also implementing leakage reduction in Sarajevo and installing some network meters. That project is specifically targeting the rehabilitation of the main well field pumping stations and conveyance pipes from them to the city. It is not expected to overlap significantly with the urban network leakage surveys and district metering scope of this action.

This activity, in addition to KJKP VIK Sarajevo, should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš, JKP Komunalac Hadžići.

Benefits

Improved understanding of the water balance throughout the supply system will facilitate identification of illegal connections, leakage reduction, pressure management and asset condition. Minor social benefits to public health, access to services and safety.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: water (5) Pressure: water (26, 25.3, 25)	WR01 Improve efficiency of water use	2

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2024
EUR 400,000 BAM 782,332	EUR 8,000 BAM 15,647	Cantonal budget, IFI and donors, Federal Budget	

Notes on cost estimate CAPEX based on expert judgement, comprised of the EUR 200,000 installation of 12 district meters in system with telemetry and a EUR 200,000 leakage surveys undertaken by specialist contractors. This assumes a mix of international and local labour inputs. OPEX is required for maintenance of meters based on replace one every few years.

[26] EBRD, 2017. Available from: https://www.ebrd.com/cs/Satellite?c=Content&cid=1395255371079&d=Mobile&pagename=EBRD%2FContent%2FContentLayout.

Owner	Stakeholders
Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo, KJP Vodostan Ilijaš, JKP Komunalac Hadžići	Customers, Municipalities

Water Resources WR03 - I	Smart

Implement measures to reduce water losses - infrastructure and facilities

Description

Reduction of water losses from the water supply network through capital maintenance and/or replacement of the existing water supply system.

Despite the fact that there appears to be capacity to supply the city's population at current rates of water loss, leakage management is recommended as an action to comply with the Water Framework Directive and improve the environmental conditions and sustainability in Sarajevo. Demand management activities (actions to reduce domestic and industrial demand by behaviour change) are not a priority.

As noted in the 'Sarajevo Canton Spatial Plan for the period 2003-2023', water losses are one of the biggest problems in the current water supply network, resulting in regular cuts to water supply. As reported in the KEAP, overall water losses in the central water supply system in 2015 were 74.80% (equivalent to 72,828,019 m^3/year of unbilled water) classified as a "red" indicator in the GCAP Indicators Database, where the red indicator threshold is 45%. The target is 20% non-revenue water.

The existing water supply network consists of 1,200 km of mains water pipes and about 750 km of connecting pipes, to give a total of 1,950 km. Addressing water losses through capital maintenance of the existing water supply network could be undertaken in the short/medium term; This work will be undertaken through a variety of measures:

1. Pressure Management: based on feedback from the District metering (WR02) and network modelling (WR01) the NRWRAP will have developed a strategy for reducing leakage by the installation of pressure control valves and improved pressure management systems. In this action such equipment will be installed and put into operation.
2. "Find and Fix": the leakage surveys (WR02) will have identified company detected and community reported specific leaks. These spot problems will be repaired under this action. These may be done as instant repairs at time of finding or included in the NRWRAP for repair in accordance with a timetable.
3. Mains Replacement: The GIS, condition survey and modelling (WR01) will have identified sections of the mains that are in worst condition or most likely to fail soon. The NRWRAP will have prioritised these for replacement under a phased programme of mains replacement. This is a very high cost action so highest priority mains (based on cost benefit analysis of cost of failures (including critical infrastructure affected) vs cost of replacement) will be replaced first.
4. Extending Mains: The water supply network will be extended to reach customers not currently connected. This is also expensive so there will have to be some balance between the cost, the likely future revenue and the wider social and economic benefits. The new mains will be less likely to cause leakage and so will also contribute to the overall reduction in losses per metre of pipe across the city.

This action needs to carry an Asbestos Containing Material survey by certified contractors to determine the presence of asbestos as well as appropriate mitigation actions for safe options for storage, transport and disposal of asbestos containing pipes. Mains replacement is typically undertaken at an annual rate of 2% of the length of the network, i.e. 40km/year. This level is sustainable from a disruption and organisation point of view. The typical cost of mains

replacement in Europe is estimated at EUR 200 per metre. Thus 40 km would cost EUR 8 million to replace. It is estimated that an additional EUR 5 million per year of maintenance and pressure management actions will be required.

The programme of work would build up over the first few years of the programme, peaking in 2023 to 2024 then reducing somewhat to a maintenance level. Based on experience elsewhere, though significant reductions in leakage may be achieved it is unlikely that the 20% leakage target can be achieved in five years due to limits on the practicality of replacing large amounts of the network in a short period. It is not possible at this time to know how effective find and fix or pressure management will be in reducing leakage in Sarajevo. WR01 and WR02 will clarify the likely leakage reductions that can be achieved and inform update of associated cost estimates based on local experience.

EBRD loan 48252 Sarajevo Water Project, approved 2017, is also implementing leakage reduction in Sarajevo. Project 48252 is specifically targeting the rehabilitation of the main well field pumping stations and conveyance pipes from them to the city. Though some network rehabilitation and metering is included it is not expected to overlap significantly with the urban network leakage scope of this action. Contractors under both schemes should coordinate.

Though reducing leakage will save money for the water company in not having to treat as much water, the incremental cost savings will be relatively small so will not make a significant difference to revenues. The extended network will generate significant new revenue.

This activity, in addition to KJKP VIK Sarajevo, should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš, JKP Komunalac Hadžići.

Benefits

Capital maintenance of the water supply system will reduce water losses and cuts to water supply. It will also provide environmental (including carbon) and financial benefits associated with reducing abstraction, treatment and distribution of water. Economic benefits through increased returns and growth. Social benefits through improved access to services and public health.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: water (5) Pressure: water (25, 25.3, 26)	WR01 Improve efficiency of water use	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021 onwards
EUR 65,000,000 BAM 127,128,950	EUR 80,000 BAM 156,466	Cantonal budget, IFI and donors, Federal Budget	

Notes on cost estimate CAPEX at EUR 13,000,000 per year over five years is comprised of EUR 5,000,000 on network maintenance (pressure management and spot repairs) and EUR 8,000,000 on network replacement. This is based on EUR 200 per metre to replace pipes, with 2% of network replaced / rehabilitated, 40 km each year 2020 to 2025. OPEX is required for service pressure management systems. These estimates do not account for any loan payments already received from the ERBD. Savings from implementing action. Pipe replacement costs depend on diameter and local labour costs; eventual costs may be lower than the EUR 200 / m estimated, which would allow more pipe to be replaced for the budget and get closer to 20% leakage target. As this is for replacement and rehabilitation it is assumed that the typical 1 to 2% OPEX cost of the pipe assets is included in current budgets.

Owner	**Stakeholders**
Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo, KJP Vodostan Ilijaš, JKP Komunalac Hadžići	Customers, municipalities

Water Resources WR04 - I

Reduce risks to water quality and increase connection of population to mains supply

Description

According to the 'Development Strategy of the Sarajevo Canton until 2020', the percentage of microbially contaminated and physically/chemically defective drinking water samples from local water supply systems (self-supply wells) in 2014 was 2.15%. In contrast, the percentage of contaminated drinking water samples from public wells and the mains urban supply system was 0%. To reduce the risk of inadequately treated water being supplied to customers, the current urban water supply network should be extended to reach those who are currently reliant on local water supply networks (4.26% in 2014).

This action involves increasing public water supply coverage to these customers. It is suggested that a feasibility study and full economic assessment be undertaken within the next 1-3 years, with the actual construction being undertaken in the medium term (5-8 years).

Analyses show that drinking water from the springs which supply Sarajevo Canton is of good quality and that it is used immediately after the disinfection at the spring or in the distribution tanks. However, decisions on the protection of springs were not implemented in accordance with the ruling on the determination of conditions for zones of sanitary protection, and protection of springs for the public water supply (Official Gazette of FBiH 88/12), which means legally the springs are not protected. In order to legally protect the springs, it is necessary to undertake implementation in accordance with the Law on Waters of the FBiH. In May 2013, a study for the protection of drinking water sources in Sarajevsko Polje was completed. In April 2014, the Government of Sarajevo Canton adopted this study and accepted the preliminary draft decision on the protection of this spring with a programme of measures and financing plans for a period of 10 years. However, the decision has not yet been formally adopted.

Furthermore, it is noted in the KEAP that asbestos-cement pipes currently account for 20% of the total length of water supply network of the city. To minimise the risk of asbestos contamination from the aging water supply network, replacement of this section of the network should be prioritised as part of the replacement work suggested in WR03.

Connecting the as yet un-serviced areas of the city, 4.26% of 1200 km as an estimate, would cost EUR 10 million or so and replacing 20% of the mains due to asbestos risk would cost EUR 48 million. However, much of this is already included in WR03 and risk assessments should be undertaken on the real threat posed by the asbestos cement mains. It is suggested that the EUR 10 million for extension of network is higher priority than the water quality driven replacement of asbestos cement pipes.

Benefits

Connection of the entire city's population to the public water supply network, and replacement of aging asbestos-cement pipes in the supply network, would ensure that high quality drinking water is available to all, providing significant health benefits, and improved access to services.

Minor opportunity for increased economic returns.

Current baseline

State: water (2)

Pressure: water (2, 27)

Environmental performance (alignment with GCAP objectives)

WR01 Improve efficiency of water use	2
WR02 Maintain and improve surface water and groundwater quality	1
AR1 Improve resilience to climate change and other natural disaster	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 50,000,000 BAM 97,791,500	EUR 200,000 BAM 391,160	Cantonal budget, IFI and donors, Federal Budget	2023 – 2028

Notes on cost estimate CAPEX based on 20% of 1200 km to repair equals 240 km or 240,000 m of new pipelines, each km repaired or replace at EUR 200 per metre, totalling EUR 48m, plus taking into consideration other extras would give total of EUR 50m. Assuming 20% of that would be overlap with WR03, deduct EUR 10m. Adding EUR 10m for extension of network to new customers gives total of EUR 50m. OPEX based on 2% of CAPEX for the EUR 10m new pipe extensions only.	
Owner Ministry of Communal Affairs and Infrastructure, Ministry of Economy, CPUC ViK Sarajevo, Municipal Authorities, KJP Vodostan Ilijaš, JKP Komunalac Hadžići	**Stakeholders** Ministry of Communal Affairs and Infrastructure, Ministry of Economy, CPUC ViK Sarajevo, Municipal Authorities, customers

Water Resources WR05 - I	Smart

Establish digital asset management systems for municipal wastewater and drainage infrastructure and implement a wastewater action plan

Description

This action will develop and apply digital systems to support the planning, design, procurement and efficient operation of new and improved wastewater assets in Sarajevo. Similar to WR01 for drinking water, this wastewater action will cover three stages:

1. Set up digital systems – GIS, asset databases, digital models;
2. Plan, design and procure construction of assets by using the digital systems; and
3. Develop digital asset management system to optimise efficient operation and maintenance of the assets.

Stage 1: Development of a GIS, database and network models to confirm asset locations, condition and performance. Procure software, hardware and trained human resources to enter all available data into appropriate digital systems, identify needs for further data by way of asset surveys (of the wastewater network and treatment systems); plan gathering performance data by monitoring of flows and water quality under various conditions (execution of surveys is under WR06); and validation of models of the performance of the assets suitable to be used in the planning and design stage to meet demand and achieve compliance with environmental and ecosystem objectives.

Stage 2: Development of a wastewater action plan. Develop scenarios for capacity requirements based on the water use demand under agreed scenarios for population, economy and climate change. Use digital design processes such as Building Information Modelling (BIM) to develop outline designs that can then be developed in detail and taken to construction through a digital procurement process for delivery under WR07 and WR08.

The planning and design of wastewater network and treatment options will need to coordinate with the implementation of SuDs principles in the development of green spaces and other actions related with runoff characteristics to storm and combined drainage systems (WR09). Where possible stormwater should be attenuated or passed to watercourses rather than allowed to enter the sewer system.

Extensions and refurbishment of the wastewater treatment plant should consider options for distributed treatment with package plants versus conveyance for centralised treatment.

Opportunities for effluent reuse should be considered. This will include upgrading of sludge treatment to meet capacity requirements and to produce safe and useful biosolids products or energy. CAPEX and OPEX estimates developed under the wastewater action plan should take full consideration of options and risks and fit within financial models of projected revenues and any changes in regulatory systems (WR10). Cost benefit analysis should consider the multiple benefits associated with green infrastructure systems, improved urban environment and property values.

Stage 3: Operational digital asset management system. The digital systems and BIM will be taken through to the operational phase of the wastewater assets as a digital twin and can be used in the optimisation of operation and to plan and manage capital maintenance. This would be a component of Sarajevo's smart city digital systems.

This activity, in addition to KJKP VIK Sarajevo, should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš, JKP Komunalac Hadžići.

Benefits

Better planning and design of the wastewater systems investments, resulting in higher quality and lower cost solutions with greater confidence that all regulatory and financial objectives will be met. The digital planning and design tools can be adapted during the operational phase to be part of a digital asset management system and possibly linked to future smart cities systems. Minor benefits to public health and access to services.

<table>
<tr><td colspan="2">Current baseline
State: water (2), biodiversity and ecosystems (7, 7.1)
Pressure: water (27), industry (20)</td><td colspan="2">Environmental performance (alignment with GCAP objectives)<table><tr><td>WR02 Maintain and improve surface water and groundwater quality</td><td>3</td></tr><tr><td>BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC</td><td>1</td></tr><tr><td>BE02 Reduce the impact of human activities on biodiversity</td><td>2</td></tr></table></td></tr>
<tr><td>CAPEX
EUR 300,000
BAM 586,740</td><td>OPEX
EUR 10,000
BAM 19,558</td><td>Potential funding options
Cantonal budget, IFI and donors, Federal Budget</td><td>Start/end year 2021-2023</td></tr>
<tr><td colspan="4">Notes on cost estimate CAPEX based on expert judgement, comprising EUR 100,000 for sewerage studies and planning, EUR 50,000 for sewerage modelling, EUR 100,000 for wastewater treatment design and sludge treatment specification and EUR 50,000 for procurement document preparation. OPEX is for maintenance of software licenses and some labour to update models.</td></tr>
<tr><td colspan="2">Owner
Ministry of Communal Affairs and Infrastructure</td><td colspan="2">Stakeholders
Customers, Municipal Administrations, AVP Sava, private companies, CPUC ViK Sarajevo, Ministry of Physical Planning, Construction and Environmental Protection, KJP Vodostan Ilijaš, JKP Komunalac Hadžići</td></tr>
</table>

Water Resources WR07 - I

Execute wastewater network construction: extension, refurb and new build

Description

The older parts of Sarajevo city centre had combined sewers running direct to the river, then with suburban areas added and served by septic tanks. In more recent decades separate storm and foul sewers have been installed in many areas. The wastewater from combined systems and newer separate systems is transferred by interceptor sewers to a centralised treatment plant downstream at Butile.

The septic tanks and private treatment systems would not meet modern WFD / UWWTD (Water Frame Directive / Urban Wastewater Treatment Directive) standards and are estimated to still serve 22% of the population (GCAP TA Report). It is not known if there are any areas still discharging direct to the river. Some other settlements in the Canton do discharge without treatment and some sewerage and treatment plants are under planning.

For those areas of the city not currently connected to the centralised sewer system there are two options to take forward:

1. Install decentralised wastewater treatment with smaller package type treatment works in each district of the Canton. These could help with allowing localised recovery and re-use of wastewater effluent and so reduce demand on the water supply network. A decentralised network would also reduce the required investment in interceptor and collector sewers and pumping stations to convey the sewage to the more distant central works. However, the cost advantages of this would be off-set by the higher costs per unit of treatment of multiple smaller plants, the site acquisition issues and the higher operation and maintenance costs.
2. Conveying the wastewater to the central treatment plant by extending the foul drainage system with new sewers and pumping stations to connect to the existing systems. This would be the conventional and default solution.

In addition to collection of foul wastewater for treatment before discharge to the river the drainage system needs to convey stormwater away to avoid flooding. A combination of increased sewer capacity, improved sewer overflows and possibly storm water storage tanks in the sewer system will be required to cope with the more severe storms. Sustainable drainage features incorporated in buildings and urban spaces can also reduce the load on the sewers and offset some of the requirements for additional investment. However, under the more severe storm conditions hard grey engineering solutions are required in addition to green infrastructure to ensure protection against severe flood risks. The wastewater network designs should include sufficient capacity to meet future demand and climate scenarios.

This activity, in addition to KJKP VIK Sarajevo, should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš and JKP Komunalac Hadžići.

Benefits

Conveyance of wastewater to an extended treatment works and reduction of flood risks will improve the urban environment and the health of the river ecosystem, enabling many other urban improvements that will support greater economic growth and enhance property values. Human health risks due to contact with wastewater will be reduced, access to services will be improved. Opportunities for economic returns, growth, employment and inclusion.

Current baseline

State: water (2), biodiversity and ecosystems (7, 7.1), adaptation and resilience (9, 9.1)

Pressure: water (27, 28), industry (20)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	3
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	1
GH01 Reduce GHG emissions	1

	BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
	BE02 Reduce the impact of human activities on biodiversity	1
	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX EUR 50,000,000 BAM 97,791,500	**OPEX** EUR 1,000,000 BAM 1,955,830	**Potential funding options** Cantonal budget, IFI and donors, private sector	**Start/end year** 2023-2026
Notes on cost estimate CAPEX based on expert judgement for open cut replacement of 25 km of urban sewers at EUR 2,000 per m for typical 600mm diameter sewer. OPEX based on 2% of CAPEX. Improvements may generate additional revenue from new sewerage charges.			
Owner Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo, KJP Vodostan Ilijaš, KJP Komunalac Hadžići		**Stakeholders** Customers, Municipalities, AVP Sava	

Water Resources WR08 - I

Execute Wastewater Treatment Works extension adding nutrient removal capability, optimise thermal treatment and disposal of sludge

Description

Wastewater treatment plant at Butile, originally constructed in 1982, was rehabilitated during 2015 to 2017. This works is reported to have a capacity of 600,000 PE[27] (equivalent to 40,000 to 50,000 m^3/d). It has preliminary screening (added in 2016), primary settlement, Activated Sludge aeration lanes (upgraded from mechanical to bubble diffuser aeration 2016) and final settlement. Extension under the EBRD programme was to proceed in two phases, to increase capacity from 600,000 PE to 900,000 PE, add nutrient removal and facilities for better residual sludge disposal.

The most pressing issue remaining is that although sludge digestion and energy recovery systems have been refurbished with the rest of the plant, there is no facility for the proper disposal of the dewatered sludge. It is stored on site or land filled.

In 2018 Sarajevo Canton prepared a project proposal for thermal treatment of sludge that needs financing. The project is prepared based on the finding of the Feasibility Study for treatment and disposal of the sludge from WWTW Butile, financed by the World Bank and prepared by IPSA Institute d.o.o. Sarajevo and Institute for Ecological Engineering d.o.o. Maribor. This study recommended sludge drying be added at Butile, at estimated CAPEX of EUR 6.9m, to take dewatered sludge from 25% dry solids to >91% dry solids prior to transportation by truck to cement plant for co-incineration (Protocol 555/18 15.11.2018). Operational costs of the dryer and for transport of sludge and payment to kiln for disposal was estimated at EUR 1.9m per year. There are two cement factories, Lukavac and Kakanj, within reasonable distance. If these become unavailable in future many other disposal routes are available for dried sludge which are not possible for wet sludge.

It is assumed that the WWTW expansion to 900,000 PE capacity will be deferred, but that the nutrient removal stage will be added to the current works at cost of EUR 10m, slightly increasing total capacity and incurring additional OPEX.

Benefits

Compliance with EU UWWTD for the treatment works and WFD for the river, based on the local equivalent to these. Reduced requirements for land filling of sludge, increased biodiversity and ecosystem health in the river. Human health risks will be reduced, access to services will be improved. Opportunities for economic returns, growth, employment and inclusion.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: water (27,), industry (20)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	3
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GH01 Reduce GHG emissions	2
BE01 Maintain and enhance natural environmental assets	1
BE02 Reduce the impact of human activities on biodiversity	1

[27] Population Equivalent: pollution load (BOD) of household sewage produced by one person during 24 hours.

CAPEX	OPEX	Potential funding options	Start/end year 2023-2026
EUR 16,900,000 BAM 33,053,020	EUR 2,415,000 BAM 4,723,257	Cantonal budget, IFI and donors, private sector	
Notes on cost estimate CAPEX estimate based on SC project proposal and expert judgement, for construction of a plant for thermal treatment and drying of sludge at the location of the WWTW of EUR 6,900,000, together with construction of nutrient removal and extension of treatment works capacity if required, with estimated of CAPEX of EUR 10,000,000 (does not include expansion from 600,000 to 900,000 PE if required). OPEX based on estimated EUR 1,915,000 per year for sludge dryer operation on site and disposal to cement kiln, plus 5% of CAPEX for nutrient removal (EUR 500,000 per year) which covers energy and chemical costs.			
Owner Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, CPUC ViK Sarajevo KJP Vodostan Ilijaš, JKP Komunalac Hadžići		**Stakeholders** Customers, Municipalities, AVP Sava	

Water Resources WR11 - I	Smart

Strategy and programme for treatment of wastewater in industry and other commercial activities

Description

It is known that some businesses have wastewater treatment facilities, while others discharge wastewater into the sewage system without any treatment.

A database of all industrial plants should be created, within which data on the method of collection and treatment of wastewater (sanitary, stormwater and technological) will be collected. It is also necessary to draft a proposal for sustainable management of wastewater from industry and other activities (car washes, hospitals, laboratories, gas stations, etc.), in accordance with the law and applicable by-laws.

Industrial effluent may require pre-treatment before discharge to sewer to remove high strength waste, toxic or hazardous material, untreatable components or oils and fats, etc. Industrial sites, petrol stations, etc. to have oil traps before runoff to storm sewers also.

The strategy should also include a program of measures to be undertaken by the responsible enterprises to which such decision would apply.

The strategy should identify partnership opportunities for cooperation with domestic and international investment support funds (Environmental Fund, EBRD, IFC, WB, UNIDO, etc.).

Benefits

Improved water quality in river, compliance with EU UWWTD and WFD. Opportunities for economic returns and growth, minor public health benefits.

Current baseline

State: air quality (1.1, 1.2), water (2), biodiversity and ecosystems (7, 7.1), adaptation and resilience (9, 9.1)

Pressure: water (27, 28), industry (20)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	2
GS01 Expand and improve provision of high quality, accessible green spaces	1
BE02 Reduce the impact of human activities on biodiversity	1
AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2022-2026
EUR 50,000 BAM 97,792	EUR 0 BAM 0	Private sector and responsible enterprises	

Notes on cost estimate CAPEX for the development of study and program based on earlier start if EUR 50,000 with the investment costs provided by specific enterprises. Access to a strategic fund or soft loans may be made available. No OPEX costs have been identified.

Owner	**Stakeholders**
Ministry of Communal Affairs and Infrastructure	Industrial enterprises, CPUC ViK Sarajevo, AVP Sava, Ministry of Physical Planning, Construction and Environmental Protection , KJP Vodostan Ilijaš, JKP Komunalac Hadžići.

Water Resources WR12 - I

Construction of Wastewater Treatment Plant (WWTP) and sewage network in the area of municipalities Vogošća, Ilijaš and Hadžići [28]

Description

One of the problems related to public utility infrastructure in Sarajevo Canton is that wastewater from the Vogošća, Hadžići and Ilijaš municipalities is discharged directly into the river Bosna without any treatment because connection from these areas to the central WWTP in Butile is considered uneconomic.

In March 2014, the municipalities of Vogošća, Hadžići and Ilijaš (in Sarajevo Canton) and Breza (in Zenica-Doboj Canton) expressed their interest in jointly resolving the issue of sewage and wastewater treatment on their territories. The Preliminary Design has now been prepared for the construction of main collectors and WWTP, to address problems of wastewater for the municipalities of Vogošća, Hadžići, Ilijaš, and Breza.

Since Breza is not located in Sarajevo Canton, the Study of Drainage and Sanitary Wastewater Treatment in the Sarajevo Canton (2016-2036) of the Ilijaš, Hadžići and Vogošća municipalities was observed separately from the Breza municipality. The study plans the construction of collectors in the mentioned municipalities and the construction of three separate treatment plants. In accordance with the conclusions of the study, it is necessary to prepare investment and technical documentation, obtain the necessary permits and start the implementation of projects.

Implementation of the steps outlined in the implementation plan is proposed over a period of five years.[29]

Figure shows Option 1 from the Preliminary Design (2014).

Benefits

Compliance with EU UWWTD for wastewater discharges and WFD for river compliance in their local implementations.

Increased biodiversity and ecosystem health in rivers.

Opportunities for economic returns, employment and inclusion.

Major benefits for access to services in the above areas and public health.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
	AQ01 Improve ambient air quality compliant with EU standards	1

[28] Sarajevo Canton, Development Planning Institute of SC, Implementation Action Plan 2019-2021, Development Strategy of Sarajevo Canton until 2020; FBiH, March 2019, Federal Ministry of Finance, Public Investment Program of the FBiH 2019-2021, October 2018.
[29] Projekt, d.d. Nova Gorica - Slovenia, Presentation of examples of environmental projects suitable for the use of EU funds (IPAII): Construction of a joint wastewater treatment plant and sewage system in the municipalities Vogošća, Ilijaš and Breza, March 2017.

State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1) Pressure: water (27, 28), industry (20)	WR02 Maintain and improve surface water and groundwater quality	3
	SL01 Protect and enhance soil quality across Sarajevo Canton	1
	GH01 Reduce GHG emissions	2
	BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
	BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2027
EUR 98,789,000 BAM 192,803,850	EUR 4,930,000 BAM 9,640,000	Cantonal budget, IFI and donors, Private sector	

Notes on cost estimate CAPEX estimated based on expert judgement to carry out activities to construct WWTP and sewage network, and referencing 2014 study. OPEX is based on 5% of CAPEX.

Owner	**Stakeholders**
Sarajevo Canton Administration and Zenica-Doboj Canton Administration, Municipality Vogošća, Municipality Ilijaš, Municipality Hadzici, CPUC ViK Sarajevo, Ministry of Communal Affairs and Infrastructure, Ministry of Economy, PUC Vodostan Ilijaš, PUC Komunalac Hadžići	Customers, Municipalities, AVP Sava, Roads / Highways Directorates

5.7. Energy and buildings

5.7.1. Current initiatives

5.7.2. Key challenges and policy gaps

Sarajevo Canton is supplied with electrical power by JP Elektroprivreda BiH d.d. Sarajevo. Electricity production plants are not located in SC. Thus, the Canton is not affected by direct emissions associated with electricity generation. The share of the population with an authorised connection to electricity (95%) is benchmarked as “green”. The number of electrical interruptions per customer in 2018 was 0.5, thus also benchmarked as “green”.

According to the BiH Law on Consumer Protection, energy supply charges should be based on individual consumption calculated using the readings of consumer meters. At present, in SC billing for electricity is based on actual consumption, while billing for heat energy consumption is not. Not all households in residential and commercial buildings have meters installed and, in these cases, billing is based on heated surface. Therefore, the indicator in metering and billing for personal energy use is benchmarked as “yellow”.

In terms of energy pressures, electricity consumption in residential buildings is high. With a value of 45 kWh/m^2, this is considerably higher than the “red” benchmark for the associated indicator. However, according to available statistics, electricity consumption in non-residential buildings is benchmarked as “green”. Consumption of fossil fuels in both residential (101 kWh/m^2) and non-residential buildings (147 kWh/m^2) is relatively high and the indicators for each are benchmarked as “yellow”. This is despite the fact that according to data from the Draft BiH Building Renovation Strategy, residential houses are underheated, i.e. only 70% of the total residential area is heated. The high residential electricity consumption may be partly as a result of the use of electricity for space and hot water heating, that is used either as the main heat source or to supplement other heating sources.

The production of energy for heating is the second main contributor to air pollution in SC. Natural gas accounts for 53.2% of the Cantonal energy balance, of which 29.7% is gas consumption in the district heating system. Of the remaining energy balance, firewood accounts for 17.5%, coal lignite 13.05%, coal 7.7%, electricity 6.0%, fuel oil 1.6% and pellets / briquettes 0.95%. If wood is considered as the only type of renewable energy source in the current energy balance, then the value for the indicator related to share of RES in total energy consumption is about 17.5%, which is benchmarked as “yellow”. There are no RES technologies applied in district heating.

Approximately one quarter of the population has access to district heating in SC and there is no district cooling. Consequently, the associated indicator is benchmarked as “red”. Of the 210,589 housing units in Sarajevo Canton, 46.6% use wood, coal or liquid fuel for heating. Unfortunately, in some households, automotive tyres, plastics and garbage are used as fuel, which significantly exacerbates air pollution.

