



Common borders. Common solutions.



BALANCED SCORECARD MANUAL



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

BALANCED SCORECARD MANUAL



Continuous improvement strategy for the management of wastewater treatment facilities

Author:

RD Hydraulics Ltd



Under the Supervision of:





Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Abstract 5

Notations and Symbols..... 5

1. Introduction..... 7

2. Black Sea fragile environment..... 8

3. Overview of the Wastewater Treatment Process - Technical and Legal aspects..... 8

 3.1 Legislation for Waste Water Treatment..... 8

 3.2 Wastewater Treatment Process..... 9

 3.3 Define the purpose of Wastewater Treatment and its quality indicators 10

 3.5 Wastewater treatment processes in a typical Wastewater Treatment Plant (WWTP) 12

 3.6 Processing and Handling of Solids 15

 3.7 Products of the Wastewater Treatment Process 16

 3.8 Permits and Monitoring 16

 3.9 The role of People 17

Guidelines to Design and Implement a Balanced Scorecard for a Wastewater Treatment Plant..... 19

4. A Balanced Scorecard Helpdesk for Users in the Wastewater Treatment Sector 20

 4.1 Origins of the Balanced Scorecard 20

 4.2 Overview of the Balanced Scorecard 21

5. Implementing Stages of a Balanced Scorecard in a WWTP..... 27

 5.1 Stage 1: Project Set - Up..... 29

 5.2 Stage 2: Taking Stock: Gather and review background material and Information 33

 5.3 Stage 3: Define the Mission, Vision and Strategy of a WWTP..... 35

 5.4 Stage 4: Perspectives and Objectives 40

 5.5 Stage 5: Cause and Effect Analysis 40

 5.6 Stage 6: Develop objectives and measures in each of the Balanced Scorecard perspectives..... 41



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

5.7 Stage 7: Action Planning, Implementation and Review	44
7. The Balanced Scorecard Paradigm in the WWTP of the Municipality of Drama, Greece ...	44
Glossary of the Wastewater Treatment Process.....	62
Glossary of the Balanced Scorecard	64
Balanced Scorecard Bibliography	66



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Abstract

The present Balanced Scorecard Manual outlines the Wastewater treatment which complies with the latest legislation and technological advancements and is accomplished through a series of treatment processes and stages: preliminary treatment, secondary treatment, tertiary treatment, disinfection, de - chlorination, post-aeration, solids processing, release of the treatment effluent to the receiving stream of the Black Sea Region and reuse of the stabilized waste solids (biosolids) as a soil amendment/fertilizer on several neighboring agricultural fields.

Defines the Balanced Scorecard as a progressive and innovative way to communicate to town leaders, employees and the community how each WWTP in the Black Sea Region will achieve its mission and strategic objectives.

Identifies the steps towards the design and implementation of a Strategy Map and a Balanced Scorecard of a WWTP which will do the following: 1) Tell the story of the WWTP's strategy and is connected to that of the referral Region, 2) Show that every objective selected is a link in the cause-and-effect relationships that compose the Region's strategy, 3) Drive performance by using a variety of measures and targets to encourage proactive management, 4) Involve the participation of division heads, key staff, and employees throughout the Region, 5) Ensure financial viability and 6) Positively change the behavior in the Region by developing strategic initiatives.

Defines that the WWTP in the Black Region must: 1) Review their existing initiatives and subsequent budget requests to ensure they are aligned with the Region-wide strategy, 2) Assure that each initiative has at least one performance measure used to gauge progress toward achieving the initiative, 3) Update at the end of each fiscal year the status of these performance measures and communicate their results to the Board of the Region, 4) Determine whether they want to stay the course or develop new initiatives for achieving the REGION's strategic objectives and 5) Analyze the Accomplishments and Challenges of their Wastewater Treatment Services in the Region.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Notations and Symbols

WWTP: Waste Water Treatment Plant

WWTF: Waste Water Treatment Facility

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

BSC: Balanced Scorecard

MBO: Management by Objectives

PDP: Personal Development Planning



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

1. Introduction

The present Balanced Scorecard Manual is intended to be a guidance tool for continuous management improvement for sewage works owners, managers, designers, process engineers, and operators who have an interest in improving the operation and/or performance of a sewage works, reducing the operating costs, or minimizing the capital cost of upgrading or expanding. Users should have a sound understanding of sewage works process design fundamentals and sewage collection systems as these are not covered in this Manual.

The purpose of the Balanced Scorecard Manual is to provide the Wastewater Treatment Plants (WWTPs) with a <tool> which is going to be used for the following purposes:

1. To "translate" the abstract concepts of the Vision, Mission, Strategy and Policy of a WWTP on specific projects, targets and measurement indicators (metrics).
2. To be able the Leadership of a WWTP to monitor its actual performance indicators towards the realization of the Vision and Strategy
3. To facilitate the decision making by the leadership at every level and competence in a WWTP, based on real numbers and performance, selected as important to the realization of the Vision and Strategy
4. To easily tracked and infallibly the individual (per address or function) key performance indicators of a WWTP.

The Present Balanced Scorecard Manual will be used as a "sitemap" that will play the role of "dashboard" organ of a car and clearly shows the current situation of the Organization to a WWTP's Leadership, just as dashboard of a car showing the current state of the vehicle to the driver. It is going to identify and implement optimization approaches that could be applied to all components of sewage works, namely: the sewage collection system, the liquid treatment process train and the solids treatment process train. In this regard, It is also important to recognize that optimization of one component of the sewage works may impact the performance of other components.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

2. Black Sea fragile environment

The **Black Sea** is located in Southeastern Europe. It is bounded by Europe, Anatolia and the Caucasus, and drains through the Mediterranean, and from there into the Atlantic Ocean, via the Aegean Sea and various straits.

The total surface of the Black Sea is 436,400 km² (168,500 sq mi), not including the Sea of Azov, with the maximum depth of 2,212 m (7,257 ft), and a volume of 547,000 km³ (131,000 cu mi). The shape of Black Sea is that of an elliptical depression on a east-west axis, which lies between Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. The longest east-west extent is about 1,175 km (730 mi).

The most important problems of the Black Sea are pollution, loss of biodiversity and coastal degradation. The wastes from agricultural, domestic and industrial sources are responsible for the eutrophication phenomenon or the over-fertilization of the sea by compounds of nitrogen and phosphorus, which also called nutrients. This process degrades the Black Sea ecosystem. Six coastal countries contribute about to the 70% of the total amount of nutrients flowing to the Black Sea as waste from human activities, with the nutrients of the remaining countries with no direct access to the sea entering the Black Sea through the Danube River. Major pollutants of the Black Sea are the following:

- 1) Oil pollution which enters the marine environment of the Black Sea as a result of operational or accidental discharges from vessels, as well as through insufficiently treated wastewaters from land based sources.
- 2) Heavy metals such as cadmium, copper, chromium and lead are usually associated with waste from the heavy industry and ash remaining from burning coal for generating electricity. Pesticides enter the sea mostly through rivers and streams due to agriculture.
- 3) The discharge of insufficiently treated sewage waters, which results in microbiological contamination and poses a threat to public health. Also the radioactive substances which have been introduced to the Black Sea in small quantities from nuclear power plants and in more significant amounts after the nuclear power plant disaster in Chernobyl in 1986.
- 4) The introduction of exotic species from ships, mostly through exchange of ballast waters or other wastewaters, that they proliferate in the new environment because of lack of natural predators that can limit their numbers.
- 5) The solid waste which are dumped into the sea from ships and some coastal towns. And because any floating or semi-submerged waste inevitably ends on the seashore, the beaches of the Black Sea tend to accumulate a lot of garbage, which present a risk to the health of humans and marine species.

3. Overview of the Wastewater Treatment Process - Technical and Legal aspects

3.1 Legislation for Waste Water Treatment

The **Urban Waste Water Treatment Directive** (full title **Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment**) is a European Union directive



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

concerning the "collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors". The directive was adopted on 21 May 1991. Its main objective is "to protect the environment from the adverse effects of urban waste water discharges and discharges from certain industrial sectors".

The directive requires the collection and treatment of waste water in agglomerations with a population equivalent (PE) of over 2.000, and more advanced treatment in agglomerations with a PE greater than 10.000 in sensitive areas. It is very important for the Black Sea Region to follow the above legislation in order to adapt its activities to the strict rules of the European Community.

3.2 Wastewater Treatment Process

Clean water is one of the main sources of life on earth. Water is naturally cleaned and reused as part of the hydrologic cycle in the environment. Water used in human activities is also cleaned and reused. Although sewers for carrying away foul smelling water were common in ancient Rome, treatment of wastewater is a relatively modern practice. The Cities began to understand the need to reduce the pollutants in the used water they were sending back into the environment from the 19th century.

Nowadays wastewater is channeled to wastewater treatment plants where it is cleaned and released back into lakes and rivers. This water reenters the hydrologic cycle and will eventually be pumped back up by another water treatment plant to be purified and released to customers (**see water cycle below**).

Wastewater is mostly water and in average includes 99.94% water by weight with only a small portion of 0.06% is actually waste material. This material, that is either dissolved or suspended in the water, can come not only from the most obvious human waste, but also from human daily activities which contribute with many other water pollutants, including food particles, paper products, dirt, oil and grease, proteins, organic materials such as sugars, inorganic materials such as salts, personal care products, pharmaceuticals, cleaning chemicals and hundreds of other chemicals.

Concentrations of these substances are usually referred to in milligrams of pollutants per liter of water (mg/l) or parts per million (ppm). To have an idea of this dimension, one ppm is equivalent to one minute of time in 1.9 years or one inch in 16 miles, which means that wastewater treatment processes designed to remove a few milligrams per liter of a pollutant are similar to sifting through a haystack to remove a tiny needle.

Wastewater can be classified as domestic, industrial, or storm, according to its origin. Domestic sources include water used for normal activity in homes, businesses and institutions. Domestic wastewater is readily treatable.

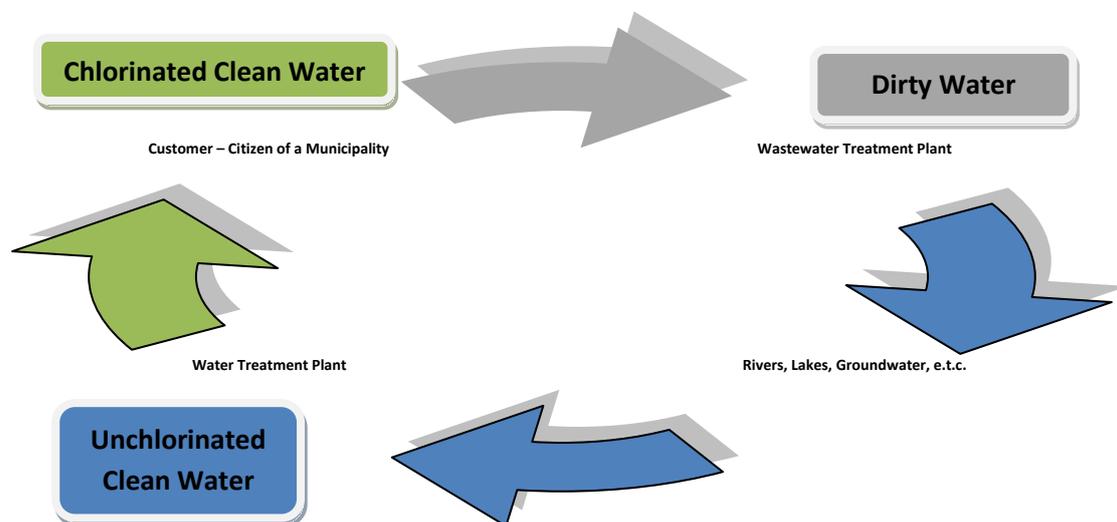
The way of treatment of the industrial wastewater depends on the type of industry using the water. Some industrial wastewaters can be treated the same as domestic wastes without difficulty instead others that may contain toxic substances or high percentages of organic materials or solids which make treatment difficult. In such cases, the industrial plant has to pretreat its wastewater in order to remove these pollutants or reduce them to treatable levels before it is accepted into a Wastewater Treatment Facility.

Continuous improvement strategy for the management of wastewater treatment facilities

Storm water often goes to a Wastewater Treatment Plant, although it is usually low in pollutants. Great amounts of storm water can interfere with treatment efficiency in two ways: Storm water may cause too much dilution of the wastewater. At the same time, it may cause hydraulic overloading of the plant. In most cases, wastewater systems now call for separate storm sewers.

Until now a lot of technological improvements have been made in the clean water collection and treatment and as a result of them, public health and water quality are all enhanced and protected better today than ever before. For example a tour in a Wastewater Treatment Plant is a short course in environmental engineering, chemistry, biology, microbiology and public policy.

Water Cycle



3.3 Define the purpose of Wastewater Treatment and its quality indicators

The main purpose of wastewater treatment is to eliminate the impact of human and industrial effluents to the natural environment and in extension to human health. For example irrigation with wastewater is indeed an effective form of wastewater disposal but it is necessary some degree of treatment of the raw municipal wastewater before it can be used for agricultural or landscape irrigation or for aquaculture. The quality of treated effluent used in agriculture has a great influence on the operation and performance of the wastewater-soil-plant or aquaculture system and depends on the crop or crops to be irrigated, the soil conditions and the system of effluent distribution adopted.

The effluent of the wastewater treatment has to meet the recommended microbiological and chemical quality guidelines both at low cost and with minimal operational and maintenance requirements, in order to be used in agriculture. A low level of treatment maybe is desirable in developing countries, not only from the point of view of cost but also from the problems which come from the difficulty of operating complex systems reliably.

But also there are cases where a higher-grade effluent will be necessary and it is essential that information on the performance of a wide range of wastewater treatment technology should be available. The design of wastewater treatment plants around the world is usually



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

based on the need to reduce organic and suspended solids loads towards the reduction of the environmental pollution.

Pathogen removal has very rarely been considered an objective of the wastewater treatment but in the case of reuse of effluents in agriculture this must be of primary concern and processes should be selected and designed accordingly. Although treatment to remove wastewater constituents that may be toxic or harmful to crops, aquatic plants and fish is technically possible, it is not normally economically feasible.

There are short-term variations in wastewater flows observed at municipal wastewater treatment plants with flow is typically low during the early morning hours, when water consumption is lowest and when the base flow consists of infiltration-inflow and small quantities of sanitary wastewater. The first peak of flow generally occurs in the late morning, when wastewater from the peak morning water use reaches the treatment plant and a second peak flow usually occurs in the evening. Small communities with small sewer systems have a much higher ratio of peak flow to average flow than do large communities. Because of the daily variations in flow from a municipal treatment plant, it is impracticable in most cases to irrigate with effluent directly from the treatment plant. It is necessary some form of flow equalization or short-term storage of treated effluent to provide a relatively constant supply of reclaimed water for efficient irrigation.

As all natural waterways contain bacteria and nutrients, almost any waste compound introduced into such waterways will initiate biochemical reactions which create what is measured in the laboratory as the biochemical oxygen demand (BOD). Such chemicals can also be broken down using strong oxidizing agents and these chemical reactions create what is measured in the laboratory as the chemical oxygen demand (COD).

BOD and COD tests are a measure of the relative oxygen-depletion effect of a waste contaminant and have been widely adopted as a measure of pollution effect with the BOD test measures the oxygen demand of biodegradable pollutants and the COD test measures the oxygen demand of oxidizable pollutants.

The 5-day BOD measures the amount of oxygen consumed by biochemical oxidation of waste contaminants in a 5-day period. The total amount of oxygen consumed until the completion of the biochemical reaction is called the Ultimate BOD. Because the Ultimate BOD is consumed in the period of 5 days, the 5-day BOD has been almost universally adopted as a measure of relative pollution effect. There are also many different COD tests with probably the most common the 4-hour COD.

The correlation between the 5-day BOD and the ultimate BOD can't be generalized. The same applies for the correlation between BOD and COD. It is possible to develop such correlations for specific waste contaminants in a specific wastewater stream but such correlations cannot be generalized for use with any other waste contaminants or wastewater streams.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

3.4 Wastewater treatment processes in a typical Wastewater Treatment Plant (WWTP)

Wastewater Treatment Plants are designed **to produce a stream of clean water that is safe to return to the environment.**

In a wastewater treatment plant essentially happens the same process that occurs naturally in a stream or lake. The processes in a treatment plant simply speed up water's natural process, where other small organisms live in the water by feeding from waste with result to eliminate waste and produce new bacterial cells, carbon dioxide, and other products in a natural cycle.

In the modern world nowadays most homes, businesses and institutions are connected to a network of belowground pipes that carry their wastewater to a treatment plant. A network of sanitary sewer systems carry only domestic and industrial wastewater, while a combined sewer system also carries storm water runoff. In this network wastewater flows by gravity or is pumped into the treatment plant and in some cases a combination of both methods is used.

Conventional wastewater treatment consists of a combination of physical, chemical and biological processes and operations for the removal of solids, organic matter and sometimes, nutrients from wastewater, along with processes to reuse or dispose of the remaining products. These processes and operations can be categorized in the following major phases: 1) preliminary, 2) primary, 3) secondary, 4) tertiary or advanced wastewater treatment and 5) in some cases, when is necessary, disinfection to remove pathogens.

