

**GUIDE ON PREPARATION OF MASTER PLANS
FOR WATER AND WASTEWATER PROJECTS**

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**Technical Assistance for Strengthening the Programming Capacity of the
Ministry of Environment and Sustainable Development**

GUIDE ON PREPARATION OF MASTER PLANS FOR WATER AND WASTEWATER PROJECTS

A Master Plan (MP) for water and wastewater projects is a strategic long-term planning tool to help meet future demand (usually 20 or more years) for water and wastewater.

A MP typically includes:

1. Description and inventory of existing water and wastewater systems;
2. Population projections, service area projections, present and planned land use, water demand projections, and future water quality demand;
3. Water supply quantity and quality projections and new source identification;
4. Improvements needed to meet future water demand; hydraulic modelling approaches to estimate long-term needs with documentation of each option;
5. Justification of selection of particular system improvement (based on needs, cost effectiveness, constructability, reliability, operation, maintenance, etc);
6. Recommended system improvements;
7. Maps showing improvement components and service areas;
8. Documentation and description of costs of system improvements;

The MP should be re-evaluated and updated periodically (at least every five years) to keep up with changing system needs and technologies.

1. REVIEW OF EXISTING MP INDEXES

Romanian experience

To prepare this guide, the following MP and coordination documents have been reviewed:

- MESD's TOR for Master Plan and Macro-affordability assessment (Technical Assistance for project preparation in the Environment Sector, Romania – 2003 RO 16 P PA 013 – 4 Water, 2003 RO 16 P PA 013 – 5 water), (and 2003 RO 16 P PA 013 – 6 Waste);
- MESD's TOR for strengthening the programming capacity of the Ministry of Environment and Sustainable Development - 2003 RO 16 P PA 013 – 7;
- Proposal of Haskoning for Arges County MP for Water Supply and Sanitation (Arges Regional Water Project) – project financed by EU; infrastructure to be financed by EU;
- Proposal of Pell Frischmann & Romair for Water & Wastewater Infrastructure Applications – project financed by WB; infrastructure to be financed by EU;

- MP of Cluj County – Water & Wastewater Infrastructure Application – project financed by EU; infrastructure to be financed by EU;
- MP of Calarasi County – Water & Wastewater Infrastructure Application – project financed by EU; infrastructure to be financed by EU; and
- Proposal of Halcrow & Cowi (May 2004)/ translation by Mott MacDonald (April 2005) of the MP Guidelines for SAMTID small and medium towns water infrastructure

International Experience

The following water and wastewater MP have been reviewed:

- MP for Water Supply and Sewerage Systems in Anne Arundel County / Maryland, US;
- MP for Orange Water and Sewer Authority in Carrboro / North Carolina, US;
- Water Infrastructure MP for City of Surprise / Arizona, US (June 2004);
- Infrastructure MP for the City Ottawa / Canada (June 2003), prepared based on the existing local and regional legislation; and
- Water Supply MP for Kingston Urban Area / Ontario, Canada (June 2007)

2. MP GUIDE

This guide for preparing MP for water and wastewater project proposals that are candidates for financing/co-financing from the EU Cohesion Fund includes two sections:

- A comprehensive Index (Table of Contents) of the MP, and
- Scope and information to be included in each chapter of the MP.

The index is primarily based on the guidelines for developing an Infrastructure MP for projects to be financed by SAMTID (prepared by Halcrow and Cowi JV in May 2004, and translated by Mott MacDonald, Safege, ULGN and GIE JV in April 2004). We have modified this index based on the TOR for Master Plan and Macro-affordability assessment (as per the Technical Assistance for project preparation in the Environment Sector, Romania – 2003 RO 16 P PA 013 – 4 Water and 2003 RO 16 P PA 013 – 5 Water). We have also included some general and specific planning information from various regional and local infrastructure development MP (see chapter 2).

There are two annexes:

1. Terms and Definition of the Urban Wastewater Directive (91/271/EEC)
2. Template List for documents required for CF Application (EIA, land acquisition, “Urbanism Certificates”, etc.)

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EXECUTIVE SUMMARY

- Objectives and Scope of the Master Plan
- Current Situation and Deficiencies
- Projections
- National Objectives and County Targets
- Option Analysis
- County Strategy
- Long-term Investment Plan
- Financial and Economic Analysis
- Macro-affordability
- Priority Infrastructure Investments

1. INTRODUCTION

Describe the background of the MP.

1.1 Project Framework

- Information provided by MESD
- Reference to the Terms of Reference
- Stakeholders, beneficiaries, target groups
- Other relevant references

1.2 General Goal and Approach for Developing the MP

- Describe the goals, objectives, and policies for developing the MP (and on which the MP is based)
- Report needed changes to the objectives
- Briefly describe the approach for achieving the objectives

MP will be the basis to demonstrate that:

- Proposed investments are part of a long-term cost-effective development plan
- Operator is viable and efficient
- Investments are sustainable in time
- Investments will offer better services to the public and will improve environmental quality

Develop the MP at the county level, taking into account all urban and rural agglomerations in the designated counties.

1.3 Structure of Report

- A table of contents with chapters and a description of the content of each chapter
- Project deliverables and their distribution
- A list of documents making up the MP
- A list of Annexes and description of content

Note: Provide core information in a clear, transparent, and open form, easy to understand and to use by the administration. All other information is only needed to explain and justify the solutions presented.

2. ANALYSIS OF CURRENT SITUATION

Assess the current water and wastewater situation by:

- Collecting local and regional data on water and wastewater (current state, age, performance, population served, water consumed, water flow, non-billed water, wastewater, water losses, maintenance, conformity with quality and environmental standards)
- Analysing collected data (hydraulic modelling, treatment processes, structural state, maintenance state)
- Results (performance indicators and deficiencies)

Include the following information:

- Previous plans, studies, design reports, and a full picture of the current situation as well as background information for the project
- Objective review of available information, and additional measurements, analyses, and surveys deemed necessary
- As many as possible concrete and credible data, given that the EU financing institutions provide financial support based on reliable information
- Information sources

2.1 Abstract

Provide a short summary of all sub-chapters including:

- Methodology and assumptions
- Conclusions (deficiency and critical issues)
- Summary of all relevant base data relevant for projections, focusing on (i) key socio-economic data such as population and industrial trends; (ii) water resources; (iii) water pollution; (iv) water consumption; and (v) key infrastructure data (indicator table)

2.2 Project Area

Provide an overview of the project area (County) including:

- Location of the County

- Short description of the main characteristics (number of population, surface area, number of settlements, topography, county specific aspects, main economic activities, GDP/capita, etc.)
- Map with location of the County in Romania
- Map of the County

2.3 Natural Features

Give a general view/characterisation of the natural features in the project area (county, human settlements) and describe the natural features including:

- Environment
- Climate
- Landscape and topography
- Geology and hydrogeology
- Ecology and sensitive areas

Note: The input data for the MP are important for the correct outcome and conclusions. If the provided (official) data are deemed unreliable, conduct minimum surveys according to TOR requirements. In any case, always mention the data sources in the document.