SC currently has no green building certification standard in place but it does have a building energy rating certification standard in place, which indicates a building's energy performance. Information systems incorporating energy building rating certificates have not been implemented and so the energy category of certified buildings was not available during GCAP production.

Moreover, the KEAP anticipates that activities on the implementation of energy efficiency measures in public and residential buildings will be financed by public resources from the Canton and the municipalities.

The response indicator on public and private investment in energy efficiency in buildings is benchmarked as "yellow" as there is public and private investment in energy efficiency of buildings, but not at a sufficient level. Activities related to the promotion of green building through incentives are under implementation in SC by promotion of public and commercial supported grant funds and affordable credit lines. For this reason the indicator regarding the promotion of green building through standards and fiscal incentives is benchmarked as "green".

According to the Law on Renewable Sources for Energy and Efficient Cogeneration and its by-laws, renewable energy facilities in private buildings are incentivised through feed-in-tariffs. The related annual budget is, however, limited. For these reasons the indicator on incentives of renewable energy facilities in private buildings is benchmarked as "yellow" while the indicator on renewable energy technologies is benchmarked as "green", as renewable energy technologies are developed and supported through public and private investment.

Activities for the promotion of renewable energy facilities are not in place so the indicator on awareness campaigns on renewable energy facilities is benchmarked as "red".

5.7.3. Current initiatives

A number of current initiatives are referred to in the section above. These are amongst many that are at various stages of development, but information regarding substantive initiatives that are being progressed is currently limited. Key initiatives include the following:

- An Energy Efficiency Action Plan (EEAP) for Public Buildings for the period 2018-2021 - the aim of this plan is to reduce energy consumption by around 6,960 MWh per year or 5% of current energy needs, with 322 public buildings analysed in the study;
- Building renovations to enhance energy efficiency – in 2018 a model for improving energy efficiency in buildings was developed by the SC and Sarajevo Economic Region Development Agency (SERDA) and this resulted in the identification of necessary improvements, half of which will be financed by building owners and the other half by the government. It is apparent that the scope of improvements required will, however, be broader than identified in this study; and
- Implementing a priority investment plan for 2020 – 2024 – this investment plan is based on the findings of a UNDP funded feasibility study (Feasibility Study on Expanding and Improving the District Heating System in the Canton of Sarajevo, 2019), which assessed the potential for improving and expanding the district heating (DH) system in SC. It is oriented towards maximisation of operational cost savings and improved efficiency of the heat production and distribution companies in SC. The short-term investment plan includes legal, institutional, technical and environmental and health and safety measures.

5.7.4. Short-term actions

A total of six energy and buildings actions were developed as part of the GCAP which are listed in Table 5-8, all of which have been prioritised by the government.

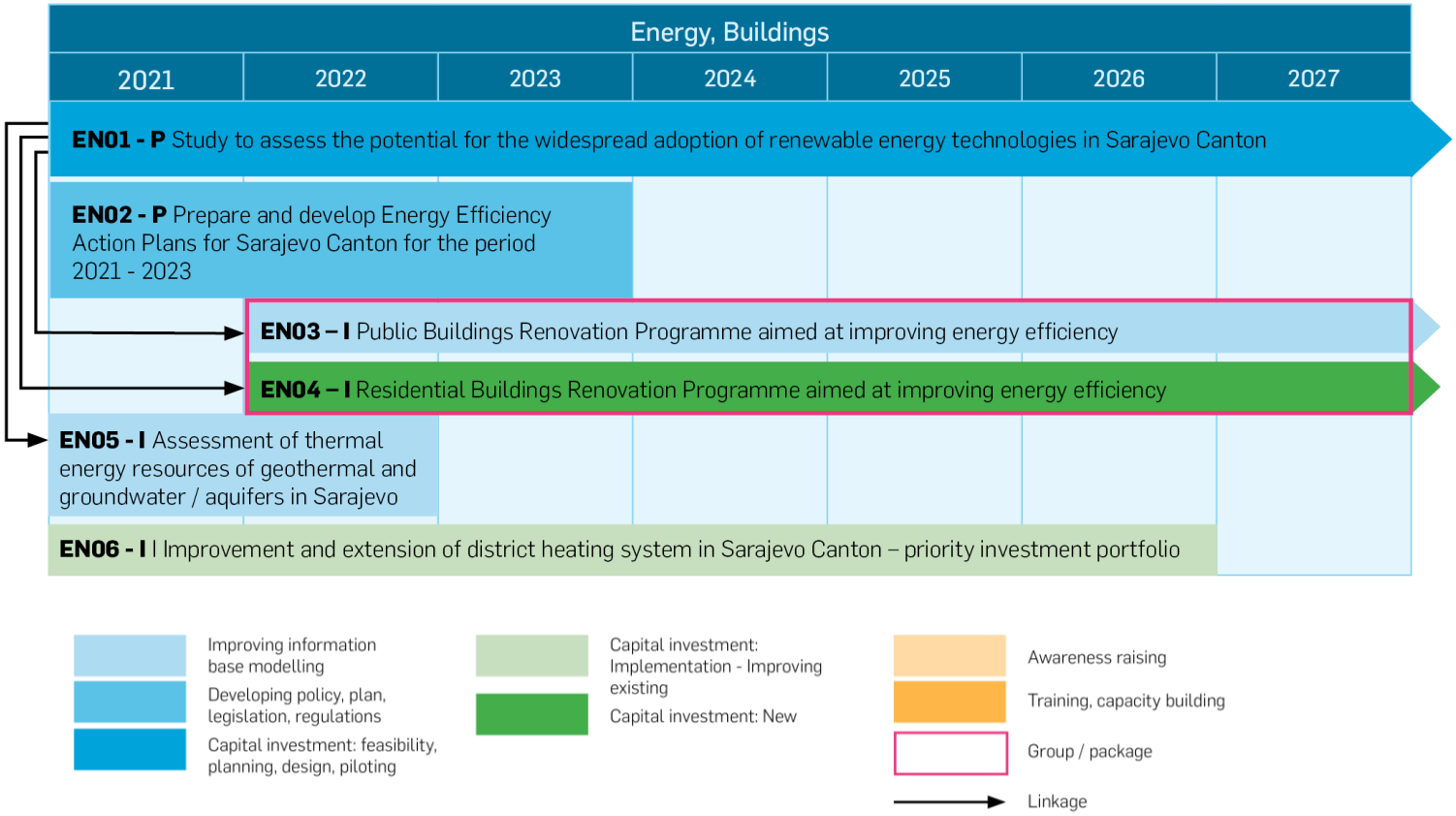
In response to the need to enhance the level of planning in the sector, an action has been proposed to Prepare and Develop Energy Efficiency Action Plans for SC for the period 2019 to 2023. This will be informed by a Baseline Emission Inventory, the assessment of which will help to identify the most appropriate areas of action and also the Cantonal CO_2 emission reduction target. These will in turn be used to define concrete energy efficiency improvement measures. Two studies to assess the potential for improvements in the sector will also be initiated in the short-term. These are a study to assess the potential for the widespread adoption of renewable energy technologies in the Canton, and another to assess the potential for thermal energy resources and of geothermal and groundwater/ aquifers in SC. These will inform future studies and infrastructure investments.

The other three actions will all begin with studies to inform infrastructure investments, which are the focus of each action. These are a Public Buildings Renovation Programme and Residential Buildings Renovation Programme, both of which focus on the deployment of renewable energy technologies. The third involves the development of a priority investment portfolio for rehabilitating and extending the SC district heating system and investment in the same. This portfolio is likely to contain actions including the construction of new boiler houses complete with primary and secondary networks to connect users to these extensions to the district heating system.

Table 5-8 - Energy and buildings actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Policy Option / Action Owner	CAPEX	OPEX (Annual)	Timeline	Smart Action	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
EN01 - P	Study to assess the potential for the widespread adoption of renewable energy technologies in Sarajevo Canton	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy, DHN operators	EUR 50,100,000 BAM 97,987,083	EUR 5,500,000 BAM 10,757,065	Study: 2021 - 2022 Implementation: 2022 - 2031	Y	1	2	0	0	0	3	2	2	0
EN02 - P	Prepare and Develop Energy Efficiency Action Plans for Sarajevo Canton for the period 2021-2023	Ministry of Economy	EUR 100,000 BAM 195,583	EUR 30,000 BAM 58,675	2021 - 2023	Y	2	2	0	0	0	3	2	2	1
EN03 - I	Public Buildings Renovation Programme aimed at improving energy efficiency	Ministry of Economy	EUR 30,000,000 BAM 58,674,700	EUR 25,000 BAM 48,896	2022 - 2032	Y	3	1	0	0	0	3	1	1	0
EN04 - I	Residential Buildings Renovation Programme aimed at improving energy efficiency	Ministry of Economy, Ministry of Physical Planning, Construction and Environmental Protection, City of Sarajevo, Municipalities, SERDA	EUR 40,000,000 BAM 78,233,200	EUR 20,000 BAM 39,117	2022 - 2032	Y	3	1	0	0	0	3	1	1	0
EN05 - I	Assessment of thermal energy resources of geothermal and groundwater / aquifers in Sarajevo	Ministry of Economy, Ministry of Communal Affairs and Infrastructure	EUR 350,000 BAM 684,541	EUR 5,000 BAM 9,779	2021 - 2022	Y	1	2	0	0	0	3	2	2	1
EN06 - I	Improvement and extension of district heating system in Sarajevo Canton – priority investment portfolio	Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy	EUR 52,000,000 BAM 101,969,886	EUR 10,000 BAM 19,558	2021 - 2026		3	1	0	0	0	2	0	0	0

Figure 5-4 - Energy and buildings actions programme



Energy and Buildings EN01 - P	Smart

Study to assess the potential for the widespread adoption of renewable energy technologies in Sarajevo Canton

Description

Sarajevo Canton has ambition to improve energy efficiency in industry and the building sector, as well as to increase the proportion of renewable energy in the total energy balance.

Federal Energy Efficiency Action Plan (2016-2018), Action Plan for Renewable Energy in BiH (2016-2020) followed by the Study on Potential for Renewable Energy Production in BiH (2019, UNDP) support the ambitions of the Canton to have more concrete actions towards introduction of renewable energy technologies. Initial deployment of solar PV technologies has begun in Sarajevo, to act as educational hubs, in the form of *'solar tree'*. These will provide local lighting and charging hubs for tourists and locals and have been backed by the Mayor of Municipality Stari Grad. A good case study in the sector of public buildings is Primary School Meša Selimović, with installation of solar PV on the roof of the school building.

There is also a reasonable proportion of low-rise building stock in the city, meaning that there is a relatively high ratio of available roof space per person, which can be utilised for solar energy technologies.

The proposed investment in a wind farm by Suzlon indicates that there is a credible, bankable wind resource in the Sarajevo area. In conjunction with solar energy and heat pumps / geothermal energy, wind power can provide a significant component of low carbon energy infrastructure.

The study should assess potential for application of renewable energy technologies in private and public buildings and in areas around the urban municipalities. This should also include the assessment of solar, wind and heat pump technologies and opportunities for integration in building renovation packages.

The study will include a gap analysis and recommendations for improvement of the existing regulatory framework regarding PV grid integration, applicable tariffs and net metering schemes.

An operational programme for implementation of renewable energy (RE) technologies will be based on recommendations given in the study and split into two components:

- RE technologies as part of cantonal private and public building renovation programme.
- Private investments in heat or electricity RE technology-based production.

Benefits

- Addressing climate change and renewable energy targets.
- Reducing GHG emissions and local air pollutant emissions.
- Benefits to local communities, including economic and employment; reducing energy poverty; access to National/European funding.
- Economic benefits through returns, growth, employment and inclusion.
- Minor social benefits to public health and access to services.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1) Pressure: energy (15.1, 15.2 18.1, 18.2, 23)	AQ01 Improve ambient air quality compliant with EU standards	1
	GH01 Reduce GHG emissions	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year**
EUR 50,100,000	EUR 5,500,000		2021 - 2022 for study

BAM 97,987,083	BAM 10,757,065	Cantonal budget, IFI and donors, Private sector	2022 - 2031 for deployment
Notes on cost estimate CAPEX based on expert judgement for a EUR 100,000 study and EUR 50,000,000 costs which will be dependent on units deployed and technology. Indicative CAPEX estimates for various Renewable Energy technologies include residential 2kW PV system at EUR 3,500 with annual OPEX at 3-5% of CAPEX, Large Ground Mounted PV Arrays (1-5MW) at EUR 1,250/kW with annual OPEX at 3% of CAPEX and Large Scale Onshore Wind Turbine (1-3MW0 at EUR 1,300/kW with annual OPEX at 5% of CAPEX.			
Owner Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy, DHN operators		**Stakeholders** Municipalities, Industry, public and private building owners	

Energy and Buildings EN02 - P	Smart

Prepare and Develop Energy Efficiency Action Plans for Sarajevo Canton for the period 2021-2023

Description

Preparation of an Energy Efficiency Plan (EEP) for Sarajevo Canton is a legal obligation based on Federal Law on Energy Efficiency.

The EEP should be built on the Baseline Emission Inventory to identify the best areas of action and opportunities for setting the Cantonal CO_2 reduction target. It will define concrete reduction measures, together with timeframes and assigned responsibilities, which translate the long-term strategy into action.

The activity will start with gap analyses of the existing Baseline Emission Inventory and followed by its upgrade if necessary.

The EEP will cover the main target sectors: buildings, industry and other commercial users and urban transport. The EEP will also include actions related to local electricity production (development of PV, wind power, CHP (Combined Heat and Power), improvement of local power generation), and local heating/cooling generation. The plan will identify the key financing resources that will be used to finance the actions. An operational program for implementation of renewable energy (RE) technologies will be based on recommendations given in the study and split into two components:

- RE technologies as part of cantonal private and public building renovation programme.
- Private investments in heat or electricity RE technology-based production.

Benefits

- Reduced GHG emissions and local air pollutant emissions.
- Demonstrate commitment to environmental protection and efficient management of resources.
- Participation of civil society, improvement of local democracy.
- Economic and employment benefits, e.g. retrofitting/ insulation of buildings.
- Develop a clear, holistic and realistic strategy for improvement in current conditions.
- Access to National/European funding.
- Improved citizens' well-being (reducing energy poverty).
- Local health and quality of life (reduced traffic congestion, improved air quality).
- Secure future financial resources through energy savings and local energy production.
- Improved long-term energy independence of the Canton.
- Support improved implementation of national and/or EU policies and legislation.

Current baseline

State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1) adaptation and resilience (9, 9.1)

Pressure: energy (14.1, 18.2, 23, 15.1, 15.2 18.1, 18.2, 23)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	2
GH01 Reduce GHG emissions	3
AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 100,000 BAM 195,583	EUR 30,000 BAM 58,675	Cantonal budget, IFI and donors	2021-2023

Notes on cost estimate CAPEX of EUR 100,000 is based on expert judgement and previous studies. EUR 30,000 OPEX required to coordinate delivery and monitoring of the new Energy Efficiency Action Plan and previous action plans.	
Owner Ministry of Economy	**Stakeholders** Building owners, range of heat users, district energy operators, industry and transport investors, Ministry of Physical Planning, Construction and Environmental Protection , Ministry of Transport, DHN operators

Energy and Buildings EN03 - I	Smart

Public Buildings Renovation Programme aimed at improving energy efficiency

Description

Sarajevo Canton adopted an Energy Efficiency Action Plan (EEAP) for Public Buildings for the period 2018-2020 in accordance to the Law on Energy Efficiency in the Federation of Bosnia and Herzegovina ("Official Gazette of the Federation of BiH", No. 22/17). The aim of this plan is to reduce energy consumption by around 6,960 MWh per year or 5% of current energy needs, with 322 public buildings analysed in the study. Its implementation is projected to result in financial savings of around EUR 500,000 annually, while achieving required standards for indoor thermal comfort, i.e. temperature and humidity in work and living spaces, budget savings, reduction in the use of fossil fuels, conservation of natural resources, and ultimately improvement of air quality in Sarajevo Canton. 36 buildings have been selected for renovation over a three-year implementation period. With support of the UNDP Green Economic Development Program 21 public buildings have been renovated to date, with renovation of the other 15 on-going. A total of around EUR 4m has been invested to date. The remaining 286 buildings will be renovated in coming years. It is recommended that an ambitious target to renovate at least a further 200 public buildings by 2030 is set, where these are prioritised on a through-life cost and user benefit basis. The on-going public building renovation programme should be upgraded by renovation packages that combine building envelope renovation with HVAC (Heating, ventilation, and air conditioning) and hot water production based on renewable energy technologies where possible. Prior to a decision on optimal cost renovation packages for public buildings, an energy audit and cost-benefit analyses of different renovation packages (including renewable energy technologies) should be undertaken for each building.

The programme should build upon the conclusions and recommendations of the study of potential for market penetration of renewable energy technologies in Sarajevo Canton and the SC EEAP (EN02).

It is recommended that a target of an average of 20 public buildings per year is set from 2021-2030, resulting in 200 buildings over the 10-year period. Based on the reported figures for the existing UNDP renovation programme the typical cost per building, assuming completion of 21 buildings and a 50% completion of the 15 on-going buildings, is around EUR140,000. This equates to an average annual spend of around EUR2.8M for the renovation of twenty buildings and a total spend in the region of EUR28M. A preliminary 10 year budget of EUR 30M is suggested to cover unforeseen non-standard renovation requirements.

It is also recommended that the programme is monitored and refined on an annual basis, with a major review being undertaken every two years. This would assess the benefits of the measures applied, consolidate and disseminate lessons learned and current best practice, and tune the approach and prioritised list of buildings for the next phase of renovation. It would also monitor and reforecast the renovation programme costs.

It is recommended that the programme development include the following steps:

- Undertake a comprehensive thermal imaging programme (in winter months) of the buildings that are selected for potential renovation.
- Utilise the thermal imaging programme, in conjunction with building occupants and building information to prioritise target buildings.
- Develop an asset log of space heating and hot water heating methods for all buildings via a survey programme, starting with the prioritised building list.
- Discuss issues with existing space heating and hot water with building occupants, establishing why current methods are used and if there are any preferences / hurdles for change.
- Include an educational programme to provide information on building energy efficiency measures and the changing of heating fuel sources.
- Align programme with priority buildings and occupants, incorporating occupant feedback and building survey information.
- Deliver programme based on annual targets, include an annual progress / lessons learned review to be used to inform subsequent years priority building list.

Activities under this action should be closely coordinated with those of actions EN04, EN05 and EN06 to ensure optimum synergies and efficiencies.

Benefits

- Improved indoor thermal comfort.
- Reduced energy consumption.
- Reduced GHG emissions and local air pollutant emissions.
- Increased renewable energy in total energy balance.
- Increased employment opportunities.
- Potential benefits to public health., via more stable indoor temperatures and reduced need for local combustion of fuels such as coal and wood for provision of heat.
- Minor economic benefits through economic returns, growth and employment.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	3
Pressure: energy buildings (14.2, 15.2, 23)	GH01 Reduce GHG emissions	3

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2022-2032
EUR 30,000,000 BAM 58,674,700	EUR 25,000 BAM 48,896	Cantonal budget, IFI and donors, Private sector	

Notes on cost estimate CAPEX of EUR 30,000,000 based on existing renovation programme, current reported expenditure, buildings completed and identified target list of outstanding buildings for renovation. Dependent on depth of renovation required. OPEX is based on expert judgement, based on 2 / 2.5 FTE with ongoing coordination and administration by Canton Administration. No additional OPEX associated with refurbishment of buildings.

Owner	**Stakeholders**
Ministry of Economy	Public building owners, DHN operators

Energy and Buildings EN04 - I	Smart

Residential Building Renovation Programme aimed at improving energy efficiency

Description

In November 2018, Sarajevo Canton in cooperation with Sarajevo Economic Region Development Agency Sarajevo Economic Regional Agency (SERDA) developed a model for improving energy efficiency in buildings focused on increasing the number of users. The model is based on a 50:50 ratio for financing: 50% comes from building owners, while 50% is subsidised by the government. It is estimated that renovation of building envelopes will cost approximately EUR 250,000 annually. The Canton supported this programme with EUR 125,000 in 2019. However, building renovation based only on renovation of building envelopes will achieve only limited emission reductions, since most individual houses use fossil fuel for heat production. In addition to gas, in Sarajevo Canton in 2017 the registered consumption of solid fuels amounted of 96,098 tonnes, of which fuel wood comprised 52%, brown coal 12%, coal lignite 34% and other solid fuels (wood charcoal, wood briquettes and pellets) 2%. Thus, the renovation packages in Sarajevo Canton, beside renovation of building envelope, should include new heating and cooling and hot water production technological solutions including renewable energy technology solutions.

The programme should build upon conclusions and recommendations of the study of potential for market penetration of renewable energy technologies in Sarajevo Canton and the SC EEAP (EN02).

It is recommended that the programme development include the following steps:

- Undertake a comprehensive thermal imaging programme (in winter months) of the buildings that are selected for potential renovation.
- Utilise the thermal imaging programme, in conjunction with resident and building information to prioritise target buildings.
- Develop an asset log of space heating and hot water heating methods for all buildings via a survey programme, starting with the prioritised building list.
- Discuss issues with existing space heating and hot water with building residents, establishing why current methods are used and if there are any preferences / hurdles for change.
- Include an educational programme to provide information on building energy efficiency measures and the changing of heating fuel sources.
- Align programme with priority buildings and residents, incorporating resident feedback and building survey information.
- Deliver programme based on annual targets, include an annual progress / lessons learned review to be used to inform subsequent years priority building list.

Activities under this action should be closely coordinated with those of actions EN03, EN05 and EN06 to ensure optimum synergies and efficiencies.

Benefits

- Improved indoor thermal comfort.
- Reduced energy consumption.
- Reduced GHG emissions and local air pollutant emissions.
- Increased renewable energy in total energy balance.
- Increased employment opportunities.
- Potential benefits to public health and access to services.
- Economic benefits through economic returns and growth.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	3

Pressure: buildings (14.1) energy (15.1, 23)	GH01 Reduce GHG emissions		3
CAPEX EUR 40,000,000 BAM 78,233,200	**OPEX** EUR 20,000 BAM 39,117	**Potential funding options** Cantonal budget, IFI and donors, Private sector plus ESCO model	**Start/end year** 2022-2032
Notes on cost estimate CAPEX is based on estimated expenditure by SERDA for existing residential refurbishment programme of EUR 250,000 per annum. This does not include low carbon / RE heating. It is considered that the programme should be expanded to target the thermal upgrading, including supply of heat where practicable, of a minimum of 2,000 dwellings average per year, or 20,000 over the next decade. At an average of EUR 2,000 per dwelling, the total cost is estimated as EUR 40,000,000. The Canton currently have EUR 2,500,000 planned investment in this area, to be match funded. It is expected that this would be increased to at least EUR 5,000,000 for a EUR 40,000,000 ten-year programme. OPEX estimate is based on expert opinion of one FTE plus part time assistance / expertise for EUR 20,000 to administer and coordinate programme. Potential revenue from payback of loans from tenants (where applicable). Commercial details would need to be assessed during the early stages of the refurbishment programme.			
Owner Ministry of Physical Planning, Construction and Environmental Protection, City of Sarajevo, Municipalities, SERDA		**Stakeholder** Municipalities, residential building owners, DHN operators	

Energy and Buildings EN05 - I	Smart

Assessment of thermal energy resources of geothermal and groundwater / aquifers in Sarajevo

Description

Sarajevo has a widespread district heat network (DHN), composed of several smaller networks. According to historic and recent reports, large areas of the network are in a state of disrepair / damaged and many of the heat sources are also in need of replacement. The main heat sources are understood to be steam boilers, fuelled by gas and heavy oil, and are distributed across many different locations. A UN (United Nations) sponsored study completed in 2019, Feasibility Study on Expanding and Improving the District Heating System in the Canton of Sarajevo, concluded that replacement of steam heating plant and distribution pipework with low temperature hot water (LTHW) based systems was the preferred approach for future refurbishment and expansion of the DHN.

Modern district heat networks are utilising ever decreasing flow and return temperatures to distribute the heat. This results in two key benefits, the first being that the losses associated with distributing the heat are much lower, and the second being that lower temperatures are much more suited to the use of heat pumps, which utilise renewable energy from the local environment in a very efficient manner.

If areas of the district heat network were converted to low temperature distribution, the large geothermal resource could be harnessed to potentially provide a significant amount of the city's heating. Heat pumps can be coupled with low grade heat from the geothermal resource to supply heat at the necessary temperatures to end users.

To be able to properly assess the potential benefits that could be provided by the geothermal and aquifer-based heat sources it is recommended that a full study of the resource across the City of Sarajevo and nearby areas is undertaken. It is also recommended that this is completed and fully considered prior to significant investment being undertaken in the existing heat network distribution system and heat supplies.

The use of the geothermal resource and other local low-grade heat sources has the potential to provide a future ready thermal energy system for the city. The Municipality of Ilidja has already made steps towards utilising these resources. This would be highly decarbonised, efficient and clean and, with the proposed extensive DHN rehabilitation and expansion work, the development of the network in a manner to accommodate a wider range of clean, low carbon thermal sources is strongly recommended.

The study would be conducted in two phases. Phase 1 would comprise a desktop analysis of all existing known resources. Phase 2 would entail conducting additional ground investigations as identified in Phase 1.

It is recommended that this study is completed, and the findings fully considered, prior to the decision on major investment in new biomass boilers and any extensive expansion of the existing DHN (see EN06 below). Activities under this action should be closely coordinated with those of actions EN03, EN04 and EN06 to ensure optimum synergies and efficiencies.

Benefits

- Mapping of geothermal and aquifer resource.
- Facilitating of local renewable heat for use across the city.
- Reduced GHG emissions and local air pollutant emissions.
- Enable optimum targeting of district heat network rehabilitation and future investment.
- Benefits to public health due to much lower air borne pollutants than alternative heat sources.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1),	AQ01 Improve ambient air quality compliant with EU standards	1

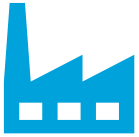
<table>
<tr><td colspan="2">adaptation and resilience (9, 9.1)
Pressure: buildings (14.1, 15, 15.1, 15.2), energy (22, 23)</td><td colspan="2">GH01 Reduce GHG emissions</td><td>3</td></tr>
<tr><td colspan="2"></td><td colspan="2">AR01 Improve resilience to climate change and other natural disasters</td><td>1</td></tr>
<tr><td>CAPEX
EUR 350,000
BAM 684,541</td><td>OPEX
EUR 5,000
BAM 9,779</td><td>Potential funding options
Cantonal budget, IFI and donors, Federal budget together with Grant for desktop study and partly ground investigation</td><td colspan="2">Start/end year 2021-2022</td></tr>
<tr><td colspan="5">Notes on cost estimate The CAPEX is based on expert judgement with an EUR 70,000 desktop study and costs dependent on extent of EUR 280,000 ground investigations conducted and availability of existing material. OPEX based on 0.5 FTE EUR 5,000 required for ongoing monitoring and coordination.</td></tr>
<tr><td colspan="2">Owner
Ministry of Economy, Ministry of Communal Affairs and Infrastructure</td><td colspan="3">Stakeholders
Ministry of Physical Planning, Construction and Environmental Protection, DHN operators, customers, current and future heat suppliers</td></tr>
</table>

Energy and Buildings EN06 - I
Improvement and extension of district heating system in Sarajevo Canton – priority investment portfolio
Description A UNDP funded feasibility study (Feasibility Study on Expanding and Improving the District Heating System in the Canton of Sarajevo, 2019) has recently been undertaken to assess potential for improving and expanding the district heating (DH) system in Sarajevo Canton. The study's selected scenario implies the modernisation of existing boiler rooms, including the replacement and installation of new gas fuelled boilers. In addition, installation of biomass and/or chip wood fuelled boilers has also been considered. Such new wood biomass boiler rooms should be set up in municipalities outside the City of Sarajevo; more specifically, one boiler room each in Vogošća, Ilijaš and Ilidža (in the neighbourhood of Hrasnica). The new wood biomass boiler rooms would have sufficient capacity to meet the heat demand in the municipalities of Vogošća and Ilijaš, and the neighbourhood of Hrasnica. The study's priority investment plan 2020 – 2024 is oriented towards maximisation of operational cost savings and improved efficiency of the heat production and distribution companies in SC, as well as priority measures, which are applicable (in accordance with the conclusions of the baseline study) for the considered period of three to five years. The short-term investment plan includes legal, institutional, technical and environmental and health and safety measures. Expansion of the DH system in the period considered is focused towards connection of the public and residential buildings in the system area to boiler houses which have sufficient capacity to cover heat demand, as well as modernisation of some boiler houses based on the current state of equipment. In addition, it is planned to install a new boiler house in Bistrik in Stari Grad municipality in order to enable the connection of public buildings to the DH system, as well as a new boiler house in the University of Sarajevo Campus located in Novo Sarajevo municipality in order to enable the connection of public and residential buildings in Centar Sarajevo and Novo Sarajevo municipalities. Furthermore, a new biomass-based boiler house is envisaged in Hrasnica in Ilidža municipality, complete with primary and secondary networks to connect new users to the DH system, as well as replacement of the existing heavy fuel oil boilers with biomass-based boilers in Vogošća municipality including network extension. This action comprises implementation of the above proposals. Prior to the start of the implementation of the program of priority measures, it is necessary to develop an Operational Program for the expansion of the DHN and the connection of new users. The cost of developing this program is approximately 160,000 BAM. However, it is recommended that the outputs from EN05 are fully considered, in particular other approaches and alternative low carbon supplies, prior to finalising major investment programmes. The use of low temperature district heating systems results in lower standing losses which could in turn enable summer time hot water for district energy connected consumers. Expansion of the district heating system may also consider local networks operating at nearer to ambient temperature (referred to as 5GDHC or an ambient loop), that draw heat from the main DHN to provide thermal balancing. Local users connect to an ambient temperature network via heat pumps (either directly or via small local LTHW networks supplied by a heat pump station), providing an efficient means to distribute thermal energy. This approach would allow direct electric water heating to be replaced with more efficient low carbon heating. Activities under this action should be closely coordinated with those of actions EN03, EN04 and EN05 to ensure optimum synergies and efficiencies.
Benefits Based on a previous report, the total heated surface area after the implementation of the selected scenario will be around 4.8m m^2, with the following benefits in terms of emissions reductions: CO_2e 10%; SO_2 14%; NO_2 10%; PM_{10} 10%. There would be economic benefits through economic returns and employment opportunities. There would be social benefits to public health and access to services.