Phase 1: Preliminary Treatment

During the preliminary treatment (**see the flow diagram below**) takes place the removal of coarse solids and other large materials often found in raw wastewater, which is necessary to enhance the operation and maintenance of subsequent treatment units. Preliminary treatment includes operations like coarse screening, grit removal and in some cases comminution of large objects. The velocity of the water through the grit chamber is maintained sufficiently high or air is used, in order to prevent the settling of most organic solids. Comminutions are sometimes adopted as supplement to the coarse screening and serve the reduction of the size of large particles, which will be removed in the form of sludge in subsequent treatment processes. Flow measurement devices, often standing-wave flumes, are always included at the preliminary treatment phase.

Phase 2: Primary Treatment

In the phase of Primary treatment a more sophisticated settling tank is involved which also called a sedimentation tank or clarifier. During this phase can be removed up to 50% of pollutants through a series of operations which remove most of the solids that float or settle.

During the phase of primary treatment takes place the removal of: 1) settle able organic and inorganic solids by sedimentation and 2) materials that will float (scum) by skimming. And more specifically in this phase takes place the removal of approximately 25 to 50% of the

Continuous improvement strategy for the management of wastewater treatment facilities

incoming biochemical oxygen demand (BOD₅), 50 to 70% of the total suspended solids (SS), 65% of the oil and grease and also of some organic nitrogen, organic phosphorus and heavy metals associated with solids but not colloidal and dissolved constituents which are not affected. The output from primary sedimentation units is referred to as primary effluent.

Sedimentation tanks are designed to hold wastewater for several hours. During this time period, floating material, such as oil and grease, can be skimmed off the top and suspended solids can drift to the bottom of the tank, where they are collected by mechanical scrapers and pumped out of the bottom of the tank. The removed solids at this point are called primary solids and they are usually pumped along for further treatment or solids thickening.

Phase 3: Secondary Treatment

As it has been mentioned above wastewater which flows out of primary treatment still contains solid materials, either floating on the surface, dissolved in the water, or both. These substances, in a natural stream, are a source of food for hungry protozoa, fungi, algae, and hundreds of varieties of bacteria and microorganisms and this is exactly the case in wastewater treatment plants.

During the phase of secondary treatment, which is a highly controlled artificial environment where the ideal conditions are created for microscopic organisms to work as fast and efficiently as they can, care is taken to create an environment with the appropriate temperature, oxygen level, and contact time to support rapid and complete consumption of dissolved wastes. Under these conditions and just as they would in nature, the microorganisms biologically convert the dissolved solids in the wastewater into suspended solids, which can then physically settle out with the final products are carbon dioxide, cleaner water...and more microorganisms.

One of the most common forms of secondary treatment is the activated sludge process, during which incoming wastewater and microorganisms are mixed in a large tank using constant aeration and agitation for a period of anywhere from a couple hours to an entire day with the microorganisms to be essentially “activated” by bubbling oxygen through the mixture.

Activated sludge is a continuous process, which is a portion of the settled solids that contain active microorganisms, also known as return activated sludge, is circulated back to the beginning of the process to continue working. The portion which does not go back into circulation is called waste activated sludge and it is forwarded for further treatment. The mixture of water and microorganisms flows on to a sedimentation tank, similar to the one used in primary treatment, where the microorganisms and other solids settle to the bottom.

Some of the several variations on the activated sludge process are the following: 1) suspended growth activated sludge with the microorganisms are suspended in and moving around a tank, 2) fixed-growth activated sludge which involves the insertion of various media into the tank to encourage the growth of additional microorganisms that will help treat the wastewater, 3) membrane bioreactors which involves the usage of a membrane at the end of the tank to draw clean water through the membrane filtering equipment while leaving solids in the tank with the big advantage that no sedimentation tank is needed.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

There is also another form of secondary treatment which uses aerated basins or lagoons and relies heavily on the interaction of sunlight, algae and oxygen and because of these interactions are relatively slow, the wastewater is aerated to speed up the process. This process usually operates without the use of a sedimentation tank. Suspended solids settle to the bottom of the lagoon where they remain or are removed every few years. In general lagoons are simpler to operate but less efficient than other forms of secondary treatment. At the end of the most forms of secondary treatment processes, 85% to 90% of the waste has been removed from the flow of water.

Phase 4: Tertiary Treatment (Advanced Treatment)

The next phase of the production procedure in a Wastewater Treatment Plant is the tertiary treatment which is used to improve the quality of water even more. These systems are used in certain cases to remove specific toxic substances that may be present in the water stream, when the most common systems remove suspended solids and nutrients. A Wastewater Treatment Plant can use a variety of tertiary processes to remove materials that remain in the wastewater after secondary treatment.

All domestic and some industrial wastewater contain nutrients. The discharge of too many nutrients into water results to the stimulation of the growth of algae and other aquatic vegetation, as they produce a fertilizer-like effect. Because of this, excessive plant growth can use so much dissolved oxygen that an insufficient amount remains for fish and other aquatic life. To prevent this unacceptable result many Wastewater Treatment Plants employ processes to remove nutrients and the two primary targets are phosphorus and nitrogen.

Phosphorus can be removed: 1) by adding aluminum-based chemicals to separate it from the wastewater and allowing it to settle out, 2) by forcing bacteria to consume and remove it, through the variation of the amount of oxygen available to the bacteria. This process is known as biological phosphorus removal, or BPR.

Nitrogen, which is present in the form of urea in urine and also as ammonia in domestic wastewater, can be converted to another compound—nitrate with a process which is called nitrification and it consists of using special bacteria to change ammonia to nitrates, compounds that are less harmful to be released in the waters since they do not require oxygen from the stream. There are cases of streams which are sensitive to nitrogen stream and because of this almost all of the nitrogen must be removed from the wastewater to maintain acceptable water quality. Then an additional biological process, which is known as denitrification, is employed after nitrification. Denitrification is the process that further converts the nitrogen in the nitrates to nitrogen gas, a gas that is then released into the atmosphere.

Filtration is the process used to achieve a higher level of suspended solids removal than is possible through primary and secondary screening and sedimentation. During this process wastewater passes through granular material, such as sand and coal and usually several types and sizes of filtering materials are mixed together in what is known as a multimedia filter. Finally the filter becomes clogged with material removed from the wastewater, and it is cleaned by reversing the wastewater flow in a process called backwashing. Removed solids are then recycled back into the wastewater plant for further processing. Occasionally membrane filters are used in place of granular filters to produce a very high-quality effluent.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Phase 5: Disinfection

Disinfection is used by a lot of Wastewater Treatment Plants as the final phase in the treatment process before water is released back into the environment. Disinfection contributes significantly to the reduction of any remaining bacteria and viruses in the wastewater and also to the protection of the public from exposure to potentially pathogenic microorganisms. Many Wastewater Treatment Plant used for years methods which involving chlorination in the phase of disinfection, but nowadays alternative methods, such as ultraviolet and ozone disinfection, are becoming more widespread.

Disinfection phase normally involves the following processes: 1) the addition of a chlorine solution to wastewater to disinfect or kill pathogens that are present in the flow and or 2) the addition of sodium hypochlorite solutions, which are similar to the chlorine found in swimming pools or bleach in order to avoid the hazardous effects of the chlorine gas. As the chlorine is still present in the water after the completion of the disinfection phase, it can also be carried into the stream. But in the cases of some sensitive water bodies the remaining chlorine has to be removed, because its toxic effects to the aquatic organisms living in the stream. This removal process, which called dechlorination, is usually performed by adding sulfur compounds (sulfur dioxide) to absorb the chlorine.

Nowadays many Wastewater Treatment Plants (WWTP) are directed to the usage of ultraviolet (UV) light in the disinfection phase because this process does not produce the toxic byproduct that are associated with chlorine. During this process the wastewater flows over submerged light bulbs, much like fluorescent lights, which generate UV light that kills the pathogenic bacteria and by this way succeed the disinfection of the wastewater quickly.

Ozone disinfection is also another option that some WWTP are implementing through the usage of ozone to oxidize organic matter and kill any present pathogens. As ozone can be created onsite and does not need to be stored in large volume, this method is considered to be relatively safer than the traditional chlorine one, because of less possibility to have hazardous accidents

After the properly completion of the disinfection phase, the clean water can be safely sent back to the oceans, rivers and lakes.

3.5 Processing and Handling of Solids

As it is mentioned above wastewater treatment processes not only create clean water but also solids, which have to be sent for further processing that can often be more expensive and complex than the actual process of purifying the water.

Untreated solids are often referred as sludge, when treated solids are known as biosolids. These are slurries of water and solids that are roughly 100 times more concentrated than the wastewater that first enters a WWTP, which is still only about 3% to 6% solids.

As these mixtures contain a lot of water and more mass equates to higher processing and handling costs, it is logical for a WWTP to try to dispose of or recycle as much liquid as possible. There are different techniques to serve this target and include the following procedures:

Continuous improvement strategy for the management of wastewater treatment facilities

- 1) Conditioning and thickening consist the first procedure in handling solids. Conditioning procedure is based on chemicals or heat to encourage the release of water, while thickening procedure uses gravity, flotation and chemicals to separate water from the solids.
- 2) Stabilization procedure is used to further treat the sludge by reducing odors and pathogen levels, in order the product of this procedure can be used beneficially or disposed of without posing a hazard in the environment. Stabilization procedure can be implemented by the usage of oxygen (aerobic) or without oxygen (anaerobic) in special tanks which called digesters. Sometimes chemicals, such as lime, are also used to raise the pH level and eliminate odors. Anaerobic digesters have started to become more favored because they can also generate methane gas, which can be used as fuel or to help heat the digester.
- 3) Dewatering procedure is implemented through the usage of mechanical means, as filters, centrifuges and sludge presses, which remove even more water from the biosolids. There are also other techniques, such as drying beds, that can be used to dewater, and produce up to 50% solids, about the consistency of dry soil. At the end of this procedure, the concentrated solids can be beneficially used: 1) after transformation in compost as a soil conditioner, 2) for energy and thermal recovery through incineration and 3) as a filler in landfills.

3.6 Products of the Wastewater Treatment Process

As it has been mentioned in previous paragraphs wastewater moves through the different phases of treatment process, in which solids are removed, the water is cleaned and the produced byproducts follow their own treatment course.

As the most of the cleaned water after a Wastewater Treatment process is returned to the environment, water scarcity is causing people in many areas to rethink about the handling process of this valuable commodity. As a result from the increasing populations and the climate change there are water shortages around the world, and the newly cleaned water flowing out of Wastewater Treatment Plants is a valuable resource that the communities have to take advantage of.

Treated water can be recycled and used again as water for toilets, irrigation water for golf course and landscape, or even in groundwater recharge programs where highly treated plant water is replaced in the soil to replenish the supply.

Biosolids can be buried in a landfill, or can be burned in the incinerators of manufacturing plants and through the transformation into ash make the disposal easier. Energy recovery from these incinerators and thermal processes is also gaining broader use and contributes to the reduction of the facility's energy use. Biosolids can be also used in land reclamation projects or as soil improver

3.7 Permits and Monitoring

As the Wastewater Treatment Process includes many and complex phases, it is necessary for the WWTP to constantly monitor the water to make sure that everything is running smoothly. So in a typical WWTP, numerous sampling points and laboratory tests are used to monitor the quality condition of the water. Some sampling is done by hand: bottles are



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

lowered into the flow to collect samples for analysis at a laboratory. Each phase in the Wastewater Treatment Process has its own sampling and monitoring requirements, which are very important for the protection of public health.

An operator of a WWTP must know what is happening at each phase of the production procedure so he/she can adjust the controls to compensate for changes in the composition and behavior of the water and its contents. Many Wastewater Treatment Plants have their own laboratories, which in many cases are very sophisticated.

The permit of a WWTP constitutes its operational structure, which ensures the quality of the water it discharges back into the environment and the public health. A permit is based on a particular Wastewater Treatment Plant and its processes, with the minimum being set at secondary treatment plus any additional treatment required to meet the water quality standards of the receiving water body.

3.8 The role of People

The success of any wastewater treatment plant, large or small, is based on the hard work of a large number of people working together. Because of the continuous operation of each facility and the dynamic change of the water characteristics depending on the weather or industrial activities, there are no holidays for the personnel.

In order to produce clean water, a Wastewater Treatment Plant needs the proper management to ensure cost-efficient operations. This means making the best use of funds generated through local user charges.

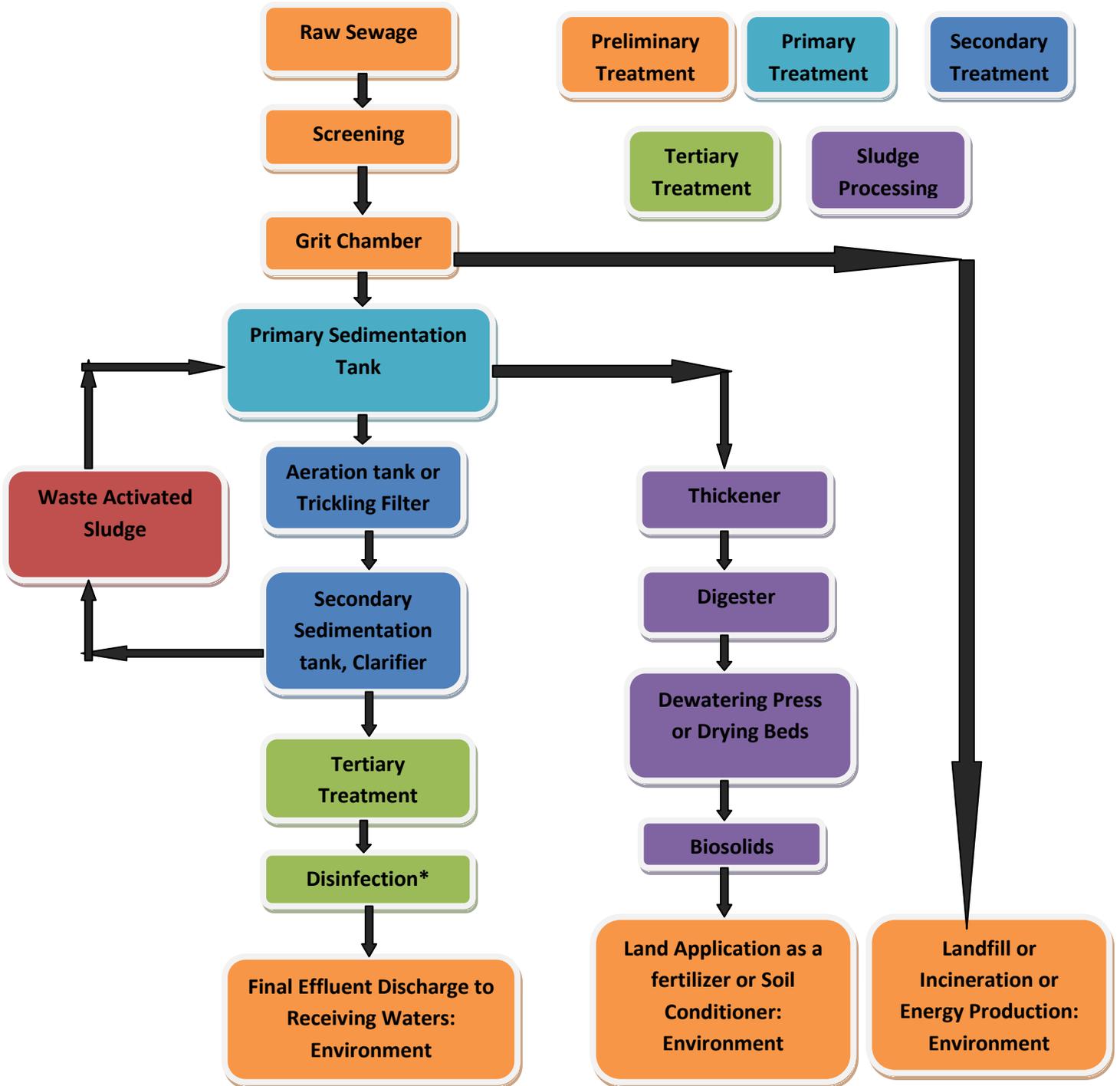
The job of Manager of a WWTP is to bring together money, staff, and materials to ensure that a treatment plant meets its goals, as wastewater collection, treatment, and ultimate disposal in a safe and efficient manner.

A successful plant manager must have many skills including safety consciousness, planning and budgeting, purchasing equipment, recruiting and managing personnel, communicating with the public and initiating government procedures. Operators must also be skilled in many areas such as mechanics, chemistry, hydraulics, biology and computer science.

Important role to the efficiency of a WWTP has the proper training of its personnel, which initially is provided on-site by the engineering firm that designs the plant and the equipment manufacturers and subsequently becomes the responsibility of the treatment facility staff.