Proposed subchapters:

- 2.3.1 Environment
- 2.3.2 Climate
- 2.3.3 Landscape and topography
- 2.3.4 Geology and hydrogeology
- 2.3.5 Ecology and sensitive areas

2.4 Infrastructure

Collect and evaluate information on relevant existing infrastructure, other than water infrastructure such as: transportation, district heating, solid waste, electricity, etc.

2.5 Socio-economic Assessment

Assess the socio-economic conditions at the local and regional levels; the data will be the basis for water demand and wastewater projections as well as the affordability of investments. Provide information with clear references on sources of information on:

- Population
- Distribution of human settlements
- National economy situation and projection (national and regional GDP growth, local inflation)
- Household income and expenditures considering the average household and the lowest income deciles
- Socio-economic profile of the county
- Employment and income
- Economic activity and main industrial activities

Analysing the current socio-economic situation should include, but not be limited to:

- Collect data in the county at minimum for the past five years;
- Review here the regional, county, and local statistics (e.g., censuses and estimations);
- Collect data on trends inside the county (e.g., migration trends of population from rural to urban area) and between neighbouring counties;
- Compare county trends to national trends;
- Collect also information (existing studies) on projections for the next decades.

Proposed subchapters:

2.5.1 Socio-economic Profile of Romania

2.5.2 Socio-economic Profile of x County

2.6 Assessment of Institutional and Legal Framework

2.6.1 General Administrative Framework

Briefly describe the general administrative framework in Romania at the national, county, and municipal levels.

2.6.2 Legal Framework

This chapter gives an overview of the legal framework. Pay particular attention to all legal documents relevant to achieve compliance with national and EU legislation in the water and environmental sector.

Briefly describe the relevant legal framework including:

- European legislation in water and wastewater sector
- Relevant national environmental legislation
- Legislation in the water sector
- Harmonisation of national legislation with EU Legislation (Accession Treaty)
- International Treaties and conventions (Danube River Protection convention, Ramsar Convention)

Note: Discuss strategy and policy documents (i.e. SOP) in Chapter 4.

2.6.3 Environmental institutions

Provide an overview of all relevant organisations involved in monitoring and regulating the water and environmental sectors in Romania at the national and county levels (ministries and other public institutions). Briefly describe the functions of each institution.

2.6.4 Water and wastewater institutions

- Main characteristics of the existing water and wastewater operators in the project region (County)
- Legal structure

- Legal status and ownership structure
- Functions and organisation structure
- Relationships with other institutions (contractual relationship, etc.)
- Institutional and financial capacity of water operators in the region
- Current operational and financial performance (provide key indicators such as staff efficiency, operating ratio, collection efficiency, etc.); compare performance of different operators and comment on the potential to achieve economies of scale
- Key deficiencies
- Recommendations for improvement

2.6.5 Current tariffs

- Past and current structure and level of water and wastewater tariffs for each water operator
- Analysis/comparison of different tariff systems applied within the County (and with tariff systems in other Counties)
- Key deficiencies
- Recommendations for Improvement

2.7 Water Resources

2.7.1 General

- Provide an overview of water resources (quantity and quality of groundwater and surface water resources) at County level
- Describe drainage area and main characteristics of rivers and lakes at County level
- Describe main characteristics of ground water resources (aquifer, hydrogeological situation, etc.)
- Provide a map showing available resources (i.e., thematic map with classification of water quantity and quality)
- Describe problem areas with scarcity of water or conflicts among various consumers

2.7.2 Surface water

- Provide an overview of available surface water resources in each agglomeration (water quantity and quality)
- Describe and quantify current water abstraction for water supply and other purposes (i.e. agriculture, industry) in each agglomeration
- Describe and quantify evolution of water production from surface water sources in the past 3-5 years
- Describe and quantify surface water fluctuation (monthly and yearly)
- Describe water quality monitoring practices (frequency, responsible institutions, reliability of analysis, etc.)

- Describe and quantify water quality of surface water resources (summary of statistical analysis of laboratory tests for raw water; evolution of water quality in the past 3-5 years; compliance with EU DWD) in each agglomeration; provide evidence of water quality (laboratory analyses) in annexes
- Describe key constraints for surface water exploitation in each agglomeration
- Summarise potential of surface water resources to meet current and future drinking water demand

2.7.3 Ground water

- Provide an overview of available ground water resources in each agglomeration (water quantity and water quality)
- For other information to be provided, see Chapter 2.7.2 *“Surface Water Resources”*
- Pay particular attention to water quality parameters defined in the EU Accession Treaty (nitrate, ammonia, etc.); thoroughly assess existing data and conduct own water quality analysis to provide a reliable basis for further decision on water resource development (i.e. option analysis); put in annex details on water quality analysis (laboratory tests)

2.8 Water Pollution

2.8.1 Major pollution sources

- Brief description of most important current pollution sources (industries, agriculture, etc.) in the County (summary of Chapter 2.8.4 industrial wastewater)
- Provide wastewater volume discharged to each sub-drainage area (broken down by category of economic activity)
- Estimate wastewater load discharged to the recipient (indicating treatment efficiency for existing WWTPs)
- Provide list of main polluters with quality indicators exceeding admissible limits

2.8.2 Impact of wastewater discharge

Describe and assess present effects (environmental impact) of treated and untreated wastewater and sludge discharges on receiving waters in case of direct discharge into surface water bodies and/or on environment and ground water in case of discharge to evaporation fields, appropriate sampling of effluents at selected points of sewer network, verify laboratory results.