<table>
<tr><td colspan="2">Current baseline
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1)
Pressure: buildings (14.1, 15, 15.1, 15.2), energy (22, 23)</td><td colspan="3">Environmental performance (alignment with GCAP objectives)
AQ01 Improve ambient air quality compliant with EU standards — 3
GH01 Reduce GHG emissions — 2</td></tr>
<tr><td>CAPEX
EUR 52,000,000
BAM 101,969,886</td><td>OPEX
EUR 10,000
BAM 19,558</td><td>Potential funding options
Cantonal budget, IFI and donors, Private sector plus ESCO model</td><td colspan="2">Start/end year 2021-2026</td></tr>
<tr><td colspan="4">Notes on cost estimate CAPEX estimate based on priority investment plan from UNDP funded Feasibility Study on Expanding and Improving the District Heating System in the Canton of Sarajevo, 2019. OPEX estimate for coordination of refurbishment programme based on one FTE at EUR 10,000. DHN OPEX borne by DHN operators.</td></tr>
<tr><td colspan="2">Owner
Ministry of Communal Affairs and Infrastructure, Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy</td><td colspan="3">Stakeholders
DHN operators, Municipalities, customers, current and future heat suppliers</td></tr>
</table>

5.8. Industry

5.8.1. Key challenges and gaps



Data regarding the energy consumption of industries in Sarajevo Canton are not available and data on emissions of air pollutants from industry are also not available. Related details should be reported in a Pollutant Release and Transfer Registry (PRTR) at the federal level but the PRTR is not functioning properly and so for the purpose of the GCAP has had to be inferred. Industry in SC is largely comprised of food processing (dairy, meat processing, brewery, soft drinks and bakery), wood processing (hardwood floors and furniture), quarries, construction and metal production. Food and wood processing industries are highly energy intensive and so their energy use and emissions should be further analysed as a priority, including in the context of current and potential future response measures. The potential emissions of Particulate Matter (PM) from quarries and the construction industry are also high and so should also be subject to investigation in the short-term. There only two companies certified to the ISO50001 standard in BiH, neither of which are located in SC.

5.8.2. Key current initiatives

SC industry does, however, appear to be willing to engage in energy and material efficiency programmes. A number of Cantonal industrial companies voluntarily participated in the resource efficiency and cleaner production programme of UNIDO (United Nations Industrial Development Organisation, National Cleaner Production Programme for BiH, 2016 to 2018), for example. The KEAP also indicates industrial support for activities relating to the implementation of resource efficiency measures and cleaner production in industries, although no related activities have yet been implemented. The response indicator regarding support for energy efficient industrial technologies (electricity, heat and industrial processes) through private investment is therefore benchmarked as “yellow”. The other industry related response indicators are also benchmarked as “yellow” (44-Energy efficient industrial machinery is regulated and incentivised through fiscal instruments, 45-Efficiency of new built industrial facilities and waste recycling is regulated and incentivised through fiscal instruments, and 46-Industrial wastewater treatment / reuse / recycle is promoted through regulations and fiscal incentives). An environmental permit is obligatory for specific industrial facilities in accordance with the Federal Law of Environmental Protection, for example, resource efficiency and Best Available Technology (BAT) are requested and promoted through environmental permit, and water protection fees are in place. Inspection of industrial facilities is not, however, adequate due to a lack of inspectors and the absence of penalties for non-implementation of measures to mitigate negative environmental impacts. There are also no incentives for energy efficient industrial machinery, material efficiency of new built industrial facilities, waste recycling, nor for industrial wastewater treatment, reuse or recycling.

5.8.3. Short-term actions

Three industry actions were developed as part of the GCAP process and one was prioritised (see Table 5-9). They will all contribute towards improving air quality and managing GHG emissions and the capacity building action will contribute towards achieving most of the other strategic objectives.

The actions reflect the need to build capacity within SC industries to implement energy and material efficiency measures, along with wider cleaner production measures. A two year-long action has been prioritised, targeted at all environmental permit holders in SC, which will involve the development and delivery of a comprehensive training programme. It will be designed to enable industries that participate to build their capacities regarding the effective and efficient development, application, adaptation, scaling up and mainstreaming of resource efficiency and cleaner production concepts, methods, policies, practices and technologies.

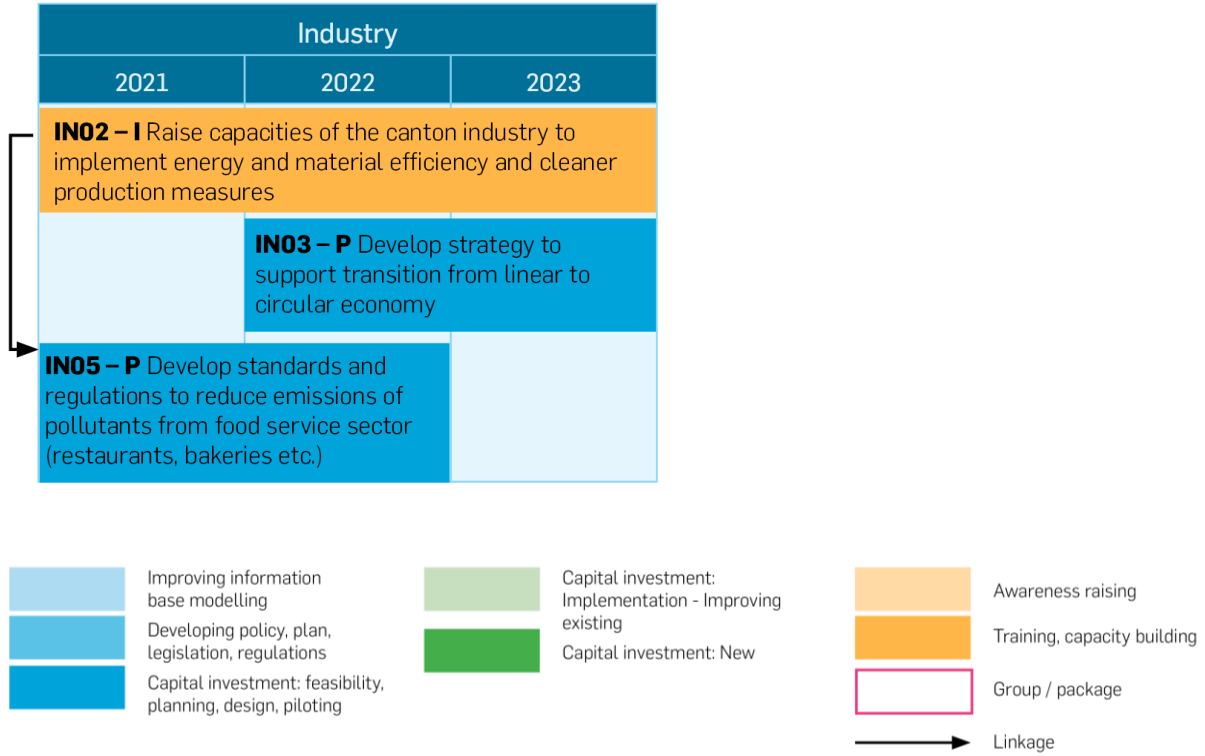
The capacity building action will be complemented by the development of a strategy to support the transition from a linear to circular economy. A circular economy, which is one in which materials are kept in use for as long as possible to reduce negative environmental impacts and maximise their economic value, can be planned by mapping SC resources and collaborating with businesses and citizens in the SC to support the identification of enabling factors, for example relating to the regulatory framework, and options for transitioning to a circular economy.

The third action will be to develop standards and regulations to reduce air pollutant emissions from the food sector. Small restaurant, catering and bakery businesses in SC are not subject to environmental permitting and this is a gap that needs to be closed to address emissions from the sector more widely. This action will extend to conducting awareness raising of the technical standards developed and potential technological solutions, with a capacity building component also involved.

Table 5-9 – Industry actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Policy Option / Action Owner	CAPEX	OPEX (Annual)	Timeline	Smart Action	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
IN02 - I	Raise capacities of the Canton industry to implement energy and resource efficiency, and cleaner production measures	Ministry of Economy	EUR 40,000 BAM 78,233	EUR 0 BAM 0	2021 - 2023	Y	1	1	1	1	0	2	0	1	0
Additional actions															
IN03 – P	Develop strategy to support transition from linear to circular economy	Ministry of Economy	EUR 75,000 BAM 146,687	EUR 0 BAM 0	2022 - 2023		1	1	0	1	0	1	0	1	0
IN05 – P	Develop standards and regulations to reduce emissions of pollutants from food service sector (restaurants, bakeries etc.)	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy	EUR 50,000 BAM 97,791	EUR 0 BAM 0	2021 - 2022		2	0	0	0	0	2	0	0	0

Figure 5-5 - Industry actions programme



Industry IN02 - I	**Smart**

Raise capacities of the Canton industry to implement energy and resource efficiency, and cleaner production measures

Description

Industry is the holder of environmental permits and is responsible for preventing and controlling emissions to the environment. Traditionally, industry is control oriented and has knowledge on best available techniques, pollution prevention, resource efficiency and cleaner production options.

A comprehensive training programme is proposed for industries that will build their capacities for effective and efficient development, application, adaptation, scaling up and mainstreaming of resource efficiency and cleaner production concepts, methods, policies, practices and resource efficiency technologies, cleaner production and use of technologies using reviewable energies for the industrial purposes.

The programme should include both in-class and on-the-job training for industries with the ultimate aim of developing implementable options for resource efficiency and emission reduction in each industry.

The programme should address all environmental permit holders, from both cantonal and federal level, with facilities located in the territory of the Canton.

The support to industries for implementation of identified measures should be ensured in cooperation with funds for investments in green and smart technologies such as Green Economy Financing Facility (GEFF).

Benefits

Improved industrial environmental performance and cleaner environment in the Canton. Minor public health benefits could also be felt indirectly.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: industry (18.1, 18.2,19, 20)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR01 Improve efficiency of water use	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GH01 Reduce GHG emissions	2
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2023
EUR 40,000 BAM 78,233	EUR 0 BAM 0	Cantonal budget, IFI and donors	

Notes on cost estimate The CAPEX is based on expert judgement. There is zero OPEX.

Owner	**Stakeholders**
Ministry of Economy	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Administration for Inspection Affairs, the Sarajevo Canton Chamber of Commerce, industry located in the territory of the Canton, National Cleaner Production Programme in BiH.

5.9. Sustainable waste management

5.9.1. Key challenges and gaps

In 2016, annual municipal solid waste generation was 450 kg / capita, and thus the associated indicator is benchmarked as “yellow”. The SC’s GDP divided by total municipal waste generation gives high values and thus GDP per domestic material consumption is benchmarked as “red”.

The percentage of inhabitants covered by waste collection services is 95%, and only 5% of generated waste is disposed of in illegal ways. Thus, the indicators regarding share of the population with weekly municipal solid waste (MSW) collection and percentage of MSW which is disposed of in open dumps, controlled dumps or bodies of water, or is burnt, are benchmarked as “green”. All collected municipal waste is transported and disposed of in the landfill Regional Centre for Waste Management Smiljevići (RCUO Smiljevići), which covers 94.5 ha including a buffer zone; currently 53.4 ha are active. In 2016, the construction of a new space of 15,000 m^2 for waste disposal area began, along with the capacity expansion of the sorting plant and installation of a new truck weighing scale.

Cantonal landfill is equipped with a landfill gas evacuation system and with a gas-to-energy plant. However, there are associated gaps in provision. These include the fact that while landfill leachate is properly collected, operational problems mean that it is not treated at the on-site wastewater treatment plant as the technology on-site is not adequate. The amount of leachate varies with the precipitation, which affects the capacity and choice of technology at RCUO Smiljevići. Also, the remaining life of current landfill is estimated to be until 2027 and therefore indicator no. 32, landfill efficiency capacity, is benchmarked as “yellow”.

In SC there are no adequate local stations for separate waste collection. In several SC municipalities there are collectively more than 600 containers for the separate collection of paper, cardboard and Polyethylene Terephthalate (PET) packaging. The containers for paper and plastics, however, no longer serve their purpose. This is owing to factors including insufficient education, residents’ irresponsible behaviour and the provision of inadequate containers. This has resulted in residents disposing of, de facto, all the mixed municipal waste. In the area of SC there is only one recycling yard located in the area of RCUO Smiljevići, which serves as a link between citizens, authorised collectors and authorised waste management facilities and / or the cantonal landfill. The current recycling rate (indicator number 31) is low (< 1%); thus it is benchmarked as “red”. In addition, SC has no composting plants for the treatment of biodegradable waste. The mechanical treatment of waste only takes place at the sorting plant at the landfill “Smiljevići“ but its full capacity is not being utilised.

5.9.2. Key current initiatives

Several ongoing studies have been conducted to determine solutions to address the challenges summarised above. These include:

- Study on the locations of recycling yards and green islands for the area of all nine municipalities of Sarajevo Canton with location in the spatial planning documentation and an investment plan which determines the locations of green islands, recycling yards and zones of two-line waste collection system. This presents a financial framework, priorities and dynamics of implementation of activities on the construction of the planned infrastructure. During the preparation of the study, technical guidelines for the design of infrastructure for waste reception were prepared, in which the conceptual solutions of the planned infrastructure were presented;

- A Feasibility Study for Waste Treatment Options for SC, which was completed in June 2020 – this evaluated a number of scenarios and resulted in the preparation of related costings of actions that were recommended based on a detailed technical, economic and environmental assessment; and
- A project on Leachate Generation Assessment for RCUO Smiljevići, Lifespan Analysis and Progressive Closure for Leachate Minimisation – this included preliminary costings of recommended actions, the implementation of a number of which is already planned.

The above initiatives are aligned with key strategic documents, notably the Sarajevo Canton Waste Management Plan 2015 – 2020 and the Sarajevo Cantonal Plan of Environmental Protection 2017 – 2022.

The response indicator on the reduction of material consumption / solid waste generation is benchmarked as "yellow", as the need for reducing solid waste has already been identified and related activities are also planned in the KEAP, but not yet implemented. Among the activities for reduction of material consumption and solid waste generation are: distribution of bins for separation of biodegradable waste at source; encouraging composting where housing is mostly in individual households; re-using 90% of paper, cardboard, glass, plastic packaging, and; reducing the total amount of waste by 10% in industrial production.

The coverage of municipal solid waste collection is well implemented in the Canton, covering 95% of the area. The Canton does not have responsibility for the regulation of waste categories such as batteries and accumulators, motor oils and medical waste. This is the responsibility of the Federal Ministry for Environment Protection and extended producer responsibility for these categories is still not regulated. This issue is identified within the KEAP, which has proposed the following measures: increase overall percentage of adequate disposal of waste motor oils; increase overall percentage of adequate disposal of electrical and electronic waste; 100% appropriate disposal of waste from healthcare institutions, and; establish facilities for adequate disposal of animal waste. For the above reasons, the response indicator on the coverage of solid waste collection systems is categorised as "grey".

The response indicator on disincentivising littering and non-compliance to sorting systems through fines and penalties is benchmarked as "yellow". In SC waste collection is provided by communal officers. They do not, however, have the authority to charge penalties to persons who are breaching the law.

The response indicator on composting, recycling and waste-to-energy facilities is also benchmarked as "yellow", as activities are identified, and measures are proposed but not implemented. Among the planned activities are construction of a recycling yard and green islands and construction of the remaining part of the landfill site of inert material for the establishment of recycling of construction waste. Activities regarding the promotion of solid waste reuse, sorting and recycling are foreseen in the KEAP but not implemented. With regards to overcapacity issues in landfills, activities foreseen are: laying multi-barrier protection to extend the active landfill; creating technical documentation for opening a new sanitary landfill, and; establishing facilities for adequate disposal of animal waste. Some of these activities are under the first phase of implementation, but not fully in operation.

5.9.3. Short-term actions

Six solid waste actions were developed and prioritised (see Table 5-10).

The six GCAP actions include two policy measures. The first is the development of a new tariff model for waste management services as the current system of area-based fees (as opposed to fees based on quantity of waste generated) is not profitable. The new tariff will help to reduce quantities of waste, but the increased financial penalties associated with illegal dumping as a result of the change will require measures, such as high fines, to be introduced in parallel and regulatory changes to be made at SC level. The second investment involves the development of an animal waste incineration facility, the first phase of which will be a feasibility study that will develop, evaluate and compare different animal waste management scenarios, no provision for which currently exists in SC. The second phase of this action will be investment in the waste treatment technology identified as being most appropriate for SC.

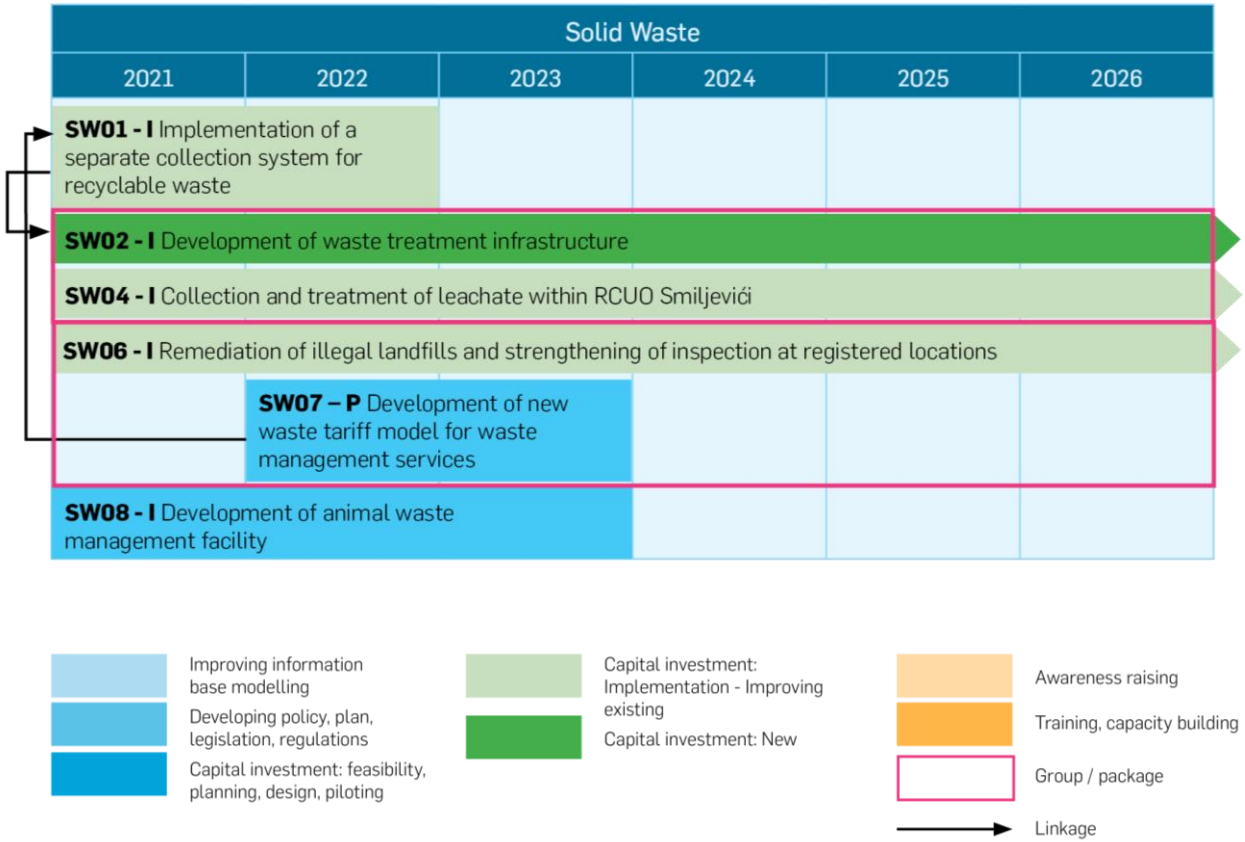
The other four short-term actions all relate to investment in new, and modification of existing, infrastructure. One of these actions is to develop SC's waste treatment infrastructure, with a potential solution to be implemented being the treatment of municipal waste in a Mechanical Biological Treatment Plant, which would also generate electricity with biogas production, providing a sustainable solution for recycling and biowastes management, reducing GHG emissions and contributing towards the protection of soil quality and the wider natural environment. This action, along with other waste sector actions, would reduce the volume of waste disposed of in RCUO Smiljevići, the progressive closure of which for leachate minimisation is another priority action.

Infrastructure investment actions also include the implementation of a separate collection system for recyclable waste and waste oils, which is an objective of the Sarajevo Canton Waste Management Plan 2015 – 2020. Waste oils can be collected for recycling / reuse in various facilities. How this is done, and who is responsible, will be the subject of the Solid Waste Management Strategy. Solid waste management is normally classified as utility infrastructure. In order to be effective this will require changes to the charging system for waste management services, an approach for which will be developed as a component of this action. The removal of illegal open dumps and littering prevention is another infrastructure investment action, albeit on a smaller scale to the others. It will involve monitoring remediated areas to contribute towards future illegal dumping events.

Table 5-10 - Solid waste actions and prioritisation by strategic objective

Policy Option / Action Ref.	Short term actions	Action Owner	CAPEX	OPEX (Annual)	Timeline	Smart Action	Strategic Objective								
							AQ01	WR01	WR02	SL01	GS01	GH01	BE01	BE02	AR01
Priority actions															
SW01 – I	Implementation of a separate collection system for recyclable waste	Ministry of Physical Planning, Construction and Environmental Protection, Ministry for Communal Affairs and Infrastructure	EUR 5,000,000 BAM 9,779,150	EUR 500,000 BAM 977,915	2021 - 2022		1	0	1	1	0	2	0	1	0
SW02 – I	Development of waste treatment infrastructure	Ministry of Physical Planning, Construction and Environmental Protection	EUR 45,000,000 BAM 88,012,350	EUR 3,150,000 BAM 6,160,865	2021 - 2027	Y	2	0	1	2	0	3	1	1	0
SW04 – I	Collection and treatment of leachate within RCUO Smiljevići	Ministry of Communal Affairs and Infrastructure, Cantonal Communal Solid Waste Management Utility CPUC Rad	EUR 5,000,000 BAM 9,779,150	EUR 500,000 BAM 977,915	2021 - 2027		0	0	2	3	0	1	0	0	0
SW06 – I	Remediation of illegal landfills and strengthening of inspection at registered locations	Ministry of Communal Affairs and Infrastructure, Cantonal Communal Solid Waste Management Utility CPUC Rad	EUR 100,000 BAM 195,583	EUR 10,000 BAM 19,558	2019 - ongoing		1	0	1	3	0	1	1	1	0
SW07 – P	Development of a new tariff model for waste management services	Ministry of Communal Affairs and Infrastructure	EUR 200,000 BAM 391,166	EUR 0 BAM 0	2022 - 2023	Y	0	0	1	2	0	1	0	1	0
SW08 – I	Development of animal waste management system	Ministry of Economy, Ministry of Communal Affairs and Infrastructure	EUR 1,650,000 BAM 3,227,120	EUR 150,000 BAM 293,375	2021 - 2023		1	0	1	2	0	1	0	1	0

Figure 5-6 - Solid waste actions programme



Solid Waste SW01 - I

Implementation of a separate collection system for recyclable waste

Description

Sarajevo Canton currently relies mainly on a single-stream collection system for municipal solid waste (MSW) and more than 98% of collected MSW is disposed of in Smiljevići's landfill. The establishment of a separate waste collection system for recyclable waste and waste oils in all municipalities of the canton has been identified as an objective in the Sarajevo Canton Waste Management Plan 2015 – 2020. The implementation of a separate collection for recyclables can take place through various systems, leading to different outcomes and recycling rates. However, in order to maximise the recycling performance, it is recommended that additional recyclable waste collection bins for the source segregation of valuable materials will be provided to the population of the Canton. Changes in the current charging system for waste management services will be required to promote source segregation of recyclables.

In 2019 the Canton prepared a "Study on location of recycling yards and recycling centres in the territory of nine municipalities in Sarajevo Canton with their location in spatial documents and including the investment plan", the GIS database with waste collection locations, and Technical Guidelines for Design of Waste Disposal Infrastructure.

The implementation of this action requires the procurement of waste disposal equipment such as additional recyclable waste collection bins for the storage of recyclable waste and collection vehicles for their transport to a suitable treatment facility.

The Technical Guidelines present the existing situation in the municipal waste management system in Sarajevo Canton, the concept of collection, guidelines and conceptual solutions for the planned infrastructure, as well as the zoning of Sarajevo Canton according to the typical municipal waste quality. The Technical Guidelines were produced with the aim to ensure efficient separation and collection of waste materials in accordance with the objectives (i) plan the space for location of waste infrastructure in spatial planning documents; (ii) prescribe technical requirements and ensure functional usage and maintenance.

Benefits

Benefits from the separate collection of recyclable waste include improvements in recycling and recovery rates, landfill diversion rates and increased remaining capacity for Smiljevići's landfill.

Economic benefits through growth, returns, employment and inclusion.

Significant social benefits to public health and access to services.

Current baseline State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: solid waste (29, 29.1, 31, 31.3, 31.1, 32,), industry (19)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GH01 Reduce GHG emissions	2
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2022
EUR 5,000,000 BAM 9,779,150	EUR 500,000 BAM 977,915	Cantonal budget, IFI and donors, Private sector	

Notes on cost estimate The CAPEX was estimated based on expert judgement for the EUR 5,000,000 procurement of waste disposal equipment and construction of recycling centres. OPEX was estimated as 10% of CAPEX.

Owner	Stakeholders
Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Communal Affairs and Infrastructure	, Cantonal Communal Solid Waste Management Utility CPUC Rad, EPR operators, Municipalities

Solid Waste SW02 - I	Smart

Development of waste treatment infrastructure

Description

Sarajevo Canton has prepared a Feasibility Study for Waste Treatment Options for the Canton. The study analysed four different scenarios:

- Scenario S1 implies Mechanical and Biological Treatment (MBT) aiming to separate recyclables and produce refuse derived fuels (RDF) and compost. The intention is to sell RDF to cement factories in BiH (Kakanj or Lukavac).
- Scenario S2 also implies MBT, with biogas instead of compost production. This scenario also envisages a cogeneration plant for combustion of the resulting biogas, where heat energy is used to heat the digestor while electric energy can be sold at feed-in rates. This scenario considers using slaughter waste in the total balance.
- Scenario S3 represents the thermal treatment of municipal waste in a cogeneration plant to produce electrical and thermal energy. It is estimated that the facility can provide heat for 17,000 households. The installed power of the plant would be 5 MW.
- Scenario S4 is the same as S3, with the addition of 45,000 t / year of sludge from the wastewater treatment plant that will be incorporated.

The value of the investment in plant construction varies from EUR 25 million (S1) to EUR 45 million (S2), EUR 80 million (S3) and EUR 112 million (S4).

