INTEGRATION OF SUSTAINABLE URBAN DRAINAGE SYSTEMS INTO THE DESIGN OF NEIGHBOURHOODS AS A WATER REHABILITATION ACTION

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ABSTRACT

The design of urban systems that allow the introduction of techniques for the recycling and drainage of rainwater represents a new aspect for the development of urban planning with sustainability criteria, since its main objectives include: the optimisation of the use of water as a resource in cities, the minimisation of the impacts on the natural cycle of water, and the protection of the ecosystem upon which it depends.
Our proposal is based on the so-called water-sensitive urban rehabilitation', and involves planning a management system that can be applied to the rehabilitation of neighbourhoods or urban units, built on a new design of urban elements.
In the present paper, a model of analysis is proposed of the urban area of intervention in order to be able to perform the water diagnosis and to develop the water rehabilitation plan. This data forms the basis for the selection of systems that enable the characterisation of rainwater collected in the urban unit under study: that coming from the roofs of buildings and from roads and open urban spaces. With this information, we can choose those sustainable urban drainage systems (SUDS) that are the most appropriate for the urban area studied, in order to enable a housing project to be carried out that allows the rehabilitation of water in the neighbourhood or in the urban area with sustainability criteria.
It should be emphasised that, when choosing an urban unit or neighbourhood as a basis for our proposal, apart from providing a more detailed analysis of sustainability criteria for the accomplishment of the project, it allows us to suggest actions that strengthen the assimilation of social and cultural elements of the neighbourhood. In this respect, we conclude the communication with the development of a project of water rehabilitation for an area selected in the neighbourhood of Los Bermejales, Seville, as an experimental model.

Keywords: Sustainable Urban Drainage Systems; Water Rehabilitation, Urban Water Cycle.

1.- Introduction

1.1.- Sustainable Urban Drainage Systems

One of the issues derived from the growth of cities, is the increase of impervious surfaces that modify the natural water cycle of the urban territory, thereby causing a series of problems, which include:

- Reduction of the flow of the natural volume of water to the subsoil thereby modifying the water table and reducing the volume of clean water.
- Increase of the surface runoff that generates great amounts of water in rainy season and causes major floods.
- The increase of the water volume to the drainpipe network, thereby adding volumes of water that exceed the capacities of the main drains, with the subsequent cost due to the need for new infrastructures and to the derived problems in such a network.
- The increase in contaminated water, since when uncontaminated rainwater, harvested in a single plumbing system, is contaminated when it comes in contact with waste water, it results in the fact that sewage water treatment plants have to deal with a greater volume of water, with the subsequent energy consumption. Another option is that this water, since it is mostly rainwater, is sent to Rain-Water Pumping Stations (RWPS) and is subsequently returned to its natural waterway with a high level of contamination.

These issues set out the need to address the management of rainwater from a perspective different to that of conventional management, by introducing environmental and sustainability criteria. In this sense, Sustainable Urban Drainage Systems (SUDS), represent a new solution in the development of urban infrastructures since they control the runoff and let us introduce new techniques for the drainage and storage of rainwater [1].

Although in Spain these strategies for the management of rainwater have been included in some autonomous regions, as in the case of Technical Instructions of Water Works [2], their establishment is not widespread. Nevertheless, there is a broad path of executions and exploitation of these techniques in the rest of Europe and USA [3], whereby most of these actions have been planned with the aim of regulating rainwater flows in the rainy season, both in volume and in maximum flow.

However, in our project, we have focused on analysing how these systems allow the management of the water cycle of rainwater in dry weather too. This idea stems from being able to store or maintain rainwater with an appropriate quality to be reused for certain urban uses that do not require the high quality of potable water, such as: watering gardens, hosing down streets, and its use in fountains and ornamental ponds. The water free from contamination and with controlled flows, which is not reused, can be returned to its natural environment or led to the subsoil for the recharging of ground water.

1.2.- Urban water rehabilitation in consolidated neighbourhoods

Currently, in our country, local governments are including the necessary procedures in development plans for urban projects to contemplate basic facilities so that alternative water resources can be employed [4].