2.8.2.1 *Impact on surface water*

Assess the impact of each main pollution source on the water quality of the recipient, indicating change (increase) of selected parameters (BOD, NH₄) downstream of the discharge point;

2.8.2.2 *Impact on ground water*

Assess the impact of each main pollution source (i.e., ex-filtration from sewer network, leaking septic tanks, agriculture, industry) on ground water quality, by identifying possible pollution sources and comparing with data on ground water quality (prepare thematic map with pollution sources and ground water quality).

2.8.3 Sludge management and disposal

- Briefly assess current sludge management in each agglomeration
- Assess compliance with national and EU legislation
- Assess impact of current sludge management practices on the environment in general and on water resources in particular
- Summarise key critical issues with regard to sludge management

2.9 Current Water Consumption

- Quantify current water consumption and development in the past 3-5 years for each agglomeration by using existing data and own measurements
- Carry out measurements (with portable ultrasonic flow meter) at representative consumer types (metered/un-metered, apartment blocks, individual households, etc.) and verify actual consumer readings with measurements
- Break down consumption by category of consumers (domestic, non-domestic, rural/urban, etc.)
- Comment on data reliability and key critical issues (exceptionally high or low consumption)

2.10 Existing Facilities and Current Performance

2.10.1 Water supply infrastructure

Investigate and assess current water system at county/regional level; include at least the following data:

- Assess current systems and facilities, including water sources and catchments, treatment plants, transmission mains, pumping, storage, and distribution system/s. Present a schematic map and include a detailed map for each agglomeration in Annexes
- Assess the main components of the system/s in terms of capacity, energy efficiency, performance, state of repair, maintenance practices, age, quality of materials and equipment (treatment plants, pipes, valves, pumps, etc.), adequacy, bottlenecks etc. Outline and assess leakage record and leakage detection/repair policy
- Assess the present and future operation and maintenance practices. Based on hydraulic assessment of flows and pressure in the primary distribution system, summarise and evaluate interaction of major system components (transmission, pumping, storage, distribution (pressure zoning)) and detect critical problems and bottlenecks
- Assess current monitoring and metering practices (SCADA system, etc.)
- Assess the current number of repair and development in the past years
- Calculate water balance (IWA standard water balance) and define key performance indicators (Infrastructure Leakage index, water losses per km of pipeline/ day, etc.)
- Assess compliance of infrastructure with EU legislation (safety standards, technological process, treatment efficiency, etc.)

- Summarise key deficiencies.

Proposed subchapters:

- 2.10.1.1 *Well fields*
- 2.10.1.2 *Water treatment*
- 2.10.1.3 *Water storage and pumping stations*
- 2.10.1.4 *Water transmission*
- 2.10.1.5 *Water distribution*
- 2.10.1.6 *Water metering*

2.10.2 Wastewater infrastructure

Investigate and assess the current wastewater collection system/s and wastewater treatment system at county/regional level, including the following components:

- Existing systems and facilities, including area served, length, diameter and type of main sewers, whether separate or combined, pumping stations, discharge points and storm water overflows, location of major wastewater contributors (industry); present a schematic map. Check infiltration into sewers at key points of the sewerage network
- Assess system components in terms of capacity, energy efficiency, performance, state of repair, reliability, adequacy, maintenance practices, infiltration/inflow, age and quality of materials and equipment (pipes, valves, pumps, etc.)
- Assess the sewerage network operation: based on hydraulic assessments (i.e., field measurement) of flows in the primary collection system, summarise and evaluate interaction of major system components (transmission, pumping, system storage) and detect critical problems and bottlenecks.

Proposed subchapters:

- 2.10.2.1 *Wastewater collection*
- 2.10.2.2 *Wastewater treatment*
- 2.10.2.3 *Sludge disposal*

2.10.3 Industrial wastewater facilities

Conduct an inventory of industrial wastewater facilities and describe and assess the present industries discharging effluents at the county level, including:

- Investigate quantity and type, extent of pre-treatment, institutional and legal framework
- Assess current mechanisms for licensing discharges to sewer (consider compliance with the Integrated Pollution and Prevention Control (IPPC) Directive (96/61/EC))
- Assess existing wastewater treatment facilities, including sludge handling and disposal
- Analyse compliance with applicable effluent standards and applicable regulations
- Recommend which investigations and investments are necessary to assure sustainability of the measure (i.e., reduce operation costs)
- Summarise key deficiencies

2.11 Sufficiency of data

Collect and verify all data needed for the MP; if such data are not enough or not reliable, develop further investigations or surveys.

- Describe availability of data and quality of existing data
- Prepare a table comparing required base data with available base data and comment on necessary investigations
- Investigation studies should include, but not be limited to:
 - Wastewater and infiltration, as well as industrial wastewater flows, including sampling and analysis, flow measurement and recording;
 - Topographical surveys, including field and hydraulic or engineering surveys along both water and wastewater systems networks and on WWTP site(s)
 - Geo-technical surveys, including drilling, foundation studies, and geo-technical studies
 - Hydrological and hydrogeological surveys;
 - Water losses.

2.12 Conclusions

- Summarise current deficiencies and critical issues.

3. PROJECTIONS

3.1 Abstract

Short summaries of:

- Methodology and assumptions
- Conclusion for water demand projection
- Conclusion for wastewater flow and load projection

3.2 Methodology and Assumptions

- Describe in detail the methodology and assumptions used for the projections given in the chapters below
- The source of all provided data shall be traceable (make reference to compilations and detailed calculation of base data provided in annexes or explanations for assumptions)
- Check base data for plausibility

3.3 Socio-Economic Projections

The socio-economic assessment at the local and regional levels will be the basis for:

- Affordability of investments
- Water demand projections
- Domestic and industrial wastewater flow projections
- Sludge management projections

Socio-economic projection should include, but not be limited, to the following aspects:

- Macro-economic outlook including projection of macroeconomic indicators (i.e., economic growth, foreign direct investments, inflation, employment rate and salaries, increase of industrial production)
- Demographic projections at national and county levels broken down by rural and urban areas
- Demographic projection for each agglomeration in the county concerned
- Projection of household income (minimum and average): gross/net household income, household expenditures, salaries
- Projection of economic activities (industry, commerce, construction, service sector) at county level

Prepare projections for the entire planning horizon of the MP (breakdown per year) based on the following scenarios:

- Pessimistic
- Optimistic
- Equilibrium

Projections should include data for the past 3-5 years at the beginning of each table.