It is noted that water resources action WR08 entails an alternative option for valorisation of sludge from the wastewater treatment plant. Therefore, we recommend that S4 is assessed against or after WR08 is confirmed whether it will be taken forward or not.

A detailed technical-economic-environmental assessment of all options has been carried out and was followed by a multi-criteria analysis to select the optimal scenario and most appropriate technology. Within the context of the Sarajevo GCAP, S2 is considered as the more environmentally sustainable option, as well as the second most economical from a CAPEX and OPEX perspective. By developing and operating an MBT facility which includes biogas and electricity production, the Canton would be adopting the most preferable option in the EU Waste Framework Directive Waste Hierarchy, which entails recycling of dry recyclables and biowastes. It would also contribute to the Canton's circular economy, in line with the EU's Circular Economy Package.

The next steps for the decision making and development procedure of the Waste Treatment Plant would be the finalisation and adoption of the preferred solution by the Canton Administration, and the selection of a location. These will be followed by the preparation of a financing model, the preparation of the technical documentation and tender, the selection of a partner and the tendering and construction of the plant. The minimum timeframe for these steps is expected to be four years.

Benefits

Ensuring alternative waste treatment will increase the rate of recycling and recovery of useful materials or energy from waste as well as reduce the quantities of waste to be landfilled. Energy and materials recovery from waste can lead to revenue generation.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: solid waste 29, 29.1, 31, 31.3, 31.1, 32), industry (19)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	2
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	2
GH01 Reduce GHG emissions	3
BE01 Maintain and enhance natural environmental assets protecting biodiversity/geodiversity	1
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX EUR 45,000,000 BAM 88,012,350	**OPEX** EUR 3,150,000 BAM 6,160,865	**Potential funding options** Cantonal budget, IFI and donors	**Start/end year** 2021-2027
Notes on cost estimate CAPEX was estimated based on expert judgement, based on waste composition in KEAP, and referencing scenario 2 from the SC study. OPEX was estimated as 7% of CAPEX.			
Owner Ministry of Physical Planning, Construction and Environmental Protection		**Stakeholders** Ministry of Communal Affairs and Infrastructure, Canton Administration, Cantonal Communal Solid Waste Management Utility CPUC Rad, EPR operators, Municipalities	

Solid Waste SW04 - I	**Smart**

Collection and treatment of leachate within RCUO Smiljevići

Description

Following the World Bank study in 2018/19, the document 'Spatial Plan of the Area of Special Characteristics RCUO Smiljevici' was produced with regard to identifying a solution to the collection and treatment of leachate at the RCUO Smiljevići site. New waste disposal cells will be introduced in the existing landfill, in order to increase the capacity and accommodate future treatment technology.

The treatment of leachate is planned following two options: 1) discharge into open water course; if this option is adopted stricter criteria and more complex technological scheme is needed; 2) discharge into the public sewerage system 'Zabrđe'; however, this sewerage system is still to be built due to the unresolved issue of deciding the final treatment plant.

Moreover, there are two possible options for the layout of the collector Zabrđe. The first option is the connection of the collector Zabrđe to the local WWTP downstream, which will be determined by the Urban Plan that is being developed. Alternatively, the collector can be connected to the central WWTP at Butile, whereby the construction of a pumping station would be required.

It should be ensured that the treatment technology and the capacity of the leachate treatment plant meet strict standards and legislation related to water quality. When choosing the technological scheme, it should be ensured that additional capacity of seven days of inflow can be provided, in case of failure of the filtrate treatment device.

In order to monitor the environmental impact of RCUO "Smiljevići", regular monitoring of leachate, effluent and water in Lepenički potok should be established across all phases of construction, operation, closure and after reaching the full capacity of RCUO "Smiljevići". This environmental monitoring should also establish a station to monitor the quality of surface waters on the Lepenički stream and should be included in the monitoring programme of the Water Agency.

Benefits

Reduced quantity of leachate production decreased load on the future leachate treatment facility, reduced impact on water resources, faster stabilisation of the landfill.

Economic benefits through growth, returns, employment and inclusion.

Social benefits to public health and access to services.

Current baseline

State: water (2), soils (4.1b), biodiversity and ecosystems (7, 7.1).

Pressure: solid waste (31, 32, 31.3)

Environmental performance (alignment with GCAP objectives)

WR02 Maintain and improve surface water and groundwater quality	2
SL01 Protect and enhance soil quality across Sarajevo Canton	3
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2027
EUR 5,000,000 BAM 9,779,150	EUR 500,000 BAM 977,915	Cantonal budget, IFI and donors	

Notes on cost estimate CAPEX was estimated based on expert judgement. OPEX was estimated as 10% of expected CAPEX.

Owner	Stakeholders
Ministry of Communal Affairs and Infrastructure, Cantonal waste utility CPUC Rad	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Communal Solid Waste Management Utility CPUC Rad

Solid Waste SW06 - I

Remediation of illegal landfills and strengthening of inspection at registered locations

Description

According to the Sarajevo Canton Waste Management Plan 2015 – 2020, a total of 41 illegal open dumps has been counted in Sarajevo Canton. Additional smaller temporary dumps are formed around waste containers, due to insufficient waste collection capacity. Some former industrial sites also present a notable risk from hazardous waste. Waste littering was also identified as an issue in public spaces in the canton.

According to the KEAP 2017-2022, the creation of illegal dumps and littering are caused by the lack of adequate collection infrastructure and poor public awareness.

Sarajevo Canton in spring of 2019 financed a two-month long clean-up action to remove most of the illegal dumps in nine municipalities. Following the removal of the wastes, the identified areas are sanitised and recovered. Enhanced inspection and supervision at the recorded locations is recommended in order to avoid similar illegal dumping events. The clean-up action should be continued in future with permanent financing.

Rehabilitation should be carried out according to the Program for Rehabilitation of Illegal Landfills SC.

Benefits

The removal of illegal open dumps will ensure the controlled disposal of wastes and minimise hazards to the environment, such as the generation of leachate and infiltration in soils and groundwaters and will reduce GHG emissions (in the form of methane release to the air) in case of dumping of organic waste. The remediation of the contaminated areas will support enhanced soil quality. Significant benefits to public health and safety.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: solid waste (31.13)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	3
GH01 Reduce GHG emissions	1
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 100,000 BAM 195,583	EUR 10,000 BAM 19,558	Cantonal budget, IFI and donors	2019-ongoing

Notes on cost estimate CAPEX was estimated based on expert judgement. OPEX was estimated as 10% of CAPEX most of the OPEX is related to labour costs.

Owner	Stakeholders
Ministry of Communal Affairs and Infrastructure, Cantonal Communal Solid Waste Management Utility CPUC Rad	Ministry of Physical Planning, Construction and Environmental Protection, private land owners, environmental companies and associations

Solid Waste SW07 - P	**Smart**

Development of new tariff model for waste management services

Description

The current Spatial Plan for Sarajevo Canton 2003 – 2023 does not include any allocated space for the development of waste treatment and waste disposal infrastructure.

A change in the waste fees system will be required as the current system is not profitable. This is based on the occupied square metres rather than on the actual generated quantities of waste, as proposed in the Sarajevo Canton Waste Management Plan 2015 – 2020.

The new tariff model should also encourage manufacturers to recover useful waste. The tariff model study should identify and establish an economically viable and affordable tariff model system and specify the legal, technical requirements and investments needed to enable the model.

Moreover, high fines will also need to be introduced in order to avoid the risk of illegal dumping due to the increment in tariff.

Benefits

The review of waste charges that allow a shift from an area-based fee system towards a system based on generated quantities. The new system will be an important driver for the reduction of waste generated, as residents producing large quantities will be financially penalised.

Overall lower quantities of waste will have indirect benefits for air quality, GHG emissions reduction, soils, water resources and health and wellbeing.

Opportunities for economic returns and economic growth.

Current baseline

State: water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: solid waste (29, 29.1, 31, 31.3, 31.1, 32), industry (19)

Environmental performance (alignment with GCAP objectives)

WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	2
GH01 Reduce GHG emissions	1
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2022-2023
EUR 200,000 BAM 391,1661	EUR 0 BAM 0	Cantonal budget, Federal Budget	

Notes on cost estimate CAPEX was estimated based on expert judgement. There is zero OPEX required. The costs would comprise consultancy fees, estimated at international rates, for financial modelling and economic analysis for the development of a full tariff structure and charging system.

Owner	**Stakeholders**
Ministry of Communal Affairs and Infrastructure	Cantonal Communal Solid Waste Management Utility CPUC Rad

Solid Waste SW08 - I

Development of animal waste management system

Description

Animal waste management system is not developed in BiH yet. Development of regulatory and institutional framework is at federal level. SC has issues with animal waste arising from slaughterhouses, butchers, and the food industry.

A cantonal register of animal waste production has been recently developed. SC needs to carry out a feasibility study and detailed assessment in line with waste hierarchy, the EU Animal By-product Directive and the EU Industrial Emissions Directive in order to develop, evaluate and compare different animal waste management scenarios including the potential procurement of an animal waste incineration facility as it is intended by SC.

There is a risk of dioxin formation related to animal waste incineration however, emissions will depend on the chosen technology. If the preferable scenario after conducting the feasibility study is animal waste incineration, the SC needs to undertake a Health Impact Assessment alongside an Environmental Impact Assessment to address any risk related to dioxins and other toxic substances to ensure adequate monitoring, mitigation and disposal measures are in place such as safe disposal of ash.

Benefits

Overall lower quantities of waste will have indirect benefits for air quality, GHG emissions reduction, soils, water resources and public health and wellbeing.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1),

Pressure: solid waste (29, 29.1, 31, 31.3, 31.1, 32), 29.1, 31, 31.3, 31.1, 32), industry (19)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	2
GH01 Reduce GHG emissions	1
BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 1,650,000 BAM 3,227,120	EUR 150,000 BAM 293,375	Cantonal budget, IFI and donors, Private sector	2021-2023

Notes on cost estimate CAPEX was estimated based on expert judgement, for a EUR 150,000 feasibility study, project design EIA study, water permit study and a EUR 1,500,000 investment in animal waste treatment technology. This EUR1.5 million could be invested in the installation-retrofitting of 3 - 4 small size Anaerobic Digestion (AD) plants on existing animal farms (typical unit CAPEX ranging from EUR 350,000 to EUR 500,000), or 5 - 15 package animal incinerators (depending on size) or to a centralized AD or animal incineration facility installed on a large animal farm or abattoir in the area. OPEX was estimated as 10% of the animal waste treatment technology CAPEX.

Owner	Stakeholders
Ministry of Economy, Ministry of Communal Affairs and Infrastructure	Waste management operators

6. Green Canton monitoring, evaluation and reporting

The Government of the Sarajevo Canton will be responsible for the Green Canton monitoring, which will involve monitoring the implementation of GCAP actions and also the impact of the GCAP actions. The monitoring, evaluation and reporting approach adopted will be developed by the SC in the next step of the GCAP process, but an indicative approach is outlined in this chapter.

6.1. Scope and purpose of GCAP monitoring and evaluation

Monitoring and evaluation (M&E) are two distinct but complementary processes, with evaluation providing context to monitoring. Figure 6-1 summarises the distinction between the two activities as used in this chapter and as applied in relation to the GCAP.

A strong monitoring process is essential to ensure the success of the GCAP programme. Monitoring allows application of a learning by doing approach, by assessing success and weaknesses at the earliest stage, and adjusting and correcting implementation issues. In order to monitor and evaluate the implementation and impact of GCAP actions and the GCAP as a whole, data will need to be collected regarding:

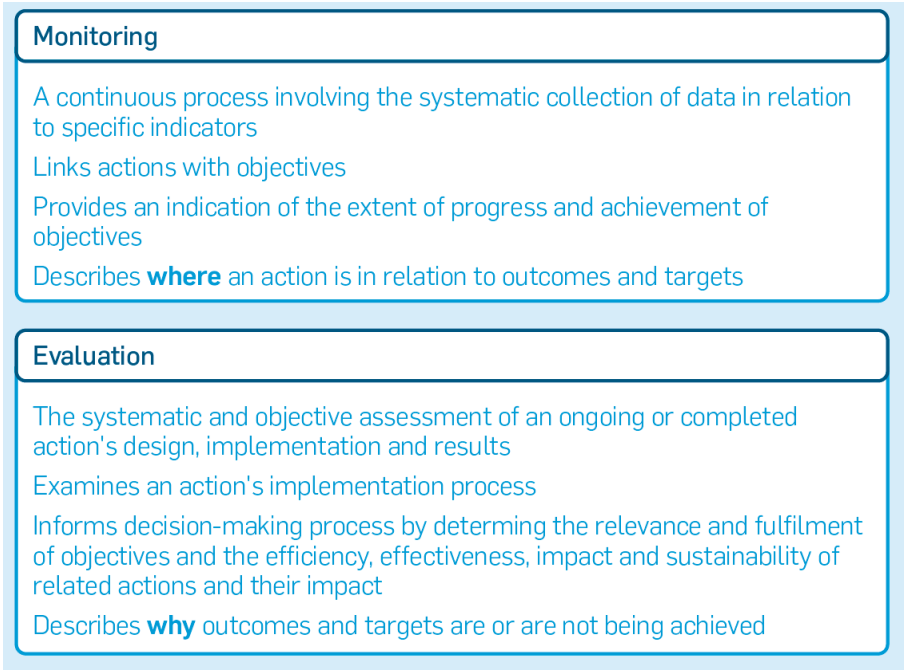
- **The implementation status of each GCAP action**: This should be recorded as 'No Action,' 'In Preparation,' 'Implementation Underway,' or 'Completed,' with an explanatory note provided;
- **Any changes to the Implementation Plan for each GCAP action**: Details regarding the budget, scope and implementation programme of each action should be collected; and
- **GCAP indicators that will be used to determine the impact of each GCAP action:** It is anticipated that these will largely comprise indicators used to assess Sarajevo's Green Canton baseline, and Chapter 5 featured the indicators that can be monitored to determine the impact of each GCAP action.[30]

These data, once verified, will be analysed to determine factors including:

- The likelihood of the GCAP vision, objectives and targets being achieved;
- Lessons learnt (notably what has gone well and where there is room for improvement);
- The need to take any corrective action, for example the revision of an element(s) of the GCAP Implementation Plan;
- Cost-effectiveness of investments;
- The effectiveness of the monitoring process; and
- Whether there should be a refresh of the GCAP.

[30] It is not necessary to collect data to update all indicators in the Indicators Database. But doing so would constitute good practice and facilitate a holistic understanding of the state of the environment, pressures and responses in Sarajevo. This can be a valuable tool for informing decision-making and enable the periodic revisiting of GCAP challenges, objectives, actions and targets and its ultimate refresh.

Figure 6-1 – The distinction between monitoring and evaluation



6.2. M&E process, reporting and frequency

Monitoring is an ongoing process to ensure that actions are being pursued in the right direction and in line with the agreed scope, identify emerging issues, and address these early. Monitoring is not just a data exercise based on collecting and analysing quantitative data. The M&E process comprise two components:

- How the GCAP programme is progressing, under the **Progress Monitoring Plan (PMP)**. This aims to have an updated understanding of the status of action implementation over time including budget spent, alignment with deadlines and achievement of key milestones.
- The external impact of the programme, under the **Impact Monitoring Plan (IMP)**. This aims to assess the effective impact of actions against the targets that were initially set up, for instance, reduction in air pollution, share of green spaces, etc.

The EBRD has established reporting requirements that apply to all GCAPs. These require the submission of two reports:

1. A report summarising the implementation status of actions included in GCAPs, which should adopt the format of the template in Table 6-1 Progress Monitoring Plan (PMP). It was populated at the end of the GCAP development process and will be updated within a year of the GCAP being adopted, and then at least annually thereafter;
2. A report summarising the status and likelihood of achieving GCAP visions, objectives and targets. This will take the form of an 'Impact Monitoring Plan' (IMP) (see Table 6-2) which, like the PMP, was completed at the end of the GCAP development process and will be updated after three years and five years to report on the environmental, social and economic impacts of the GCAP. It will be populated by drawing on the relevant indicator data in the Indicators Database.

The Progress Monitoring Plan will require more frequent updates than the Impact Monitoring Plan, because new external data will only be released occasionally.

In addition to these two reports, the Indicators Database will continue to be used to present data collected alongside global benchmark values. The Indicators Database is presented in the Appendix G and also in the Technical Assessment Report. Any additional reporting requirements will be set by the GCAP Co-ordinator, which is likely to be a member of the Cantonal Ministry of Physical Planning, Construction and Environmental Protection, as entity responsible for the KEAP, or of the Premier's Cabinet, in Step 3 of the GCAP process ('Green Canton Implementation').

The Sarajevo Canton will submit these reports to the EBRD, circulate them internally to inform internal decision-making, and communicate them with other stakeholders as appropriate.

Table 6-1 – Screenshot of the Progress Monitoring Plan (PMP) reporting template

Sector	Action Reference Number	GCAP Actions	Strategic Objectives	Action Classification	Action Owner	Potential Source of Funding	Implementation Timeframe	CAPEX (EUR)	CAPEX (BAM)	Yearly OPEX (EUR)	Yearly OPEX (BAM)		Responsible Department	Responsible M&E Expert	Implementation Partners	Status Implementation	Initial Budget	Budget Spent to Date	Notes (Explain What has Happened to Date, Issues, Partnership)	Date Enter
Land Use	LU02 - I	Upgrade and enhance integrated Geographic Information System (GIS) based land use for Sarajevo Canton to facilitate effective monitoring and evaluation systems for planning and management	WR01 WR02 SL01 GS01 BE01 BE02 AE01	Improving information base, modelling	Ministry of Spatial Planning, Construction and Environmental Protection	Cantonal budget, IFI and donors	2020-2021	1,700,000	3,324,911	28,000	54,763									
Transport	TR07 - I	Enhance and expand cycling infrastructure	AQ01 WR02 SL01 GS01 GH01	Capital investment: implementation - improving existing	Ministry of Transport	Cantonal budget, IFI and donors, Private sector, Federal budget	2020-2025	5,300,000	10,365,899	265,000	518,295									
Water	WR01 - P	Develop Water Supply digital asset management system, customer management system and non-revenue water reduction action plan	WR01	Developing policy, plan, legislation, regulations	Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	Cantonal budget, IFI and donors, Federal budget	2020 - 2022	550,000	1,075,705	10,000	19,558.30									
Energy	EN01 - P	Study to assess the potential for the widespread adoption of renewable energy technologies in Sarajevo Canton	AQ01 WR01 GH01 BE01	Capital investment: feasibility, planning, design and piloting	Ministry of Physical Planning, Construction and Environmental Protection, Ministry of	Study: Cantonal budget, IFI and donors Deployment	Study: 2020 - 2021 Deployment Programme:	Study: 100,000 Deployment Programme:	Study: 195,583 Deployment Programme:	Study: 0 Deployment Programme:	Study: 0 Deployment Programme:									
Industry	IN02 - P	Raise capacities of the Canton industry to implement energy and resource efficiency, and cleaner production measures	AQ01 WR01 WR02 SL01	Awareness raising	Ministry of Physical Planning, Construction and Environmental Protection	Cantonal budget, IFI and donors	2020 - 2022	40,000	78,233	0	0									
Solid Waste	SW02 - I	Development of waste treatment infrastructure	AQ01 WR02 SL01 GH01	Capital investment: implementation – new	Ministry of Physical Planning, Construction and Environmental Protection	Cantonal budget, IFI and donors	2020 - 2026	80,000,000	156,466,400	8,000,000	15,646,640									

Table 6-2 – Screenshot of the Impact Monitoring Plan (IMP) reporting template

GCAP Environmental Topic Area	GCAP Strategic Objectives	Indicator Code	Indicator	Type of Indicator	Benchmark IDB	Latest Value in IDB at GCAP Adoption	Unit	Year Latest Value in IDB	Data Source / Contact Detail	GCAP MT Target Value	MT Target (Value Only)	GCAP LT Target Value	LT Target (Value Only)	Related GCAP Actions (Major Impact)	Responsible Data Collection officer	Value 2021	Value 2022	Value 2023	Value 2024	Value 2025	Medium Term Target (2025)	MT Target Achieved	Value 2026	Value 2027	Value 2028	Value 2029	Value 2030	Long Term Target (2030)	LT Targets Achieved
Air Quality	AQ01	1.1	Average annual concentration of PM10	State		48	µg/m3	2017	City of Sarajevo/ annual report of air quality in FBIH,	40 µg/m3	40	30 µg/m3	30								40							30.00	
Water Resources	WR01	26	Share of non-revenue water	Pressure		75	%	2015	KEAP, page 57	55%	55	35%	35																
Soils	SL01	29	Total solid waste generation per capita	Pressure		450	kg/year/ capita	2016	KEAP, page 33	370 kg/year/capita	370	300 kg/year/capita	300																
Green Space	GS01	6	Open green space area ratio per 100,000 inhabitants	State		9	m2 / capita	2016	KEAP page 45; Institute for Canton Sarajevo planning	10 m2/capita	10	>10 m2/capita	9.9																
Mitigation of GHG Emissions	GH01	8	Annual CO2 equivalent emissions per capita	State		4.27	t / yr / capita	2013	KEAP, page 112	4 t/yr/capita	4	< 4 t/yr/capita	3.9																

Note: Excel spreadsheet of M&E framework including a dashboard sheet is presented in Appendix F.

A list of actions to be pursued under the M&E process are listed below:

1. **Supervise progress (PMP)**: M&E Sector Experts should review programme actions to ensure that:
   - Actions are being implemented timely, in line with the implementation programme.
   - Actions are still in line with objectives and programme scope.
   - Budget is aligned with the implementation programme.

   The review will be based on qualitative monitoring (information from other stakeholders on actions progress) as well as quantitative monitoring (new data when published).
2. **Supervise impact (IMP)** when new quantitative data are released, the M&E sector experts will collect and analyse the data.
3. **Identify and report issues**: M&E sector experts must report frequently to the M&E Co-ordinator.
4. **Address issues identified:** the M&E Co-ordinator ensures that the monitoring process is conducted effectively. S/he supports M&E sector experts if monitoring issues have been identified and helps them to find adequate solutions, so that actions can be pursue in line with the implementation programme.
5. **Update the Monitoring spreadsheet:** the M&E Sector Experts and M&E Co-ordinator ensure that the monitoring spreadsheet is kept up-to-date:
   - **Progress Monitoring Plan (PMP):** the PMP should be updated at least every year. The implementation status of each GCAP action ('No action', 'In Preparation', Implementation under way', or 'Completed') should be updated as needed, as well as information on budget spent. Where there has been 'No Action' the note should include a justification, and actions 'In Preparation' and where 'Implementation [is] Underway' should be accompanied by a short summary of progress. 'Implementation Underway' and 'Completed' actions should also be accompanied by a note summarising any social, economic and environmental impacts.
   - **Impact Monitoring Plan**: the IMP should be updated in 2021 and 2023 to align with GCAP key milestones, but more frequent updates (data permitted) are encouraged.
6. **Reporting to the GCAP Co-ordinator**: the M&E Co-ordinator reports to the GCAP co-ordinator on a regular basis. Reports should be made in writing so they can be used in the evaluation process. The M&E Co-ordinator should inform the GCAP co-ordinator of any monitoring issue. If those cannot be addressed, the GCAP Co-ordinator should inform other stakeholders.

Evaluation is punctual and assesses the outcome and impact of the GCAP actions implemented. Evaluation will take place in 2025 and in 2030, when progress will be reviewed against mid- and long-term targets. This will more likely be based on the quantitative data that have been collected over time. The evaluation process should be based on the ongoing work that has been carried on through monitoring. The evaluation process should not just look at the data but also take account of the policy, politics, economic and social dynamics to explain outcomes.

Table 6-3 – Monitoring plans updating process

Monitoring plan	When	What	Who
PMP (Progress Monitoring Plan)	Every year at least	Update action progress Justification of why an action has not been completed	M&E Sector Expert M&E Co-ordinator
IMP (Impact Monitoring Plan)	In 2021 and 2023 as a minimum	Input external data, indicators	M&E Sector Expert M&E Co-ordinator

6.3. Governance arrangements

The institutional structure of the monitoring and evaluation process is summarised in Figure 6-2. The key roles are:

GCAP Co-ordinator: it is recommended that a single designated SC official will be responsible for ensuring the timely monitoring of the GCAP and submission of related reports. This co-ordination role is likely to be adopted by the Deputy Minister of Environmental Protection within the Ministry of Physical Planning, Construction and Environmental Protection, which is also responsible for the implementation and monitoring of the KEAP. The main tasks are:

- Be responsible for the monitoring of the GCAP; and
- Delegate the required data collection, collation, analysis and reporting tasks to senior-level officials from across the Government of the SC.

M&E Co-ordinator could be someone working in close proximity to the GCAP Co-ordinator, The M&E Co-ordinator will be responsible for: - Identify and assign an official M&E Sector Expert within each of the cantonal ministries responsible for the implementation of a GCAP action(s) (see Table 6-4).

- Communicate regularly with the M&E sector experts,
- Assist M&E sector experts in resolving issues, when required;
- Set and enforce deadlines for regular reports relating to each GCAP action and indicator; and
- Report back frequently to the GCAP Co-ordinator on the progress of actions and issues, and discuss potential solutions.

M&E Sector Experts: there will be one sector expert responsible for the implementation of the GCAP actions. It is likely that these experts would be a head of sector and in most instances be the same officer responsible for the implementation of the relevant GCAP action. Their tasks include:

- Report specific issues arising from the implementation of actions to the M&E coordinator, based on information they get from other stakeholders as well as data, if applicable;
- Understand the targets and indicators relevant to their GCAP action(s) and how the data to inform each is derived and validated; and
- Collect relevant data and populate the monitoring plan.

Figure 6-2 – An overview of key roles

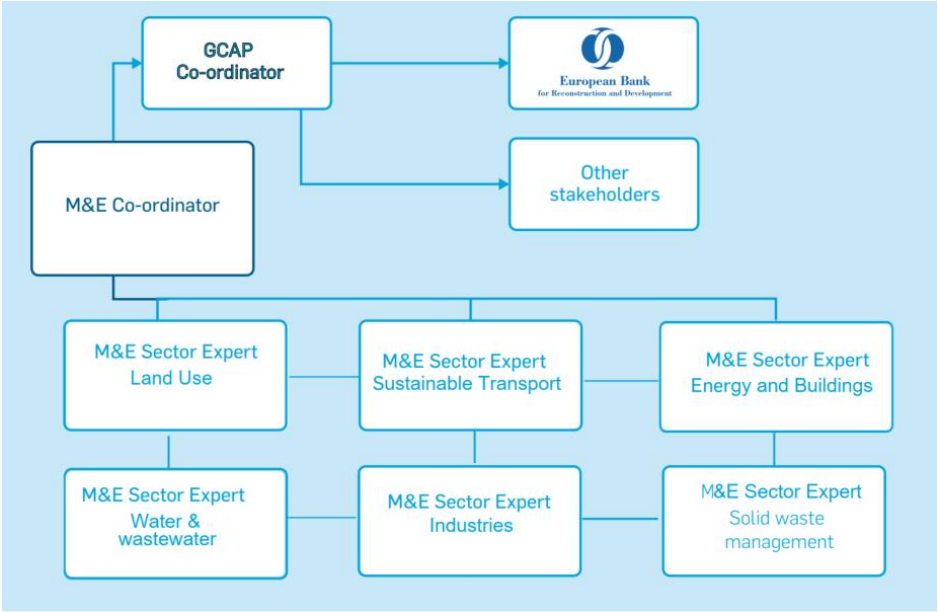


Table 6-4 – Sarajevo Cantonal Ministries and, where appropriate, Sectors responsible for monitoring and evaluation by GCAP sector

GCAP sector	Cantonal Ministry responsible for M&E of sector actions
Land use	Ministry of Physical Planning, Construction and Environmental Protection, Sector for Spatial Planning Development Planning Institute of SC
Sustainable transport	Ministry of Transport
Water	Ministry of Economy, Sector for Energy, Water Management, Entrepreneurship and Investment Ministry of Communal Affairs and Infrastructure, Sector for Communal Affairs and Infrastructure
Energy, buildings	Ministry of Economy, Sector for Energy, Water Management, Entrepreneurship and Investment, Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Communal Affairs and Infrastructure, Sector of Communal Activities and Infrastructure
Industry	Ministry of Economy, Sector for Energy, Water Management, Entrepreneurship and Investment, Ministry of Physical Planning, Construction and Environmental Protection
Sustainable waste management	Ministry of Physical Planning, Construction and Environmental Protection, Sector for Environment Protection Ministry of Communal Affairs and Infrastructure, Sector for Communal Affairs and Infrastructure

6.4. Role of stakeholders

The scope of GCAP actions and the nature and diversity of data requirements for related monitoring and evaluation dictates that internal and external stakeholders will need to be involved in the process. The stakeholders who are either responsible or accountable for elements of monitoring and evaluation, or who will need to be consulted, are listed in Table 6-5.