Continuous improvement strategy for the management of wastewater treatment facilities

Flow Diagram: Wastewater Treatment Process





Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Guidelines to Design and Implement a Balanced Scorecard for a Wastewater Treatment Plant



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

4. A Balanced Scorecard Helpdesk for Users in the Wastewater Treatment Sector

4.1 Origins of the Balanced Scorecard

The Balanced Scorecard was developed by two men, Robert Kaplan, a professor at Harvard University, and David Norton, a consultant also from the Boston area in the early 1990s, but the origins of this approach go back to earlier performance management methodologies including 'Management by Objectives' (MBO)

Kaplan and Norton presented the concept that had been labeled Balanced Scorecard in the first of three Harvard Business Review articles, "The Balanced Scorecard: Measures that Drive Performance." During the next four years a number of organizations adopted the Balanced Scorecard and achieved immediate results. At this period it had been discovered by Kaplan and Norton that the organizations, which had adopted the Balanced Scorecard, not only used the Scorecard to complement financial measures with the drivers of future performance but were also communicating their strategies through the measures they selected for their Balanced Scorecard. As the Scorecard method was implemented by more and more organizations around the globe as a key tool in the implementation of strategy, Kaplan and Norton summarized the concept and the learning to that point in their 1996 book The Balanced Scorecard.

Balanced Scorecard started from its initial application to fill non-financial performance and through its implementation process in different organizations around the world has been repositioned as a strategic and change management tool. It is recognized that Balanced Scorecard is not just a 'closed system loop' of cause and effect control, but the most important element in it are the people who operate within the system and deliver the results. So the implementation of Balanced Scorecard in an organization can therefore contribute to a change of culture in it.

There are two fundamental business issues that have been greatly enhanced as a result of the Balanced Scorecard: the problem of effective organizational performance measurement and the critical issue of successful strategy implementation.

The benefits from the implementation of a Balanced Scorecard can therefore be summarized to the following: 1) it tells the story of the organization's strategy in a way that gets buy-in from the people who will be responsible for implementing the strategy, 2) it identifies and makes explicit the sequence of hypotheses about the cause and effect relationships between outcomes measures and the performance drivers behind these outcomes, 3) it ensures that both financial and nonfinancial measures are identified and balanced, 4) it identifies the critical few drivers of the strategic objectives, and brings clarity to the trade-offs among organization priorities, 5) it develops ownership and understanding by senior executives as a team about the organization's business model and 6) it can be an effective communication, informing and learning system, not just a controlling one

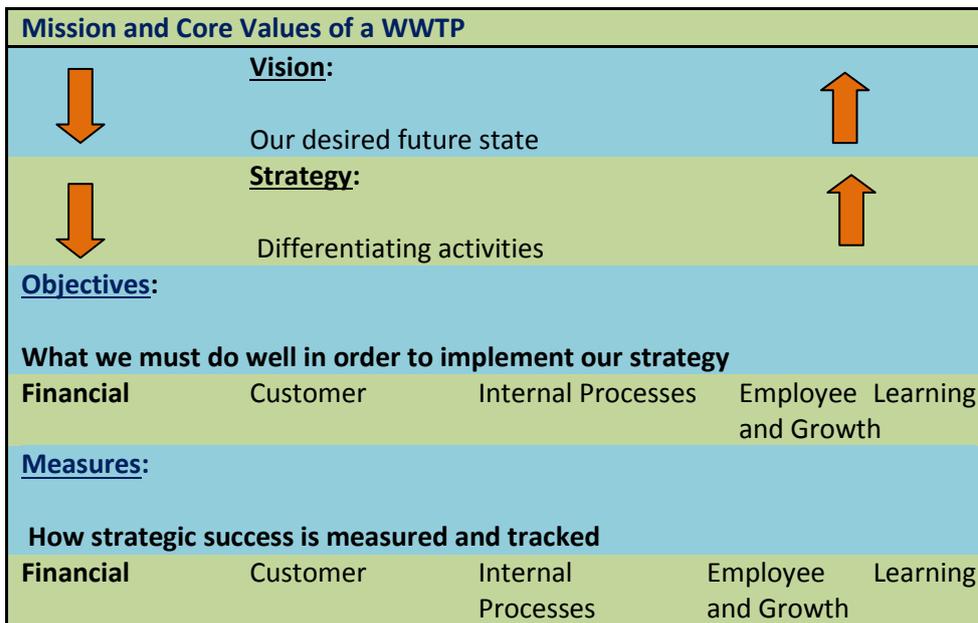
In discussing performance management, Jensen suggests that most companies fail to provide employees with the information they need in a format and context that is relevant to their unique requirements. "Working smarter means that any and all corporate data relevant to an individual's work should be available in formats that can be customized."

Continuous improvement strategy for the management of wastewater treatment facilities

4.2 Overview of the Balanced Scorecard

Balanced Scorecard can be described as a carefully selected set of measures derived from an organization’s strategy. The measures selected for the Scorecard represent a tool for the Management Team to use in communicating to employees and external stakeholders the outcomes and performance drivers by which the Wastewater Treatment Plant (WWTP) will achieve its mission and strategic objectives. Balanced Scorecard can be considered as three things: measurement system, strategic management system, and communication tool.

The Balanced Scorecard Translates vision & strategy into objectives and results



The four perspectives of Balanced Scorecard are the following:

-  **Financial**
-  **Customer**
-  **Internal Business Processes**
-  **Employee Learning and Growth.**

- **Financial perspective:** Financial perspective means pretty much that measures the financial performance of a WWTP, the results of objectives that showed what was achieved yesterday. Defines the financial steps which are necessary to ensure the execution of the strategy. For example, if a WWTP is pursuing a cost reduction or efficiency strategy, its Management Team may consider objectives such as “Lower the indirect costs” or “Increase revenue per employee.” The objectives that are chosen in the financial perspective by a WWTP will be affected by its strategy and also by the life cycle of the business process.



Project funded by the EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Choosing Financial Measures

Financial metrics have to be derived as direct translations of a WWTP’s strategy. Practically most organizations choose financial measures related to three areas: growth, profitability, and value creation.

Commonly Used Financial Measures

- | | |
|-------------------------------------|--------------------------------|
| • Total assets | • Value added per employee |
| • Total assets per employee | • Compound growth rate |
| • Profits as a % of total assets | • Dividends |
| • Return on net assets | • Market value |
| • Return on total assets | • Share price |
| • Revenues/total assets | • Shareholder mix |
| • Gross margin | • Shareholder loyalty |
| • Net income | • Cash flow |
| • Profit as a % of sales | • Total costs |
| • Profit per employee | • Credit rating |
| • Revenue | • Debt |
| • Revenue from new products | • Debt to equity |
| • Revenue per employee | • Times interest earned |
| • Return on equity (ROE) | • Days sales in receivables |
| • Return on capital employed (ROCE) | • Accounts receivable turnover |
| • Return on investment (ROI) | • Days in payables |
| • Economic value added (EVA) | • Days in inventory |
| • Market value added (MVA) | • Inventory turnover ratio |

• **Customer perspective:** Customers are important stakeholders for every public or private company. The value proposition of a WWTP for its customers will ultimately drive the objectives and measures selected for this perspective. Customer satisfaction and loyalty is always in demand.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Every Organization needs to know whether the value proposition it has worked so hard to perfect and measure with leading indicators is actually leading to happier customers who will return and do business with it once again. For a customer of a WWTP happiness has to do with cost effective bills, protection of the environment and response to the complaints.

A Sample of Customer Measures

- | | |
|---------------------------------------------|--------------------------------------------|
| • Customer satisfaction | • Win rate (sales closed / sales contacts) |
| • Customer loyalty | • Customer visits to the company |
| • Market share | • Hours spent with customers |
| • Customer complaints | • Marketing cost as a percentage of sales |
| • Complaints resolved on first contact | • Number of ads placed |
| • Return rates | • Number of proposals made |
| • Response time per customer request | • Brand recognition |
| • Direct price | • Response rate |
| • Price relative to competition | • Number of trade shows attended |
| • Total cost to customer | • Sales volume |
| • Average duration of customer relationship | • Share of target customer spending |
| • Customers lost | • Sales per channel |
| • Customer retention | • Average customer size |
| • Customer acquisition rates | • Customers per employees |
| • Percentage of revenue from new customers | • Customer service expense per customer |
| • Number of customers | • Customer profitability |
| • Annual sales per customer | • Frequency (number of sales transactions) |

• **Internal Process perspective:** Objectives here focus on the key processes for success, namely what is 'mission critical' for a WWTP. The Management Team of a WWTP must answer the question 'in which processes the WWTP must excel in order to satisfy its customers and protect the environment. The emphasis can often be on redesign processes, acquirement of new technologies, achieving joined-up working and redesign initiatives. Objectives like continuous performance improvement fit under this perspective. Customer perspective is external while internal business processes perspective is mainly internally focused.



Project funded by the EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

A WWTP, as a regulated industry, must maintain positive relationships with regulators and other governmental officials and adhere to a number of environmental regulations. Additionally must strive to be good corporate citizens in the communities in which it operates.

Internal Process Measures

- Average cost per transaction
- On-time delivery
- Average lead time
- Inventory turnover
- Environmental emissions
- Research and development expense
- Community involvement
- Patents pending
- Average age of patents
- Ratio of new products to total offerings
- Stock outs
- Labor utilization rates
- Response time to customer requests
- Defect percentage
- Rework
- Customer database availability
- Breakeven time
- Cycle time improvement
- Continuous improvement
- Warranty claims
- Lead user identification
- Products and services in the pipeline
- Internal rate of return on new projects
- Waste reduction
- Space utilization
- Frequency of returned purchases
- Downtime
- Planning accuracy
- Time to market of new products/ services
- New products introduced
- Number of positive media stories

• **Employee Learning and Growth perspective:** Objectives under this perspective are very much lead drivers and action here will take some time to show up in the results tomorrow. This perspective refers to a WWTP’s infrastructure, whether its IT, people or capital.

These objectives will emphasize sustainability to learn and improve at both organizational and individual levels. They answer to the question what are the capabilities and tools that the employees of a WWTP require to help them execute its strategy.

This perspective in most cases refers to issues relating to employee skills development like “Close skills gaps” and “Increase employee training” but although these are important



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

objectives, the Management Team of a WWTP must also look beyond its employees to the tools they rely on to get their jobs done like if they have access to the latest customer information on their computers and if there are processes in place to capture and share employee knowledge.

The only distinction between a good and a bad business is the way that it develops its own people. So it will be, for example, very important for a WWTP its ability to measure the capabilities of its own people. More specifically:

1) **to identify the core competencies it needs to achieve its strategy** through the involvement of as many people as possible from all levels of its organizational structure. After the Management Team of a WWTP has catalogued the necessary skills to create a competitive advantage then can evaluate its staff against these skills and develop them,

2) **to use personal development planning (PDP) to boost competence holders** and then track the percentage of employees who meet their personal development plan goals annually. Don't make it an annual measure,

3) **to include occupational health and safety measures** in the employee learning and growth perspective, such as lost time accidents, workers' compensation claims, and injury frequency rates. The company of the future is moving beyond these lagging indicators and attempting to create a win-win environment in which employees take responsibility for their own well-being and employers reap the benefits of lower lifestyle-related costs,

4) **to measure employee training initiatives** in order to get better skilled workers who are more versatile and link them to its goals and objectives, and also encourage trained employees to share their newfound knowledge with their peers and networks in the organization,

5) **to measure the employee productivity** which is yielded through investments in competency development and personal development planning,

6) **to measure the availability of technological instruments** and information which are critical to employee decision making,

7) **to measure employee satisfaction** by ensuring that the data are used appropriately by swiftly acknowledging areas requiring improvement and developing action steps to improve them. Corporate intranets and e-mail systems can be used to gather feedback from employees semiannually or quarterly,

and 8) **to measure the alignment of its strategy, objectives and measures** to all levels of its organizational structure.



Project funded by the EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Some employee learning and growth measures that can be considered for a WWTP's Balanced Scorecard.

- Employee participation in professional or trade associations
- Training investment per customer
- Average years of service
- Percentage of employees with advanced degrees
- Number of cross-trained employees
- Absenteeism
- Turnover rate
- Employee suggestions
- Employee satisfaction
- Participation in stock ownership plans
- Lost time accidents
- Value added per employee
- Motivation index
- Outstanding number of applications for employment
- Diversity rates
- Empowerment index (number of managers)
- Quality of work environment
- Internal communication rating
- Employee productivity
- Number of Scorecards produced
- Health promotion
- Training hours
- Competency coverage ratio
- Personal goal achievement
- Timely completion of performance appraisals
- Leadership development
- Communication planning
- Reportable accidents
- Percentage of employees with computers
- Strategic information ratio
- Cross-functional assignments
- Knowledge management
- Ethics violations

The Balanced Scorecard is a methodology of causal relationships, not just a random set of objectives and measures. If for example the Management Team of a WWTP does something, this will produce an effect, 'cause and effect'.

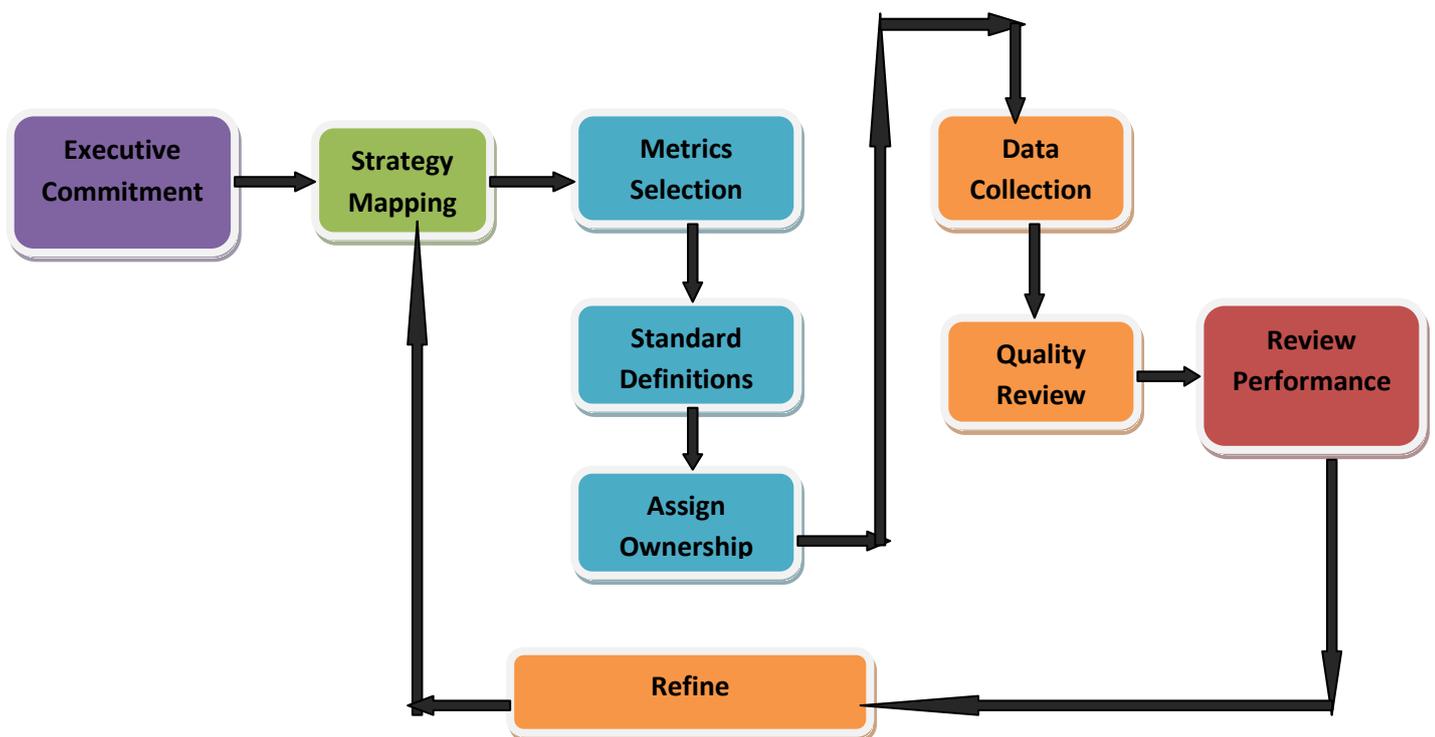
There is a relationship between measures in the Balanced Scorecard, what are called 'lead drivers' and 'lag outcomes'. The lead driver indicators predict outcomes and future performance, for example what a WWTP will get tomorrow, and are causally linked through the Scorecard to the lag indicators. The lag outcome indicators show the results of past effort, for example what a WWTP did yesterday, and measure final results. These measures have to do with the external reports of a WWTP, while lead driver measures in many areas

Continuous improvement strategy for the management of wastewater treatment facilities

have to do with internal reports. The relationship between these indicators is important, in the way that they can provide a hard, financial justification for some of the more intangible investment areas, such as training, learning, IT and innovation.

It is fine and well for a WWTP to have a vision, strategy, objectives and measures, but if its people are not lined up behind achieving the performance targets, then the desired level of success will not come.