Proposed subchapters:

- 3.3.1 *Macroeconomic trends and outlook*
- 3.3.2 *Demographic projections*
- 3.3.3 *Household income projections*
- 3.3.4 *Projections of economic activities*

3.4 Water Demand Projection

Based on data of the current situation (see Chapter 2) and results of socio-economic projections (see Chapter 3.3), develop a projection of water demand, considering the specific design criteria and assumptions given in the following chapters.

3.4.1 Domestic demand

Project water demand based on the following design parameters:

- House Connection: 110 litres/capita/day
- Yard connection: 80 litres/capita/day
- Public tap supplies: 50 litres/capita/day

Assume that:

- Current specific consumptions of domestic water will be reduced/increased to the levels above after introducing water metering and cost covering tariffs.
- Demand for small scale livestock and garden irrigation will be reduced to a minimum (replaced by local water sources if available) after introducing water metering and cost covering tariffs.

Justify any deviation from the assumptions and standards above, by providing sufficient data and agreeing with MESD prior to developing further steps of the MP.

3.4.2 Non-domestic demand

Base demand projection for non-domestic consumers (industry, commercial, public institutions) on specific investigations (for each type of industrial consumer) and/or standard values for water demand (commercial and public institutions). Agree on the applied values with MESD prior to developing further steps of the MP.

3.4.3 Water balance and water losses

The objective is to determine how much water is lost and where is it lost

- Apply IWA standards for preliminary assessment of water losses
- Estimate components of the water balance based on existing data, field measurements, and expert's estimates for each agglomeration
- Check carefully plausibility of existing data and organise measurement campaigns accordingly
- Estimate Real Water Losses (Technical Water Losses) based on various parameters indicating the physical network condition (pipe failures, age of pipes and material, etc.) and water pressure
- Use standard IWA indicators for network evaluation (Non-Revenue Water, Infrastructure Leakage Index, Water losses per length of pipe network and/or per connection)
- Classify agglomerations by category of network condition (see IWA standard classification) to determine the priority for improvement.

3.4.4 Summary of water demand forecast

Provide a summary table indicating the development of all water demand components with the following indicators:

- Specific water demand
- Domestic water demand
- Non-domestic water demand
- Real Water Losses (Technical Water Losses)
- Apparent Water Losses (Commercial Water Losses)

3.5 Projected Wastewater Flow and Load

Based on data of the current situation (see Chapter 2) and results of socio-economic projections (see Chapter 3.3), develop a projection of wastewater flow and wastewater load, considering the specific design criteria and assumptions given in the following chapters.

3.5.1 Domestic wastewater

Base projection of domestic wastewater flow and load on the following design parameters:

- Wastewater Generation: 80 %
- Sewer Connection Rate: evolution to be determined for each agglomeration
- Wastewater load: 60 g BOD₅/capita/day

3.5.2 Non-domestic wastewater

Base projection of non-domestic wastewater flow and load on the following design parameters:

- Wastewater Generation: 90 %
- Wastewater load: based on inventory of industrial polluters
- Wastewater concentrations: in compliance with Romanian and EU standards

3.5.3 Infiltration

Base projection of infiltration into the sewer system based on the following parameters:

- Current physical condition of the sewer network
- Soil condition
- Ground water level
- Water losses (infiltration of losses from water network into the sewer network)
- Assumptions of the impact of future investments in the sewer network and future condition of sewer network (after depreciation) on reduction of infiltration. Develop a normative approach with clear and traceable assumptions.

3.5.4 Summary of wastewater flow and load

Provide a summary table indicating the development of the following indicators in each agglomeration:

- Wastewater flow (m³/d)
- Wastewater load (kg BOD₅/day)

3.6 Conclusion

Provide a summary for water demand and wastewater flow projection including:

- Main data (current situation and planning horizon)
- Interpretation of results

4. NATIONAL OBJECTIVES AND COUNTY TARGETS

4.1 Abstract

Short summaries of:

- Methodology and assumptions
- Conclusion for water demand projection

4.2 National Water and Wastewater Objectives

Summarise the relevant general environmental objectives, and more specifically the national water and wastewater policies, objectives, and strategies defined in the (i) Accession Treaty, (ii) Sector Operational Program Environment (SOP ENV), based on the relevant EU Directives (i.e. EU UWWTD 91/271/EEC and EU DWD).

Provide an overview of water and wastewater targets and deadlines defined in the Accession Treaty (compliance dates for different criteria in each sector).

Comment and conclude on the objectives and targets above, in particular with regard to difficulties expected in meeting the compliance deadlines, considering the current situation described in Chapter 2.

4.3 Cross-references with National, Regional, and other Relevant Strategies and Plans

Comment on relevant cross-references between objectives defined in:

- The water and wastewater sector at the national level
- The water and wastewater sector (SOP Priority Axis 1) and other sectors (SOP Priority Axis 2 – 6); i.e., cross-reference between sludge management and waste objectives
- The general policies, strategies, and plans at the national level (i.e. National Development Plan (NDP), Local Implementation Plan)

4.4 County Targets in Water and Wastewater Sector

Prepare realistic county targets in the water and wastewater sector, based on:

- National Objectives (SOP, Accession Treaty)
- Local Implementation Plan
- Other regional Master Plans and Development Plans
- Assessment of the current situation (see Chapter 2)
- Projections (see Chapter 3)
- Other relevant data

Define the targets with key indicators and deadlines. The table below gives a list of indicators defined in the SOP:

Indicator	Baseline (2007)	SOP Target (2015)	Mid-Term Target
Localities provided with new/rehabilitated water facilities in a regional system			
New/rehabilitated wastewater treatment plants compliant with EU acquis			
Population connected to basic water services in a regional system			
Wastewater treated (of the total wastewater volume)			
Other relevant Indicators			

In addition to the objectives defined in the SOP (compliance with EU requirements), define the target level of service and agree with the beneficiaries of each agglomeration. The water supply targets should refer to indicators such as: service coverage, supply continuity (hours of water supply per day), pressure in the network, water quality, etc. The wastewater targets should refer to indicators such as: wastewater collection coverage, sludge management standards, etc.