Table 6-5 – Local stakeholders who are either accountable, responsible or will be consulted in relation to GCAP monitoring and evaluation

Sector	Sarajevo Canton Sectors/ Ministries							Cantonal Institutes[31]	FbiH Ministries	Utility companies[32]	Private enterprises	NGOs and community groups	Local academia
	Sarajevo Canton Assembly	Sector for Environment Protection[33]	Sector for Physical Planning, Construction and Environmental Protection[34]	Ministry of Transport	Sector for Energy, Water Management, Entrepreneurship and Catering[35]	Ministry of Communal Affairs and Infrastructure	Ministry of Justice and Administration						
Land use	Consulted	Accountable	Responsible	-	Consulted	Consulted	Consulted	Consulted	Consulted	-	-	Consulted	Consulted
Sustainable transport	Consulted	Accountable	Consulted	Responsible	-	Consulted	Consulted	Consulted	Consulted	-	Consulted	Consulted	Consulted
Water	Consulted	Accountable	Consulted	-	Responsible	Consulted	Consulted	Consulted	Consulted	Responsible	-	Consulted	Consulted
Energy and buildings	Consulted	Accountable	Responsible	Consulted	Responsible	Consulted	Consulted	Consulted	Consulted	Responsible	Consulted	Consulted	Consulted
Industry	Consulted	Accountable	Consulted	-	Responsible	Consulted	Consulted	Consulted	Consulted	-	Consulted	Consulted	Consulted
Solid waste management	Consulted	Accountable and responsible	Consulted	-	Consulted	Consulted	Consulted	Consulted	Consulted	Responsible	Consulted	Consulted	Consulted

Definitions:

Accountable – The accountable stakeholder must approve and explicitly sign off on the activities of any responsible stakeholder(s).

Responsible – These stakeholders will conduct and lead elements of monitoring and evaluation by following rules and regulations defined by another higher (often 'accountable') stakeholder.

Consulted – Opinion or contributions are sought on the monitoring and evaluation.

[31] Including the Construction Institute of Sarajevo Canton, the Development Planning Institute of Sarajevo Canton, and the Cantonal Institute for Protection of Cultural, Historical and Natural Heritage.
[32] These include the Cantonal waste utility CPUC Rad, the Cantonal public water utility company CPUC Vodovod I Kanalizacija d.o.o.and KJKP Toplane-Sarajevo.
[33] In the Ministry of Physical Planning, Construction and Environmental Protection.
[34] In the Ministry of Physical Planning, Construction and Environmental Protection.
[35] In the Ministry of Economy.

7. Cost and funding options

The objective of this chapter is to provide the GCAP cost estimates and high-level assessment of potential funding options for GCAP actions that require capital investment as well as a preliminary analysis of the Cantonal budget.

The GCAP actions are of two types: policies (labelled as P) and Investments (labelled as I). Actions that require substantial capital investment comprise mostly either provision of new Canton assets or the upgrading, maintaining or rehabilitation of existing Canton assets. Canton assets can be developments in the built environment of SC, as well new digital interventions, together with protection and/or enhancement of natural assets such as areas of green space and water bodies.

The GCAP actions also involve awareness and outreach, capacity building of key stakeholders in issues related to planning, management and conservation/enhancement of the Canton environmental assets. Similarly, the GCAP actions include the development of strategies, policies and plans, which, in turn, will help eliminate barriers and enable a favourable environment for greener investments to flow in GCAP measures. Often such capacity building, awareness and policy, legislative or regulatory measures are prerequisites that support individual or groups of capital investment measures.

The GCAP consists of 50 actions, divided over six sectors, of which 32 action were prioritised as follows:

- Land use: 4 priority actions out of 7
- Sustainable Transport: 6 priority actions out of 16;
- Water: 9 priority actions out of 12;
- Energy and buildings: 6 priority actions;
- Industry: 1 priority action out of 3; and
- Solid waste management: 6 priority actions.

The proposed GCAP actions are formulated to address the priority environmental challenges but their implementation should not be the sole financial responsibility of the Sarajevo Canton. At the time of writing this plan the Cantonal budget execution report for 2018 has not been approved. The implementation of the GCAP's capital investment actions will be more efficient if they are linked to ongoing local, federal and state initiatives while leveraging funding sources such as national and international donors, International Financial Institutions (IFIs), development banks and private sector funds.

For each action a high-level assessment is provided suggesting an indication of funding sources. Among other factors, the choice of appropriate funding source depends largely on the action's potential to generate revenue and/or savings.

7.1. Cantonal budget

This section provides a high-level and preliminary analysis of the Cantonal budget to indicate which GCAP actions across the six sectors (see above) could be potentially funded by the Canton. These estimates are preliminary and not the result of an in-depth study and assessment of the current legal and regulatory framework applicable to investments in SC. The high-level assessment is therefore indicative only. Before any GCAP action is taken forward, it will need to be further validated. A high-level assessment of the budget of Sarajevo Canton for the previous three years (2017 – 2019) is presented in Chapter 3 and Table 7-1 presents a consolidated summary of the Cantonal budget.

Table 7-1 – Summary of consolidated budget in thousand BAM

Item	Budget 2017	Budget 2018	Budget 2019
Budget revenues	726,875	799,846	993,673
Budget expenditures	-668,040	684,554	-909,644
Net acquisition of non-financial assets	-32,950	40,235	-111,979
Budget surplus/deficit	25,885	75,057	-27,950
Net financing	-21,180	-34,512	31,050

Total financial result	4,705	40,545	3,100
Accumulated deficit after 2017	74,359		

The accumulated deficit for 2017 should be reduced to BAM 72,902,000, but it is reported in the amount of BAM 74,359,000 (difference is BAM 1,456,000) as shown in Table 7-1. The total deficit covers accumulated deficit of the Institute for Construction of SC, and transfer of the balance of the deposit account of the Municipal Court in Sarajevo in the amount of BAM 64,000).

The surplus for 2019, in the amount of BAM 3,100,000, is mostly planned on the basis of inflows from net financing (since the budget deficit in the amount of BAM 27,950,000 is evidenced for 2019).

Credit capacity: the surplus, as the Canton's source of project financing, should be considered cautiously, even in the case of surplus realisation, as this is partly due to cover the accumulated deficit.

As an alternative source of Cantonal financing for GCAP actions, the issuance of bonds for SC may be considered within legal limits.

New borrowings from credit sources: according to the document of the Framework Budget Document of Sarajevo Canton (SCFB) for the period 2019 – 2021 and in accordance with Article 7 of the Law on Debt, Borrowing and Guarantees in the FbiH, the SC plans servicing of long-term debt, so that in 2019 the liabilities for debt servicing are in the range of 4.6% -5.15%, while the legal limit is set up to 10% of the revenue of the previous fiscal year. Therefore, the Canton has the legal capacity to increase annual repayments on potential new long-term loans.

The long-term credit capacity (annual repayments) for 2019, in accordance with the legal provision, should be calculated in relation to the revenues of the previous fiscal year, i.e. 2018.

The Assembly has not adopted the Budget Execution Report and the officially approved amount of the basis for calculation is not available (2018 revenue).

Based on the performance report 2018 being approved (data in Table 7-1), and assuming that the annual annuities on long-term loans and guarantees amount to approximately BAM 38 million, as possible potential additional annuities within legal limits, there would be approximately BAM 40 million for long-term loans and guarantees. The loan amount varies depending on the loan repayment period.

This is a very high, calculated potential amount of new annuities/guarantees and it would be subject to the Cantonal authorities showing capacity in the form of real revenues generated for additional debt (which would not result in a deficit and a negative financial result).

In the event of an increase in revenue not being realised, only the total financial result would provide potential for new annuities, assuming that it will not be used to cover part of the accumulated loss.

So far, the overall financial result rate is low (0.6% in 2017 and 0.3% in 2019), or BAM 4.7 million in 2017, and the planned amount is BAM 3.1 million in 2019.

Considering the above, the real possibilities for debts up to legal limit depend on the capacity of the Canton to generate revenue (on its own or by other means).

Based on the above analysis, the Canton's budget is limited in the funding of GCAP actions, particularly those that require large investments. Similarly, policy actions that require additional costs beyond the existing budget are likely to require varying degrees of funding assistance.

According to the Framework Budget Document of Sarajevo Canton for the period 2019-2021, the main guidelines for debt management are as follows:

- Work on finding favourable sources of financing/borrowing in the coming period in relation to credit with commercial banks;
- When planning for borrowing, ensure that a consistent repayment structure is maintained by year to minimise liquidity risk;
- To minimise currency risk, make maximum use of borrowing in EUR and BAM;
- Maintaining a majority share of fixed rate debt; and
- In the coming period, SC will borrow assets to finance capital projects and budget deficit, under the most favourable conditions. The SC

Administration is committed to use bond issue, as a way of borrowing, which will have a significant stake in the coming period.

In accordance with the Debt Management Strategy adopted in May 2019, the Strategy will be implemented in the period 2019-2021 as follows:

- External sources of financing which are approximately defined (EBRD, International Development Association (IDA)); and
- Budget support is provided by means of issuance of three-year treasury bonds, loan arrangement from the Development Bank and commercial banks.

In accordance with the Law on Budget Execution, for 2019, **short-term debt** can be incurred, solely for the purpose of temporarily financing the cash flow deficit, which is why it is not subject to further analysis.

7.2. Funding and financing sources

In the case of actions without revenue generation/saving, it is assumed that the Cantonal budget can cover a proportion of the GCAP action with the rest coming through donor's assistance (grants) for the promotion of green infrastructure and/or addressing climate change. Actions with potential revenue generation could be partly financed by Cantonal budget with debt funded from International Finance Institutions (IFIs), local banks and federal budget.

7.2.1. Federal budget

The Federal Budget is a potential financing option for capital investments, especially for actions estimated at high value for which the Cantonal/City budget cannot meet demands. This is in accordance with Article 9, part A and E of the 'Federal Law on implementation of the Budget of the FbiH for 2019', which states "the budget is executed according to the following priorities: a) servicing the external and **internal debt** of the Federation, (…) e) current transfers to cantons and lower levels of government, public companies and capital investments."

The Federal Budget can be involved as guarantor to issue the bank guarantees for the Canton. The Federal Government, with its budget, served as a loan guarantor as per the document "Total Debt and Debt Balance as of 31.12.2018", the debt of the Sarajevo Canton for which the guarantee was given for BAM 20.76 million.

According to the Law on Budget Execution for 2019, it will be possible to use the Budget of the FbiH to finance the GCAP actions through funds or guarantees. However, the Canton must prepare such actions under the prescribed procedure and deadlines, entered in PIMIS FMF (Public Investment Management Information System) and included in PJI (a programme of Public investments).

7.2.2. Private sector

Local financial institutions/ banks such as UniCredit Bank, Sparkasse Bank and Raiffeisen Bank, amongst others, can also help financing the Canton by issuing bank guarantees and placing loans. Local banks' business is usually reflected through Cantonal Public Tender, which defines the business conditions and approvals they expect from banks.

Public service providers and enterprises, such as public transport operators and public utility companies, often maintain infrastructure for public services and also provide the services that use the infrastructure. In Sarajevo, these companies include 'Cantonal Public Water Utility Company – CPUC Vodovod I Kanalizacija d.o.o. Sarajevo, Cantonal waste utility CPUC Rad, electricity supplier JP Elektroprivreda BiH d.d. Sarajevo, District Heating Network operators, Public transport Company GRAS.

In line with their remits, such utilities and enterprises will be required to make financial contributions towards, and in some cases cover even the entire cost of, a number of priority actions.

7.2.3. Donors – IFI funds and Climate Funds

IFIs can provide finance to GCAP actions through grants and loans. **Loans** are generally a common source for capital investments to renovate/upgrade existing infrastructure or implementation of new infrastructure. While fully and blended **grants** finance investments that do not generate revenue/savings such as policy, plan, studies, data collection and monitoring, capacity building.

Some donors have been operating and funding projects in SC, FBiH, and BiH and therefore represent potential options to fund GCAP actions. Examples of ongoing projects funded through IFIs grants are:

- UNIDO National Cleaner Production Programme;
- EBRD Bijeljina Wastewater and Banja Luka district heating;

- The Western Balkans Investment Framework that provides finance and technical assistance for strategic investment such as 'Flood Hazard and Flood Risk Maps project in BiH'; and
- GIZ Sustainable Urban Mobility Plan.

Climate Funds and Development Finance Institutions[36] have set ambitious targets for mobilising the finance needed to achieve the worldwide commitment to keep global warming below 2˚C and to adapt to the impacts of climate change. Bankable and transformational Climate Action projects are therefore attractive investments. Such investment in Climate Action may also attract finance from beyond the public sector. A number of sustainable finance initiatives have been the catalyst for:

- Re-orienting investments towards more sustainable technologies and businesses;
- Financing growth in a sustainable manner over the long-term; and
- Contributing to the creation of a low-carbon, climate resilient and circular economy.

Therefore, GCAP actions with significant Climate Action impact may also attract investment not only from Climate Funds and Development Finance Institutions but also from private sector Environmental, Social and Governance (ESG) Impact finance[37].

7.3. GCAP cost estimates

This section includes CAPEX and OPEX estimates for GCAP actions by sector. The figures in this chapter should be treated as preliminary indicative estimates appropriate at this stage. These are not detailed cost estimates, owing to the need for actions to be elaborated, and the legal and regulatory investment framework reviewed in more depth, before more detailed financial estimates can be generated.

The cost estimates have been determined by drawing on knowledge of similar domestic and international projects, the professional judgement of both local and international sector experts, and local expert knowledge of appropriate adjustments that need to be made, for example regarding the cost of local materials and labour. It should be noted that draft cost estimates have been discussed with the Canton Administration, with feedback from the Canton incorporated into final costs estimates as applicable

The CAPEX and OPEX estimates of actions are presented, by sector, in Table 7-2,The proformas for each GCAP action contain notes that indicate how CAPEX[38] and OPEX estimates were derived. All estimates were also subject to a plausibility check that involved consulting literature, commercial project developers and project specialists.

7.4. GCAP actions potential funding options

The findings suggest that financing of significant parts of the GCAP should be possible. However, as noted above, some of the underlying assumptions would need to be checked and discussed with main stakeholders, including Canton Administration officials, Canton-linked enterprises, private sector representatives, donors, and IFIs (starting with EBRD). Important questions concern the nature of the financial constraints of the Canton, willingness to co-invest and/or provide financing for the actions, and validation of the OPEX, CAPEX and revenues assumptions.

Preliminary evaluation of potential funding sources has been conducted for each action and summarised in Table 7-3 .

[36] Development Finance Institutions act as private sector arms of International Finance Institutions (IFIs).

[37] ESG is investing with environmental, social and governance issues in mind. Environmental, social and corporate governance refers to the three central factors in measuring the sustainability and ethical impact of an investment.

[38] The CAPEX cost estimates are exclusive of delivery risk, optimism bias and climate change adaptation costs.

Table 7-2 – Overall cost estimates by sector for GCAP priority actions

Sector	Total CAPEX (EUR)	Total CAPEX (BAM)	Annual OPEX (EUR)	Annual OPEX (BAM)	Number of priority actions
Land use	3,175,000	6,209,760	134,000	262,081	4
Sustainable transport	112,100,000	219,248,543	9,530,000	18,639,060	6
Water resource	281,989,000	551,522,545	8,662,450	16,942,279	9
Energy, buildings	172,550,000	337,478,467	5,590,000	10,933,090	6
Industries	40,000	78,233	0	0	1
Sustainable waste management	56,950,000	111,384,519	4,310,000	8,429,627	6
Total	**626,804,000**	**1,225,922,067**	**28,226,450**	**55,206,137**	**32**

A conversion rate of 1.95583 has been used to convert costs in EUR to BAM.[39]

[39] This is the exchange rate for December 2020 as stated by InforEuro, which provides the EC's official monthly accounting rates for the Euro. Available from https://ec.europa.eu/budget/graphs/inforeuro.html.

Table 7-3 Cost estimates and potential funding options for GCAP priority actions

Ref. No	Priority Action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
Land use												
LU02 – I	Upgrade and enhance integrated GIS based land use for Sarajevo Canton to facilitate effective monitoring and evaluation systems for planning	Improving information base, modelling	2021 - 2022	1,000,000	1,955,830	18,000	35,205	No	Yes	Yes	No	No
LU08 – P	Climate change risk assessment to future proofing	Developing policy, plan, legislation, regulations	2021 - 2024	1,225,000	2,395,892	1,000	1,956	No	Yes	Yes	No	No
LU09 – P	Valorisation and protection of natural areas of SC	Developing policy, plan, legislation, regulations	2024 - 2026	450,000	880,124	65,000	127,129	No	Yes	Yes	No	Yes
LU10 – I	Establishment of green corridor along the River Miljacka and the Main Road corridor from Central Park to Hamdije Čemerlića Street	Capital investment implementation–- new	2023 - 2025	500,000	977,915	50,000	97,791	No	Yes	Yes	No	Yes
Transport												
TR07 – I	Enhance and expand cycling and electric scooter infrastructure	Capital investment: implementation–- improving existing	2021 - 2026	5,300,000	10,365,899	265,000	518,295	Yes	Yes	Yes	Yes	Yes
TR10 – P	Expansion of the public sector fleet, and replacement with low emission vehicles	Capital investment: implementation–- improving existing	2022 - 2025 2021 - 2022	20,300,000	39,703,349	1,015,000	1,985,167	Yes	Yes	Yes	Yes	No
TR11 – I	Upgrading of bus station and stop infrastructure, including smart technology	Capital investment: implementation–- improving existing	Bus stops Phase 1: 2021 - 2025 Phase 2: 2026 - 2030 Park & ride 2022 - 2025	8,000,000	15,646,640	400,000	782,332	Yes	Yes	Yes	No	Yes
TR13 – I	Smart and integrated traffic management solutions	Developing policy, plan, legislation, regulations	2025 - 2030 2022 - 2023	3,500,000	6,860,000	350,000	684,541	No	No	Yes	No	Yes
TR15 – I	Reconstruction of tram tracks and purchase of new trams	Capital investment: implementation–- improving existing	2021 - 2022	50,000,000	97,791,500	5,000,000	9,779,150	No	Yes	Yes	Yes	Yes

Ref. No	Priority Action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
TR16 – 1	Construction and establishment of new tram lines	Capital investment: implementation–- new	2021 - 2023	25,000,000	48,895,750	2,500,000	4,889,575	Yes	Yes	Yes	Yes	Yes
Water												
WR01 – P	Establish an integrated water supply digital asset and customer management system and implement non-revenue water reduction action plan	Improving information base, modelling	2021 - 2023	550,000	1,075,705	10,000	19,558	Yes	Yes	Yes	No	Yes
WR02 – I	Establish monitoring of the cantonal water supply network for identification of leakage locations and system performance.	Improving information base, modelling	2021 - 2024	400,000	782,332	8,000	15,647	No	Yes	Yes	No	Yes
WR03 – I	Implement defined measures to reduce water losses–- infrastructure and facilities.	Capital investment: implementation–- improving existing	2021 onwards	65,000,000	127,128,950	80,000	156,466	Yes	Yes	Yes	No	Yes
WR04 – I	Reduce risks to water quality and increase connection of population to mains supply	Capital investment: implementation–- improving existing	2023 - 2028	50,000,000	97,791,500	200,000	391,160	Yes	Yes	Yes	Yes	Yes
WR05 – I	Establish digital asset management systems for municipal wastewater and drainage infrastructure and implement a wastewater action plan	Improving information base, modelling	2021 - 2023	300,000	586,740	10,000	19,558	No	Yes	Yes	No	Yes
WR07 – I	Execute wastewater network construction: extension, refurb and new build	Capital investment: implementation–- improving existing	2023 - 2026	50,000,000	97,791,500	1,000,000	1,955,830	Yes	Yes	Yes	Yes	Yes
WR08 – I	Execute Wastewater Treatment Works extension adding nutrient removal capability, optimise thermal treatment and disposal of sludge.	Capital investment: implementation–- new	2023 - 2026	16,900,000	33,053,020	2,415,000	4,723,257	Yes	Yes	Yes	Yes	Yes
WR11 – I	Strategy and program for treatment of wastewater in industry and other activities	Developing policy, plan, legislation, regulations	2022 - 2026	50,000	97,792	0	0	No	Y	No	No	No
WR12 – I	Construction of Wastewater Treatment Plant (WWTP) and sewage network in the area of municipalities Vogošća Ilijaš and Hadžići	Capital investment: implementation–- new	2021 - 2027	98,789,000	192,803,850	4,930,000	9,640,000	Yes	Yes	Yes	Yes	Yes

Ref. No	Priority Action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
Energy												
EN01 – P	Study to assess the potential for the widespread adoption of renewable energy technologies in Sarajevo Canton	Capital investment: feasibility, planning, design and piloting	Study 2021 - 2022	100,000	195,583	0	0	No	Yes	Yes	No	No
			Deployment programme 2022 - 2031	50,000,000	97,791,500	5,500,000	10,757,065	Yes	Yes	Yes	Yes	Yes
EN02 – P	Prepare and Develop Energy Efficiency Action Plan for SC for 2021-2023	Developing policy, plan, legislation, regulations	2021 - 2023	100,000	195,583	30,000	58,675	No	Yes	Yes	No	No
EN03 – I	Public Building Renovation Program aimed at improving energy efficiency	Capital investment: implementation–- improving existing	2022 - 2032	30,000,000	58,674,700	25,000	48,896	Yes	Yes	Yes	Yes	Yes
EN04 – I	Residential Building Renovation Programme aimed at improving energy efficiency	Capital investment: implementation–- improving existing	2022 - 2032	40,000,000	78,233,200	20,000	39,117	Yes	Yes	Yes	Yes	No
EN05 – I	Assessment of thermal energy resources of geothermal and groundwater / aquifers in Sarajevo	Capital investment: feasibility, planning, design and piloting	2021 - 2022	350,000	684,541	5,000	9,779	No	Yes	Yes	No	Yes
EN06 – I	Improvement and extension of district heating system in Sarajevo Canton – priority investment portfolio	Capital investment: implementation–- improving of existing and construction of new infrastructure	2021 - 2026	52,000,000	101,969,886	10,000	19,558	Yes	Yes	Yes	Yes	Yes
Industry												
IN02 – I	Raise capacities of the Canton industry to implement energy and resource efficiency, and cleaner production measures	Awareness raising	2021 - 2023	40,000.00	78,233.20	0	0	No	Yes	Yes	No	No
Solid waste												
SW01 – I	Implementation of a separate collection system for recyclable waste	Capital investment: implementation–- new	2021 - 2022	5,000,000	9,779,150	500,000	977,915	Yes	Yes	Yes	Yes	No
SW02 – I	Development of waste treatment infrastructure	Capital investment: implementation–- new	2021 - 2027	45,000,000	88,012,350	3,150,000	6,160,865	Yes	Yes	Yes	No	No

Ref. No	Priority Action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
SW04 – I	Collection and treatment of leachate within RCUO Smiljevići	Capital investment: implementation–- improving existing	2021 - 2027	5,000,000	9,779,150	500,000	977,915	Yes	Yes	Yes	No	No
SW06 – I	Remediation of illegal landfills and strengthening of inspection at registered locations	Capital investment: implementation–- improving existing	2019 - ongoing	100,000	195,583	10,000	19,558	Yes	Yes	Yes	No	No
SW07 – P	Development of a new tariff model for waste management services	Developing policy, plan, legislation, regulations	2023 - 2024	200,000	391,166	0	0	Yes	Yes	No	No	Yes
SW08 – P	Development of animal waste management system	Capital investment: implementation–- new	2021 - 2023	1,650,000	3,227,120	150,000	293,375	Yes	Yes	Yes	Yes	No

8. Next steps

8.1. GCAP approval process

This GCAP is a document plan that will be used by the SC to communicate its green vision and as a roadmap for realising these ambitions. It presents long-term aspirations and action priorities for the Canton in the short-term and medium-term.

The expected improvements in environmental, economic and social performance by implementing the GCAP are reflected in the objectives and targets that will be used to measure the GCAP's progress. However, to realise the transformation potential of the Plan the momentum generated during its development will need to be maintained.

The development of the GCAP will serve to support updating of the KEAP. The updated version of the KEAP will have specific elements from the GCAP as well as other elements that are required by the Law on Environmental Protection. The Sarajevo Canton will carry out the adoption of the updated KEAP and the GCAP. The updated KEAP will be available to the public for comments and feedback during a period of 30 days. The implementation of both the KEAP and GCAP would be harmonised and monitored by the Ministry of Physical Planning, Construction and Environmental Protection.

Once the GCAP is approved, it will serve as the basis for capital investment programmes, and other mid-term and long-term development plans. This will be crucial for building political support.

8.2. GCAP implementation

A concerted effort will be made to help to ensure that the GCAP Implementation period begins in early 2020 as planned. This will mark the start of the 60 to 72-month implementation period, over which time a series of GCAP actions will be delivered using a holistic and integrated approach that is fully aligned with, and embedded in, its wider sustainable framework.

The Canton Administration will need to decide which of the GCAP actions to implement. This will require further analysis of each proposal, including with regards to the funding needs and their potential to generate revenue. Feasibility and modelling studies, which are objective assessments of the practicality of proposed interventions, will need to be conducted as part of this process.

In the course of developing the GCAP, numerous examples of how the implementation and operationalisation of well-conceived measures has been identified and compromised, and in some instances abandoned, owing to factors including insufficient political support, supporting actions, institutional framework, capacity, affordability, stakeholder engagement and data. We have sought to reflect related lessons learnt in the GCAP development process.

The risks associated with operationalising the Plan must be identified and rigorously reviewed at the beginning of the GCAP implementation and risk mitigation measures should be designed and adopted. The effectiveness of these mitigation measures will be apparent in the GCAP Reporting stage, where the implementation progress of GCAP actions and their impact will be analysed.

8.3. GCAP reporting

Sarajevo GCAP Reporting is the final stage of the GCAP process which aims to identify what has been achieved and how and opportunities for improvement in each period. Chapter 6 outlines an indicative approach to guide the reporting process and will be used as a starting point, but this will need to be refined at the outset of the reporting stage.

The GCAP process is iterative, the GCAP challenges, objectives, actions and targets will need to be periodically revisited to identify changes in State, Pressure and Response indicators that could require a revised approach to be adopted and the GCAP to be updated. The effectiveness of this process will depend on continued political support and clear and consistent ownership by a committed individual within the Canton Administration.

A series of next steps, in the form of activities and suggested timelines, is outlined in Figure 8-1.