Nevertheless, there are very few examples of proposals for intervention into urban consolidated areas [5]. For this reason, our project presents two interesting suggestions:

- It is a project of urban water rehabilitation.
- A consolidated neighbourhood is chosen for the intervention

Firstly, the project is focused on the concept of ‘urban water rehabilitation’ considered as the set of actions performed in a city, with the objective of improving its hydrologic behaviour, based on the sustainable management of rainwater. This means that the project of rehabilitation of a concrete urban unit can be integrated into an overall plan of regeneration of that unit. Therefore, apart from considering technical and economic aspects for the selection of water systems and technologies appropriate for the area and the uses planned for that water, it becomes necessary to analyse other criteria related to social, patrimonial and cultural aspects that allow us to determine which innovative strategies are suitable for the economic and social regeneration of the urban unit.

Secondly, when planning the intervention of a consolidated neighbourhood, two advantages are obtained:

- On the one hand, the neighbourhood scale, as a controllable unit from the urban point of view, makes it possible to obtain a more precise assessment for the application of management systems and techniques for the rainwater cycle in a more efficient way. It also allows emphasis to be placed on intervention objectives and criteria focused on the urban habitat in which it would be set, thereby making it easier for the management of the neighbourhood to be closer to the sustainable model.
- On the other hand, as the efficiency in the management of the water cycle is based on the optimisation of its use, when working in a consolidated neighbourhood, the project can be planned for its users from a closer perspective, as well as training the population to be rational and responsible in its use. An intervention in such a consolidated neighbourhood enables the designer to work with social representatives of the neighbourhood. Since we cannot forget that the preservation and reuse of rainwater necessarily implies a relationship with the community both in familiarising oneself with the workings of the water cycle as in the responsibility of its use. Furthermore these relationships do not arise in a spontaneous way, but demand that a series of strategies must be planned including environmental education and the promotion of participation, since consumer habits will be affected. Moreover, the knowledge of pre-existences and characteristics of the neighbourhood will make it possible to include actions in the project that respect the local cultural identity, as well as to involve the integration of landscape elements and the preservation of natural areas.

2.- Objectives

As we have already mentioned, this research strives to set the basis for the integration of the SUDS in a consolidated urban area. In particular, we have chosen the neighbourhood of Los Bermejales in Seville, because, apart from the fact that it has a series of roads and public areas where the SUDS can be implemented, not only does it contain a city park with an extension of over 12,000 m^2 and a golf club, but it also boasts sport facilities of the university of Seville; all of these potential infrastructures exist in which it is viable to integrate urban systems that facilitate the recovery of rainwater as well as its treatment and storage, to be subsequently reused in urban uses not requiring quality water.

Given that nowadays in our country SUDS are in a process of development [6], to undertake interventions of water transformation in cities, it is necessary to provide models and tools in order to implement these new management processes of water, in which the incorporation of methods for the participation of the social agents involved is necessary. For this reason, it is convenient to provide experiences, especially of the processes of analysis, since they consists of complex projects in which environmental, economic and social agents interact. The analysis of indicators is recommended CHECK LOGIC so that the viability of the project can be verified and the decision-making is supported.

Hence, in the context of this research, this present communication aims to show a methodology that follows the process of previous analysis and data collection, for the development of the project and the verification of its viability. It must be borne in mind that, when dealing with water rehabilitation of an urban area, any methodological process must be planned from a very specific analysis of the zone if efficiency in the systems is to be achieved, since an urban rehabilitation project generally requires major economic investment.

Therefore, it seems convenient to plan a strategy that includes the basic criteria that must be the aim of the previous analysis, starting from the basis that the need for participation from citizens is presented as a basic principle of actions in Zoning Code [7] and, consequently, the direct participation of the social representatives of the neighbourhood users is necessary if we want the result to be considered as sustainable. Furthermore, this participation is beneficial, not only for the project planning itself, but also for its population [8].

3.- Methodological design of the previous analysis

As previously indicated, we start on the basis that the proposal of planning and design of a SUDS must be adapted to the needs of the neighbourhood under study. For this reason, the previous analyses must be planned as multidisciplinary tasks, in which diverse disciplines must intervene. Additionally, they must involve all the agents participating in the process,

including local administration and social representatives of the neighbourhood users, from the previous stages of the analysis, selection of infrastructures, and later use and maintenance.
Another important aspect in the process of analysis is that it must be conceived as an open and cyclical development, in which decisions must be made by the group of agents involved and not made exclusively by the project leader. Hence, the tasks explained here, structured in phases, must enable the process to be revisable.
In our proposal, at least the following phases of analysis are considered necessary:

1. Information and study of the zone:
   - Physical data
   - Environmental data
   - Social factors
2. Theoretical viability of intervention (at least in three aspects):
   - Legal
   - Urban and social
   - Economic
3. Assessment of the pragmatic viability, from realistic data:
   - Water conditions
   - Characterisation of the soil
   - Assessment of the contamination of the water
4. Selection criteria of SUDS
   - Systems and techniques to collect and treat water at source
   - Systems and techniques of transport and local treatment
   - Systems and techniques of retention and detention
5. Initial proposal. As a work document with the Government and social agents.