Differentiate the targets by size of agglomeration:

- below 2000 inhabitations
- between 2,000 and 10,000 inhabitants
- between 10,000 and 100,000 inhabitants
- above 100,000 inhabitants

Developing targets is an iterative process and should be seen in relation with strategy development and option analysis.

4.5 Conclusion

Conclude and comments on the objective and targets defined in this chapter.

5. OPTION ANALYSIS

- The option analysis should explain how to reach the defined targets in the most cost efficient manner.
- Further, it should assess which size of agglomeration has to be included to reach the defined targets (i.e., is it possible to reach the defined average connection rates at the county level if only agglomerations above 2,000 inhabitants are considered?).
- The MP should include two components: water supply and wastewater (including collection, treatment and disposal). For both components, it should outline and compare different technical development alternatives. This includes (but is not limited to) use of water sources, treatment processes (for both drinking water and wastewater) and plant locations, networks layout, etc.

5.1 Abstract

5.2 Methodology and Assumptions

Describe the methodology and assumptions for the option analysis considering the following:

- Define criteria for identifying and evaluating options (cost, environmental risks, health hazards, implementation risks, compliance with EU and national standards)
- Defining an Agglomeration according to the EU UWWTD 91/271 is critical for the option analysis. Population density and concentration of economic activities are the most important indicators to assess whether central or decentralised solutions will be more cost efficient. Refer to the notes in the ToR regarding Agglomerations and the Document “Terms and Definition of the Urban Wastewater Directive (91/271/EEC)” attached to this document (see Annex 1).

Note that the defined Agglomerations might not be equal for water and wastewater

- Clearly define assumptions for unit costs (i.e. costs per pers.-equiv., sewer cost per inhabitant for different size of agglomeration and population density), indicating source or calculation base
- In a first step, develop long-term strategic options. Considering the critical water quality (i.e., NO₃ and NH₄) in many regions in Romania, prepare a well founded assessment (based on sufficient water quality data and hydro-geological investigations) of strategic water supply options. Develop alternatives carefully, comparing decentralised water treatment plants with transportation of water from other sources, remediation of aquifer with surface water abstraction and treatment, different water treatment technologies. In addition to investment and operation cost criteria, consider reliability of the technology and capacity of the ROCs to operate more complex decentralised treatment plants (in particular for rural areas). For the retained long-term development option, prepare a strategy and action plan (see Chapter 6) to clearly define how and when compliance with EU and national drinking water standards will be achieved and how the achieved standard can be sustained. The action plan should clearly define which studies (i.e. hydrogeological investigations) and actions from authorities responsible for water resource protection (i.e. impose pre-treatment for industries) are necessary to implement the strategy. Discuss the action plan with the beneficiaries at an early stage of MP development in order to launch key actions - which might be beyond the scope of the Consultant - in time.

In a second step, assess short-term priority options to include in the CF application and ensure that the retained option is in line with the long-term development strategy. For example, if the long term option is groundwater abstraction after remediating the aquifer, and the only feasible short-term option is rehabilitation of surface water treatment, present a full justification, demonstrating that surface water abstraction is the least-cost option to comply in time; further, present the future function (after remediating the aquifer) of the short-term investment, demonstrating that the investment will not become obsolete after having implemented the proposed long-term supply option (i.e., standby water source).

- Develop an approach for clustering several smaller localities (less than 2,000 inhabitants) in agglomerations, or interconnecting them with larger agglomerations and analyse alternatives for all localities
- Consider a least cost and affordable solution for wastewater which meets or exceeds minimum EU environmental standards as follows: combined system relying on septic tank disposal for certain parts of the project area with low population density, along with a network of sanitary sewers and treatment in other sectors depending on the geologic conditions of the varying zones, and on the water sources protection constraints. To review this possible solution, assess the means and costs of cleaning and maintaining regularly septic tanks and treating/disposing of sludge to be collected
- Assess treatment systems appropriate for smaller agglomerations in rural areas. Consider lagoons and reed bed filters or other systems sufficiently robust and effective

- Assess different variants for connection rates (full / partial) in combination with other variants
- Clearly indicate on a map and table the proposed borders for agglomerations. Allocate each locality to one clearly defined agglomeration.
- The results of the option analysis should clearly show the required investment costs (and operation costs) to reach the defined targets for each alternative.

5.3 Evaluation of Options

Assess the following options:

- Central/decentralised solutions
- Location of sites
- Technological options (considering investment and operation & maintenance costs); compare life-cycle costs for different process alternatives for WWTP and Water Treatment Plants
- Compare most significant options based on costs considering investment and O&M costs
- When relevant, include in the cost comparison of significant options economic benefits and costs, especially for environmental externalities to justify the least cost solution(s)
- Assess institutional options for various “technical options” (i.e., a centralised system would require the establishment of a regional water company).

5.4 Proposed Option

- Present a summary table of the assessed options
- Propose the preferred option for each of the assessments above;
- Describe and comment the selected options.

5.5 Conclusion

Briefly describe the selected options

6. COUNTY STRATEGY

The main purpose of the strategy is to identify the least-cost priority measures (technical and institutional solutions) for achieving the defined county targets; the strategy should summarise:

- National objectives
- County targets and time frame
- Option analysis

and should be based on the *Assessment of the Current Situation* (Chapter 2) and the *Projections* (Chapter 3).

A General Strategy should:

- Address the most stringent problems at the county level (i.e., nitrates in ground water)

- Address specific problems for particular categories of agglomerations (i.e. below 2,000 inhabitants, above 2,000 inhabitants, etc.)
- Prioritise all agglomerations based on various criteria (cost efficiency, scarcity of water, physical condition of infrastructure, health risk, environmental risks). Develop a transparent methodology with weights for each criterion to rank all agglomerations (thematic maps and tables)
- Present selected technological options (i.e., type of WWTPs for various sizes of agglomerations)
- Present a schedule for implementing the proposed general measures based on the ranking of agglomerations, the general county strategy, and the specific strategies. The proposed strategy should be in line with the schedule defined in the Accession Treaty (and the Local Implementation Plan). The following table provides an example of a *General County Strategy*

Year	Measure
2008 - 2009	Establish Regional Operators
2008 - 2009	Launch action plan for aquifer remediation: hydro-geological study including detailed investigation on origin of water pollution, etc.
2008 - 2015	Develop water supply systems in priority towns first (i.e. agglomerations with high number of population, low connection rate, high ranking of non-monetary costs, low specific investment costs)
2010 - 2012	Rehabilitate drainage system in agglomerations above 10,000 inhabitants to reduce infiltration
2012 - 2015	Increase connection rate to water supply systems for agglomerations between 2,000 and 10,000 inhabitants
2012 - 2015	Extend drainage schemes in agglomerations above 10,000 inhabitants
2010 - 2015	Construct WWTPs for agglomerations above 100,000 inhabitants
2015 - 2018	Construct WWTPs for agglomerations between 10,000 and 100,000 inhabitants
2015 - 2018	Increase connection rate to water supply systems for agglomerations below 2,000 inhabitants
2018 - 2028	Reduce water losses to 25 % by introducing Active Leakage Control Systems
	Etc.