Figure 8-1 – Programme of next steps for the Sarajevo GCAP

Type of Activity	Activity	Year					
		2021	2022	2023	2024	2025	2026
	Confirm GCAP Coordinator						
	Engage politicians, other decision-makers and their bodies						
	Include the GCAP actions in annual budgets and mid-term and long-term development plans						
	Review and mitigate GCAP implementation risks						
	Commission feasibility studies for GCAP actions						
	Pursue sources of funding						
	Select key GCAP measures and prepare a detailed Implementation Plan						
	Establish and formalise implementation partnerships						
	Implement GCAP actions						
	Agree and refine monitoring process						
	Monitor GCAP implementation						
	Monitor contribution of GCAP towards targets						
	Report GCAP implementation progress and plan and implement any necessary corrective measures						
	Report contribution of GCAP actions towards targets and plan and implement any necessary corrective measures						
	Identify and report on changes in State, Pressure and Response indicators						
	Prepare for the next GCAP cycle						

Internal engagement
Internal and external engagement
Finance / budgeting
Feasibility
Execution
Monitoring
Reporting
Step 3: Green City Implementation
Step 4: Green City Reporting

Appendices

Appendix A. GCAP team members and roles

Table A-1 - GCAP core work team

Name	Title	Role in GCAP Development
Sarajevo Canton Administration		
Mr Mario Nenadić	Premier of Sarajevo Canton	
Mr Edin Forto	Former Premier of Sarajevo Canton	
Mr Faruk Kapidžić	Minister of Physical Planning, Construction and Environmental Protection	
Mr Damir Filipovic	Former Minister of Physical Planning, Construction and Environmental Protection	
Mrs Zijada Krvavac	Deputy Minister, Environmental Protection, Sarajevo Canton	Primary point of contact between Sarajevo GCAP team and consultants.
EBRD		
Romano Pehar	Principal, Energy Efficiency and Climate Change Department and Operational Lead	Operational Leader
Josip Polic	Senior Banker	EBRD BiH
Hiroyuki Ito	Green City Action Plans Framework Manager	Framework Manager
Rada Milisav	Associate, EBRD Bosnia and Herzegovina office	Associate Framework Monitor
Consultant Team		
Mark Hewlett	Atkins Associate Director, Sustainability	Technical Team Leader and Urban Sustainability Expert
Catalina Gallego Lopez	Atkins Principal International Planner	Project Manager and International Urban Planner
Sanda Midzic Kurtagic	Enova Consultant, Professor	Local Project Coordinator
Steven Fraser	Atkins Director	Project Director and Transport Expert
Vassiliki Kravva	Atkins Associate Director	Framework Manager and Peer Reviewer
Dragana Selmanagic	Enova Consultant	Stakeholder Engagement & Environmental Expert
Irem Silajdzic	Enova Consultant	Environmental and SEA Expert

Name	Title	Role in GCAP Development
Muhamed Hadziabdic	Enova Consultant	Air & Pollution Modelling Expert
Anela Rodić	Enova Consultant	Policy and Institutional Environmental Expert
Natasa Tabori	Enova Consultant	Urban Sustainability & Planning Expert
Senad Mrkalievic	LDK Consultant	Economic & Finance Expert
Petar Pavlovic	Enova Consultant	Legal Expert
Lejla Tabakovic	Enova Consultant	Senior Social Expert
James Dunham	Atkins Principal Climate Change Consultant	Climate Change Expert
Claudia Manca	Atkins l Waste Management Consultant	Solid Waste Expert
Davide Minniti	Atkins Principal Urban Designer	Urban Sustainability Expert
Simon Spooner	Atkins Principal Consultant r	Water & Wastewater Expert
Duncan Josh	Atkins Principal Consultant	Energy Expert
Nikos Papadopoulos	LDK Energy Specialist	Energy Efficiency Expert
Richard Brightmore	Atkins Transport Consultant	Transport Expert

Appendix B. List of stakeholders

Table B-1 – List of stakeholders involved in the GCAP development

Stakeholder	Name of individual	Role/position	Sub-section/ department
State Level			
Agency for Statistics of BiH	Velimir Jukić	Agency for Statistics of BiH	
Ministry of Foreign Trade and Economic Relations	Mirko Šarović	Minister	
Directorate for European Integration of the Council of Ministers of Bosnia and Herzegovina	Edin Dilberović	Directorate for European Integration of the Council of Ministers of Bosnia and Herzegovina	
Federal Level			
Federal Institute for Hydrometeorology	Almir Bijedić	Director	
Federal Ministry of Environment and Tourism	Edita Đapo	Minister	
	Mehmed Cero	Assistant Minister	Sector for environment
	Mirsad Ibrović	Assistant Minister	Sector for waste management, implementation of plans and strategic projects
Federal Ministry of Physical Planning	Josip Martić	Minister	
Federal Ministry of Agriculture, Water Management and Forestry	Šemsudin Dedić	Minister	
Federal Ministry of Energy, Mining and Industry	Nermin Džindić	Minister	
Environmental Protection Fund of fBiH	Fuad Čibukčić	Director	
	Indira Sulejmanagić	Head	Sector for environmental protection
Federal Bureau for Statistics	Emir Kremić	Director	
Federal Institute for Agropedology	Esada Bukalo	Director	
Federal Institute for Agriculture	Omer Kurtović	Director	
Agency for the Sava River Basin Sarajevo (AVP Sava)	Sejad Delić	Director	
Public Company Roads FB&H	Ljubo Pravdić	Director	
Cantonal Level			
Government of the Canton Sarajevo	Edin Forto	Premier	
	Mustafa Čopelj	Advisor to Premier for Energy Efficiency	
Ministry of Physical Planning, Construction and Environmental Protection	Damir Filipović	Minister	
Ministry of Economy	Haris Bašić	Former Minister	

Stakeholder	Name of individual	Role/position	Sub-section/ department
	Draško Jeličić. Nedžad Mekić	Minister Head of Water Management Department	
Ministry of Utility Companies and Infrastructure	Srđan Mandić Nihada Glamoč	Former Minister Minister	
Ministry of Transport	Adnan Šteta Adi Kalem	Former Minister Minister	
Ministry of Health	Amela Sofić	Minister	
Ministry of Education, Science and Youth	Zineta Bogunić	Minister	
Cantonal Public Institution for the Protected Natural Areas	Osman Delić	Director	
Cantonal Administration for Inspection	Fahir Halilović	Director	
	Edina Koluh	Chief Inspector	Inspectorate for Urban-Construction, Environment, Utility and Housing Inspection
Cantonal Institute for Protection of Cultural and Natural Heritage	Nervin Dacić	Director	
Institute for Public Health	Aida Pilav	Director	
Development Planning Institute of SC	Hamdija Efendić	Director	
Institute for Construction	Mirza Hulusić	Director	
Directorate for roads	Selmir Kovač	Director	
	Emir Hota		
Chamber of Economy	Muamer Mahmutović	President	
Local / Municipalities			
Municiaplity of Stari Grad	Ibrahim Hadžibajrić	Mayor of municipality	
Municipality of Centar	Nedžad Ajnadžić	Mayor of municipality	
Municipality of Novo Sarajevo	Nedžad Koldžo	Mayor of municipality	
Municipality of Novi Grad	Semir Efendić	Mayor of municipality	
Municiaplity of Ilidza	Senaid Memić	Mayor of municipality	
Municipality of Vogosca	Edin Smajić	Mayor of municipality	
Municipality of Hadzici	Ejubović Hamdo	Mayor of municipality	
Municipality of Trnovo	Ibro Berilo	Mayor of municipality	
Municipality of Ilijas	Akif Fazlić	Mayor of municipality	
City of Sarajevo	Abdulah Skaka	Mayor of Sarajevo City	
Utilities/ Operators / Private Companies			
Cantonal Public Communal Utility (CPCU) Rad	Vera Arnautović	Director	
PCU Trnovo d.o.o. Trnovo		Director	
PCU Komunalac, d.o.o. Hadzici	Nusret Kaleta	Director	

Stakeholder	Name of individual	Role/position	Sub-section/ department
PU Ilidža	Adnan Cvijetić	Director	
PCU Vodostan d.o.o. Ilijaš		Director	
CPCU Park	Amar Kečo	Director	
CPCU Vodovod i kanalizacija	Azra Muzur	Director	
CPCU Toplane	Enver Zornić	Director	
CPCU Gras	Avdo Vatrić	Director	
CPCU Sarajevogas	Nihada Glamoč	Director	
CPU Sarajevo-šume d.o.o. Sarajevo	Nermin Demirović	Director	
Centrotrans Eurolines Sarajevo	Safudin Čengić	Director	
Academic/ Research/ Semi-Academic Institutions			
Faculty of Architecture	Mevludin Zečević	Dean	
Faculty of Civil Engineering	Samir Dolarević	Dean	
	Amra Serdarević	Docent	
Faculty of Transport and Communications	Samir Čaušević	Dean	
Faculty of Forestry	Mirza Dautbašić	Dean	
Faculty of Natural Sciences and Mathematics	Mustafa Memić	Dean	
Faculty of Economics	Jasmina Selimović	Dean	
Faculty of Mechanical Engineering	Izet Bijelonja	Dean	
Faculty of Electrical Engineering	Samim Konjicija	Dean	
IPSA Institute Sarajevo	Enko Hubanić		
CETEOR Sarajevo	Dragan Ajanović	Director	
Hydro-engineering Institute (HEIS)	Tarik Kupusović	Director	
NGOs/ CSO/ CBO			
SEE Change Net	Garret Patrick Kelly	Executive Director	
EKO-TIM	Rijad Tikveša	President	
GREEN COUNCIL	Sanela Klarić		
EKOAKCIJA	Anes Podić	President	
CENER 21	Fethi Silajdžić	President	
REIC	Vedad Suljić	President	
COOR	Sabina Hadžiahmetović	President; Chairman of the Supervisory Board	
	Erna Zildžović		
International Organisations/ Embassies			
Embassy of Japan	Kunihiko Yasuda		
	Hideyuki Sakamoto		

Stakeholder	Name of individual	Role/position	Sub-section/ department
GIZ Office Sarajevo	Dubravka Bošnjak		

Appendix C. Sarajevo Canton Administration

Table C-1 - Overview of the administration of Sarajevo Canton

Ministry	Sectors	Other institutions, organisations and public enterprises in SC relevant for environmental issues
Ministry of Finance	Sector for Budget and Fiscal System, Sector for Borrowing, Debt Servicing and Development, Sector for Treasury.	Budget Inspectorate, Internal Audit Unit, Non-organizational unit.
Ministry of Communal Affairs and Infrastructure	Sector of Communal Affairs and Infrastructure, Sector for Legal, Economic- Financial Affairs and Investments.	CPUC Park d.o.o. Sarajevo, CPUE Pokop d.o.o. Sarajevo, CPUE Rad d.o.o. Sarajevo, CPUE Sarajevogas d.o.o. Sarajevo, CPUE Toplane-Sarajevo d.o.o. Sarajevo, CPUE Tržnice-pijace d.o.o. Sarajevo, CPUE Vodovod i kanalizacija d.o.o. Sarajevo.
Ministry of Culture and Sport	Sector for Culture, Sector for Sport, Sector for Economic and Legal Affairs.	
Ministry of Justice and Administration	Sector for Justice and Execution of Sanctions and Measures, Sector for Administration, Sector for Legal and Economic Affairs.	Administrative Inspectorate, Affairs outside the organisational units.
Ministry of Economy	Sector for Economic and Financial Affairs and Investments, Sector for Energy, Water Management, Entrepreneurship and Catering, Sector for Agriculture, Veterinary Medicine and Forestry: Department of Agriculture, Veterinary Medicine and Forestry, Department for Agricultural Expert Affairs.	Forestry Directorate, CPUE Sarajevo-šume d.o.o. Sarajevo, Directorate for Tourism, Tourism Board of SC, Veterinary Station Sarajevo.
Ministry of Physical Planning, Construction and Environmental Protection	Sector for Spatial Planning, Sector for Second Instance Administrative and Normative-Legal Affairs, Sector for Management, Projects Implementation and Surveillance in the Housing Area, Sector for Environment Protection.	Administration for Housing Affairs, Administration for Geodetic and Property–- Legal Affairs, Cantonal Public Institute 'Protected Natural Areas' Development Planning Institute of SC Cantonal Institute for Construction.
Ministry of Traffic	Sector for Traffic Management, Sector for Stationary Traffic.	Directorate for Roads, CPUE GRAS d.o.o. Sarajevo.
Ministry of Internal Affairs		Police Administration, Administration of Support, Administration of Interior,

Ministry	Sectors	Other institutions, organisations and public enterprises in SC relevant for environmental issues
		Inspectorate for Fire Protection, Supervision of Agencies for Protection of People and Property and Internal Security Services, Supervision of Registries and Civil Registry.
Ministry of Veteran Affairs	Sector for Veteran-Invalid Care, Sector for Economic Affairs, Sector for Legal, General and Administrative Affairs.	
Ministry for Education, Science and Youth	Sector for Preschool and Primary Education and Inclusive Education, Sector for Secondary Education and Adult Education, Sector for Higher Education, Science and Youth, Sector for Informatization, International Cooperation and EU Integration, Sector for Economic Affairs, Sector for Traffic and Education.	Pedagogical Institutes.
Ministry of Labour, Social Policy, Displaced People and Refugees	Sector for Social Policy, Sector for Social Planning, Sector for Financial–- Accounting and Legal Affairs.	
Ministry of Health	Sector for Pharmacy, Sector for Health Care, Sector for Legal and Financial-Economic Affairs.	Public Health Institute of SC.
Development Planning Institute of SC	Spatial Planning Sector, Sector for Detailed Planning Documentation, Infrastructure Sector, Sector for Planning of Socio-Economic Development, GIS Sector, Sector for Technical Preparation, Sector for Legal, General and Accounting Affairs.	
Cantonal Institute for Protection of Cultural, Historical and Natural Heritage Sarajevo	Department for Protection of Cultural Heritage, Preservation and Reconstruction of Historical Sites and Buildings, Department for Museums and Protection of Movable Heritage, Information and Documentation Department, Legal and General Affairs Department, Financial Department.	
Construction Institute of SC	Sector for Preparation of Urban Land Development, Sector for Cadastre of Utilities, Sector for Construction of Buildings and Equipping of Urban Construction Land, Sector for Common Affairs.	

Appendix D. State, Pressure and Response indicators

Table D-1 - Overview of Indicators relevant to the GCAP

ID	State/Pressure	Topic/ Sector	Indicator
1.1	State	Air quality	Average annual concentration of PM_{10}
1.2	State	Air quality	Average daily concentration of SO_2
2	State	Water bodies	Biochemical Oxygen Demand BOD in rivers and lakes
4.1b	State	Soil	Concentration of cadmium in soil
6	State	Green space	Open green space area ratio per 100,000 inhabitants
6.1	State	Green space	Share of green space areas within urban limits
7	State	Biodiversity and ecosystems	Abundance of bird species all species
7.1	State	Biodiversity and ecosystems	Abundance of other species
8	State	Mitigation of GHG emissions	Annual CO_2 equivalent emissions per capita
8.1	State	Mitigation of GHG emissions	Annual CO_2 emissions per unit of GDP
9	State	Adaptation and resilience	Percentage of public infrastructure at risk
9.1	State	Adaptation and resilience	Percentage of households at risk
10	Pressure	Transport	Average age of car fleet total and by type
10.1	Pressure	Transport	Percentage of diesel cars in total vehicle fleet
10.2	Pressure	Transport	Fuel standards for light passenger and commercial vehicles
10.3	Pressure	Transport	Share total passenger car fleet run by cleaner fuels
11.1	Pressure	Transport	Transport modal share in total trips
11.2	Pressure	Transport	Motorisation rate
11.3	Pressure	Transport	Average number of vehicles cars and motorbikes per household
11.4	Pressure	Transport	Kilometres of road dedicated exclusively to public transit per 100000 population
11.5	Pressure	Transport	Kilometres of bicycle path per 100000 population
12.	Pressure	Transport	Average travel speed on primary thoroughfares during peak hour
12.1	Pressure	Transport	Travel speed of bus service on major thoroughfares daily average
13.1	Pressure	Transport	Efficiency of transport emergency systems in case of disaster
14.1	Pressure	Buildings	Electricity consumption in residential buildings
15	Pressure	Buildings	Heating cooling consumption in buildings fossil fuels residential buildings fossil fuels
15.1	Pressure	Buildings	Heating cooling consumption in residential buildings fossil fuels
15.2	Pressure	Buildings	Heating cooling consumption in non-residential buildings fossil fuels

ID	State/Pressure	Topic/ Sector	Indicator
18.1	Pressure	Industry	Fossil fuel combustion in industrial processes per unit of industrial GDP
18.2	Pressure	Industry	Share of industrial energy consumption from renewable energy
19	Pressure	Industry	Share of industrial waste recycled as a share of total industrial waste produced
20	Pressure	Industry	Percentage of industrial wastewater that is treated according to applicable national standards
22	Pressure	Energy	Share of population with access to heating cooling
23	Pressure	Energy	Proportion of total energy derived from RES as a share of total city energy consumption in TJ
24	Pressure	Energy	Average share of population undergoing prolonged power outage in case of climatic extremes over the past 5 years
25.3	Pressure	Water	Industrial water consumption as percent of total urban water consumption
26	Pressure	Water	Non-revenue water
27	Pressure	Water	Percentage_of_residential_and_commercial_wastewater_that_is_treated_according_to_applicable_national_standards
28	Pressure	Water	Percentage of dwellings damaged by the most intense flooding in the last 10 years
29	Pressure	Solid waste	Total solid waste generation per capita
29.1	Pressure	Solid waste	GDP per domestic material consumption
31	Pressure	Solid waste	Proportion of MSW that is sorted and recycled total and by type of waste e.g. paper glass batteries PVC bottles metals
31.3	Pressure	Solid waste	Percentage of MSW which is disposed of in open dumps, controlled dumps or bodies of water or is burnt
31.1	Pressure	Solid waste	Percentage of collected MSW composted
32	Pressure	Land use	Remaining life of current landfills
33	Pressure	Land use	Population density on urban land
33.3	Pressure	Land use	Proportion of the population living within 20 minutes to everyday services grocery stores clinics etc.
34	Pressure	Land use	Average annual growth rate of built-up areas

Table D-2 - Indicators contributing to air quality challenges (values)

State indicators		Value and benchmark
Average annual concentration PM_{10}		**48**
Average daily concentration SO_2		**22**
Sector	**Pressure indicator**	Response indicators
Transport	Average age car fleet (16)	High-polluting vehicles are regulated. Energy efficient vehicles are incentivised through fiscal instruments
	Percentage of diesel cars in total vehicle fleet (50)	
	Fuel standards for vehicles (EURO 4)	
	Share total passenger car fleet run by cleaner fuels (2%)	Extension and improvement of public and non-motorised transport is planned
	Motorisation rate (0.34)	
	Average number of vehicles per household (0.7)	
	Km road dedicated exclusively to public transit (6.04)	Public and non-motorised transport is promoted through Information and awareness campaigns
	Kilometres of bicycle path / 100k population (6.8)	
	Average travel speed on primary thoroughfares during peak hour (30)	Traffic demand is managed congestion charges smart technologies
	Travel speed of bus service on major thoroughfares daily average (24kmph)	
Buildings	Electricity consumption in residential buildings (45kWh/m^2)	Public and private investment in energy efficiency in buildings
	Heating cooling consumption in residential buildings fossil fuels (101kWh/m^2)	Metering and billing for personal energy use regulated
	Heating cooling consumption in non-residential buildings fossil fuels (147kWh/m^2)	
Industries	Heavy_metals_Pb_emission_intensity_of_manufacturing_industries	Energy efficient industrial machinery is regulated and incentivised through fiscal instruments electricity heat industrial processes
	Fossil_fuel_combustion_in_industrial_processes_per_unit_of_industrial_GDP	Energy efficient industrial technologies electricity heat industrial processes is supported through private investment
Energy	Share of population with access to district heating / cooling (23%)	Renewable energy facilities in private buildings are incentivised through fiscal instruments
	Proportion of total energy derived from RES as a share of total city energy consumption in TJ (15%)	Renewable energy facilities are incentivised through awareness campaigns

Table D-3 - Indicators contributing to water resource challenges

State indicators		Value and benchmark
Biochemical Oxygen Demand BOD in rivers and lakes		**2.47mg/L**
State indicator is benchmarked green for drinking water		
Sector	**Pressure indicator**	**Response indicator**
Industries	Percentage_of_industrial_wastewater_that_is_treated_according_to_applicable_national_standards	Industrial WW treatment/ reuse/recycle promoted through regulations and fiscal incentives
Water	Industrial water consumption as percent of total urban water consumption (21%)	Buildings access to wastewater collection and treatment systems is improved through plans and investment
		Wastewater treatment is promoted through regulations and fiscal incentives
		Wastewater billing is regulated
Waste	Proportion of municipal waste that is sorted and recycled (1%) Percentage of municipal waste composted (0%)	Littering and non-compliance to sorting systems is dis-incentivised
Potable Water	Industrial water consumption as percent of total urban water consumption (21%)	Metering and billing for water use is regulated
	Non-revenue water (75%)	Water saving reuse is encouraged through awareness campaigns
		Coverage and efficiency of water supply networks is improved through plans and investment

Table D-4 - Indicators contributing to soils challenges

State indicators		Value and benchmark
Concentration of cadmium in soil		**1.98mg/kg**
Sector	**Pressure indicator**	**Response indicator**
Waste	Total waste generation per capita (450kg/year)	Reduction of material consumption waste generation is promoted through awareness campaigns
	GDP per domestic material consumption (19.6USD/kg)	Littering and non-compliance to sorting systems is dis-incentivised
	Proportion of municipal waste that is sorted and recycled (1%)	Composting recycling and waste to energy facilities are developed through plans and investment
	Percentage of collected municipal waste composted (0%)	Waste reuse sorting and recycling is promoted through information and awareness campaigns
	Remaining life of current landfills (7 years)	Overcapacity issues in landfills are tackled through plans and investment
Industry	Share_of_industrial_waste_recycled_as_a_share_of_total_industrial_waste_produced	Material efficiency of new built industrial facilities and waste recycling is regulated
	Percentage of industrial wastewater that is treated according to applicable national standards	Industrial wastewater treatment promoted, enforced through fiscal incentives and fining

Sector	Pressure indicator	Response indicator
Water	Percentage_of_residential_and_commercial_wastewater_that_is_treated_according_to_applicable_national_standards	Access to wastewater collection and treatment is improved through planning and investment
		Wastewater billing is regulated

Table D-5 - Indicators contributing to green spaces challenges

State indicators	Value and benchmark
Open green space area ratio per 100,000 inhabitants	**9m²**
Percentage share of green space areas within urban limits	**2%**

Sector	Pressure indicator	Response indicator
Land use	Population density on urban land (1,580 inhabitants/km²)	Transit-oriented development is promoted
	Average annual growth rate of built up areas (No data available)	Mixed use development is promoted through zoning regulations or incentives.
	Proportion of population living within 20 minutes to everyday services (70%)	
Waste	Percentage_of_MSW_landfilled_disposed_of_in_EUcompliant_sanitary_landfills	Littering and non-compliance to sorting system is dis-incentivised through fines and penalties

Table D-6 - Indicators contributing to GHG emissions

State indicators	Value and benchmark
Annual_CO_2 equivalent emissions per capita	**4.27**
Annual CO_2 emissions per unit of GDP	**0.0005**

Sector	Pressure indicator	Response indicators
Transport	Average age car fleet (16years)	High-polluting vehicles are regulated Energy efficient vehicles are incentivised through fiscal instruments
	Percentage of diesel cars in total vehicle fleet (50%)	
	Fuel standards for vehicles (EURO 4)	
	Share total passenger car fleet run by cleaner fuels (2%)	Extension and improvement of public transport and NMT (Non-Motorised Transport) is planned Public transport and NMT is promoted through Information and awareness campaigns
	Motorisation rate (0.34)	
	Kilometres of bicycle path (6.8)	
	Share of total passenger car fleet run by cleaner fuels (2%)	Traffic demand is managed congestion charges smart technologies
Buildings	Heating cooling consumption in residential buildings fossil fuels (101kWh/m²)	Public and private investment in energy efficiency in buildings
	Heating cooling consumption in non-residential buildings fossil fuels (147kWh/m²)	
Industries	Heavy_metals_Pb_emission_intensity_of_manufacturing_industries	Energy efficient industrial machinery is regulated and incentivised through fiscal instruments electricity heat industrial processes

	Fossil_fuel_combustion_in_industrial_processes_per_unit_of_industrial_GDP	Energy efficient industrial technologies electricity heat industrial processes is supported through private investment
Energy	Share of population with access to heating cooling (23%)	Renewable energy facilities are incentivised through awareness campaigns
	Proportion of total energy derived from RES as a share of total city energy consumption in TJ (15%)	
Waste	Proportion of municipal waste that is sorted and recycled total and by type of waste (2%)	Composting, recycling and waste-to-energy facilities are developed through plans and investment
		Waste reuse sorting and recycling is promoted through information and awareness campaigns
	Percentage of collected municipal waste composted (0%)	Composting, recycling and waste-to-energy facilities are developed through plans and investment
		Waste reuse sorting and recycling is promoted through information and awareness campaigns

Table D-7 - Indicators contributing to biodiversity challenges

State indicators		**Value and benchmark**
Abundance of bird species		**No data available**
Abundance of other species		**No data available**
Sector	**Pressure indicator**	**Response indicator**
Land use	Population density on urban land (1,580 inhabitants/km^2)	Transit oriented development is promoted.
	Average annual growth rate of built-up areas.	Mixed use development is promoted through zoning regulations or incentives.
Industries	Share of industrial wastewater treated to applicable national standards	Industrial wastewater treatment/reuse/recycle is promoted through regulations and fiscal incentives.
Water	Percentage of residential and commercial wastewater that is treated according to applicable national standards	Access to wastewater collection and treatment is improved through planning and investment
Waste	Percentage of MSW landfilled disposed of in EU compliant sanitary landfills	Littering and non-compliance to sorting system is dis-incentivised through fines and penalties

Table D-8 - Indicators contributing to natural disaster risks

State indicators		**Value and benchmark**
Percentage of public infrastructure at risk		**20%**
Percentage of households at risk		**40%**
Sector	**Pressure indicator**	**Response indicator**
Transport	Efficiency of transport emergency systems in case of disaster (Emergency transport systems are able to run in case of disaster, but with limited efficiency)	Public transport emergency management in publicly and or privately-run networks is planned and tested
Energy	Share of population undergoing prolonged power outage in case of climatic extremes no data	The resilience of electricity networks in case of disaster is tested and enhanced through investment (No data)

State indicators		Value and benchmark
Percentage of public infrastructure at risk		**20%**
Percentage of households at risk		**40%**
Sector	**Pressure indicator**	**Response indicator**
Water	Percentage of dwellings damaged by flooding (1%)	Drainage facilities are developed through plans and investment.
		Business and community resilience is not encouraged through awareness campaigns
		Citizens are aware of natural disaster risk but do not have resilient attitudes

Appendix E. Additional Actions

Table E-1 - Cost estimates and potential funding options for GCAP additional actions

Ref. No	Additional action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
Land use												
LU01 – P	Develop, adopt and enforce the Sarajevo Canton Long-Term Urban Development Strategy until 2040, in accordance with the Handbook of Sustainable Urban Development Strategies	Developing policy, plan, legislation, regulations	2021 - 2023	600,000	1,173,498	0	0	No	Yes	Yes	No	Yes
LU03 – P	Establish land value capture mechanisms in accordance with spatial planning development measures	Developing policy, plan, legislation, regulations	2024 - 2026	100,000	195,583	0	0	Yes	Yes	No	No	No
LU04 – P	Introduce an Urban Rulebook for Sarajevo Canton which will integrate the spatial and environmental aspects, conditions of land use, and building code regulations	Developing policy, plan, legislation, regulations	2023 - 2024	150,000	293,375	1,500	2,934	No	Yes	No	No	No
Transport												
TR01 – I	Develop Canton-wide data collection programme and transport model	Improving information base, modelling	2021 - 2023	3,200,000	6,258,656	120,000	234,700	Yes	Yes	Yes	No	No
TR02 – P	Restricted car zone policies and city centre pedestrianised zone	Developing policy, plan, legislation, regulations	2021 - 2023 2021 - 2025	2,125,000	4,156,139	105,000	205,362	Yes	Yes	No	No	No
TR03 – P	Develop pricing mechanisms to promote mode shift	Developing policy, plan, legislation, regulations	2024 - 2026 2021 - 2022	10,500,000	20,536,215	2,005,000	3,921,439	Yes	Yes	Yes	No	No
TR04 – P	Develop car parking rationalisation and management policies	Developing policy, plan, legislation, regulations	2021 - 2023 2021 - 2023	375,000	733,436	10,000	19,558	Yes	Yes	No	Yes	No
TR05 – I	Promotional campaigns for car sharing, walking and cycling	Awareness raising	2021 - 2022	300,000	586,749	15,000	29,337	Yes	Yes	No	Yes	No
TR06 – I	Implement city-wide pedestrian wayfinding signage network	Capital investment: implementation–- improving existing	2021 - 2025	400,000	782,332	20,000	39,117	No	Yes	Yes	No	No
TR08 – P	Develop standards and guidelines for travel planning, parking and street design	Developing policy, plan, legislation, regulations	2021 - 2022	500,000	977,915	30,000	58,675	Yes	Yes	No	No	Yes
TR09 – I	Implement infrastructure to promote public uptake of low emission vehicles	Capital investment: implementation–- new	2021 - 2022 2022 - 2025	2,700,000	5,280,741	135,000	264,037	Yes	Yes	Yes	Yes	Yes
TR12 – I	Implement bus network infrastructure	Capital investment: implementation–- improving existing	2022 - 2026 2026 - 2031	54,500,000	106,592,735	2,725,000	5,329,637	Yes	Yes	Yes	Yes	No

Ref. No	Additional action title	Classification	Timescale	Total CAPEX		TOTAL OPEX		Revenue generation or savings	Overall funding sources			
				EUR	BAM	EUR	BAM		Cantonal budget	IFI and donors	Private sector	Federal budget
TR14 – I	Feasibility study for expansion of tram system	Capital investment: feasibility, planning, design and piloting	2022 - 2026	500,000	977,915	0	0	No	Yes	Yes	No	Yes
Water												
WR06 – I	Conduct data surveys and monitoring of wastewater, stormwater and river flows	Improving information base, modelling	2021 - 2023	250,000	488,958	5,000	9,779	No	Yes	Yes	No	No
WR09 – I	Sustainable Drainage Systems (SuDS) construction	Capital investment: implementation–- new	2022 - 2026	30,000,000	58,674,900	1,000,000	1,955,830	Yes	Yes	Yes	Yes	Yes
WR10 – I	Study into Wastewater Treatment Works, sewerage and SuDS financing; review water company regulation and management	Capital investment: feasibility, planning, design and piloting	2021 - 2022	150,000	293,375	0	0	No	Yes	Yes	No	No
Industry												
IN03 – P	Develop strategy to support transition from linear to circular economy	Developing policy, plan, legislation, regulations	2022 - 2023	75,000.00	146,687	0	0	No	Yes	Yes	No	No
IN05 – P	Develop standards and regulations to reduce emissions of pollutants from food service sector (restaurants, bakeries etc.)	Developing policy, plan, legislation, regulations	2021 - 2022	50,000.00	97,791	0	0	Yes	Yes	No	No	No

E.1. Land use

Land Use LU01 - P	Smart
Develop, adopt and enforce a Sarajevo Canton Long-Term Urban Development Strategy until 2040, in accordance with the Handbook of Sustainable Urban Development Strategies[40]	
Description The Sarajevo Canton Long-Term Urban Development Strategy until 2040 will be a strategic document which defines policies and priorities to guide development, by taking into account all urban development dimensions: spatial, environmental, economic and social. This will be developed in accordance with the Manual on Development of Sustainable Urban Development Strategies, published by the European Commission Joint Research Centre in February 2020. The early 1990s brought major changes in the society and economy, as well as Sarajevo''s urban development. The diminishing opportunities for spatial development encourage the Canton to rethink its objectives towards sustainable and green development. The long-term strategy is a conceptual urban planning instrument, which may optionally have additional specialized strategies such as SMART strategies, as basic guidelines for drafting spatial and land-use plans. General and specialized objectives for creating spatial and land-use plans must be harmonized with the general and specialized objectives of the long-term urban development strategy. Strategic planning is encouraged in European spatial planning systems and supported by European funds for regional planning. Spatial planning strategies and concepts are documents already created for cities in the Danube Macro Region such as: Zagreb, Ljubljana, Vienna, Graz, Munich, Bratislava, Budapest etc.). Sarajevo is part of the Danube Macro Region. This document would define guidelines for Sarajevo Canton development in terms of sustainable development, environmental protection, city as a system and city in context of the Danube Macro Region. The strategy may define general objectives of long-term urban development such as: 1. Liveable city and city to live in, 2. City as a public space, 3. City as a place to work in, 4. City as a system, 5. City as a region. In the framework of general goals, the special goals are defined such as: 1a. Healthy environment; 1b. Raising housing standards;	

[40] Handbook of Sustainable Urban Development Strategies, European Commission Joint Research Centre (2020): Available at: https://urban.jrc.ec.europa.eu/#/en/urbanstrategies

1c. Housing accessibility to public transport and other social services;

2a. Protecting and enhancing urban public space;

2b. Multiculturalism;

2c. Integration and inclusion of all social categories;

3a. New spaces for work;

3b. Intelligent urban mobility;

3c. Green economy development based on knowledge, skills and sustainability;

4a. Development and enhancement of communal and transport infrastructure;

4b. Spatial planning digitalization;

4c. Enhancing and protecting ecosystems in the Sarajevo Canton core canton area and the wider canton area;

5a. Encouraging cross border (between Entities) cooperation;

5b. Inter-regional cooperation (within the Danube Macro Region);

5c. Sarajevo Canton international significance.