Implementation Process of the Balanced Scorecard in a WWTP



5. Implementing Stages of a Balanced Scorecard in a WWTP

Below are presented the signs that a WWTP may need a New Performance Measurement System:

1. **Performance in a WWTP is acceptable on all dimensions except cost reduction:** A focus on quality and other measures has led to improvements in isolated areas, but not in cost reduction.
2. **New Customers don't want to connect with the sewage network of a WWTP or complain about the provided services even when prices are competitive:** The problem may lie in your relative performance to competitors.
3. **No one of the employees of a WWTP notices when performance measurement reports aren't produced:** Data in the reports no longer contains meaningful information for decision makers.
4. **Managers of a WWTP spend significant time debating the meaning of the measures:** Measures must be clearly linked to strategic objectives.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

5. **A WWTP hasn't changed its measures in a long time:** Performance measures should be dynamic based on the organization's strategic direction.
6. **A WWTP has recently changed or has no corporate strategy:** All measures should link back to your strategy.

At the development phase of the Balanced Scorecard in a WWTP the concept of balance is central to this system, specifically relating to three areas:

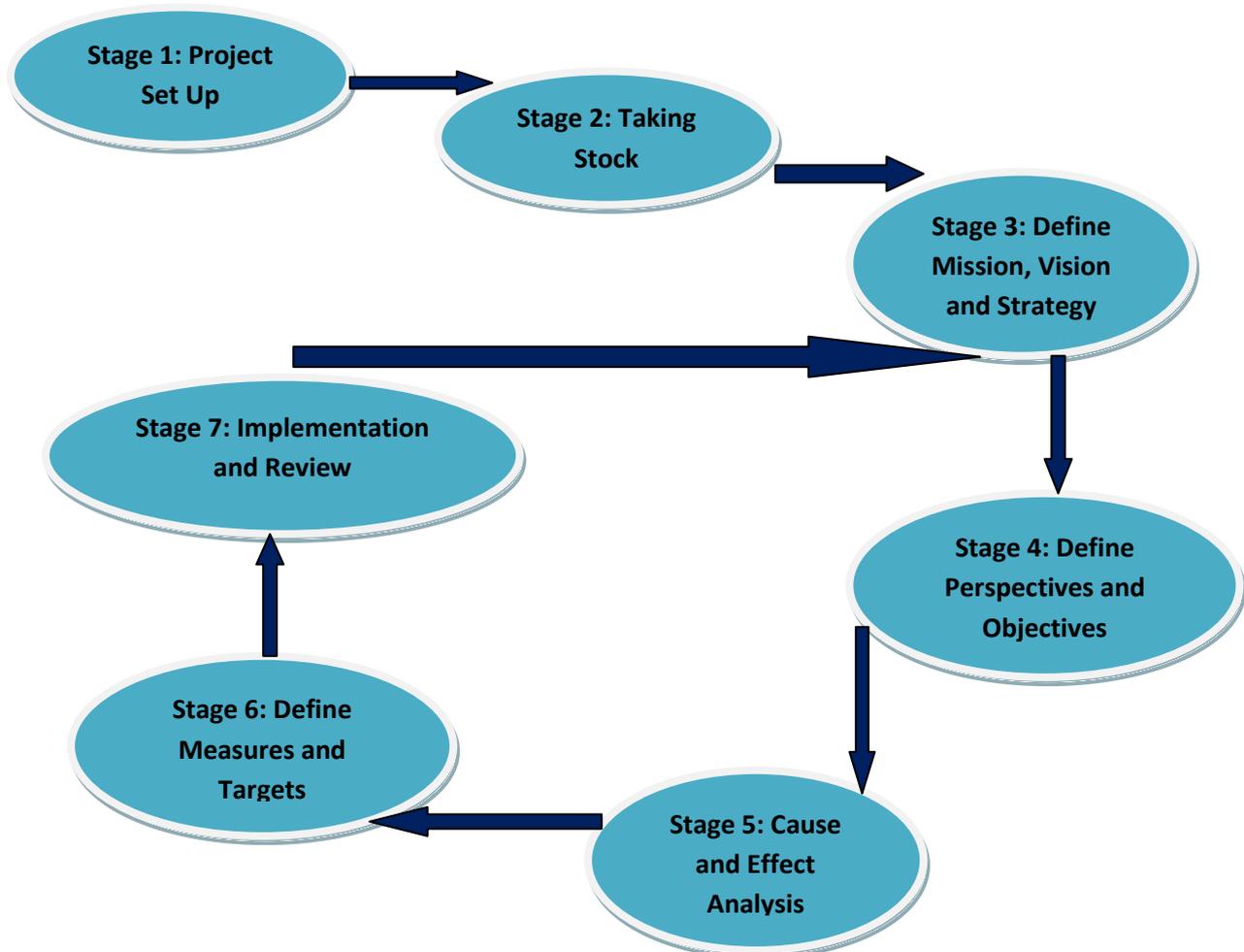
Balance between financial and nonfinancial indicators of success: Balanced Scorecard is to assist an organization like a WWTP to measure its performance through diverse indicators not just financial and budgetary indicators. This principle is essential to ensuring the scorecard is 'balanced'.

Balance between internal and external constituents of a WWTP: The Scorecard needs to take into account all interests, even contradictory or conflicting interests. For example, the Scorecard should take into account the views of stakeholders and consumers – i.e., external forces as well as those internal forces like the employees.

Balance between lag and lead indicators of performance: As inferred above, a Balanced Scorecard needs to have lag and lead indicators. Lag and lead indicators giving better meaning to each other. A lag indicator reflects past performance, like past customer satisfaction, while a lead indicator measures processes and activities like worker productivity. The correlations between the two give a better measurement of performance, for example employee response rates and treatment of customer (a 'lead' process) relates to how a customer feels treated (a 'lag' indicator).

Continuous improvement strategy for the management of wastewater treatment facilities

Implementation Stages of the Balanced Scorecard in a WWTP



5.1 Stage 1: Project Set - Up

It is from project set-up to which problems down the line can often be traced. These problems often revealed through lack of organization and/or top management ownership, meaning that the Balanced Scorecard starts off as a ‘project’ with an endpoint, rather than a process which will be embedded in the organizational structure of a WWTP. At its worst, the Scorecard is sometimes seen as the ‘baby’ of an enthusiastic sponsor, who may not even be at the top of the organizational structure of a WWTP. And at this point a realistic question is how the Management Team of a WWTP can overcome these problems.

At this point the Management Team of a WWTP has to make sure that the implementation team has the right expertise, ownership and commitment, and is led by a champion who has top-level sponsorship. This is the most important thing of the whole process. If the Management Team doesn’t own the Scorecard, the implementation is doomed from the outset (**See Table:** Balanced Scorecard Team Roles and Responsibilities).

Next, the process should be include all the key stakeholders, namely the people whose performance will be measured. If the employees of a WWTP do not contribute with all their

Continuous improvement strategy for the management of wastewater treatment facilities

strength during the design and implementation process of the Balanced Scorecard, then a million and one ways will be found to undermine it.

In this framework, the implementation process could be set up as a development initiative of a WWTP, since behavioral change will often be necessary to achieve the stretch targets set by the WWTP.

Finally, a range of interventions should be considered by the Management Team of a WWTP to take forward implementation. These could include the following: 1) work/task groups, 2) workshops, 3) open space events, 4) coaching/mentoring, 5) facilitation, and 6) the best use of information, communications and technology (ICT).

Table: Balanced Scorecard Team Roles and Responsibilities

Balanced Scorecard Team Roles and Responsibilities	
Role	Responsibilities
Executive sponsor	<ul style="list-style-type: none"> Assumes ownership for the Balanced Scorecard implementation Provides background information to the team on strategy and methodology Maintains communication with senior management Commits resources (both human and financial) to the team Provides support and enthusiasm for the Balanced Scorecard throughout the organization
Balanced Scorecard champion	<ul style="list-style-type: none"> Coordinates meetings, plans, tracks, and reports team results to all audiences Provides thought leadership on the Balanced Scorecard methodology to the team Ensures all relevant background material is available to the team Provides feedback to the executive sponsor and senior management Facilitates the development of an effective team through coaching and support

Continuous improvement strategy for the management of wastewater treatment facilities

<p>Team members</p>	<ul style="list-style-type: none"> • Provide expert knowledge of business unit or functional operations 	<ul style="list-style-type: none"> • Act as Balanced Scorecard ambassadors within their unit or department
	<ul style="list-style-type: none"> • Inform and influence their respective senior executives 	<ul style="list-style-type: none"> • Act in the best interests of the business as a whole
<p>Organizational change expert</p>	<ul style="list-style-type: none"> • Increases awareness of organizational change issues • Investigates change-related issues affecting the Balanced Scorecard implementation • Works with the team to produce solutions mitigating change-related risks 	

Important actions to be implemented at this stage:

1. Securing Executive Sponsorship of a WWTP

It is very important for the successful implementation of the Balanced Scorecard in a WWTP to have its senior management team willing to give its time and commitment to this endeavor. In this case senior management commitment is necessary for the following reasons:

Understanding of strategy: Middle level management usually have on minor understanding of the WWTP’s overall strategy, meaning that senior management needs to create a team to effectively articulate the strategy.

Decision Rights: It is recognized that middle level management does not have the power of decision, only senior management has the right to decide strategic priorities such as customer value propositions and related operating processes that are critical to the development of any Balanced Scorecard.

Commitment: it is vital that senior management of a WWTP is committed to the Balanced Scorecard. Otherwise, employees will loose interest in it. While knowledge of a WWTP’s strategy is necessary, the emotional commitment of its management team to the Scorecard program is the true differentiating feature of successful programs. Employees “watch what the boss watches” and know what merits the bosses attention.

If for example senior management of a WWTP provides only shallow and casual support for the Balanced Scorecard, this demonstration will be rapidly translated by all employees as a



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

sign the project probably is not worth their time and effort. Employees “watch what the boss watches” and know what projects are likely to merit their attention.

2. Development of a Communication Plan for the Balanced Scorecard of a WWTP

The Balanced Scorecard is a very powerful communication tool, signaling to everyone in a WWTP the key strategies of success, and the plan to achieve them. The consideration of a vision and objectives should be the starting point of a WWTP communication planning endeavors. The objectives should represent the unique attributes of the Balanced Scorecard and the culture of a WWTP, but in general at least some of the following must be included:

1. **Build awareness of the Balanced Scorecard** at all levels of a WWTP.
2. **Provide education on key Balanced Scorecard concepts to all audiences.**
3. **Generate the engagement and commitment of key stakeholders** in the project.
4. **Encourage participation** in the process.
5. **Generate enthusiasm** for the Balanced Scorecard.
6. **Ensure that team results** are disseminated rapidly and effectively.

Elements of the Communication Plan

Utilization of the **“W5” approach: who, what, when, where, and why.** Each element is discussed below in the context of communication planning.

Purpose/message (what/why): The plan should describe the content of the information.

This includes describing the new philosophy and new working culture of the scorecard and its justification, meaning the long term enhancement or performance. Other content defined in the communication plan may include timelines, project status, development issues, and training. In all cases, the plan has to be tailored to the diverse requirements of all the different employees.

Audience (who): The specific individuals or groups identified who will require messages during the project. Depending on the size and scope of your project, audiences will vary. It is very important to be included in the Communication Plan of a WWTP the following groups: senior management team, steering committee if there is one, middle management group, all employees, and the Balanced Scorecard team.

• **Frequency (when):** The timing of communication will depend on the needs of the audience groups. Those more heavily involved in the project will require more frequent communication.

• **Delivery vehicle (where/how):** The method will be chosen will be described to broadcast the message and will depend on the needs of the audience. With today’s technologies, choices of delivery vehicles are really just a function of the limits of your imagination. Any or all of the following as possibilities have to be considered: face-to-face meetings, group presentations, project plans, newsletters, intranet, workshops, brown-bag lunches, video presentations, message kits, e-mails, news bulletins, raffles and contests, pay-stub messages, demonstrations, road shows, and town-hall meetings.

Communicator (who): who issues which messages depends on the occasion, the importance of the message and the audience. The most important messages come from senior management. Day-to-day messages can be communicated by middle management.

Continuous improvement strategy for the management of wastewater treatment facilities

A simplified Communication Plan for the Balanced Scorecard of a WWTP

Audience	Purposes	Frequency	Delivery Vehicle	Communicator
<u>Executive Team</u>	<u>Gain Commitment</u>	<u>Biweekly</u>	<u>Direct Contact</u>	<u>Executive Sponsor</u>
	Remove Obstacles			
	Report Progress			
	Prevent Surprises			
<u>Management</u>	<u>Convey Purpose</u>	<u>Biweekly</u>	<u>Email</u>	<u>Champion / team members</u>
	Explain Concepts		Management Meetings	
	Report Progress		Articles	
	Gain Commitment			
<u>All Employees</u>	<u>Convey Purpose</u>	<u>Monthly</u>	<u>Email</u>	<u>Project Team Members</u>
	Introduce Concepts		Newsletters	
	Eliminate Misconceptions		Town hall meetings	
	Report Progress			
<u>Project Team</u>	<u>Track Progress</u>	<u>Weekly</u>	<u>Team meetings</u>	<u>Champion</u>
	Assign tasks		Status memos	
	Review expectations			

5.2 Stage 2: Taking Stock: Gather and review background material and Information

For a Balanced Scorecard of a WWTP to work well you need the entire scorecard team pooling all their resources and know-how together and having a unified understanding about what a WWTP is about. To build an effective Scorecard everyone must have access to the total pool of information. Here are some of the sources of information:

Annual reports: These contain detailed financial information, the WWTP’s market position, key services, prospects for the future, and even nonfinancial indicators of success.

Mission statement: Ask each member of the project team to recite a WWTP’s mission statement. In this way, the team starts to learn from the beginning what each and every persons idea behind the WWTP is and how they can come together to a common position.

Values: Does a WWTP have guiding principles? Is it just to treat waste or to have also a community function?



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Vision: where does the WWTP wish to go and to develop and is this vision a realistic one? For example does it want to use the waste to generate renewable energy or just be more energy efficient?

Strategic plan: The strategic plan can include mission and vision statements. They also indicate precisely the WWTP's long-term strategy. The Balanced Scorecard must reflect the demands of the Strategic Plan. However, many organizations, also WWTPs, do not have a strategic plan and this failure can be a big hindrance.

Project plans: Large and small WWTPs can have all sorts of projects and proposed activities circulating. Any scoreboards should try and learn as much about these projects and activities and identify their needs and their contribution to the scorecard.

Consulting studies: These can have a lot of information. Consultants research a WWTP carefully in order to ensure the study they are consulting is relevant to its needs.

Performance reports: Every WWTP is run on some kind of management reporting system. Review these reports to determine what indicators of performance are currently deemed critical to the WWTP's success

Competitor data: It is always good to know what the competitors are doing and how they improve performance. However, at the end of the day, it is a WWTP and its needs that must ultimately determine its scorecard.

Organizational histories: A lot of information can be found in a WWTP's archives. For example, explanations as to why certain key decisions were taken in the past, lesson learnt and challenges foreseen.

Analyst reports: Analysts studying the market can give a WWTP's Scoreboard insight into future developments. This could assist in assessing what technologies should be invested in or other kinds of data on how the market in waste water management is developing.

Trade journals and news articles: It is useful to refer to these to learn how the sector is developing. For example, the science and engineering press can shed light about EU funded technology projects. A Scorecard to develop a performance measure on how many times you refer to these as well as be a source of information to developing the communication plan.

Benchmarking reports: These documents provide good background and may stimulate discussion of potential measures, however, the Balanced Scorecard of a WWTP should tell the story of its strategy.

