ΔΗΜΟΣ
ΠΑΥΛΟΥ ΜΕΛΑ

Interreg
Greece-Bulgaria
LYSiS
European Regional Development Fund

EXECUTIVE SUMMARY

Introduction

This Deliverable is a report of the implemented work on the Deliverable 4.2.1 "Evaluation, efficiency assessment and scale-up opportunities report for smart irrigation system".

The deliverable is divided into the following sections:

a) Introduction

b) Description of all urban green areas in the Municipality of Pavlos Melas

c) Calculation of real needs in water of vegetation

d) Water footprint estimation by calculating blue and green virtual water

e) Calculation of carbon footprint

f) SWOT analysis of smart irrigation system

g) Cost-benefit analysis

h) Problems, constraints and challenges of the methodological approach

i) Assessing the efficiency and effectiveness of the design of pilot applications

j) System usage protocol

This deliverable is a report evaluating the smart irrigation system applied in the Dendropotamos park. The purpose of this in the paragraphs below is to achieve optimal management of water resources in the urban fabric implemented in the municipality of Pavlos Melas while aiming to introduce other parks of the same municipality where the intelligent irrigation system could be applied. This process shall take into account socio-climatic data with a view to achieving sustainable management.

2.Description of all urban green areas in the Municipality of Pavlos Melas

The study area of the existing project is the park of Dendropotamos. The park of Dendropotamos is centrally located in the area of Stavroupolis in the western part of the Municipality of Pavlos Melas, Thessaloniki's Building Complex has a total surface area of 11.100m^2 and significant historic buildings are available on its site.

Other parks in the same municipality are listed below where the smart irrigation system could be applied such as:

Jenny Karezi Park with an area of 38,000m^2, of which 14,300 m^2 is the park while the rest of it, is an afforested grove.

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Terpsithea Park with an area of 11,000m^2 that includes valuable historic buildings.

3. Calculation of real needs in water of vegetation

The water vegetation needs are calculated by applying the evapotranspiration equation using weather data. Account shall also be taken of the species of plant, the climate and the characteristics of a territorial substrate. There are various methods of assessing the evapotranspiration level which consider different parameters. The methods presented are: Blaney - Criddle, Penman - Monteith and Thornthwaite, each behaves differently by region with different climate and is valid for different time periods. A study by the American Society of Civil Engineers (ASCE) is described in order to assess the performance of these, and its findings are presented based on which, the Penman - Monteith method is the most valid.

A comprehensive list of all the methods and instruments required to assess their parameters is given. In conclusion, the evapotranspiration forms and plant factors are separated and explained.

4. Water footprint estimation by calculating blue and green virtual water

An extensive analysis of the water footprint is carried out by calculating the blue and green water and the principles for assessing it. Definitions and further explanations are given below for blue green and gray water and the differences and use of the blue and green footprint.

The risks associated with climate change shall be assessed and explained. Finally, by means of tables and diagrams, for both blue and green water, are given weather data and the ratio between the two is mentioned.

5. Calculation of carbon footprint

The first visit to the study area of the project, the current situation of the project examined regarding the size of the area and the evaluation of irrigation equipment. To assess the footprint more accurately, work was carried out on the installation of a remote sensing system. This system is made up of several modules, each performing a different role. In conclusion, the methodology, the target and the consumption data of the intelligent irrigation system are analyzed in detail.

6. SWOT analysis of smart irrigation system

The SWOT analysis is a strategic planning technique used to emerge the Strengths, Weaknesses, Opportunities, and Threats of a business or an organization. First two are implemented for matters concerned the internal environment unlike the last two that are used for the external environment of the program. The above view of the Strengths — Weaknesses is conducted from both the internal perspective and the perspective of the "customers". The overall analysis must be made in relation to competition.

Results of the analysis are presented in detail on an extensive table followed by a series of measures to improve weaknesses in the system such as monitoring the application of the program's use, depreciation of the installation capital of the smart irrigation system and compliance with strict protocols to avoid critical errors.

7. Cost-benefit analysis

The cost-benefit analysis is performed to compare the costs and benefits of implementing an action. Benefits of the "LYSIS" program are broadly highlighted followed by an explanation of the remote sensing significance both to the program the water management and the people's urban quality of life in general. There are many advantages using telemetry that are analyzed on this section such as decision-making system for the water footprint and an early warning system relating to the quality and quantity of the network's water.

The cost-benefit analysis aims to extend financial environmental and resource costs based on the actual agri-economic agri-technical cost data of irrigation water. Economic cost of water does not follow the basic idea of economic theory where the cost of a product increases by increasing the supply to the point where the revenue starts to fall. Methodology of assessing financial costs and implementation ways are given.

To proceed, environmental cost is needed in order to calculate the valuation of an environmental change. There are numerous methods explained and compared to each other for that goal, such as:

Contingent Valuation Method – CVM

Contingent Ranking

Hedonic Pricing Method – HPM

Travel Cost Method – TCM

Defensive Behavior Method

Damage Cost Method

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Dose – response

Replacement cost/ restoration cost / cost savings

Habitat Equivalency Analysis – HEA

The environmental cost assessment at intervals is necessary to identify pressures and impacts on aquatic bodies. The way in which the cost valuation

approach is achieved is based on the impact cost assessment. After an extensive literature review, methodology for the environmental cost assessment is proposed.

The concept of cost of opportunity into water resource management is introduced since resources considered are not in abundance therefore any action taken might affect or dismiss certain alternative policies, strategies or decisions. The economic concept of the resource cost is analyzed and then an explanation is given about the association of resource and environmental cost. Furthermore, the internal and external components of the resource cost and the theoretical economic background behind the resource and environmental cost are inspected. In conclusion the general approach of calculation of the two above cost components that is used in France, Spain and the Netherlands is mentioned and explained.

8. Problems, constraints and challenges of the methodological approach

The methodological approach is based on modern methods of data collection, monitoring and analysis. The most common problems encountered in telemetric monitoring are; the accuracy of the sensors which is decreasing due to natural causes and the presence of portable materials caused by soil erosion.

In order to avoid the above-mentioned problems and more general issues arising from extreme weather conditions or other anthropogenic factors, certain measures are proposed which should be respected by the municipality of Pavlos Melas and, in conjunction with the operation of the LYSIS project systems, ensure the proper functioning of the program.

9. Assessing the efficiency and effectiveness of the design of pilot applications

In order to assess the effectiveness of water use, management technologies and their environmental impact various methods are used with the most common being water balances and environmental accounting. The above methods along with certain indicators derived from them, shall accurately determine the water efficiency and effects on space and time, which is apparent from the tables of evapotranspiration temperatures and monthly irrigation water use listed.

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10. System usage protocol

The creation of a protocol of use of the system considers several factors such as the existing institutional framework, existing practices, rational urban water management and modern monitoring systems. In addition, in order to optimize the operation and implementation of the pilot system it is necessary to comply with certain conditions which are listed in detail. Prerequisites also exist to achieve the long-term viability and effectiveness of the project.

A special apparatus was then installed for the purpose of establishing a protocol on the maintenance and control of equipment and works. The assignment's schedule of individual control bodies is analyzed in tables explaining in detail the kind and frequency of measurements they take. To conclude, the optimal irrigation protocol based on two fundamental principles, the FAO rational irrigation system and the determination of actual evapotranspiration and follows specific procedural steps through its various components.

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