Benefits

Spatial planning documentation in line with EU policies will enable implementation of environmental protection and sustainability principles as well as EU planning standards. The SC Long-Term Urban Development Strategy will help to address needs and opportunities for the future development of the Canton in relation to land use, the economy, transport, community facilities and green infrastructure as well as forming a basis for conserving and enhancing the natural and historic environment, mitigating and adapting to climate change, and achieving well designed places.

According to the SC legislative framework, SEA Regulations should enhance the quality of spatial planning documentation to achieve sustainable urban development and minimise impacts on the natural environment.

Provision of green spaces and corridors will help to restore, enhance and preserve the landscape, benefit residents and visitors, enhance protection of biodiversity and wildlife and also improve human wellbeing. Development of green and blue infrastructure across the Canton as an interconnected network of built environment and natural assets will also help to preserve biodiversity, enhance recreational purposes for all and minimise risk to natural disasters.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6 , 6.1), biodiversity and ecosystems (7, 7.1), mitigation of GHG emissions (8 , 8.1), resilience and adaptation to natural disaster (9 , 9.1, 9.2)

Pressure: land use (33, 33.3, 34), transport (11.2, 11.4, 11.5, 11.6)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	2
WR01 Improve efficiency of water use	1
WR02 Maintain and improve surface water and groundwater quality	2
SL01 Protect and enhance soil quality across Sarajevo Canton	2
GS01 Expand and improve provision of high quality, accessible green spaces	2
GH01 Reduce GHG emissions	2
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity across Sarajevo Canton	3

		BE02 Reduce the impact of human activities on biodiversity	2
		AR01 Improve resilience to climate change and other natural disasters	2
CAPEX EUR 600,000 BAM 1,173,498	**OPEX** EUR 0 BAM 0	**Potential funding options** Cantonal budget, IFI and donors, Federal budget	**Start/end year** 2021 – 2023
Notes on cost estimates The CAPEX only includes the development of the strategy based on expert judgement, but excludes sector specific studies on transport, biodiversity, SEA, vulnerability assessment, feasibility studies, etc. The OPEX is zero as this is a strategy that do not have implications on operational and maintenance cost.			
Owner Ministry of Physical Planning, Construction and Environmental Protection		**Stakeholders** Sarajevo Canton Administration, Municipalities, Civil Society Organisations, Public Institutions, Development Planning Institute of SC	

Land Use LU03 - P

Establish land value capture mechanisms in accordance with spatial planning development measures

Description

The legal basis for this action is Article 23 of the Decree on uniform methodology for creating spatial planning documentation (Official Gazette of FB&H no. 63/04, 50/07 and 84/10), according to which it is permissible to make the program of spatial planning measures for the spatial plan implementation that include economic policy measures, land policy measures, investment and taxation policy and obligations regarding further detailed planning.

The programme of spatial planning measures and activities for implementation of the spatial plan should contain, according to the Decree, the following:

- Economy policy measures,
- Land policy measures,
- Investment and taxation policy,
- Obligations regarding further detailed planning.

Models of land value capture mechanisms are created to encourage landowners to develop in line with the spatial planning documentation or financial burden. This action is to establish land value capture mechanisms to respond as land policy measures and investment and taxation policy such as taxes, levies or any other fiscal instruments in order to avoid urban sprawl and illegal construction. Currently in BiH, public infrastructure for construction land development is built from fees for use of urban construction land, paid by the investor before construction begins.

New models of land value capture mechanisms should include:

- Spatial planning contracts which can be signed between municipalities and landowners for the utilisation of the plot/land in compliance with the land use plan;
- Limited period zoning for building land – measure to provide sanctions such as rezoning of building land back to original status without compensation or charges if the land is not developed according to plan within the deadline;
- Determine the percentage of the fee to be set aside from arranging construction land, for the purpose of purchasing private construction land to be used for public services and social facilities (develop a land policy model);
- Introduction and collection of compensation / rent for the use of construction land;
- Procurement of insurance for public construction land–- insurance of protected land by municipalities or cantons, for the purpose of realisation of public and social facilities.
- Building land consolidation – a land policy instrument which is used for rearrangement of the areas for future development where a lot structure is extremely difficult;

- Building moratorium[41] outside the framework of adopted spatial planning documentation – development moratorium for certain areas before issuing or amending local spatial plans, in particular land use plans. A development moratorium loses effect when the amended plans for the areas concerned take effect or at latest two to three years after entering into force (Law on Physical Planning of Sarajevo Canton ("S1. Novine KS" 22/17), Article 34, paragraph 4); and
- Certain application of property taxes.

All listed measures must be legally adopted in legislation in order to enable implementation of the spatial plan.

Benefits

- Land value capture mechanisms would help to avoid urban sprawl and illegal construction in Sarajevo Canton.
- Capturing the uplift in land value could help facilitate reinvestment and finance in developing local infrastructure, transport infrastructure, community services, affordable housing, parks and open spaces, utility upgrades, and other critical services. With this additional funding, Canton governments will enable infrastructure investment, and address the challenges of sustainable urbanisation.
- Opportunity for significant economic returns, inclusion and growth through land value gained, and strategic reinvestment.
- Improved access to services through more effective use of space.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: soils (4.1b), green spaces (6, 6.1),	SL01 Protect and enhance soil quality across Sarajevo Canton	1
Pressure: land use (33, 33.3, 34), transport (11.2, 11.4, 11.5, 11.6)	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2024 – 2026
EUR 100,000 BAM 195,583	EUR 0 BAM 0	Cantonal budget	

Notes on cost estimates: The CAPEX includes the development of land value capture is based on expert judgement, carrying out feasibility studies for land value capture mechanisms, and amending legislation. The OPEX is zero as this is a strategy that do not have implications on operational and maintenance cost. Savings from implementing action.

Owner	**Stakeholders**
Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy	Development Planning Institute of SC, Municipalities, Citizens

[41] Building moratorium can be imposed by municipalities/cities when the authority considers there is a failure to comply with the building regulations and land use plan.

Land Use LU04 - P

Introduce an Urban Rulebook for Sarajevo Canton which will integrate the spatial and environmental aspects, conditions of land use, and building code regulations

Description

The legislative framework in SC does not recognise environmental and building code regulations in the form in which they are applicable in the EU. In EU countries "public policy uses primarily two mechanisms to intentionally influence land use: it allocates public investments across space and it restricts how individuals and businesses are permitted to use land. Its main instruments are the spatial and land use planning process and environmental and building code regulations" (OECD, 2017). Sarajevo Canton Spatial Planning Law (Official Gazette of Sarajevo Canton no. 24/17 and 1/18) needs to be amended with the introduction of Environmental and Building Codes. It would be an additional document of the Spatial and Land Use Plan, a set of environmental and building possibilities, limitations, rules and regulations for zones, restricted and protected areas, hazardous zones, water source protection zones, former industrial zones, etc.

The lack of spatial planning tools such as an environmental and building code has resulted in uncontrolled urban development, affecting in particular building heights, street widths, building standards and environmental protection. There is limited guidance on procedures for what is permitted to be built / developed in a specific urban area in order to obtain planning permission. Currently, obtaining a building permit depends on the individual aesthetic criteria of municipality clerks, who create an individual frame of rules. This issue is particularly sensitive for construction in historic and natural protected areas.

Currently instead of an Environmental and Building Code there are Decisions of Plan Implementation, which would be unified in a single document with detailed rules, possibilities and building limitations in zones specified by the Cantonal Spatial Plan and the Cantonal Land Use Plan.

Currently, decisions on the implementation of spatial planning documentation and development provide urban parameters and define urban-technical conditions for obtaining urban consent. Given that there are many shortcomings in urban-technical standards for construction at the level of law, which is the environmental construction regulations, obtaining building permits often depends on subjective criteria, rather than norms and standards for design and planning. The Urban Development Rulebook would include regulations and guidelines related to the environmental aspects of construction with detailed urban-technical conditions as an integral part of the planning document, defining the conditions of land use in specified zones by the Spatial and Urban Plans in SC.

The framework for this policy option is prescribed in strategic objective 5 "Improvement of Sarajevo Canton Governance System" in the Development Strategy of Sarajevo Canton to 2020 (2016) and the Implementation Action Plan 2018 – 2020.

Benefits

- These instruments should be clear and easily understandable for individuals, developers and policymakers to meet the spatial objectives of inclusive growth and environmental sustainability.
- Introducing codes/guidelines will encourage environmental protection, sustainability and good urban life quality that are complementary with spatial planning documentation and will facilitate organic and integrated urban development.
- A set of rules and regulations considering spatial planning, environmental protection and construction will help create a stable framework for investments and enable sustainable development for future generations in SC.
- Introducing more detailed zoning guidelines and regulations will encourage environmental protection, sustainability and good quality urban liveability.
- Improved economic inclusion.
- Social benefits including public health improvements, access to services and gender equality.

Current baseline		**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6 , 6.1), mitigation of GHG emissions (8 , 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1, 9.2) Pressure: land use (33, 33.3, 34), buildings (14.1, 15.1, 15.2)		AQ01 Improve ambient air quality compliant with EU standards	2
		WR 01 Improve efficiency of water use	1
		WR02 Maintain and improve surface water and groundwater quality	2
		SL01 Protect and enhance soil quality across Sarajevo Canton	2
		GS01 Expand and improve provision of high quality, accessible green spaces	2
		GH01 Reduce GHG emissions	2
		BE01 Maintain and enhance natural environmental assets	2
		BE02 Reduce the impact of human activities on biodiversity	2
		AR01 Improve resilience to climate change and other natural disasters	3
CAPEX	**OPEX**	**Potential funding options**	**Start/end year**
EUR 150,000 BAM 293,375	EUR 1,500 BAM 2,934	Cantonal budget	2023 – 2024
Notes on cost estimates Estimated CAPEX includes the development of a rulebook / code / guidelines by an advisory board and also includes the amending of legislation. The OPEX is EUR 1,500 as this requires socialisation and enforcement of guidelines, i.e. workshop with developers.			
Owner		**Stakeholders**	
Ministry of Physical Planning, Construction and Environmental Protection, Development Planning Institute of SC		Sarajevo Canton Administration, Municipalities, construction companies	

E.2. Sustainable transport

Transport TR01 - I	**Smart**
Develop Canton-wide data collection programme and transport model	

Description

Canton wide permanent traffic data collection system

Presently, Sarajevo Canton has limited capacity to regularly monitor and collect traffic data for all transport modes across the network, although some traffic counters are in operation on the network. A routine monitoring process will provide clear data for referencing to inform policy makers, make evidence-based decision-making more efficient, improve the monitoring and evaluation of schemes and help in assessing the success of strategic transport investments.

The action is to implement an enhanced permanent data collection system, which can be linked to a central data repository. The data collection system would record traffic flows and monitor behaviour, to understand intra-urban traffic movements and also the inter-urban and through movements. This will allow for the identification of key infrastructure bottlenecks and the targeting of interventions to smooth traffic movements and reduce congestion. The data collation method would involve the implementation of additional induction loops for regular recording of traffic flow, but additional data could be collated in the form of public transport ridership information, origin and destination or travel to work surveys. A detailed assessment of the number of additional loops would be required, but at this stage approximately 100 additional loop counters should be considered for installation, along with 100 ANPR cameras.

Canton level multi-modal demand model

There is currently no multi-modal transport model available for Sarajevo Canton. Following the development of the traffic data system, a robust regional transport model will help to forecast, simulate, assess and evaluate traffic and transport proposals for use in wider city and Canton level planning and evidence-based decision-making. The model should be a multi-modal model, incorporating all the motorised transport and NMT modes in the city and will allow the Canton to test the impact of interventions and recommendations from the GCAP, Sustainable Urban Mobility Plan (SUMP) and other action plans in an integrated way, against forecasts for population changes, urban development and economic growth, on local, national and regional scales. This will improve the selection of key transport investments.

It is recommended that the Canton employs international expertise to support the development of the model and provide ongoing advisory / technical support on model maintenance. A key requirement of this action would be for international experts to work closely with the Ministry of Transport to ensure there is knowledge transfer put in place to ensure that ongoing model maintenance and updating can be (primarily) undertaken by the city.

Benefits

- Efficient traffic and transport monitoring and management.
- Evidence based decision making.
- Critical data in the formulation of robust traffic and transport strategies.
- Opportunities for employment.
- Indirect social benefits to public health, access to services and safety.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	1
Pressure: transport (10, 10.3, 11, 11.1, 11.2, 11.3,11.4,11.5,12, 12.1)	GH01 Reduce GHG emissions	1

CAPEX EUR 3,200,000 BAM 6,258,656	**OPEX** EUR 120,000 Total BAM 234,700	**Potential funding options** Cantonal budget, IFI and donors	**Start/end year** 2021-2023
Notes on cost estimate CAPEX is based on professional experience of developing city-wide traffic data collection systems and city level traffic models. The EUR 2,200,000 cost to implement a comprehensive data collection system includes traffic counts and public transport vehicle tracking. The CAPEX cost of EUR 1,000,000 for the city level multi-modal demand model includes the development of the model in specialist transport software. The EUR 110,000 OPEX for the data collection system is assumed at 5% of CAPEX for the regular review and monitoring of the different systems and infrastructure needed to collect data. The technologies are assumed to have a 10-year design life. The EUR 10,000 OPEX for the model assumes one FTE is employed to keep the model data up to date.			
Owner Ministry of Transport		**Stakeholders** Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public and private transport operators, Citizens, Development Planning Institute of SC	

Transport TR02 - P

Restricted car zone policies and city centre pedestrianised zone

Description

Restricted car zone policy

A restricted car zone policy is designed to promote an area-wide car-free zones within the city centre. It can take the form of full and permanent pedestrianisation restriction of access to certain streets and thoroughfares, which can be coupled with or time-bound restriction (e.g. a defined period of a weekday) within the zone; or by designating a particular day of a week or a month as “car-free day.”

There needs to be a regulatory change in enforcing the car-free zones and the Canton will need to take certain prior measures before the policy is adopted. They are:

- Carry out a positive campaign to inform the public about the benefits of this policy;
- Ensure buy-in from the public and other civil society stakeholders;
- Carry out a study to identify the zone that will not disrupt the regular traffic flow and other commercial activities in the city centre; and
- Develop a strategy for implementation, including the means of enforcement, and other supporting infrastructure that will be needed.

Implement expanded city centre pedestrianised zone

Pedestrianised zones are areas of a city or town reserved for pedestrian-only use and in which most or all vehicular traffic is prohibited. The aim of this type of scheme is to provide better accessibility and mobility for pedestrians, to enhance the quality and volume of business/commercial activity in the area and/or to improve the attractiveness of the local environment – in terms of air pollution, noise and safety. There needs to be careful consideration of the impact of traffic displacement to surrounding areas and what impact it could have on business/commercial activities, notably drive by trade and delivery logistics.

In the specific context of the Sarajevo Canton, it is proposed that an expansion of the existing city of Sarajevo centre pedestrian area in Sarajevo central area is implemented. The pedestrian area would extend around the central cathedral, elements of the national assembly and surrounding streets where there is a high concentration of pedestrian and retail activity. The size of the zone is estimated to be approximately 15,000sqm. To support this action, a pilot study, concept plan and public/business consultation would need to be undertaken.

Benefits

- Reduction of congestion within the city centre.
- Improvements in localised air quality.
- Improvement in road safety in city centre areas.
- Increase in health and wellbeing of residents.
- Improvements to public health, access to services, safety and gender equality in the city centre.
- Opportunities for employment growth and economic inclusion.

Current baseline

State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)
Pressure: (11, 11.1, 11.2, 12, 12.1)

Environmental performance (alignment with GCAP objectives)	
AQ01 Improve ambient air quality compliant with EU standards	3
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	1

	GH01 Reduce GHG emissions	2
	BE02 Reduce the impact of human activities on biodiversity	1

CAPEX EUR 2,125,000 BAM 4,156,139	**OPEX** EUR 105,000 BAM 205,362	**Potential funding options** Cantonal budget	**Start/end year** Restricted car zone: 2021 – 2023 Expanded city centre pedestrian zone: 2021-2025
Notes on cost estimate The CAPEX for the restricted car zone policy assumes a 12-month consultancy study at EUR 125,000 lump sum which includes writing the policy and consultation. The EUR 2,000,000 CAPEX for the city centre pedestrian zone assumes an area of 15,000 sqm to cover new infrastructure and public realm enhancements, and re-circulation of highway traffic. The OPEX assumes EUR 100,000 annual 5% to maintain the pedestrian zone (predominantly footway maintenance and public realm enhancements including seating and planting) over 10 years. It also comprises EUR 5,000 towards the restricted car zone policy.			
Owner Ministry of Transport		**Stakeholders** Municipalities, Public and private transport operators; Local businesses	

Transport TR03 - P	Smart

Develop pricing mechanisms to promote mode shift

Description

City centre low emission zone strategy and policy

The policy is to encourage the use of lower emission vehicles in the major urban areas within Sarajevo Canton, with the aim of restricting access to the most heavily polluting vehicles. The policy will include identification of appropriate geographical areas for a Low Emission Zone (LEZ) and targeted vehicle categories. Unlike the congestion charging zone, the LEZ will operate at all times throughout the year, with all vehicles with engine standards below a certain threshold required to pay to enter the zone. An example of a LEZ is identified in the "Action plan for the reduction of particulate matter in the Sarajevo Canton", which identifies areas where higher levels of emissions are recorded. Regulatory change is needed in enforcing the low emission zone, which can take several forms of low emission zones. The policy should be informed by a detailed assessment of alternative levels of restriction, with supporting fiscal and enforcement measures. The policy will also include mechanisms to enable a proportion of the revenues from the low emission zone to be invested in improved public transport. The Canton will need to take specific prior measures before the policy is adopted. They are:

- Agree the low emission zone vehicle categories following the national standard and current EU guidelines;
- Carry out a positive campaign to inform the public about the benefits of this policy;
- Ensure buy-in from the public and other civil society stakeholders; and
- Develop a strategy for implementation, including the means of enforcement, and identify additional infrastructure support that will be needed.

City centre congestion charging zone

A congestion charge is a fee charged on most motor vehicles operating within the Congestion Charge Zone. This is usually restricted to specific times during the day, primarily weekdays. Charges do not tend to be implemented at weekends or on public holidays. The charging zone would be monitored and enforced through the use of technology. The charging by type of vehicle can be tailored towards meeting specific standards, e.g. vehicles that do not meet Euro 6 standards.

Benefits

- Reduced congestion within city centre.
- Improvements in localised air quality.
- Increase in health and wellbeing of residents.
- Increase investment in public transport.
- Increased in attractiveness of low polluting vehicles.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8 , 8.1)

Pressure: transport (10.1, 10.2, 10.3, 11.1)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	3
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	1
GH01 Reduce GHG emissions	3

	BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
	BE02 Reduce the impact of human activities on biodiversity	1
	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 10,500,000 BAM 20,536,215	EUR 2,005,000 BAM 3,929,439	Cantonal budget, IFI and donors	Low emission zone policy and strategy: 2021-2022 Congestion charging zone: 2024 – 2026

Notes on cost estimate The congestion charging zone CAPEX EUR 10,000,000 is based on other case studies e.g. London (CAPEX EUR 345,000,000, OPEX EUR 132,000,000), scaled to the Sarajevo context. It includes extensive feasibility study, infrastructure and technology costs in the CAPEX. Low emission zones utilise similar technologies and infrastructure so similar costs can be assumed (with economies of scale where infrastructure is shared.) A low emissions zone policy and strategy has a CAPEX of EUR 500,000. The OPEX for charging zones is assumed at 20% per annum based on the example of London, with a design life of 10 years for the technology. EUR 5,000 OPEX is required for the low emissions zone policy and strategy.

Owner	Stakeholders
Ministry of Transport	Municipalities, Public and private transport operators, Local businesses

Transport TR04 - P	Smart

Develop car parking rationalisation and management policies

Description

Car parking management and charging policy

A car parking management policy is designed to discourage people from using cars by increasing parking charges. The revenue generated through the implementation of this policy can be used as investment into sustainable transport infrastructure. The main objectives of this policy are:

- To optimise the management of car parking spaces;
- To encourage a more balanced use of different modes of transport and safeguard the economic activities of the city;
- To reduce on-street parking demand in the city; and
- To reduce car dependency in the city centre.

A differential rate by time of day, vehicle type and car sharers should be considered in setting the tariff level, which will enable the maximisation of revenue generation. Improved enforcement and increased parking charges will encourage a shift away from private vehicle use. Increased revenue generation from existing parking facilities can be ringfenced and explicitly used for the development of alternative modes, e.g. infrastructure improvements, incentives, subsidies. The policy needs to encourage the use of modern technology for parking management and revenue collection.

Parking rationalisation and technology strategy

While the above will limit demand for parking at current rates, the growth of the economy will see car ownership increase. Unless good alternatives to cars are provided, the demand for parking space will also increase. Therefore, it is necessary to optimise the supply to meet the demand and to ensure efficient management of parking space. A parking rationalisation and technology strategy should be developed, which will include:

- Assessment of existing parking demand compared to the supply;
- Parking demand forecast by taking all development policies and plans into account;
- Develop strategies to reduce on-street parking space;
- Identify locations that are well integrated with the land use;
- Assess the feasibility of providing dedicated parking zones for electric vehicles that provide charging facilities; and
- Assess the feasibility of better parking management by using the latest technologies such as CCTV (Closed-Circuit Television), parking sensors, parking route finder, parking space information display and online or over the phone parking booking system.

This proposal is to develop a strategy only. The implementation of the strategy will need to be considered once the Canton adopts the strategy.

Benefits

- Reduction of congestion within city centre.
- Improvements in localised air quality.
- Improvement in road safety in city centre areas.
- Promotion of electric vehicle by providing dedicated parking spaces.
- Improvements to public health and access to services.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces	AQ01 Improve ambient air quality compliant with EU standards	2

(6, 6.1), mitigation of GHG emissions (8 , 8.1), biodiversity and ecosystems (7, 7.1) Pressure: transport (11, 11.1, 11.2, 11.3, 12, 12.1)	WR02 Maintain and improve surface water and groundwater quality	1
	SL01 Protect and enhance soil quality across Sarajevo Canton	1
	GS01 Expand and improve provision of high quality, accessible green spaces	1
	GH01 Reduce GHG emissions	2
	BE01 Maintain and enhance natural environmental assets	1
	BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	OPEX	Potential funding options	Start/end year
EUR 375,000 BAM 733,436	EUR 10,000 BAM 19,558	Cantonal budget, local financial institutional	2021-2023

Notes on cost estimate The CAPEX for the restricted car parking management and charging policy assumes a 12- month consultancy study at EUR 100,000 lump sum which includes writing the policy. Consultation and engagement with marketing and promotion to the general public assumed at EUR 25,000. No OPEX is EUR 5,000 for this intervention. The EUR 250,000 CAPEX for the development of a parking strategy includes a 12-month consultancy study to review requirements (including comprehensive surveys) and assess feasibility for new systems. OPEX is EUR 5,000 for this intervention.

Owner	Stakeholders
Ministry of Transport	Municipalities, public transport operators, Local businesses

Transport TR05 - I

Promotional campaigns for car sharing, walking and cycling

Description

Canton level car sharing promotional campaigns

A car sharing scheme is a way of increasing car occupancy by reducing low occupancy car trips. Schemes incentivise car drivers to share their journey with someone else with the same or adjacent destination. Car sharing schemes can reduce the overall number of single occupancy car trips. This type of scheme also allows the renting of vehicles for a short period of time instead of owning a car. The proposal is for the Ministry to undertake and support general awareness and marketing of the benefits of car sharing across the city – to both businesses and residents.

Canton level cycling rental and sharing promotional campaigns

Sarajevo Canton already has bike rental system in place established by NEXTBIKE. The objective of the promotional campaign is to encourage wider usage of cycle rental schemes to promote a greener and healthier lifestyle for citizens and visitors through promoting active take up and benefits of cycling. There should also be a consideration for promoting cycle sharing. The promotional campaign should be integrated into other demand management initiatives and the overarching improvement of cycling infrastructure.

Canton level walking promotional campaign

There is a high level of pedestrian footfall within the most urban areas of the Sarajevo Canton, specifically in central zones driven by the relatively flat topography and general walkability of the city. Presently, there is a real drive and trend for the promotion of walking to support healthy streets and improved wellbeing. The central area of the city already has a pedestrianised zone. In conjunction with other NMT development campaigns, the objective of this action will be to implement promotional initiatives to support active walking throughout the city.

Actions which would form part of the promotional campaigns could include promotion through media outlets such as distributing leaflets, TV (television) and radio advertisement and on-street billboards; running of promotional campaign in corporate offices; car-free days on certain streets in the city to promote walking; road safety awareness advice for pedestrians; walking pocket guides; the establishment of walking groups and walk to school/work days/weeks.