According to this paper, the methodological process for the analysis of viability in this project of neighbourhood water rehabilitation, from the use of rainwater, would correspond with the phases and actions of the scheme in Figure 1, in which social agents must be active in all phases.

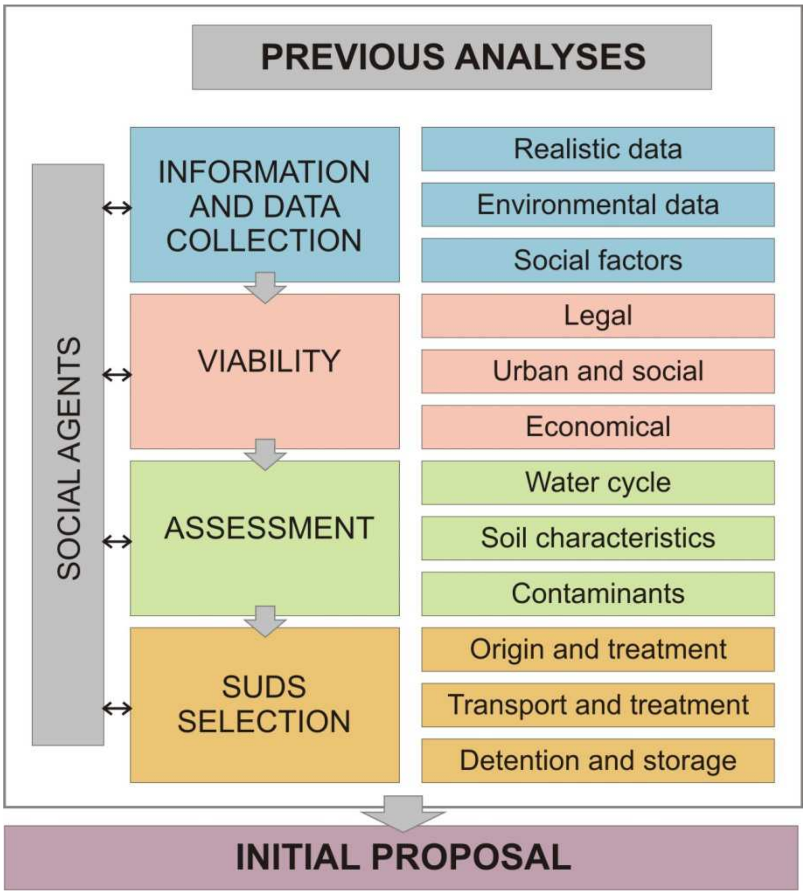

Figure 1: Scheme of the process of previous analyses
CHANGE *Economical* to *Economic*
CHANGE *Realistic data* to *Physical data*

Although summarised, we would follow with the explanation of the content and development of the phases of the analysis.

- **PHASE 1: Information and sectored study**

First, it is necessary to perform a sectored study of the context of the intervention in a broad sense, which will enable a series of data to be obtained that allows the creation of an informative report. In particular, our proposal considers the following information as starting points (adapted from Puertas et al., 2008):

Physical data of the soil	- Permeability - Topography - Hydrology - Water table - Presence of sensitive areas
Environmental data of the neighbourhood	- Availability of rainwater and its possible uses. - Possibility of placing recipient systems of the water collected - Environmental impact - Urban uses that may affect contamination of the soil
Social Factors	- Level of acceptance in the community - Landscape incorporation - Management of urban runoff - Type of exploitation and maintenance to be made according to the system

- **PHASE 2: INTERVENTION VIABILITY**

With the data obtained from the phase of information, we should be able to ascertain the theoretical viability of water rehabilitation in the neighbourhood. Ti this end, there are three aspects to be analysed: legal, social-urban, and the first economic approximation.