SWOT analysis reports: These reports are one of the most used, and abused analysis and planning tools and present 'strengths, weaknesses, opportunities and threats' of a WWTP. The mistake which is to come up with these reports is for example the long list of undifferentiated strengths (often lacking evidence), whereas a WWTP will be fortunate to have only 2-4 areas where it is really strong against the competition

Continuous improvement strategy for the management of wastewater treatment facilities

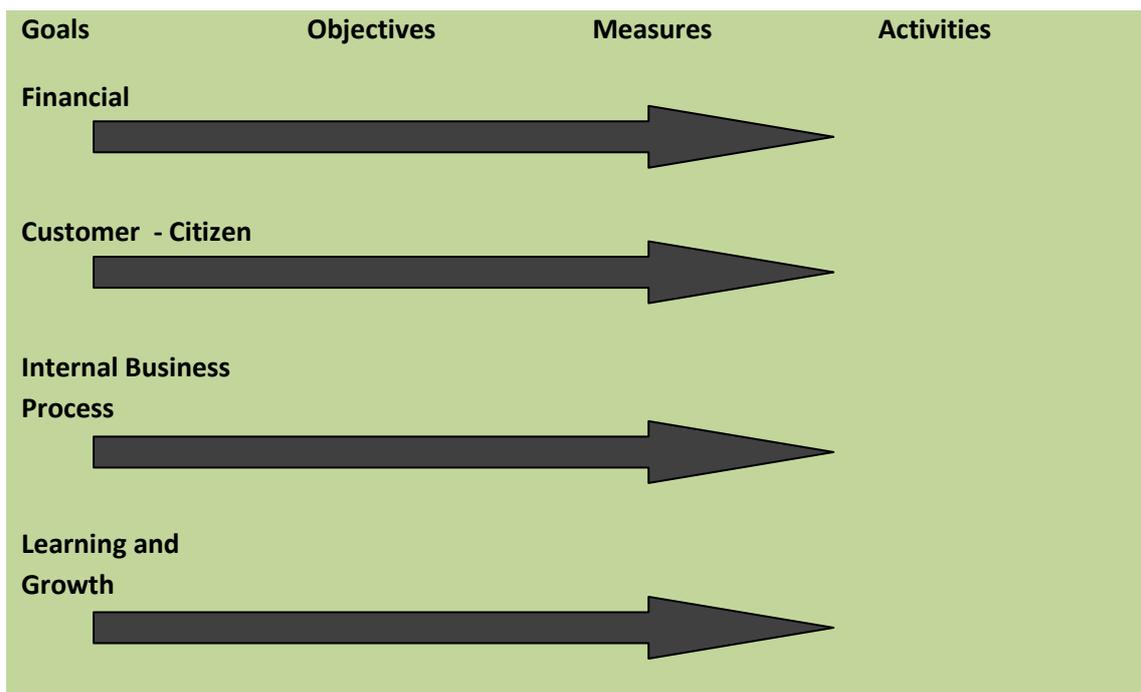
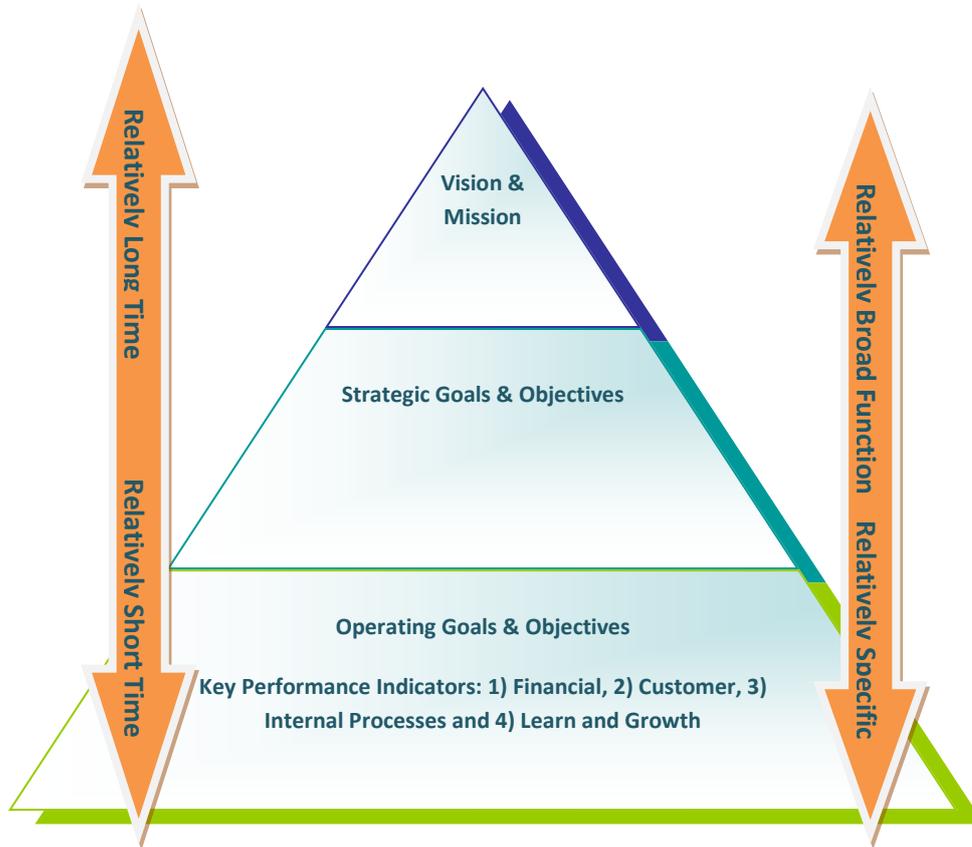
Using the Balanced Scorecard to Find Background Information

<p>Financial</p> <ul style="list-style-type: none"> • Annual report • Performance reports • Analyst report • Trade journals • Benchmark reports 	<p>Customer</p> <ul style="list-style-type: none"> • Marketing department • Trade journals • Consulting studies • Project plans • Strategic plan • Performance reports • Benchmark reports
<p>Mission, Values, Vision and Strategy</p> <ul style="list-style-type: none"> • Mission statement • Values • Vision Statement • Strategic plan • Organizational histories • Consulting studies • Project plans 	
<p>Internal Process</p> <ul style="list-style-type: none"> • Operational reports • Manufacturing reports • Competitor data • Benchmark reports • Trade journals • Consulting studies • Project plans 	<p>Employee Learning and Growth</p> <ul style="list-style-type: none"> • Human Resources data • Trade journals • Core values • Benchmark reports • Consulting studies

Continuous improvement strategy for the management of wastewater treatment facilities

5.3 Stage 3: Define the Mission, Vision and Strategy of a WWTP

The Balanced Scorecard Translates Mission, Values, Vision, and Strategy





Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

This implementation stage involves revisiting the WWTP's mission, vision and strategy. As emphasized earlier, these should be some of the building blocks already in place before embarking on developing a Balanced Scorecard. In some cases, however, organizations find that it is necessary to develop these in the first place, or change substantially what is there.

As with implementing a Scorecard itself, there is 'no one way' to define or present a mission and vision. Some organizations combine these elements; others call them different things.

A WWTP's mission clarifies its purpose, what it exists to do; presents why it should be doing what it does, and focuses on its customers, products/services, markets, technology, strengths, growth, values, competitive advantages, image, etc

A WWTP's vision clarifies what it is seeking to achieve in the future, the destination, what it aspires to, what it should look like, and how it should behave, as it fulfils its mission.

An organization, including a WWTP, can have a vision statement. It is important that the management comes up with an agreed vision statement otherwise each employee will have his or her 'vision' about what the WWTP should be doing. Indeed, what you want from the employees is to being carryout the 'mission'.

Mission: A mission statement defines the core purpose of a WWTP and informs about the reasons of its existence. A "WWTP exists to treat water". However, the following make the 'mission statement' relevant and effective:

- **Inspire change:** While the mission does not change, it should inspire change within the WWTP. Since the mission can never be fully realized, it should propel the WWTP forward, stimulating change and positive growth.
- **Long-term in nature:** the mission once defined and agree on, should remain the bedrock of a WWTP, serving as the stake in the ground for all future decisions.
- **Easily understood and communicated:** a clever mission statement can actually be used as a useful recruiting aid in attracting like-minded individuals to take up your cause.

Scorecard ensures that all employees are aligned with and working toward the mission. This represents one of the great values of the Scorecard system. The mission is where the translating efforts begin. A well-developed Balanced Scorecard ensures that the performance measures identified are consistent with the aspirations of employees in making the right choices.

When the Management Team of a WWTP develops objectives and performance measures it must critically examine them in the context of its mission to be certain they are consistent with that purpose.

Values: For some organizations it is the way they behave that makes the difference and provides the source of their strength. A WWTP may not necessarily exist as a commercially competitive company, but it is interested in efficiency and therefore interested in innovation and enhancing customer satisfaction. A WWTP can enhance its performance by valuing its contribution to society. To do this it can diverse in an innovative way by doing things like energy efficiency that satisfy customers.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Values and the Balanced Scorecard: The Balanced Scorecard represents the best solution for transmitting the values of a WWTP. Its Management Team have to review them over time, and create alignment from top to bottom in the organizational structure. The real key is alignment, having every employee see how their day-to-day actions are consistent with the values of the WWTP and how living those values is contributing to overall success.

Vision: Based on the mission and values, a WWTP now requires a statement that defines where it wants to go in the future. The vision statement does just that. A vision always follows mission and values. A vision without a mission is wishful thinking, not linked to anything enduring. The vision statement should not be abstract. It should be a present a clear picture of where a WWTP wants to be and also provide the basis for formulating strategies and objectives.

Effective Vision Statement: An effective vision statement has the following characteristics:

Concise: The best vision statements are those that grab the attention, like Starbucks: “2000 stores by 2000.” A WWTP has to create something that is simple and memorable.

Appeals to all stakeholders: The vision must appeal to everyone who has a stake in the success of a WWTP: this includes the owners, the employees, the customers, and communities, and any other stakeholder.

Consistent with mission and values: the vision is a translation of the mission and the values of underlying the WWTP. If the mission of the WWTP is about solving problems like treating water and clearing of waste then one of the core values is constant innovation in water waste treatment, a reference to innovate waste water treatment process would be expected in your vision statement.

Verifiable: make sure that vision statement is not laced with nebulous concepts like “world class” or “the best” or “leading edge”. These sort of business statements are confusing.

Feasible: The vision should be grounded in reality and to do this that a WWTP needs, to have a clear understanding of the business it is involved in, which is waste water treatment, ecological issues, energy efficiency, support to the community, ensuring customers have clean water to drink and to use for agriculture and any other important issue.

Inspirational: Vision represents a word picture of the desired future state of a WWTP. Therefore the vision statement should not only guide, but also arouse the collective passion of all employees. To be inspirational, the vision must first be understandable to every conceivable audience from the boardroom to the shop floor. An inspirational vision statement is one of the greatest assets.

Towards the development of the Vision Statement each of the senior management of a WWTP should be interviewed separately and by an impartial outside consultant unknown to the executive. Typical questions may include:

- Where and why has the WWTP been successful in the past?
- Where have the WWTP failed in the past?



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

- Why should the WWTP be proud of?
- What trends, innovations, and dynamics are currently changing the marketplace of the WWTP?
- What do the customers, stakeholders, employees expect from the WWTP?
- What are the greatest attributes and competencies of the WWTP?
- Where do the WWTP be in 3 years? 5 years? 10 years?
- How will the WWTP have changed during that time period?
- How does the WWTP sustain its success?

The results of the interviews are summarized by the interviewer and presented to the executive who can then embellish them and make them ready for general consultation.

Vision Statements and the Balanced Scorecard: The Balanced Scorecard provide a new focus to the business, therefore the potential problems represented by a misguided vision are significant. The Scorecard is essentially a device that translates vision into reality through the articulation of vision (and strategy). A well-developed Balanced Scorecard would stimulate behavioral changes among the staff.

Strategy: Strategy is hard to define because it contains several meanings. One definition is that strategy is represented by the high-level plans management devises to lead the organization into the future. Another definition is that strategy rests on the specific and detailed actions needed to be taken to achieve the desired future. Lastly, some consider strategy to be a pattern of consistency of action over time.

A Strategy of a WWTP has to be understandable by the people working in it and for this to happen needs the inspiration of its Senior Management Team. It has to differentiate its activities from the rivals and lead it to a unique and valuable position in the sector of the waste water treatment.

Strategy is more about the choice of what not to do than what to do. The chosen activities must fit one another for sustainable success. Activities must produce an integrated system. Any changes in the waste water treatment process may bring about new opportunities that can be assimilated into the current strategy, for example, new technologies, but for sure have to be made in continuity with the existing treatment processes.

Strategy involves conceptual as well as analytical exercises, which means a broad conceptual knowledge of a WWTP and the processes involved in waste water treatment.

The fundamental issue is one of implementation, translating the strategy into terms that everyone understands and thereby bringing focus to their day-to-day actions. The Balanced Scorecard provides the framework for an organization to move from deciding to live their strategy to doing it.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

The Scorecard describes the strategy, breaking it down into its component parts through the objectives and performance measures. The Balanced Scorecard ideally builds in the WWTP's strategy into objectives, measures, targets, and initiatives.

Indeed, using the Balanced Scorecard as a framework for translating the strategy, a WWTP can create a new language of measurement that serves to guide all employees' actions toward the achievement of the stated direction

A key attribute of strategy formation is performing a different set of activities than your rivals. These activities must be reflected in the Balanced Scorecard. For example, if you the WWTP engages in a series of energy efficiency activities aimed at saving money then its Balanced Scorecard should reflect this strategic direction.

One should expect to see **linked measures through the four perspectives** in which a Scorecard is based, and when taken together, drive the strategy. Measures related to service of targeted customers should appear prominently in the **Customer perspective**, linked to relationship management metrics in the **Internal Business Processes perspective**, and customer knowledge measures in the Learning and Growth perspective. These linked measures mirror the WWTP's chosen activities, and should assist towards the drive in revenue growth or efficiency in the **Financial perspective**.

5.4 Stage 4: Perspectives and Objectives

One of the many benefits of the implementation of a Balanced Scorecard in a WWTP is that forces it to make difficult choices among a variety of alternatives. Choices has to do with objectives, targets, and initiatives to achieve its targets must all be deliberated upon in developing a Scorecard that serves as the cornerstone of its management system. Nowhere is the process of making hard choices more evident than in the selection of performance measures. These measures are really the centerpiece of the Scorecard system and will provide the point of reference and focus for the entire organization.

5.5 Stage 5: Cause and Effect Analysis

There are broadly two ways to devise a Scorecard, which they are called the 'blank sheet' and 'added value' approaches:

blank sheet: this involves starting afresh in determining objectives in order to develop a Scorecard. The plus is that history does not encumber new ideas and creativity and the minus is that the designers can end up with two parallel sets of objectives

added value: this builds on a WWTP's existing strategy and objectives. The plus is that learning is not lost, and the Scorecard can more easily be linked to what is familiar. The minus is that innovation and creativity behind new ideas could be stifled

It is used to be selected the 'added value' approach.

Of course, a list of objectives that measure success is not a Balanced Scorecard, but rather just that, a list. The beauty of the Scorecard is that it is based on causal analysis, inter-relationships among:

Continuous improvement strategy for the management of wastewater treatment facilities

Perspectives: which show the hierarchical relationship among the four perspectives of the Balanced Scorecard of a WWTP.

Objectives: which show the cause and effect relationship among the objectives that populate the perspectives.

Cause-and-Effect Linkages in the Balanced Scorecard

Objectives		Measures	
		Lag Measures	Lead Measures
Financial Customer	Build the business	Revenue Growth	
	Develop customer loyalty	Customer loyalty	Hours spent with customers
Internal	Improve knowledge of customers	Additions to solution database	Solutions offered
			System downtime
Employee Learning and Growth	Increase employee productivity	Competency attainment	Ease of system use
			Training results
			PDP goals completed

5.6 Stage 6: Develop objectives and measures in each of the Balanced Scorecard perspectives

This stage has to do with what a WWTP should be doing anyway as best management practice, but also with the most difficult tasks of its Management Team, as they are for example, measuring success, and making objectives truly SMART. The Scorecard adds real value here, because it focuses the mind on what a WWTP is trying to measure in order to have financial, customer, process or growth success.

Define the meanings of measure, target and initiative:

Measure: this will show the progress to achieving the objective, and is presented as data for comparative use, mainly in a quantified form.

Target: the actual percentage, number and or time figure that enables the measure to become comparative, for example how far, how high, how fast. It can be defined as a quantitative representation of the performance measure at some point in the future, that is, as a WWTP’s desired future level of performance. The word “future” is key to the notion of targets. When developing targets a WWTP can choose to evaluate performance against a goal just for this month, quarter, or year, or we could develop a longer-term aspiration requiring additional effort and performance. There are three types of targets, each associated with a different time frame: 1) Long term Targets: Big Hairy Audacious Goals (BHAGs), 2) Midrange Targets: Stretch Goals and 3) Short Term: Incremental Targets.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

There are many ways to express metrics such as this one, which makes an objective 'SMART'. Without the clarity and focus on measures and targets, objectives will remain largely aspirational, without the transparent allocation of resources and management commitment to deliver what is set out to be achieved.

Initiative is the specific program, activity, project, or action that a WWTP has to embark on to help ensure meet or exceed its performance target. The target is a WWTP's "end in mind" for the performance measure, and to get there, it needs to determine what investments it must make in initiatives to guarantee a positive outcome.

Ensuring the Right Initiatives Are in Place

Four steps will lead us to the promised land of prioritized strategic initiatives:

1. Perform an inventory of all current initiatives taking place within a WWTP right now.
2. Map those initiatives to the objectives of its Strategy Map.
3. Seriously consider eliminating nonstrategic initiatives and develop missing initiatives.
4. Prioritize the remaining initiatives.

Selection criteria of Performance Measures

A Balanced Scorecard in a WWTP helps it to choose different solutions to all kinds of problems. To have a Balanced Scorecard a WWTP needs sound objectives, targets and well thought out actions. However, it is performance measures that are the most serious part of the Scorecard. These performance measures determine the process of the Scorecard and which must be the terms of reference to which the manager of the organization must always consult. Research has found that the most effective criteria and experience to determine performance measure include:

Lagging and Leading Measures of Performance: Performance measures need a mix of "leading and lagging indicators". Leading indicators are performance drivers, while lagging indicators measure outcomes like number of sales, level of profit, consumer satisfaction and all kinds of common measures used by management.