- ***Detailed Strategy:*** Based on the general strategy, prepare a more *Detailed Strategy* for each section (water resource protection, water abstraction, drinking water treatment, water supply network, wastewater network, wastewater treatment, sludge disposal). For interrelationship between long-term strategy and short-term options, refer to Chapter 5.2 “*Option Analysis – Methodology and Assumptions*”. The strategy should provide enough details to draft the long term investment plan. Break down to the level of agglomerations the general targets and measures defined in the General County Strategy.

7. LONG TERM INVESTMENT PLAN

7.1 Abstract

7.2 Planning Context

Strategic development of water and wastewater systems should:

- Bring a substantial contribution to the national commitments (SOP objectives)
- Consider the regional/county approach to justify selection of priority investments
- Consider Romania's relevant environmental commitments in the Accession Treaty; clearly indicate the deriving commitments of the target counties in water/wastewater
- Soundly justify compliance of the proposed improvements with the national SOP objectives and county water/wastewater Implementation Plans (Chapter 22)
- Describe the expected contribution of investment measures to achieve the Implementation Plans' objectives
- Demonstrate that the investment is part of a long-term cost-efficient water and wastewater development plan
- Demonstrate that the operator is viable and efficient
- Demonstrate that the proposed investments are sustainable and offer better services to the public and/or improve environmental protection

7.3 Long-term Investment Measures

- Identify the need for investments in water and wastewater services to achieve full compliance with relevant EC Directives, taking into account population affordability for investments and local and/or regional implementation and operation capacities
- Identify requirements for Technical Assistance to ensure adequate management capacity of the beneficiary to implement the measures and sustain the investments
- Justify each measure by summarising the findings of the current situation (and/or referencing to Chapter 2) and provide enough supporting data (i.e. increasing number of failures, supply security, water quality analysis)
- Describe each investment measure with enough details
- Describe possible options to be assessed in the subsequent feasibility study
- Identify implementation risks (i.e. availability of land)
- Identify operation and maintenance risks (i.e. insufficient capacity of beneficiary)
- Provide sketches and drawings with sufficient degree of detail (pre-feasibility level) for each measure
- Describe result of the measures based on selected indicators (connection rate, water quality improvement, treatment efficiency, reduction of wastewater load, etc.)

7.4 Basic Design Parameters and Pre-dimensioning

Prepare basic design parameters for the planning horizon of the MP, taking into account the transition periods agreed for compliance with the relevant EU Directives and the population size of the concerned localities.

The parameters should include (not exhaustive list):

- Domestic water consumption trends, idem for institutional, commercial, and industrial consumption
- Consumption elasticity rate for tariff variation and for income variation
- Quality and quantity standards to be met at each target year
- Water supply mean and peak flows
- Coverage rate for water and wastewater public services
- Mean household income, mean number of persons per household, discount rate
- Domestic and industrial wastewater flows, dry and wet wastewater flows (mean and peak values), ground water infiltration, total inflow to WWTP facilities, total industrial wastewater inflow to WWTP, total BOD load (domestic and industrial), etc.

Present in a table the proposed values for the target years with sound justifications. Pay particular attention to the robustness of the assumptions for water demand (current and future levels, both domestic and non-domestic). Reference is made to Chapter 3.4 “Water Demand Projection”.

7.5 Unit Costs

- Present data from tenders for similar projects in Romania and other Eastern European Countries to elaborate a database of unit costs for water and wastewater projects
- Use these unit costs –refined or adjusted when necessary– to estimate total costs
- Describe thoroughly the basis for unit costs (what is included in the unit cost, price base year)
- Provide a detailed Unit Cost Table in the annex expressed in the price base year corresponding to the year of submission of the MP to the client
- Provide an aggregated Unit Cost Table (investment cost for WWTP per person-equivalent; investment costs for sewer network extension /per inhabitant supplied /average per km of network extension; etc.); provide the data for different sizes of agglomerations.

7.6 Investment Cost

- Provide an investment cost table, based on the proposed investment measures and the unit cost table
- Express investment cost in the price base year corresponding to the year of submission of the MP to the client
- The table should be sufficiently detailed for pre-feasibility level (separated for each measure and each agglomeration)
- Present an aggregated cost table in real prices

7.7 Operation, Maintenance and Administration Costs

- Provide a table for operation and maintenance cost, based on the proposed investment measures and the unit cost table
- If existing data from water operators are insufficient or unreliable, use a normative approach, using standard unit costs from water utilities operating under similar conditions
- The table should be sufficiently detailed for a pre-feasibility level (separated for each measure and each agglomeration)
- Present an aggregated cost table in real prices

7.8 Implementation Schedule and Phasing of Measures

7.8.1 Criteria for phasing

Based on the strategy developed in Chapter 6, define criteria for preparing an implementation schedule and development phases. The implementation schedule should include, but not be limited to:

- Deadlines in the EU Accession Treaty
- Targets and deadlines in Chapter 4 “National Objectives and County Targets”
- General implementation schedule based on priorities in Chapter 6
- Capacity of beneficiaries (ROC/Municipalities) to implement the measures
- Capacity of the beneficiaries to operate and maintain the facilities
- Capacity of the beneficiaries to finance local contribution for the CF Investments and to finance future reinvestment cost for the facilities
- Institutional capacity (establishment of ROCs)
- Capacity and willingness of the consumers to pay for the improved service (affordability)

7.8.2 Implementation schedule and phasing plan

- Prepare an implementation schedule (up to the planning horizon of the MP) for the investment measures in Chapter 7.3, indicating start and end date for each measure. Provide also a Gantt chart with an overview of the proposed working schedule
- Discuss the proposed tentative schedule and agree with the beneficiaries (and MESD); organise a workshop with all involved stakeholders
- Develop an aggregated phasing plan based on the agreed implementation schedule.