Benefits

- Potential for reducing car ownership.
- Potential to reduce car trips, hence improve congestion and creating positive impact on the environment.
- Encourage a positive shift from short distance car trips to more environment-friendly sustainable modes of transport.
- Help to improve air quality and mitigate other adverse impacts on the environment.
- Help to reduce the burden on the public sector fund through private sector participation.
- Help to improve road and pedestrian safety.
- Improvements to public health and access to services.
- Opportunities for employment.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1)

Pressure: transport (11, 11.1, 11.2, 11.3, 12, 12.1)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	2
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1

	GS01 Expand and improve provision of high quality, accessible green spaces	1
	GH01 Reduce GHG emissions	2
	BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
	BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2022
EUR 300,000 BAM 586,749	EUR 15,000 BAM 29,337	Cantonal budget	

Notes on cost estimate The CAPEX is comprised of a EUR 100,000 car sharing scheme and promotion campaign. Typically implemented by private businesses based on shared destination benefits. However, support could be in the form of marketing and promotional materials, and/or grants to encourage businesses to initiate the implementation of the measure. This is supported by a EUR 100,000 Canton level cycling promotional campaign and a EUR 100,000 City level walking promotional campaign which could be run in parallel for savings in CAPEX costs. The OPEX is based on EUR 5,000 per promotional campaign.

Owner Ministry of Transport	**Stakeholders** Car rental businesses, corporate businesses and citizens

Transport TR06 - I

Implement city-wide pedestrian wayfinding signage network

Description

The central areas of Sarajevo Canton along the key transportation spines are relatively flat which makes it ideal for walking. The implementation of a city-wide pedestrian wayfinding network would help to encourage and promote walking, provide enhanced connectivity between city locations in terms of accessibility and visibility and would deliver a consistent approach to walking and wayfinding information throughout the city. The wayfinding network could also be integrated with other pedestrian focussed infrastructure improvements such as improved pedestrian crossings with lower curbing for mobility impaired access, wider footpaths and provision of all-weather pedestrian access/surface improvements. The wayfinding network would need to be facilitated through clear and consistent signage and floor markings as applicable. Strategically positioned on street navigation posts which would contain different levels of information. They could include:

- Signage which includes detailed directional information and a large walking map to illustrate a five-minute walk in any direction.
- Tall, narrower signs that offer detailed information on the local area but are useful where pavement space is at a premium. Their height ensures they are visible from a distance and can be spotted above a crowd of people.
- Tall signs which combine detailed directional information and walking maps. Can be used at transport interchanges or points of interest.

The signage would support the wayfinding principles including heads up mapping, accessibility, walking times, walking directions, building locations, finder mapping, integrated transport nodes and street naming.

- In the specific context of Sarajevo Canton, to ensure that any potential wayfinding signage is appropriate and user friendly, it would be recommended that initially a small area of Sarajevo city would be selected for piloting, where the network signage can be tested and feedback from users collated to enhance the product. The pilot would be undertaken in an appropriate location within the city centre, which should have high levels of pedestrian footfall and key points of interest. Once piloted, there would be a wider rollout of the network markings and signage – which would ideally emerge from a wider city level pedestrian and wayfinding strategy. It is envisaged that the signage network could be supported by up to 50 maps and signs.

Benefits

- Promotes and supports an easier, more enjoyable walking experience.
- Assists residents and visitors with improved accessibility and connectivity
- Promotes integration with other modes.
- Reduction in localised air and noise pollution.

Current baseline

State: air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1)

Pressure: transport (11, 11.1, 11.2, 11.3, 12, 12.1)

Environmental performance (alignment with GCAP objectives)

AQ01 Improve ambient air quality compliant with EU standards	2
WR02 Maintain and improve surface water and groundwater quality	1
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	2
GH01 Reduce GHG emissions	1
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1

	BE02 Reduce the impact of human activities on biodiversity	1
	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2025
EUR 400,000 BAM 782,332	EUR 20,000 BAM 39,117	Cantonal budget and donors	

Notes on cost estimate The CAPEX is based on the following assumptions for a high quality pedestrian wayfinding signage network. A feasibility study to understand and develop requirements: estimated at EUR 150,000 over a nine-month study. High quality pedestrian wayfinding signs at EUR 5,000 each up to 50 of these signs could be provided, subject to further assessment.

Owner	**Stakeholders**
Ministry of Transport	Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Citizens, Development Planning Institute of SC

Transport TR08 - P

Develop standards and guidelines for travel planning, parking and street design

Description

Workplace travel plan policy and guidelines

Workplace travel plans are long term management strategies which should support sustainable and active travel at both new and existing developments. The travel plans would provide incentives to increase public transport mode share and NMT modes. This policy and guideline would require all new developments which are expected to employ more than 100 people to have a workplace travel plan put in place, which is likely to require an update to the planning process guidelines. As a general rule, a travel plan should be submitted by the developer as part of the overall planning application. It is then the responsibility of the employer to regularly update the travel plan to ensure a continued focus in reducing private vehicle trips and the promotion of sustainable travel. This number of 100 people is in line with international good practice. Developments targeted for workplace travel plans may include office and commercial buildings, industrial, warehousing and wholesaling, retail, leisure, medical or educational facilities. The travel plans would include baseline travel surveys to establish baseline conditions, staff engagement, mode share analysis, proposals to promote public transport and NMT modes, including costs. There would also be the need to identify the appropriate delivery mechanism for the plan, which might include the appointment of travel plan coordinators.

Parking and planning standards for all new developments

Planning policies for all new developments should consider a sensible balance and mix of land use, which will promote integrated development, which in turn should help to minimise journey lengths and reliance on private vehicles for employment, shopping, leisure and education. The parking standards should limit parking within any new development (residential or commercial) and instead prioritise integration of key developments with public transport and NMU facilities to minimise the use of the car for accessing these developments. In the case of residential standards, efforts should be made to encourage low car ownership lifestyles within the Canton, through the provision of alternative options including car clubs and cycle parking, and with strong integration to wider choice of transport such as bus and tram. In addition to the parking standards identifying appropriate volumes of parking, they should additionally guide the quality of parking provision so that it is convenient, safe and secure, with appropriate parking charges that do not undermine the vitality of central areas.

Design Guidelines for Streets Manual

In support of efforts to build sustainable communities, it is good practice to change the focus of the function of streets. Traditionally, the focus of the function of streets resulted in places dominated by motor vehicles. Rethinking good design and assigning a higher priority to pedestrians and cyclists plays a role in creating places that work for all members of the community. The development of design guidelines informs design, construction, adoption and maintenance of streets and will ensure designs help to build and strengthen the communities they service, promoting inclusivity for all. Such guidance ensures a consistency and rigour to street design in line with best practice and overarching objectives for the Canton.

Benefits

- Reduce GHG and improve localised air quality.
- Promotes uptake of NMT modes.
- Promotes a coordinated approach to planning through clear principles and integration with land use planning.
- Promotes a coordinated approach to street design through clear principles.
- Promotes a participatory approach to planning practice.
- Social benefits to public health, access to services, safety and gender equality.

Current baseline air quality (1.1, 1.2), water (2), soils (4.1b), green spaces (6, 6.1), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), Resilience and adaptation to natural disaster (9, 9.1) Pressure: transport (11, 11.1, 11.2, 11.3, 11.4, 11.5, 12, 12.1, 13, 13.1)	**Environmental performance** (alignment with GCAP objectives)	
	AQ01 Improve ambient air quality compliant with EU standards	1
	WR02 Maintain and improve surface water and groundwater quality	1
	SL01 Protect and enhance soil quality across Sarajevo Canton	1
	GS01 Expand and improve provision of high quality, accessible green spaces	2
	GH01 Reduce GHG emissions	1
	BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
	BE02 Reduce the impact of human activities on biodiversity	1
	AR01 Improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2022
EUR 500,000 BAM 977,915	EUR 30,000 BAM 58,675	Cantonal budget and Federal budget	

Notes on cost estimate The CAPEX for both the workplace travel plan policy and guidelines and the design guidelines for streets is EUR 200,000 each. The cost of the parking standards is EUR 100,000. The OPEX is priced at EUR 10,000 per document.

Owner	**Stakeholders**
Ministry of Transport	Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Development Planning Institute of SC, Institute for Cantonal Development

Transport TR09 - I	Smart

Implement infrastructure to promote public uptake of low emission and electric vehicles

Description

Low emission vehicle incentivisation policy

This policy should focus on supporting measures at the Canton level which would incentivise a wider take up of low emission vehicles, which have the potential to replace some of the polluting gasoline vehicles. Specifics of the policy could include:

- Strengthening of low emission and electric vehicle (EV) regulations;
- More stringent inspection and stronger enforcement of inspections for emission quality for private vehicles;
- Implementation of low emission or EV pilot projects;
- Consumer incentives which could include purchase grants, registration tax, domestic infrastructure incentives; and
- Establishment of an innovation unit within the Cantonal Ministry of Transport which focusses on driving forward policies and proposals related to low emission vehicles.

Implement public/on-street electric vehicle charging point network

Investment in on-street electric vehicle charging infrastructure is needed to encourage uptake of EVs. The infrastructure would involve the careful planning and implementation of a network of EV charging points throughout the Canton, which would need to be positioned initially in areas of visibility to a) encourage uptake, b) promote the technology, c) support different demand/route assignment. The implementation should consider different types of charging point, which generally include rapid (30-60 mins charging time) and fast (2-4 hours charging time) chargers. Based on the total number of chargers, it is estimated that a maximum of 4,400 vehicles could be charged in a single 24 hour period.

In the specific case of Sarajevo, the initial implementation of a public EV charging network would provide the infrastructure needed to support a wider take up of EVs throughout the Canton. The network of chargers would initially be focussed on areas of the Canton which have high levels of visibility and demand. The scheme would require a phased roll out based on demand and uptake; but the initial scheme (likely targeting Sarajevo city) would include the installation of up to 200 charging points throughout the city, based on a mixture of rapid (50) and fast (150) chargers. The charging points would need to be considered as part of a wider assessment of the ability of the distribution system to supply proposed EV charging demand, including options for smoothing charging loads if the distribution system is of insufficient capacity in places

Benefits

- Reduction in GHG emissions.
- Improvements in localised air quality.
- Improvement in road safety in city centre areas.
- Increase in health and wellbeing of residents.
- Minor opportunities for economic returns, growth and employment.
- Social benefits to public health, access to services and safety.

Current baseline State**:** air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1), Pressure: transport (10, 10.1, 10.2, 10.3)		**Environmental performance** (alignment with GCAP objectives)	
		AQ01 Improve ambient air quality compliant with EU standards	3
		GH01 Reduce GHG emissions	3
CAPEX EUR 2,700,000 BAM 5,280,741	**OPEX** EUR 135,000 BAM 264,037	**Potential funding options** Cantonal budget, IFI and donors, Private sector including SME and advertising companies, Federal budget	**Start/end year** Low emission incentivisation policy: 2021 – 2022 Electric vehicle charging infrastructure: 2022 – 2025
Notes on cost estimate The CAPEX for the low emission City fleet to low emission policy development incentivisation assumes a 12-month consultancy study at EUR 300,000 lump sum which includes writing the policy. The CAPEX for electric vehicle charging infrastructure assumes the implementation of 200 charging locations with 100 charging points at EUR 20,000 each and 100 charging points at EUR 4,000 each. The OPEX cost has been set at 5% of CAPEX.			
Owner Ministry of Transport		**Stakeholders** Ministry of transport, Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, power utility, local businesses	

Transport TR12 - I
Implement bus network infrastructure
Description **<u>Implement corridor-based dedicated bus lanes</u>** Corridor-based dedicated bus lanes exist in parts of the urban area. There are currently no means of prioritising the bus movements on the road network outside the urban area. As a result, buses do not currently offer any additional comparative travel time advantages against the other modes of transport. Prioritising public transport (buses specifically) on the roads will help to improve travel time reliability, which is a positive incentive for users to switch from car to public transport. The Canton needs to consider the introduction of dedicated bus lanes along the busiest corridors. It is suggested to consider and analyse the possibility of adding bus lanes at the following locations • "Sutjeska" and "Park" terminals • Alipašina, Hamza Hume and Terezija streets • Island terminal • Stup terminal • Ilidža terminal • Ante Babić street The bus lanes will allow buses to avoid sharing road space with other vehicles at peak commuting times and thus reduce travel time, although most bus lanes permit use by taxis, motorcycles and bicycles. The bus lane proposals can be enhanced through the provision of bus priority measures at junctions. In the Canton, it is proposed that 15 km of dedicated bus lanes are implemented on the most congested links in the Canton. The action would include a short (potentially 3-month) consultancy study on the analysis of public transport lines, draft plans for the priority public transport lines and a cost-benefit analysis of the scheme. The approximate per km cost of dedicated bus lanes is EUR 200,000 per km. **<u>Implement corridor-based Bus Rapid Transit (BRT) routes</u>** Bus Rapid Transit (BRT) is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. A fully developed BRT system can carry up to 200,000 passenger trips per day. It does this through the provision of dedicated lanes, either segregated or un-segregated from the road, and given priority at intersections, with busways and iconic stations typically aligned to the centre of the road, off-board fare collection, and fast and frequent operations. BRT contains features similar to a light rail or metro system. As such, it is much more reliable, convenient and faster than regular bus services. With the right features, BRT is able to avoid the causes of delay that typically slow regular bus services, like being stuck in traffic and queuing to pay on board. It is recommended that BRT is implemented on the most heavily congested routes in the Canton, with a specific focus on connectivity with existing public transport infrastructure, including the current tram network. It is proposed that 5 km of dedicated and focussed BRT infrastructure is implemented within the Canton. The approximate cost of BRT is EUR 10.3m per km.
Benefits • Improves travel time reliability of public transport. • Improves attractiveness and promotes use of public transport. • Reduces congestion on key arterial routes into the city. • Minor opportunity for improved economic returns and inclusion. • Social benefits including public health, access to services, safety and gender equality.

<table>
<tr><td colspan="2">Current baseline
State: air quality (1.1, 1.2) mitigation of GHG emissions (8, 8.1)
Pressure: transport (11, 11.1, 11.4, 12, 12.1)</td><td colspan="2">Environmental performance (alignment with GCAP objectives)
AQ01 Improve ambient air quality compliant with EU standards — 1
GH01 Reduce GHG emissions — 1</td></tr>
<tr><td>CAPEX
EUR 54,500,000
BAM 106,592,735</td><td>OPEX
EUR 2,725,000
BAM 5,329,637</td><td>Potential funding options
Cantonal budget, IFI and donors, private sector</td><td>Start/end year
Corridor-based dedicated bus lanes: 2022- 2026
BRT routes: 2026- 2031</td></tr>
<tr><td colspan="4">Notes on cost estimate CAPEX for bus lanes is estimated at EUR 200,000 per km for a minimum suggested 15km. CAPEX for BRT is estimated at EUR 10.3m per km with a total of 5km assumed. OPEX is estimated as 5% of CAPEX.</td></tr>
<tr><td colspan="2">Owner
Ministry of Transport</td><td colspan="2">Stakeholders
Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Other bus operators, Development Planning Institute of SC</td></tr>
</table>

Transport TR14 - I	Smart

Feasibility study for expansion of the tram system

Description

With the increase in public transport demand, there may be a need to increase the capacity of the current tram system in the city. The proposal is to carry out a feasibility study for expanding the tram system on critical corridors in Sarajevo Canton. The feasibility study will need to include the following level of assessment:

- Current and future public transport demand;
- System specification suitable to meet the demand;
- Potential routes inside the city that are well integrated with the land use plan;
- Preliminary design of the potential routes;
- Economic and financial feasibility of such a system;
- Potential social, financial and environmental risks;
- Potential financial mechanism for implementation; and
- Phased action plan for implementation.

The study should cover a comprehensive area of Sarajevo Canton including Raštelica, Hadžići, Ilidža, the centre of Sarajevo, Vogošća, Ilijaš, Podlugovo, Lješevo, Visoko, and Zenica.

A tram system will present an opportunity for private sector involvement through PPP or operation franchise. Funding has already been secured for the extension of the tram system from Ilidža to Hrasnica, the purchase of additional trams and to upgrade existing infrastructure.

Benefits

- Help to make an informed decision for an expansion or renewal of the tram system in Sarajevo that would have a low environmental impact in the city.
- Increase ridership in the public transport system.
- Social benefits including public health, access to services, safety and gender equality.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	2
Pressure: transport (11, 11.1, 11.2, 11.4, 12, 12.1)	GH01 Reduce GHG emissions	2

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2022-2026
EUR 500,000 BAM 977,915	EUR 0 BAM 0	Cantonal budget, IFI and donors, Federal Budget	

Notes on cost estimate The CAPEX assumes a 12-month consultancy EUR 100,000 study which includes development of routes with EUR 300,000 plans for route solutions and a EUR 100,000 Cost Benefit Analysis. There is zero OPEX.

Owner	Stakeholders
Ministry of Transport	Ministry of Physical Planning, Construction and Environmental Protection, Municipalities, Public transport Company GRAS, Citizens, Development Planning Institute of SC

E.3. Water Resources

Water Resources WR06 - I	**Smart**

Conduct data surveys and monitoring for wastewater, stormwater and river flows

Description

The purpose of this action is to collate existing data and where necessary surveys to gather new data for all of the drainage and wastewater systems. Network modelling requires accurate data on the flows in the system for calibration and verification. Wastewater process design requires up to date information on the flows and loads entering the treatment works. Estimation of river impacts requires data on the flows and water quality in the river. Flood protection and stormwater runoff modelling requires knowledge of the characteristics of the catchments and their connections to storm drains or combined foul and storm sewer networks.

There will therefore be a need to undertake flow surveys in the sewer system to calibrate models in accordance with requirements established in stage 1 of WR05 under dry weather and storm conditions and, if necessary, undertake flows and loads surveys for the wastewater treatment systems to establish the composition of the flows to be treated and the basis of process designs for actions WR08 and WR12. There would also be a need to collate data on river flows and quality to use in planning and assessment of flow volume and water quality compliance.

This action would also include obtaining information on surface water runoff characteristics, permeability and drainage catchments, connections to parts of wastewater and stormwater networks to provide baseline data for planning of wastewater network capacity, flood protection and SuDS measures in accordance with requirements of the SuDs planning action WR09. The use of SuDs can reduce the impact of rainfall runoff on the sewer networks and affect flood risks.

It is assumed that the base river flow data will already be available but that some additional water quality monitoring may need to be carried out.

Benefits

Ensures provision of data and control infrastructure for the planning and operation of wastewater assets and to be able to ensure river water quality objectives compliance. Minor benefits to public health and access to services.

Current baseline

State: water (2), biodiversity and ecosystems (7, 7.1), air quality (1.1, 1.2), Adaptation and resilience (9, 9.1, 9.2),

Pressure: water (27, 28), industry (20)

Environmental performance (alignment with GCAP objectives)

AQ01 improve ambient air quality compliant with EU standards	1
WR02 Maintain and improve surface water and groundwater quality	2
BE02 Reduce the impact of human activities on biodiversity	2
AR01 improve resilience to climate change and other natural disasters	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2023
EUR 250,000 BAM 488,958	EUR 5,000 BAM 9,779	Cantonal budget, IFI and donors	

Notes on cost estimate CAPEX based on expert judgement, comprising EUR 125,000 GIS, EUR 150,000 asset surveys EUR 150,000 flow monitoring EUR 100,000 modelling and EUR 100,000 wastewater action plan. OPEX based on 0.25 full time employed to collate river data and carry out regular river monitoring if not already covered by other budgets. No equipment or ongoing costs in sewers.

Owner	Stakeholders
Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	Customers, Municipalities, AVP Sava, Roads Directorate of Sarajevo Canton

Water Resources WR09 - I

Sustainable Drainage Systems (SuDS) construction

Description

Based on data from the BiH Climate Atlas, the multi-year monthly average precipitation varies from 67.10 mm in February to 94.2 mm in December, usually spread fairly evenly through the year. Extreme average monthly highs have occurred in May (203.3 mm) and October (259.0 mm) and November (206.0 mm). The danger of torrential floods has been identified as a significant risk for this area.

Sarajevo Canton has a well-developed infrastructure for stormwater drainage, which collects water from the surface, drains and discharges into the recipient waterbody. Sustainable Drainage Systems (SuDS) are an approach to urban water management based on "green" technical solutions and, in combination with conventional drainage systems, provide integrated solutions that can be adapted to the specific needs of each settlement. SuDS aim to harmonise modern drainage systems with the natural hydrological cycle. This makes urban drainage systems more compatible with the components of the natural water cycle by allowing water infiltration into the soil and bio-filtration. SuDS combine different measures, such as green roofs, green belts, underground infiltration with or without rainwater retention tanks (for reuse), construction of surface reservoirs embedded in the landscape, and many other solutions.

SuDS should be viewed as a whole part of green infrastructure, i.e. a network of natural, semi-natural areas and green spaces that provide ecosystem services, while promoting human well-being and quality of life.

Possible solutions for green drainage infrastructure should first be considered and adopted for the Canton level. Construction, therefore, should be preceded by the development of a plan; this should be coordinated with LU10 on green spaces planning.

Benefits

Improved water quality in river, improved urban air quality and microclimate. Greater value of development along river and in other urban areas, reduced flood risks, improved urban environment, increased biodiversity and ecosystem health. Minor opportunities for economic returns, employment and inclusion. Public health and safety benefits would also be felt.

Current baseline State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), adaptation and resilience (9, 9.1)

Pressure: water (27, 28), industry (20)

Environmental performance (alignment with GCAP objectives)

WR01 Improve efficiency of water use	1
WR02 Maintain and improve surface water and groundwater quality	2
SL01 Protect and enhance soil quality across Sarajevo Canton	1
GS01 Expand and improve provision of high quality, accessible green spaces	2
BE01 Maintain and enhance natural environmental assets protecting biodiversity and geodiversity SC	1
BE02 Reduce the impact of human activities on biodiversity	1
AR01 Improve resilience to climate change and other natural disasters	2

CAPEX	OPEX	Potential funding options	Start/end year
EUR 30,000,000 BAM 58,674,900	EUR 1,000,000 BAM 1,955,830	Cantonal budget, IFI and donors, Private sector	2022-2026

Notes on cost estimate: CAPEX based on expert judgement (value dependent on area to be done and ability come to agreements with land owners (cost sharing may be possible)). OPEX based on 3% of CAPEX.	
Owner Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	**Stakeholders** Customers, Municipalities, AVP Sava, Road Directorate of Sarajevo Canton Customers, Municipalities,

Water Resources WR10 - P

Study into Wastewater Treatment Works, sewerage and SuDS financing; review water company regulation and management

Description

The utility company issues invoices and charges for water supply and wastewater drainage services, as well as special water charges for water protection and water use. Financing of the construction of new sewers and the Wastewater Treatment Works (WWTW) extensions may be on a loan basis or by PPP letting some form of design, build, operate contract or a concession. Studies would be required for the most effective approach to this in the situation of Sarajevo.

The funding of the sewer improvements and integration with SuDS solutions should be considered in the context of the strategic urban environment development plan, coordinated with circular economy and smart cities solutions. Ownership, maintenance and management aspects also need to be considered.

The study should review the setup and business models of the water supply and wastewater companies, how they interact with the Canton government, industrial enterprises, property owners and customers. Regulatory and financial structures should be analysed. This study would build on the technical sector studies of WR01 and WR05 in providing the context for the financial operation of the utility company. Like the technical studies, this study should take a 20 year planning horizon from which to propose actions over the next five years.

EBRD have already launched a similar study – Preparation of the Financial and Operational Performance Programme ("FOPIP"), to assist the Company to prepare and sign a Public Service Contract ("PSC") with the Canton including the phased achievement of full cost recovery tariffs to address current issues on water service pricing. Any studies under this programme should fully coordinate with FOPIP actions.

This activity should also include the municipalities of Ilijaš and Hadžići, where the management of water supply and sewerage systems is performed by KJP Vodostan Ilijaš and JKP Komunalac Hadžići.

Benefits

Better understanding of the most efficient options for financing the different components and linking these with other infrastructure improvements in the Canton. Minor public health and access to services benefits could also be felt indirectly.

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: water (2), biodiversity and ecosystems (7, 7.1)	WR02 Maintain and improve surface water and groundwater quality	2
Pressure: water (27, 28), industry (20)	BE02 Reduce the impact of human activities on biodiversity	1

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2022
EUR 150,000 BAM 293,375	EUR 0 BAM 0	Cantonal budget, IFI and donors, and grants	

Notes on cost estimate comprising of EUR 100,000 for international experts to support EUR 50,000 of local expert including stakeholder engagement events. No OPEX costs have been identified.

Owner	**Stakeholders**
Ministry of Communal Affairs and Infrastructure, CPUC ViK Sarajevo	Customers, Municipalities, AVP Sava, Road Directorate of Sarajevo Canton.

E.4. Industry

Industry IN03 - P			
Develop strategy to support transition from linear to circular economy			
Description According to recent EU policies on circular economy, cities need to prioritise a systematic transition from the linear paradigm of production and consumption to a circular model, keeping materials in use for as long as possible and maximising their economic value. This transition to circular economy and industrial symbiosis can be further facilitated with the development of sustainable industrial zones where it is easier for an industry to use the waste of another one (e.g. thermal waste from one industry can be used as heat by another). Therefore, it is suggested the new study examines this option from a technical point of view. Residual biosolids from the treatment of municipal and industrial wastewaters would comprise one of the materials to consider in such circular economy solutions. Given that the Cantonal Administration has the primary responsibility for waste management at the local level, they have a unique opportunity to map resources and collaborate with businesses and citizens to create urban-industrial symbiosis or knowledge exchange programmes. The policy option involves development of a strategic study on transition to circular economy, mapping the resources and identifying enabling factors and options for urban-industrial symbiosis. As a further step it is suggested to perform a gap analysis regarding whether the needed regulatory framework is in place. Based on the results of the gap analysis on the needed regulatory framework the relevant legal drafting can be followed.			
Benefits Reducing pressure on the environment, improving the security of the supply of raw materials, increasing competitiveness, stimulating innovation, boosting economic growth, creating jobs. Minor social benefits to public health, access to services and gender equality.			
Current baseline State: air quality (1.1, 1.2), water (2), soils (4.1b), mitigation of GHG emissions (8, 8.1), biodiversity and ecosystems (7, 7.1), Pressure: waste (29, 29.1, 31, 31.3, 31.1, 32), industry (19)		**Environmental performance** (alignment with GCAP objectives)	
		AQ01 Improve ambient air quality compliant with EU standards	1
		WR01 Improve efficiency of water use	1
		SL01 Protect and enhance soil quality across Sarajevo Canton	1
		GH01 Reduce GHG emissions	1
		BE02 Reduce the impact of human activities on biodiversity	1
CAPEX EUR 75,000 BAM 146,687	**OPEX** EUR 0 BAM 0	**Potential funding options** Cantonal budget, IFI and donors	**Start/end year** 2022-2023
Notes on cost estimate The CAPEX is based on expert judgement. There is zero OPEX.			

Owner	Stakeholders
Ministry of Economy	Ministry of Physical Planning, Construction and Environmental Protection, Cantonal Communal Waste Management Utility CPUC Rad, industries in Sarajevo Canton, waste generators, EPR (Extended Producer Responsibility) operators, National Programme for Cleaner Production in BiH, Chamber of Commerce of Sarajevo Canton, Municipalities

Industry IN05 - P

Develop standards and regulations to reduce emissions of pollutants from food service sector (restaurants, bakeries, etc.)

Description

Small restaurant, catering and bakery businesses in Sarajevo Canton are not subject to environmental permitting but are contributing to the air pollution and odour emissions which create nuisance for the citizens. Depending on the type of the restaurant and the furnace and fuel used, most common emissions are PM, VOCs (Volatile Organic Compounds), oily fumes and cooking odour.

There is a need for development of technical standards (BAT based) and legally binding rules for HVAC systems and flue gas treatment for the food service sector that will eliminate the existing problem. Appropriate legislative changes should also be introduced to support use of these standards. Development of technical standards and technological solutions should be coupled with their promotion among the service providers and include their capacity building to implement the standards.

Benefits

- Improved environmental performance of food service sector.
- Reduction of air emissions and cleaner air in the Canton.

Minor social benefits to safety and public health

Current baseline	**Environmental performance** (alignment with GCAP objectives)	
State: air quality (1.1, 1.2), mitigation of GHG emissions (8, 8.1)	AQ01 Improve ambient air quality compliant with EU standards	2
Pressure: industry (18.1, 18.2)	GH01 Reduce GHG emissions	2

CAPEX	**OPEX**	**Potential funding options**	**Start/end year** 2021-2022
EUR 50,000 BAM 97,791	EUR 0 BAM 0	Cantonal budget	

Notes on cost estimate The CAPEX is based on expert judgement. There is zero OPEX.

Owner	**Stakeholders**
Ministry of Physical Planning, Construction and Environmental Protection, Ministry of Economy	Cantonal Administration for Inspection Affairs, food service sector, Municipalities

Appendix F. M&E Plan

The M&E Plan is presented in a separate appended spreadsheet file.

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