Continuous improvement strategy for the management of wastewater treatment facilities

Lag and Lead Performance Measures

	Lag	Lead
Definition	Measures focusing on results at the end of a time period, normally characterizing historical performance.	Measures that “drive” or lead to the performance of lag measures, normally measuring intermediate processes and activities.
Examples	Market share Sales	Hours spent with customers Proposals written
Advantages	Employee satisfaction Normally easy to identify and capture	Absenteeism Predictive in nature, and allow the organization to make adjustments based on results
Issues	Historical in nature and do not reflect current activities; lack of predictive power	May prove difficult to identify and capture; often new measures with no history at the organization.
The Balanced Scorecard should contain a mix of lag and lead measures of performance.		

Linked to strategy: A WWTP must make sure that its Scorecard only has performance measures that access the impact of its strategy. Unnecessary performance measures will result in confusion among employees who would measure performance of tasks that are not relevant.

Quantitative: The need to mathematically indicate performance should not be underestimated. Using subjective criteria and ratings like “it is ‘good’, ‘bad’ or ‘fair’” is pure subjectiveness. Quantitative measures can give a mathematical indicator, i.e., a number. For example the number of deliveries, or the number of late or on time deliveries on the organization’s product or service. Indeed, it is possible through creative means to calculate all performance measures in a quantitative way.

Accessibility: A Balanced Scorecard will indicate to a WWTP what Kaplan and Norton call the “missing measures”. These are the performance measures you failed to indicate. These missing performance measures will show themselves quite quickly. Management therefore has to be flexible and innovative enough to include these missing measures and in this way the business starts to re-calculate the costs and benefits of the Scorecard even better than before.

Easily understood: Scorecard readers should be able by just looking at the scorecard to explain the operational and strategic significance of every measure and the desired movement of each measure. If employees do not see the immediate value of the Scorecard, then it needs adjusting, otherwise the Scorecard’s motivational value is lost.

Counterbalanced: Management needs to be aware of the need to ensure that measures are balanced.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Relevant: it is always tempting for the Scorecard to try an accurately measure an objective. For example, any organization, like a WWTP, will have as an objective a “contented workforce”. However, if the performance measure is fixed at indicating only employee’s ability to reach targets and thus infer worker satisfaction, and leave out other important measures like absence from work, or employees leaving to other firms, then you start having problems.

Common definition: The Scorecard team, should include all management personnel, e.g., finance, administration, etc, to ensure that the definitions used for the performance measures have precise meaning all agree on. In this way, the Scorecard team ensures that the performance measures reflect the meaning and give the scorecard value. But also these definitions are clear and ‘relevant’. For example, customer satisfaction needs to be measured in a relevant way so that the entire scorecard team understands its meaning.

When you first launch your Initiative, you probably want to use an Output Measurement. Once the Initiative is up and running, change your measurement to an Outcome to see if the Initiative is really having strategic impact.

5.7 Stage 7: Action Planning, Implementation and Review

The key to success of a Balanced Scorecard in a WWTP is sustainability. There are only very few Scorecards that have stood the test of time. Many of them begin as a top management initiative, and then management changes. Other initiatives are delegated down a WWTP, in which case they lack top level ownership from the start. Still other Scorecards are set up to run in parallel with the normal reporting processes in a WWTP, so lack acceptance and never become embedded.

Other common pitfalls include: IT-driven project, lack of expertise among designers, Scorecards not connected with vision and strategy, lack of alignment with divisional agendas.

Key factors for success to overcome these obstacles include: 1) executive ownership from the outset, 2) alignment of previous strategy work and the Balanced Scorecard, 3) wide involvement in development of the Scorecard, 4) Scorecard cascaded down the WWTP, 5) robust baseline of data to underpin measures and targets, 6) clear ownership of objectives and accountability for achieving targets, 8) reporting incorporated into corporate management process and 9) alignment of Scorecard reporting and individual objectives and appraisal. This has been a long journey to get to this point.

Continuous improvement strategy for the management of wastewater treatment facilities

7. The Balanced Scorecard Paradigm in the WWTP of the Municipality of Drama, Greece

Short Description of the WWTP in the Municipality of Drama



Location of the WWTP in Drama Greece

Operator of the WWTP: Municipal Enterprise of Water Supply and Sewage in Drama

Project Management: Technical Department of the Municipal Enterprise of Water Supply and Sewage in Drama

General Director of the WWTP: Mr. Vogiatzis Xristodoulos

Number of Direct Employees to the WWTP: 4 (1 Administrator, 1 Chemist, 1 Biologist and 2 Workers)

Indirect Employees to the WWTP: Electricians and Mechanical Engineers from the Technical Department of the Municipal Enterprise of Water Supply and Sewage in Drama

The Waste Water Treatment Facility was constructed on 1/1/2000 and started its operation on 23/5/2005. At the time it serves the city of Drama and the villages of Milopotamos, Nikotsaris, Ambelakia, Kalos Agros, Koudounia, Nea Sevasteia and Proastio with a new network with total population of 53.000.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Basic Operational Data of the WWTF in Drama:

Capacity of the WWTF: 60.000 People equivalent

Network type: Universal Flow

Incoming Supply	Annual average (Kg BOD5/day)	Maximum (Kg BOD5/day)
Total incoming supply to the WWTP	1.200	3.600
Incoming Waste Water flowrates	1.200	3.600
Incoming load of sewage	-	-

Incoming Supply	Annual average (m3/day)	Maximum (m3/day)
Total incoming supply to the WWTP	9.700	12.000
Incoming Waste Water flowrates	9.700	12.000
Incoming load of sewage	-	-

Waste Water Treatment Line: primary, secondary, nitrogen removal, phosphorus removal, biological disinfection, chlorination

Sludge Treatment Line: thickening, dehydration

Disposal of treated effluent – Recipient: Saint Barbara River

Reuse of treated effluent: No Disposal to landfill: 200.000 kg DS/year

Check operation - Conformance Requirements

The WWTF is met the required effluent limits set the Directive 91/271 / EEC and the Joint Ministerial Decision 5673/400/1997 adopt the criteria and compliance requirements.

Year	BOD5	COD	TSS	T-N	T-P
2013	✓	✓	✓	✓	✓
2012	✓	✓	✓	✓	✓
2011	✓	✓	✓	✓	✓

Services supplied by the WWTP are organized around the following service areas:

Administration: Provides departmental level functions such as key business decisions, human resources, budget, financial management, rate setting, technology, communications, training, revenue recovery, safety, security and competitiveness via continuous improvement.



Continuous improvement strategy for the management of wastewater treatment facilities

Customer Service: Oversees new connections, service availability and customer account management including bill inquiries, meter reading, leak investigation and back flow prevention.

Engineering: Provides design and construction of the facilities, sewer main rehabilitation and extensions, donated projects and surveying.

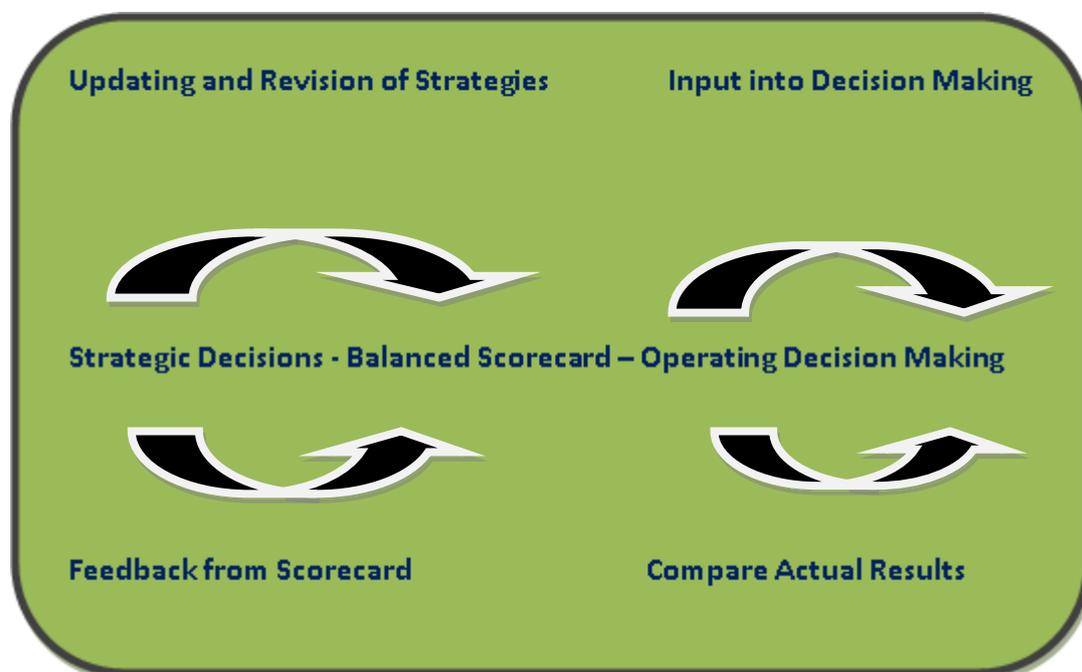
Environmental Management: Manages the treatment of wastewater before it is discharged back into the environment according to its environmental permit and operating license.

Field Operations: Maintains more than 8,000 miles of sewer pipe and more than 253,000 service connections.

Laboratory Services: Provides testing of wastewater for compliance to the Directive 91/271 / EEC and the Joint Ministerial Decision 5673/400/1997 and manages water quality issues relating to taste, color, and odor.

The Balanced Scorecard Paradigm for the Municipal Enterprise of Water Supply and Sewage (WWTP) in Drama: A group of measures used to help implement the strategy of the WWTP. It is a tool/system for its Management Team to use in communicating to employees and the community the outcomes and performance drivers by which the WWTP will achieve its mission and strategic objectives.

The Balanced Scorecard as a Double Loop Learning Process:





Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

When a Wastewater Treatment Plant (WWTP) can use Balanced Scorecard:

The Balanced Scorecard Tool is used for the following purposes:

1. To "translate" the abstract concepts of its Vision, Mission, Strategy and Policy on specific projects, targets and measurement indicators (metrics).
2. To be able the Leadership of a WWTP to monitor its actual performance indicators towards the realization of the Vision and Strategy
3. To facilitate the decision making by the leadership at every level and competence in a WWTP, based on real numbers and performance, selected as important to the realization of the Vision and Strategy.
4. To easily tracked and unmistakably the individual (per address or function) key performance indicators of a WWTP.

What a WWTP will achieve with the use of Balanced Scorecard:

The Balanced Score Card is for a WWTP the "sitemap" that is playing the role of "dashboard" organ of a car and clearly shows the current situation of a WWTP in Leadership, just as dashboard of a car showing the current state of the vehicle to the driver.

Developing the Strategy of the Municipal Enterprise of Water Supply and Sewage (WWTP) in Drama

Strategy Map and Balanced Scorecard of the Municipal Enterprise of Water Supply and Sewage (WWTP) will do the following: 1) Tell the story of the WWTP's strategy, 2) Shows that every objective selected is a linkage in the cause and effect relationships that compose the Municipality's strategy. 3) Drive performance by using a variety of measures and targets that look at short & long-term results to encourage proactive management, 4) Involve the participation of the Management Team, key staff and employees throughout the department, 5) Is financially viable and 6) Positively changes departmental behavior by developing strategic initiatives.

Balanced Scorecard: Key Definitions & Components

Mission: Why we exist.

Core Values: What we believe in, guiding principles.

Vision: Word picture of the future.

Focus areas: Themes on which the organization will concentrate efforts, dedicate resources, and strive to achieve significant improvements. The focus areas reflect what the Municipality's Board of Commissioners believes must be done to succeed.

Perspectives: The four different views that are used to create a "balanced" way of establishing objectives and measurements to assist the organization in accomplishing the



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

vision and strategic priorities. The traditional four perspectives used in corporate strategic planning and program evaluation are 1) Financial, 2) Internal Business Process, 3) Customer, and 4) Innovation, Learning, & Growth. While the names and definitions of these perspectives are frequently modified to meet different organization's specific needs, the original intent of these four traditional perspectives usually remains intact.

Objective: A concise statement describing the specific things the organization must do well in order to execute its strategy. Objectives often begin with action verbs such as “increase,” “reduce,” “improve,” “achieve,” and similar words. Examples: Enhance Customer Service, Maintain Adequate Water Pressure, Promote Learning & Growth, Invest in Infrastructure, Deliver Competitive Services, Maintain Fiscal Strength, Maintain a Skilled & Diverse Workforce, Create Unity Between Neighborhoods, Provide Affordable Services, Protect the Environment, Enhance Walkability, etc.

Measure: A standard used to evaluate and communicate performance against desired results. Reporting and monitoring measures help organizations gauge progress toward effective implementation of strategy. Example: Percentage of water customers with an average pressure of 30 PSI or greater.

Target: The desired result of a measure that communicates the expected level of performance. Example: 98% of customers will have average water pressure of 30 PSI or greater. A “stretch target” is a challenging target that may not be met. It may be a multi-year goal with milestones.

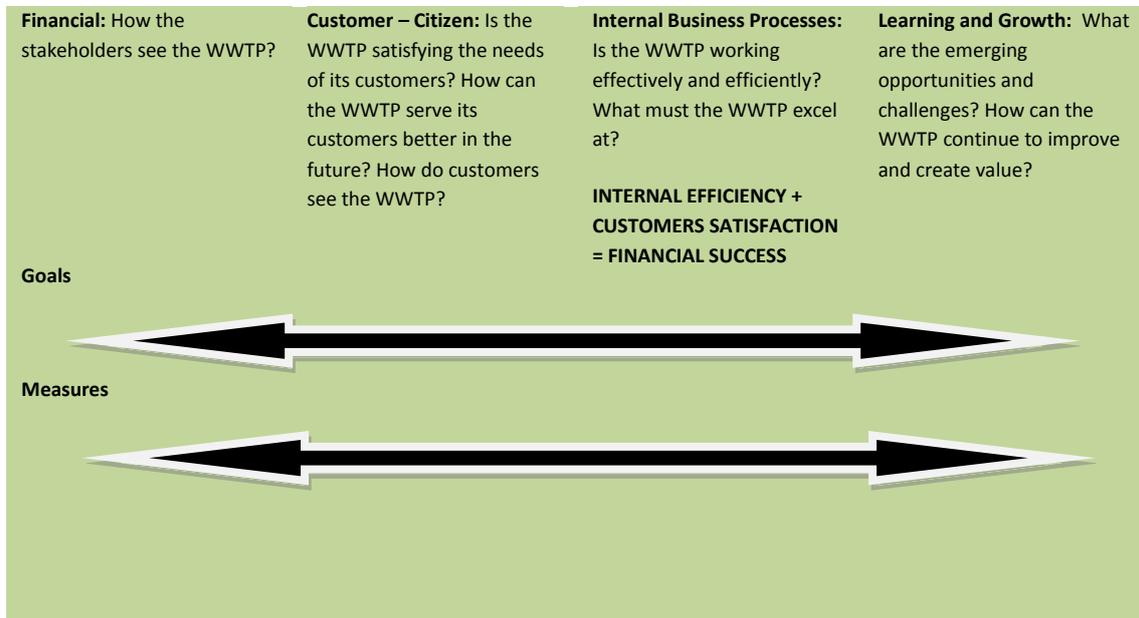
Initiative: The specific programs, activities, projects, or actions the Town will undertake in an effort to meet performance targets. This is generally a one-time activity that goes away once you do it. Examples: A) Install Maple Avenue water main connector to increase pressure in the western pressure zone, and B) Develop and implement Water Booster Pump Cost Sharing Policy for service connections with pressure below 30 PSI.

Cascading: The process of developing “aligned” Scorecards throughout an organization. Each level of the organization will develop Scorecards based on the objectives and measures it can influence from the group to which they report.

Cause & Effect: The concept of cause and effect separates the Balanced Scorecard from other performance management systems. The measures on the Scorecard should link together in a series of cause-and-effect relationships to tell the organization's strategic story (See the following template).

Continuous improvement strategy for the management of wastewater treatment facilities

Relationships in the Balanced Scorecard



Components of a good measure: Measures should be specific. Stating that the WWTP in Drama will be the “best” in Greece or will “maximize customer satisfaction” are more like vision statements and are difficult to measure. There are ways to measure less tangible goals. Surveys, if properly designed, can be used to measure the perception of service quality, awareness of issues, customer satisfaction, etc. A WWTP must identify the following:

- 1) Does the measure really evaluate the initiative being pursued?,
- 2) Is the measure reliable?,
- 3) Is the measure easy to understand and explain?,
- 4) Are the departments of a WWTP using a variety of measures in evaluating their initiatives (workload, results, efficiency, effectiveness, short term v. long-term)?,
- 5) Does the measure clearly communicate the expected performance? It is important for a WWTP to know where and where you want to go. Ideally, departments should have a baseline measure for current performance in the form of last year’s actual data, best practices or industry standards for comparison.