7.9 Impact of Proposed Measures

Assess the impact (positive and negative) of the proposed investment measures on:

- Environment
- Public health
- Socio-economic environment (i.e., job creation)

7.10 Achievement of Targets

Present the expected output *for each phase* of the investment plan with the selected indicators for achieving:

- SOP Targets (see Chapter 4)
- Regional/County targets (see Chapter 4)

Present also the related investment costs necessary to achieve the targets in the table above with the following indicative list of indicators:

- Total investment costs for each phase
- Specific investment costs (i.e. per capita investment costs)

Note: The proposed measures have to be in line with EU and Romanian legal requirements and make clear reference to them. The reference points are the deadlines agreed for compliance in the Accession Treaty.

7.11 Institutional Requirements

Present recommended institutional arrangement for the operation of the ROC/ IDA

7.12 Conclusion

The main output of the MP shall be a list of investment measures, in order of priority for the planning horizon of the MP. The proposed measures should respect the criteria of affordability, institutional set-up and financial viability.

Conclude on the pre-feasibility of the implementation plan by describing:

- Summary of phased investment measures and costs
- Summary of output and impact of the investment measures (key indicators)
- Summary table with compliance dates (separated for water and wastewater) for each agglomeration
- Potential constraints: (i) economic, (ii) technical, (iii) environmental, (iv) institutional; (v) time
- Main assumptions and conditions relevant for implementing the measures

The assessment of the pre-feasibility will help identify any shortcomings (institutional, financial, technical, etc.) at an early stage of project development.

8. FINANCIAL AND ECONOMIC ANALYSIS

At this stage of MP development, the financial and economic analysis mainly aims at developing the necessary input data for the affordability assessment and preparing:

- Overall investment and reinvestment cost of the proposed measures over the defined evaluation period;
- Overall O&M cost as required for (i) sustainable operation and maintenance of the rehabilitated and extended water and wastewater systems, and (ii) meet expected service standards and (iii) the full technical lifetimes of the investment

under the prevailing conditions (estimated and projected on an annual basis for the planning horizon of the MP)

The Feasibility Study will develop a more detailed Financial and Economic analysis.

8.1 Abstract

8.2 Assumptions

List assumptions made for projecting investment and O&M costs.

8.3 Investment Costs

The investment cost table should:

- be broken down per year for the planning horizon of the MP
- be based on the net investment cost tables presented in Chapter 7.6. (net of contingencies, engineering and design costs)
- include costs for contingencies (max. 10%), technical assistance for construction supervision (5%), final design (5%)
- be expressed in current prices taking as base year the year of submission of the MP to the client

8.4 Operation and Maintenance Costs

O&M costs (breakdown per year) should be based on:

- Financial assessment of existing water operators as described in Chapter 2.6.4 “Analysis of Current Situation / Water and Wastewater Institutions”
- Projections prepared in Chapter 3
- Costs defined in Chapter 7.7 “Operation, Maintenance and Administration Costs”
- Be expressed in current prices taking as base year the year of submission of the MP to the client

8.5 Net Present Value

Prepare a preliminary estimate of the Net Present Value of the overall investments (broken down in water and wastewater) for each agglomeration based on the following assumptions:

- Reinvestment after 15 years of components with limited useful lifetime (machinery and equipment) and 30 years for civil works and pipe works;
- Discount rate of 5%

Develop the Average Incremental Cost (AIC: discounted cash-flow of the system over the period of the project divided by the flow of environmental resources consumed or treated during the period) of the projected investment and O&M costs as proxy of the average tariff needed to cover the investment and/or O&M portion of the cost of the overall investment in the project area

8.6 Conclusion

9. AFFORDABILITY

Estimate the potential contribution capacity of different groups of consumers to investments and operation of water and wastewater services by:

- Comparing the maximum potential contribution capacity of the beneficiary community and the total investment programme costs, minus all available grants
- Developing a mathematical model (spreadsheet) to calculate the affordability for various investment programmes, both changing the amount and phasing of the investments and other related costs. The model should distinguish between different sizes of agglomerations (i.e. “smaller”/rural; “bigger”/ urban agglomerations) and different consumer categories (i.e. domestic, non-domestic)
- Considering the total investments proposed for the planning horizon of the MP
- Using AICs as proxy of average tariffs, differentiated for each agglomeration and comparing with current water tariffs highlighted in Chapter 2.6.5
- Estimating the maximum potential contribution capacity of the beneficiary community on the basis that the average monthly expenditure for water should not exceed 4% of the average monthly household income of the lowest income decile (for resident population) based on a consumption of at least 70 l/cd, during all the period of analysis, plus the contribution of other categories of consumers (industrial, commercial)
- Indicating how current tariffs for each municipality can be progressively merged to a unique tariff for the system to be operated by a single regional operator

Proposed subchapters:

- 9.1 Abstract**
- 9.2 Methodology and Approach**
- 9.3 Assumptions**
- 9.4 Tariffs**
- 9.5 Affordability**
- 9.6 Sensitivity Analysis**
- 9.7 Conclusion**

10. PRIORITY INFRASTRUCTURE INVESTMENT PROGRAMME

- The water and wastewater systems proposed for EU co-financing will be the first stage of a long-term phased investment programme designed to fully comply with the relevant EC Directives;
- This first stage will include the priority measures with a positive impact on quality and quantity of the provided services and on environmental protection, and will represent the project to be co- financed by EU Cohesion Funds

- The investment programme will take into account:
 - Transition periods for the relevant Directives
 - Affordability of the proposed investment for population
 - Local implementation capacity
- According to the SOP Environment (strategic document for 2007-2013), given the need to comply with the EU Acquis in the water sector in many agglomerations in a relatively short transition period, prioritise large-scale integrated water/waste water projects (not only drinking water services), mainly in urban agglomerations.