Guidelines for Setting Targets: 1) Targets should be realistic, but challenging enough to motivate greater accomplishment, 2) Departments can be more aggressive when setting multi-year targets, 3) Provide a rationale explanation as to why achieving a target is important, especially with stretch targets, 4) When setting a target departments should review the linkage (cause-and-effect relationship) of the “enabling” perspectives to make sure they have the ability to achieve the target, thus the following questions should be asked: 1) Do departmental personnel have the skills and tools necessary to get the job done?, 2) Does the department have sufficient resources/funding?, 3) Are internal operations adequate?

Stretch Targets: these are usually long-term or multi-year goals. Departments should only set one to two stretch targets per year. These are reserved for those initiatives that are critical in making a particular breakthrough. Stretch targets can be especially useful to help



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

a department break from its comfort zone or traditional way of running operations so as to spark creative thinking and results oriented problem-solving. Every department should have at least one stretch target.

Balanced Scorecard: Strategic Priorities of the Municipality of Drama

Quality of Life: The Municipality of Drama is always searching for ways to add value to the community and individual citizen's lives by preserving its history and heritage (cultural, social, demographic, and economic), providing parks, recreation opportunities, sidewalks and greenways, improving transportation, making housing affordable for all citizens, protecting the environment and supporting cultural activities and the arts.

Superior Services: Essential municipal services provided to the community should be of a good value, customer-service focused, dependable, relevant (services that the community wants and needs), conducted in a professional, well managed and sustainable manner. The Municipality of Drama will ensure that vocational training opportunities are provided to employees, elected and appointed officials and also volunteers to create an environment of continual growth and learning, an Open Learning Organizational Structure, and a willingness to implement innovative strategies, technologies, processes and approaches that result in more efficient and effective service provision to the citizens of Drama. Towards these directions the Municipality of Drama will use EU Funds to finance projects and actions and promote international cooperation and extroverted municipal policy.

Strategic Growth: Plan and manage growth in a manner that yields development which maintains and strengthen the character of the Municipality of Drama and improves the quality of life for its citizens. The Municipality will use forward-thinking to create a Strategic Plan for land use, Energy Production and Consumption, environmental protection, Urban development, infrastructure development in tourism, health, education, environment protection and culture, recreation, public safety, public health and education, financial, and other critical issues will be used to ensure new development enhances rather than detracts from the community. All new development should clearly contribute to the financial sustainability of the Municipality, encourage and plan for economic development to promote sustainability, support current businesses, bring new businesses to town, stimulate economic prosperity through quality job creation and serve as a catalyst for growth and development.

Economic Development: The Municipality of Drama will take advantage of the opportunities through gradually overcoming any of its inherent weaknesses and threats that exist around it and the rearrangement of its strengths by making the most of human and natural resources at its disposal. The Municipality of Drama will attract, retain, expand clean, environmentally friendly industry like alternative and cultural tourism, development of permanent residence and renewable energy plants and production of quality agricultural products, that protects its natural and cultural resources. Through tax grants and other non-financial incentives, the Town will seek to attract development that expands existing businesses, improves municipal infrastructure, improves energy/water conservation, reduces unemployment, protects labor, promotes labor market development and social protection.



Continuous improvement strategy for the management of wastewater treatment facilities

Balanced Scorecard: Define Objectives – Measures – Initiatives Perspective

The “balanced” portion of the Scorecard uses four perspectives to answer critical service delivery questions. This helps provide the balance of the WWTP’s need to successfully plan, implement, measure and evaluate performance.

Customer Perspective: Serve the Community: What is the mission and vision of the Municipality of Drama? What do the customers - citizens want? Managers must know if the Town is meeting citizen needs. They must determine the answer to the question: Are the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama delivering the services the community wants?

Serve the Community

What do the customers - citizens want?

What must be done to implement the vision and mission of the Municipality?

Strengthen Citizen Involvement & Access: Improve the quality and frequency of communication to enhance public access to information about the Municipality of Drama services, meetings, key issues and emergency situations. Provide a variety of ways for citizens to meaningfully share ideas, concerns, and questions with Municipality officials.

Preserve Cultural & Natural Resources: Protect the environment, landmarks and intangible assets such as community and cultural events that bring Drama’s diverse citizenry together.

Improve Satisfaction with Services: Conduct Municipal of Drama operations in such a way that citizens feel their needs are being addressed through high quality & responsive service.

Balanced Scorecard of the Municipal Enterprise of Water Supply and Sewage in Drama
Framework for the translation of the strategy in operational terms

What and/or how will the Municipal Enterprise of Water Supply and Sewage Serve the Community?	Customer Perspective: Serve the Community			
	Objectives	Measures	Targets	Initiatives

The complement of the above diagram follows the below logic: For the realization of the vision and strategy of the Municipal Enterprise of Water Supply and Sewage should be implemented the following:

Municipality of Drama – Wide Objective: Preserve Cultural & Natural Resources.

Measure: percentage of permitted nitrogen discharged to the Saint Barbara River.



Continuous improvement strategy for the management of wastewater treatment facilities

Target: To meet the required effluent limits set the Directive 91/271 / EEC and the Joint Ministerial Decision 5673/400/1997.

Initiative: Protect the Water Quality of Saint Barbara River.

Rating of Targets' fulfilment with colors: 'Green': indicates that the target was satisfactorily met. A green rating is only achieved when performance is at 100 percent of the target

Internal Process Perspective: Run the Operations: What internal processes must the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama excel to provide valuable services to the community while achieving the mission and vision? Managers need to focus on those critical operations that enable them to satisfy citizens. Managers must answer the question: Can the Municipality – WWTP in Drama improve upon a service by changing the way a service is delivered?

Run the Operations

What internal processes must the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama excel to provide valuable services while achieving the vision and mission?

Enhance Emergency Preparedness: Improve the ability to effectively anticipate and respond to emergency situations, from minor incidents to major disasters, through planning, training, collaboration with public and private agencies and community education.

Improve Communication & Collaboration: Increase the quality and frequency of communications throughout all areas of the Municipality – Municipal Enterprise of Water Supply and Sewage in Drama to promote problem-solving partnerships within and outside of the organization. Good communication enables the vision to be implemented.

Provide Responsive & Consistent Services: Provide quality services to citizens in a courteous, responsive and reliable manner that is effective in achieving desired results. Excel at the technical aspects of providing services to the community.

Balanced Scorecard of the Municipal Enterprise of Water Supply and Sewage in Drama Framework for the translation of the strategy in operational terms				
What must the Municipal Enterprise of Water Supply and Sewage excel at to effectively Serve the Community?	Internal Process Perspective: Run the Operations			
	Objectives	Measures	Targets	Initiatives



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

The complement of the above diagram follows the below logic:

For the realization of the vision and strategy of the Municipal Enterprise of Water Supply and Sewage should be implemented the following:

Municipality of Drama – Wide Objective: Provide Responsive & Consistent Services.

Measure: State issued “Notices of Violations” for wastewater services.

Target: 0.

Initiative: Consistently and reliably protect water quality of the Saint Barbara River.

Rating of Targets’ fulfilment with colors: ‘Green’: No violation in FY11, FY12 or FY13.

Financial Perspective: Manage Resources: How do the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama deliver quality services efficiently and remain financially sound while achieving the mission and vision? Managers must focus on how to meet service needs in an efficient manner. They must answer the question: Is the service delivered at a good price?

Manage Resources

How do the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama deliver quality services efficiently and remain financially sound while achieving the vision and mission?

Invest in Infrastructure: Prioritize funding for infrastructure maintenance to avoid excessive deterioration while minimizing long-term operational and capital costs. New infrastructure investments help achieve key priorities and optimize the use of current assets.

Develop Long-Term Financial Plans: Build upon current financial planning instruments to provide a longer term view of what finances and operations of the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama may look like in the future. These plans are intended to identify potential challenges, opportunities, and proactive response options.

Deliver Efficient Services: Ensure citizens are receiving a good value from their investments by delivering cost efficient services. Maximize the use of public funds through service optimization, innovation, process improvement, competition, and other means.

Continuous improvement strategy for the management of wastewater treatment facilities

**Balanced Scorecard of the Municipal Enterprise of Water Supply and Sewage in Drama
Framework for the translation of the strategy in operational terms**

What must be done financially and/or efficiently to achieve the objectives of the Municipal Enterprise of Water Supply and Sewage?	Financial Perspective: Manage the Resources			
	Objectives	Measures	Targets	Initiatives

The complement of the above diagram follows the below logic:

For the realization of the vision and strategy of the Municipal Enterprise of Water Supply and Sewage should be implemented the following:

Municipality of Drama – Wide Objective: Invest in Infrastructure.

Measure: Peak monthly demand as % of wastewater treatment capacity.

Target: <100%.

Initiative: Increase the emphasis placed on wastewater services infrastructure.

Rating of Targets’ fulfilment with colors: ‘Green’: Target was met in FY11, FY12 or FY13. But when 80% of permit capacity is reached, design of the next upgrade must begin.

Learning & Growth Perspective: Develop Know-How: What skills, tools and organizational climate do the employees of the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama need to meet the community’s needs while achieving the mission and vision? An organization’s ability to improve and meet citizen demands ties directly to the employees’ ability to meet those demands. Managers must answer the question: Is the of the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama providing employees with the training, technology and proper work environment to enable them to succeed and continuously improve?

Develop Know-How

What skills, tools and organizational climate do the employees, elected officials, and volunteer advisory board members need to meet the community’s needs while achieving the mission and vision of the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama?

Develop a Skilled & Diverse Workforce: Create a work environment that allows the Municipality - Municipal Enterprise of Water Supply and Sewage in Drama to hire and retain



Continuous improvement strategy for the management of wastewater treatment facilities

a diverse workforce of skilled employees who are capable of meeting the community's needs. Focus on career development and succession planning.

Support Training, Learning, & Growth: Create a culture of stewardship by maximizing developmental opportunities for employees to ensure they are technically competent, collaborative, and have the core skills necessary to excel on the job. Support governing and advisory boards, the community-at large, and the media by providing key information and training opportunities regarding municipal governance.

Balanced Scorecard of the Municipal Enterprise of Water Supply and Sewage in Drama Framework for the translation of the strategy in operational terms

What and/or how will the Municipal Enterprise of Water Supply and Sewage Serve the Community?	Learning & Growth Perspective: Develop Know-How			
	Objectives	Measures	Targets	Initiatives

The complement of the above diagram follows the below logic:

For the realization of the vision and strategy of the Municipal Enterprise of Water Supply and Sewage should be implemented the following:

Municipality of Drama – Wide Objective: Develop a Skilled & Diverse Workforce.

Measure: % of employees that have obtained higher, or additional certifications, or have reached the maximum certification level for their department.

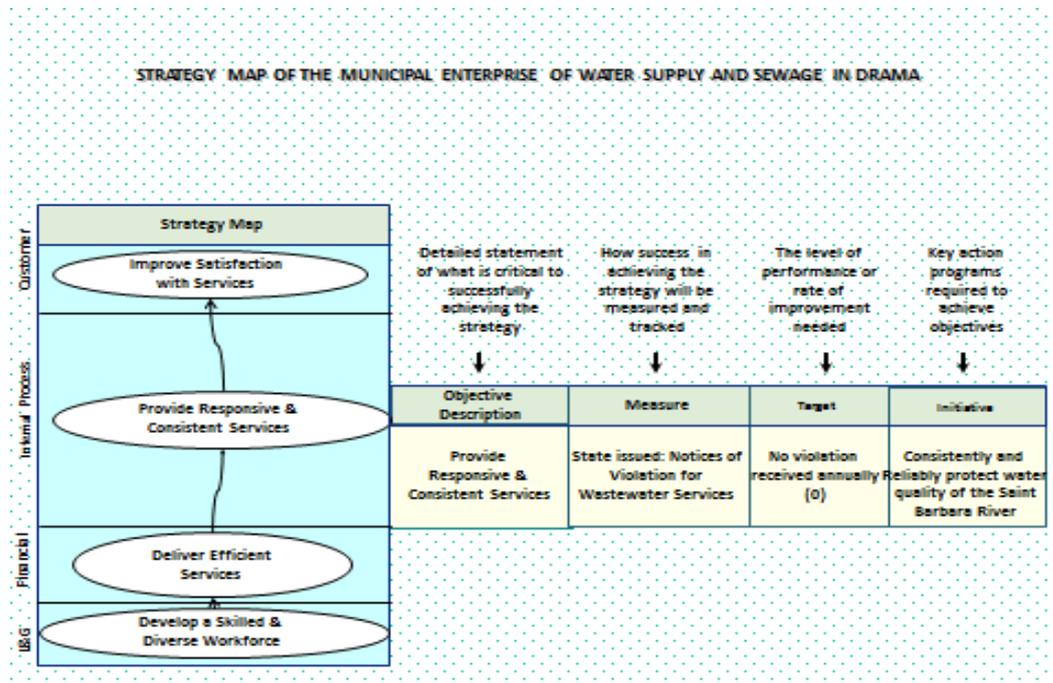
Target: Define an annual percentage.

Initiative: Provide ongoing training opportunities.

Rating of Targets' fulfilment with colors: 'Green', 'Yellow' and 'Red': According to the results percentage in FY11, FY12 or FY13.

Continuous improvement strategy for the management of wastewater treatment facilities

Strategy Map



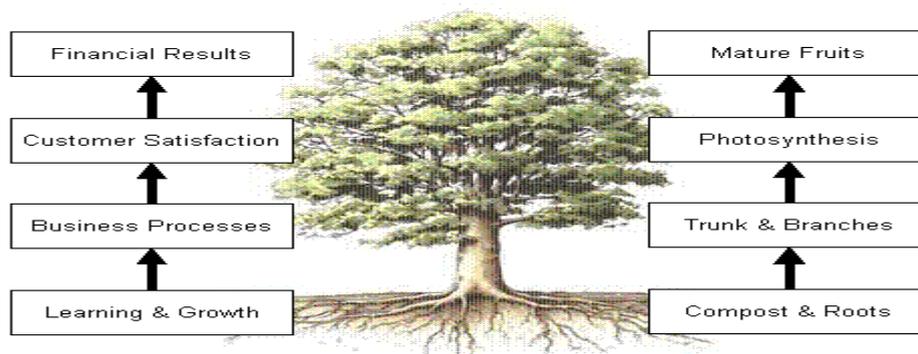
The bottom up Rationale of the Four Perspectives of the Balanced Scorecard

The level of learning and innovation is a fertile soil in which.....

Grows a tree with a strong trunk (processes), which.....

Produces many leaves and flowers (Customers) which

End in fruits (financial results)





Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Yearly Balanced Scorecard Accomplishments and Challenges: a process of reviewing results:

Accomplishments:

Which targets did your department, WWTP or its departments meet and/or exceed? What is the significance of meeting these targets? How did the department meet/exceed these targets? What will be done to ensure continued success?

Challenges:

Which targets did your department, WWTP or its departments, not meet? What challenges did the department face in meeting these targets? What will be done to try to meet the targets going forward (i.e. adjustments in strategy)?

Ratings Applied to Measurements:

Green: indicates that the target was satisfactorily met. A green rating is only achieved when performance is at 100 percent of the target.

Yellow: indicates performance was within 90-99 percent of established target. For environmentally-critical measures there is no yellow rating. For those measures, a rating of red is given for any performance falling below target.

Red: means performance has fallen below 90 percent of established target. For critical measures in which performance must be maintained at or above 100 percent, red indicates failing to meet 100 percent of target. However, any performance for environmentally critical measures that falls below 100 percent of target will receive a color rating of red.

Continuous improvement strategy for the management of wastewater treatment facilities

Municipal Enterprise of Water Supply and Sewage in Drama, Greece

Balanced Scorecard Strategy Map

<Municipal Enterprise of Water Supply and Sewage in Drama Greece >
Balanced Scorecard: Strategy Map

Town Board Strategic Priorities:
Quality of Life
Strategic Growth
Superior Services
Economic Development

Vision of the Municipality of Drama: We envision Drama as the Community of choice for Living, Working and Leisure. The standard of quiet, cozy, human and properly organized provincial town must be maintained and further

Mission of the Municipality of Drama: We are stewards of the public trust who exist to make the Vision for Drama a reality. We manage and provide the infrastructure, resources and services that enhance the quality of life for the living beings and land within our Town

Mission of the Municipal Enterprise of Water Supply and Sewage in Drama: We are committed to customer satisfaction and confidence by providing responsive services, reasonable rates, system capacity and effective communication. We provide safe and sufficient drinking water by protecting, treating and distributing drinking water. We protect the environment by collecting and treating wastewater, reusing residuals beneficially, and regulating system discharges.

Core Values of the Municipality of Drama: 1) Supply quality services with high quality customer service, 2) Maintain the standard of quiet, cozy, human and properly organized provincial which reveals strong sense of community, 3) Serve as a catalyst for change, 4) Build on Dramas' unique "sense of place" including its history, architecture, citizens and nature environment, 5) Recognize the community's diversity, 6) Drama is for everyone, 6) Foster the sense of an alive Community where things are growing, happening with lots of positive energy, 7) Recognize those citizens who are not able to pay by looking at ways to keep services affordable.

Strategic Objectives			Planned Actions & Initiatives
Customer Perspective: Serve the Community			
Strengthen Citizen Involvement & Access	Preserve Cultural & Natural Resources	Improve Satisfaction with Services	What and/or how will the Municipal Enterprise of Water Supply and Sewage serve the Community?: Participate in school field trips for utilities facilities tours, Publish Water Quality Report & Wastewater Report, Protect the water quality of the Saint Barbara River, Reduce CO2 emissions from fleet, Provide water and sewer services at an affordable rate.
↑ ↓	↑ ↓	↑ ↓	
Internal Process Perspective: Run the Operations			
Enhance Emergency Preparedness	Improve Communication & Collaboration	Provide Responsive & Consistent Services	What must the Municipal Enterprise of Water Supply and Sewage excel at to effectively Serve the Community?: Update & increase key information on website, Respond to citizen requests in a timely manner, Conduct quarterly meetings with all Water/Sewer divisions, Provide employee training in emergency response procedures.
↑ ↓	↑ ↓	↑ ↓	
Financial Perspective: Manage Resources			
Invest in Infrastructure	Develop Long-Term Financial Plans	Deliver Efficient Services	What must be done financially and/or efficiently to achieve the objectives of the Municipal Enterprise of Water Supply and Sewage?: Stay within departmental budget, Implement a preventative maintenance program, Increase the emphasis placed on infrastructure maintenance, Update 20-year Asset Management System.
↑ ↓	↑ ↓	↑ ↓	
Learning & Growth Perspective: Develop Know - How			
Develop a Skilled & Diverse Workforce	Support Training, Learning, & Growth		What will the Municipal Enterprise of Water Supply and Sewage do to provide personnel with the skills, tools, and organizational climate that are necessary to implement objectives?: Provide Ongoing Training Opportunities, Encourage Participation in Associations & Committees, Encourage Cross-Training/Certification.

Continuous improvement strategy for the management of wastewater treatment facilities

**Balanced Scorecard: Internal Business Perspective
December 2014**

Internal Business Perspective Internal Business Objective Type	Municipality of Drama - wide Objective	Measure	Year 2011	Year 2012	2013	Target	Status: Target Fulfillment
Run the Operations	Provide Responsive & Consistent Services	Proactively work to reduce sewer back-ups Consistently and reliably protect water quality of the Saint Barbara River	NA	NA	NA	<2%	2% is the industry average
	Improve Communication & Collaboration	Minimize sewer system odors	No violation	No violation	No violation	no violation	
Respond to citizen requests in a timely manner		Number of odor complaints at pump stations Number of odor complaints at the WWTP	NA	NA	NA	NA	New Measure to begin tracking New Measure to begin tracking
Utilize the Employee Survey results by increasing awareness and communication with employees		% of work orders completed within 48 hours "Management listens to employee ideas" – Average rating of Employee Survey respondents "Information and knowledge are shared with employees" – Average rating of Employee Survey respondents "Communication is encouraged between departments" – Average rating of Employee Survey respondents	100% response				

**<WWTP in the Municipality of Drama>
Balanced Scorecard: Customer Perspective**

Customer Perspective Customer Objective Type	Municipality of Drama - wide Objective	Measure	FY 11 Actual	FY 12 Actual	FY 13 Actual	Annual Target	Status: Target fulfillment	
Serve the Community	Preserve Cultural & Natural Resources	Protect the Water Quality of Saint Barbara River	% of permitted nitrogen discharged to the Saint Barbara River	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC		
			% of permitted phosphorous discharged to the Saint Barbara River	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC		
			Wastewater biochemical oxygen demand removal efficiency	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC		
			Wastewater suspended solids removal efficiency	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC		
Improve Satisfaction with Services	Strengthen Citizen Involvement & Access	Wastewater Chemical Oxygen Demand removal efficiency	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC	meet the limits set the Directive 91/271 / EEC			
		Number of sanitary sewer overflows	NA	NA	NA	<5	Green or Red	
		"I feel the water and wastewater services received are of good quality" - Average rating of Citizen Survey respondents	N/A Biannual Survey	N/A Biannual Survey	N/A Biannual Survey	10 point rating scale: 1 = strongly disagree 10 = strongly agree	Target fulfillment with average rating over 8	
		"I feel the water and wastewater services received are of good value" - Average rating of Citizen Survey respondents	N/A Biannual Survey	N/A Biannual Survey	N/A Biannual Survey	10 point rating scale: 1 = strongly disagree 10 = strongly agree	Target fulfillment with average rating over 8	
		Number of Wastewater Treatment Plant tours per year or school / public presentations	0	0	0	24		

Continuous improvement strategy for the management of wastewater treatment facilities

**<WWTP in the Municipality of Drama>
Balanced Scorecard: Learning and Growth Perspective
<Date>**

Learning and Growth Perspective	Municipality of Drama - wide Objective	Initiative	Measure	Year 2011	2012	2013	Target	target fulfillment
Zone: Develop Know-How	Municipality of Drama - wide Objective Develop a Skilled & Diverse Workforce	Provide ongoing training opportunities	% of employees that have obtained higher, or additional certifications, or have reached the maximum certification level for their department "I receive the training I need to do my job well" – Average rating of Employee Survey respondents	37.00%	65.00%	44.00%	30.00%	44.00%
		Encourage participation in associations and committees	"I receive the training I need to do my job well" – Average rating of Employee Survey respondents	NA	NA	NA	NA	10 point rating scale: 1 = strongly disagree 10 = strongly agree
Zone: Develop Know-How	Municipality of Drama - wide Objective Support Training, Learning, & Growth	Encourage participation in associations and committees	Number of committees in professional organizations staff is involved in	6 committees	8 committees	9 committees	5 committees	9 committees
		Encourage professional development	"My supervisor encourages and supports my professional development" – Average rating of Employee Survey respondents	Average rating 6	Average rating 8,5	Average rating over 9	Average rating over 8	Average rating 10 point rating scale: 1 = strongly disagree 10 = strongly agree
			"I'm encouraged to learn from my mistakes" – Average rating of Employee Survey respondents	Average rating 7	Average rating 8,6	Average rating 8,9	Average rating over 8	Average rating 10 point rating scale: 1 = strongly disagree 10 = strongly agree

**<WWTP in the Municipality of Drama>
Balanced Scorecard: Learning and Growth Perspective
<Date>**

Learning and Growth Perspective	Municipality of Drama - wide Objective	Initiative	Measure	Year 2011	2012	2013	Target	target fulfillment
Zone: Develop Know-How	Municipality of Drama - wide Objective Develop a Skilled & Diverse Workforce	Provide ongoing training opportunities	% of employees that have obtained higher, or additional certifications, or have reached the maximum certification level for their department "I receive the training I need to do my job well" – Average rating of Employee Survey respondents	37.00%	65.00%	44.00%	30.00%	44.00%
		Encourage participation in associations and committees	"I receive the training I need to do my job well" – Average rating of Employee Survey respondents	NA	NA	NA	NA	10 point rating scale: 1 = strongly disagree 10 = strongly agree
Zone: Develop Know-How	Municipality of Drama - wide Objective Support Training, Learning, & Growth	Encourage participation in associations and committees	Number of committees in professional organizations staff is involved in	6 committees	8 committees	9 committees	5 committees	9 committees
		Encourage professional development	"My supervisor encourages and supports my professional development" – Average rating of Employee Survey respondents	Average rating 6	Average rating 8,5	Average rating over 9	Average rating over 8	Average rating 10 point rating scale: 1 = strongly disagree 10 = strongly agree
			"I'm encouraged to learn from my mistakes" – Average rating of Employee Survey respondents	Average rating 7	Average rating 8,6	Average rating 8,9	Average rating over 8	Average rating 10 point rating scale: 1 = strongly disagree 10 = strongly agree



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Glossary of the Wastewater Treatment Process

Activated Sludge: is produced by mixing primary effluent with bacteria-laden sludge in a process that is activated using aeration and agitation to promote biological treatment.

Advanced Waste Treatment: is wastewater treatment beyond the secondary or biological stage of treatment. It includes the removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. It is also often called tertiary treatment.

Aerobic: refers to life or processes that require the presence of free elemental oxygen.

Aeration: is the process of exposing something to circulating air.

Anaerobic: refers to life or processes that require the absence of free elemental oxygen.

Bacteria: are single-cell microscopic organisms that grow in nearly every environment on Earth. In wastewater treatment, they can perform a variety of biological treatment processes, including biological oxidation, sludge digestion, nitrification, and denitrification.

Biochemical Oxygen Demand (BOD): is the measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. The greater the BOD, the greater the degree of pollution.

Biosolids: are the primarily organic solid product of wastewater treatment processes and can be beneficially recycled or appropriately disposed of via landfilling or incineration.

Combined Sewer: is a sewer system that carries both sanitary sewage and storm water runoff.

Denitrification: is the reduction of nitrate nitrogen to nitrogen gas.

Effluent is wastewater: treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall

I and I (I/I): is short for infiltration and inflow (see below).

Infiltration: is entry of water into a sewer system through such sources as defective pipes, pipe joints, connections, or manhole walls.

Inflow: is entry of water into a sewer system from sources other than infiltration, such as basement drains, storm drains, and street washing.

Influent: is water, wastewater, or other liquid flowing into a reservoir, basin, treatment plant, or treatment process.

Infrastructure: in the wastewater treatment industry refers to the expansive network of reservoirs, plants, and pipes above and below ground that provides, processes, and treats our water.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Land Application: is the treatment or disposal of wastewater or wastewater solids by spreading it on land under controlled conditions.

Membranes: are soft, pliable sheets or layers that can be used in filtration processes.

Membrane Bioreactors: combine activated sludge treatment processes and membrane filtration equipment to separate liquids and solids.

Micro constituents: are trace complex organic compounds, generally from industrial, medicinal, pharmaceutical, and personal care products, but may also be naturally occurring. They are sometimes called compounds of emerging concern (CECs) or endocrine disrupting compounds (EDCs).

Microorganisms: are microscopic organisms, either plant or animal, invisible or barely visible to the naked eye, for example, bacteria, fungi, protozoa, and viruses.

Nitrification: is the oxidation of ammonia nitrogen to nitrate nitrogen in wastewater by biological chemical reactions.

Nutrients: are elements or compounds, such as nitrogen, phosphorus, and potassium, that are necessary for plant growth.

Operations and Maintenance (O&M): is the organized procedure for causing a piece of equipment or a treatment plant to perform its intended function and for keeping the equipment or plant in such a condition that it is able to continually and reliably perform its intended function.

Permit: is a legal document issued by a government agency. In wastewater treatment, a discharge permit requires that the plant operator achieve specific water quality standards and discharge limits and also establishes monitoring and reporting requirements.

Preliminary Treatment: is the initial treatment process within a treatment plant where solids from the incoming influent are removed to enhance further treatment processes and future prevent damage to equipment.

Primary Treatment: is the stage in wastewater treatment where screens and sedimentation tanks are used to remove most material that floats or will settle. Primary treatment results in the removal of a substantial amount of suspended matter but little or no dissolved matter.

Receiving Stream: is a river, lake, ocean, or other watercourse into which wastewater or treated effluent is discharged.

Sanitary Sewer: is a sewage system that carries only household, commercial, and industrial wastewater.

Secondary Treatment: is the phase in the wastewater treatment process where bacteria are used to digest organic matter in the wastewater. Sometimes the term is used interchangeably with the concepts of biological wastewater treatment.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Sludge: is solid matter that settles to the bottom of septic tanks or the material that results from wastewater treatment plant sedimentation.

Suspended Solids: are solid pollutants that either float on the surface of or are suspended in wastewater primarily due to their small size. They can also be called total suspended solids (TSS).

Ultraviolet Disinfection: is the process of using ultraviolet light to kill disease-causing bacteria and viruses.

User Charges: are charges billed to users of water and wastewater systems for services supplied.

Wastewater: is used water from a community or industry that contains dissolved or suspended matter.

Glossary of the Balanced Scorecard

Cascading: Translating - Communicating the Organization-wide strategic plan (referred to as Tier 1) down to Programs and support departments (Tier 2) and then teams or individuals (Tier 3). The end result should be focus and alignment across all levels of the agency.

Challenges: A summary of a WWTP's Weaknesses and Threats, which must be addressed in order to progress.

Enablers: A summary of a WWTP's Strengths and Opportunities – the forces propelling it forward.

Evaluation: A review of a WWTP's progress toward planned strategic results and of the overall strategic planning and management system to determine how it can be improved.

Initiatives: Specific activities or actions undertaken to improve performance on one or more objectives, including the plans and milestones. Answers to the question: 'What projects, programs or activities will contribute to the intended result of one or more objectives?'

Mission: A statement defining why a WWTP exists and whom it serves.

Objectives: Answers the question, "What continuous improvements are needed to achieve the Strategic Results desired for the Themes?" Objectives include commentary outlining outcomes, which are used to develop outcome indicators.

Outcome: A description of what improved performance on an objective would look like.

Outcome Indicator: A quantification of the performance of an objective over time, used to provide an analytical basis for decision making and to focus attention on what matters most. Outcome Indicators answer the question, "How is the organization doing at the job of meeting its strategic objectives?"



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Parking Lot: A method used by facilitators to save ideas that will be re-visited later, such as items that will be used in later steps in the process or issues that are not on the agenda but need to be addressed at some point.

Perspectives: Different “lenses” through which the strategy and performance of the organization can be viewed. All perspectives must be addressed in a strategic plan in order to improve performance.

Stakeholder: Individuals or groups within the universe of people with an interest in the organization's products/services and/or success. Stakeholders have an impact on, or are impacted by, the organization's activities.

Client Value: What an organization must deliver to develop, retain and deepen its Improving Performance. Proposition relationship with clients: a description of the key benefits gained by clients as a result of the organization's activities.

Strategic Result: The desired outcome for a Theme of the organization's strategy. Each theme has a corresponding strategic result.

Strategy Elements: Previously identified strategic planning components, which may be reviewed, included, or revised in the new plan.

Strategy Map: A graphic that displays the cause-effect relationships among the Objectives making up a strategy. A good Strategy Map tells a story of how the organization creates value for clients and stakeholders.

SWOT Analysis: A summary of the Strengths, Weaknesses, Opportunities and Threats facing an organization. Strengths and Weaknesses refer to internal attributes of the organization, while Opportunities and Threats arise outside the organization, but require a reaction from it.

Targets: The desired level of performance for a given measure in a particular reporting period.

Themes: An elaboration of the Vision statement, identifying key areas where improved performance is desired.

Values: Ethical guidelines for behavior and decision-making, a key component of organizational culture.

Vision: A compelling description of the desired future.



Project funded by the
EUROPEAN UNION



Continuous improvement strategy for the management of wastewater treatment facilities

Balanced Scorecard Bibliography

P Niven: “Balanced Scorecard Step - by-Step for Government and Nonprofit Agencies”, John Wiley, New Jersey, 2003.

Brophy P. (2006): Measuring Library Performance: principles and techniques. London, Facet. Chapter 13: The Balanced Scorecard, 160-165.

Ceynowa, K. (2000): Managing academic information provision with the balanced scorecard: a project of the German Research Association. Performance Measurement and Metrics, 1 (3), 157-164.

Kaplan, R.S. and Norton, D.P. (1992): The Balanced Scorecard: measures that drive performance. Harvard Business Review, 70 (1), 71-79.

Kaplan, R.S. and Norton, D.P. (1996): The Balanced Scorecard: translating strategy into action. Boston, Harvard Business School Press.

Matthews J. (2006): The library balanced scorecard: is it in your future? Public Libraries 45 (6), 64-71.

Matthews J.R. (2008): Scorecards for Results: a guide for developing a library balanced scorecard. Westport CT, Libraries Unlimited.

Poll R. (2001): Performance, processes and costs: managing service quality with the Balanced Scorecard. Library Trends, 49 (4), 709-717.

Self J. (2003): From values to metrics: implementation of the balanced scorecard at a university library. Performance Measurement and Metrics, 4(2), 57-63.

Self J. (2004): Metrics and management: applying the results of the balanced scorecard. Performance Measurement and Metrics, 5 (3), 101-105.

Willis A. (2004): Using the balanced scorecard at the University of Virginia Library: an Interview with Jim Self and Lynda White. Library Administration & Management, 18 (2), 64-67.

Article: A J Rucci, S P Kirn, R T Quinn, “The Employee-Customer-Profit Chain at Sears”, Harvard Business Review, January– February, 1998.

Websites: 1) Balanced Scorecard Institute: www.balancedscorecard.org , 2) Balanced Scorecard Collaborative: www.bscol.com and 3) Food and Agriculture Organization of the United Nations: www.fao.org

Address: 33, Platonos Str.
25100, Aegion, GREECE
Tel.: +30 26910 60427
E-mail: info@erfc.gr
Web: erfc.gr

The title of the project:
Continuous improvement strategy for the management of wastewater treatment facilities -
- CISWastewater, 2.2.3.72546.202 MIS ETC 2177.

The editor of the material:
European Regional Framework for Co-operation (ERFC) - Inter-Regional Development Organization

Date of publishing:
April 2015

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of European Regional Framework for Co-operation (ERFC) and can in no way be taken to reflect the views of the European Union.