10.1 Abstract

10.2 Prioritisation of Project Measures

10.2.1 Criteria

Select priority measures in two steps:

1. All obligatory measures necessary to be implemented to comply with EU Acquis and national laws
2. All non-obligatory measures (all measures improving the service level) based on a ranking of cost benefit ratio.

Explain the selected criteria clearly and use a rational and simple ranking system. The prioritisation system should include weights defined by the beneficiaries.

Note that phase I shall concentrate on **urban agglomeration having deadline for compliance by 2015. All financing sources will be identified/estimated, thought Cohesion Fund will finance:**

- Environmental projects, (primarily wastewater);
- Priorities according to Accession Treaty (new facilities);
- Affordable investments with significant impact on the population covered

Priority projects are evaluated based on Annex 2 of the SOP Environment. Agglomerations included are selected based on their size, in the following order of importance, according to the obligations within the Accession Treaty:

1. Agglomerations with more than 10,000 p.e.,
2. Agglomerations between 5,000 p.e. and 10,000 p.e.
3. Agglomerations between 2,000 p.e. and 5,000 p.e.

Note that full compliance (according to the deadlines defined in the Accession Treaty) should be achieved within the project period (Phase 1 – Priority Phase) for a prioritised agglomeration. Thus, it is not acceptable to shift part of the investments (necessary to achieve compliance) within one agglomeration to a subsequent phase (Phase II).

Further, prioritise projects considering the entire water cycle (water and wastewater). New extensions of the sewer network (resulting in additional wastewater load) will require adjusting the treatment capacity to avoid any deterioration of the existing water quality of the recipient. Thus, it is not acceptable to build sewer extensions in Phase 1 and shift construction of WWTPs to a subsequent phase (Phase II).

10.2.2 Results

Describe the results of the prioritisation process for each section (water abstraction, water treatment, water supply networks, sewer networks, wastewater treatment).

10.3 Key Performance Indicators

Present the benefit of the project with selected output indicators for achieving:

- SOP Targets (see Chapter 4)
- Regional/County targets (see Chapter 4)
- Other systems performance indicators and ratio (i.e. non-revenue water, length of distribution network, investment cost per population etc.)

Ensure that the proposed measures will have a significant impact on the defined targets.

10.4 List of Prioritised Investment Measures

Prepare a list of priority measures including:

- Investment component number
- Name of agglomeration
- Description of measure (incl. dimensioning, location, etc.)
- Population served with EU acquis compliant systems
- Justification of investment
- Implementation period
- Investment costs

A table should also summarise:

- Capital requirements for the priority phase
- A first recommendation for financing of capital investments (EU grant CF/Beneficiary/State and Local government)
- Affordability and Economic Analysis for Priority Measures

11. ACTION PLAN FOR PROJECT IMPLEMENTATION

Prepare a checklist for all requirements (documents or actions) to be prepared until submission of the application including:

- Deadlines for submission;
- Duration for preparation of documents;
- Current status of available documents;
- Responsible organisation;
- Comments on expected problems.

The checklist should refer to:

- Administrative Requirements (land purchase, etc.)
- Environmental Requirements (EIA)
- Institutional Requirements (establishment of ROCs);

Ensure that the responsible organisations are aware of all deadlines for submitting the requested documents. Report progress on preparing documents to MESD and the beneficiaries.

A sample summary of required documents (EIA, land acquisition, “Urbanism Certificates”, etc.) is attached to this Guidance document (see Annex 2).

12. ANNEXES

Example for ANNEXES:

Annex A: Sources of Information, Available Data and Documents Consulted

- Annex A1: Documents
- Annex A2: Official letters (Apele Romana, Environmental Protection Agency, County councils and City Councils)
- Annex A3: Summary of relevant Regulations
- Annex A4: Summary of MEWM Implementation Programme

Annex B: Environmental Documentation

- Annex B1: Method for Evaluation of Punctual Pollution on Water Resources
- Annex B2: Impact of Effluent Discharges on Recipients in Cluj County and Environmental Data sheets of the Project Region
- Annex B3: Results of Analytical Sludge Investigations
- Annex B4: Legal Background for Sludge Disposal and general Disposal Options and related Cost Structure
- Annex B5: Inventory of Industrial Wastewater

Annex C: Technical Documentation

- Annex C1: Hydrogeology
- Annex C2: Water Supply
- Annex C2.1: DW Water Balance
- Annex C2.2: DW Network Extension and Rehabilitation Options
- Annex C2.3: Water Treatment Components
- Annex C3: Wastewater Treatment
- Annex C3.1: Wastewater Treatment Technologies
- Annex C3.2: Rough Design of the WWTP
- Annex C4: County Strategy (Investment Cost per Commune)
- Annex C5: Measurement Campaign
- Annex C5.1: Measurements on Water Distribution Networks
- Annex C5.2: Measurements on Sewers
- Annex C6: Design Criteria
- Annex C6.1: Design Criteria
- Annex C6.2: Projections
- Annex C7: Assessment of Existing Works

Annex D: Analysis

- Annex D1: Costs
- Annex D1.1: Unit Costs
- Annex D1.2: O&M Costs
- Annex D2: Financial / Economic Analysis
- Annex D2.1: Population Forecast
- Annex D2.2: Income Forecast
- Annex D2.3: Analysis and Forecast of Economic Activity
- Annex D2.4: Contribution Capacity of Households
- Annex D2.5: Contribution Capacity of Economic Agents
- Annex D3: Project Components
- Annex D3.1: Components for ROC
- Annex D3.2: Components for Turda
- Annex D3.3: Components for Campia Turzii
- Annex D3.4: Components for Viisoara
- Annex D3.5: Components for Mihai Viteazul
- Annex D3.6: Components for Trittenii de Jos
- Annex D3.7: Components for Luna
- Annex D3.8: Components for Calarasi
- Annex D3.9: Components for Sandulesti
- Annex D3.10: Components for Petrestii de Jos
- Annex D3.11: Components proposed for Technical Assistance

Annex E: Maps

- Annex E1: General Layouts for Project Towns
- Annex E1.1: Water Supply Network
- Annex E1.2: Sewer Network
- Annex E2: County Strategy
- Annex E2.1: Principal Features
- Annex E2.2: Present Service Levels
- Annex E2.3: Water Sources and Facilities
- Annex E2.4: Wastewater and Sanitation
- Annex E2.5: Alternatives