A. Legal viability

It must first be checked that the recovery of rainwater and its reuse for urban uses is a viable project in terms of the regulatory framework.
Currently in Spain, the legal code and norms of application in five areas should be checked: European, national, regional, technical instructions, and local area.
None of the previous areas considers a regulatory system for the urban management of rainwater through sustainable drainage techniques. Nevertheless, these instruments have been considered efficient for the analysis:

- From a European level, the Directive Framework of Water (Directive 200/60/CE), establishing the concept of water planning and considered as a fundamental instrument for the sustainable management of water.
- From the national area, the RD 1620/2007, about the reuse of treated water. Although this norm has not been specifically considered for the use of rainwater, it is a legal text incorporating requirements for the quality of water according to its uses.
- From the regional perspective and especially about rainwater, the few examples that can be illustrative include the Principality of Asturias and its Supramunicipal Ordinance of 2006, and the Regional Government of Catalonia with Decree 21/2006.
- As for Technical Instructions, although they are not binding regulations, they can still be helpful for this project, since they consider design criteria and recommendations for the implementation of management techniques. In this particular case, references to the Technical Instructions for Water Works in Galicia can be given.
- Finally, regarding municipal area, references are taken from big towns. In this case, the Ordinance of Management and Efficient Use of Water from the City Council of Madrid can be referenced, as can recommendations of the 'Guide for the development of the Local Regulation against climate change' and in particular Document 5,'Regulation about the sustainable management of water'.

B. Urban and Social Viability

Although, from the environmental point of view, the use of rainwater in an urban area is possible, it is necessary to analyse the availability of the resource and to establish the requirements of the quality of the water for its specific foreseen uses.
In the first phase of the analysis, the viability of the use of the rainwater must be assessed, in terms of urban, environmental and social benefits, in order to enable qualitative values to be balanced with the economic cost of intervention.
Our methodological proposal is essentially planned with two analytical elements. First, it must be checked that, in a normal hydrological period, the different surfaces of the neighbourhood are going to permit the generation of a runoff water flow that can be appropriately controlled, halted, and stored for later use. Second, there must be urban uses in the same neighbourhood or vicinities that will require that stored water. All this must be in accordance with the criteria established by the social agents involved.

C. Initial Economic Viability

Another element that must be analysed in this phase is the initial economic viability. Initially for a project with this magnitude to be successful, the recovery of costs must be planned from the beginning. However, in this particular case not only must the financial cost of the services be considered, but also the environmental and resource costs. This constitutes a complex issue, and is the reason why it is important to count on the support of the social agents of the neighbourhood, since the recovery of costs must take into account not only the

cost of rainwater management, but also the possible impacts that this rainwater may generate on tangible and intangible values for society.
For these reasons, the proposal includes, in this phase, the evaluation of the reduction in the demand for potable water that will be produced for the expected uses. Another important point for the support of the viability of the project is the determination of the economic savings that the intervention will represent, in the transport of waste water and, especially, in the energy savings achieved in the purification of waste water, since it will lead to less volume of waste water to the treatment plants.

- **PHASE 3: Assessment**

Once theoretical viability of the plan has been checked, the second phase must tackle the practical viability. I our opinion, this could be considered the most complex phase, since a synthesis of the problem analysed must be created in order to attain appropriate solutions, define basic strategies of intervention, generate systems of environmental preservation, and strengthen cultural and social elements.
In order to develop a proper assessment that could allow the most suitable SUDS to be chosen, three types of data must be analysed and dealt with:

- Water conditions of the neighbourhood
- Soil characteristics
- Analysis of the contamination of rainwater

A. Water Conditions

Firstly, the volume of rainwater that can be harvested by the SUDS must be determined. To this end, calculation procedures used for conventional systems are not valid, since these systems are designed to guide runoffs provoked by storm water with the aim of fast drainage to the receiving environment.
In order to measure the SUDS suitably, it is necessary to calculate the runoff created for the percentile corresponding to 90% of the rain events [9]. This limit generally corresponds to rain with associated return periods of between 1 and 2 years. Therefore, the SUDS are measured to capture volumes related to Intensity-Duration-Frequency curves [10], with associated return periods between 1 and 2.33 years.

B. Soil characteristics

Considering the SUDS as systems that are developed on the surface of the soil, in order to select the most suitable techniques, it is necessary to analyse the characteristics of the soil, to ascertain its composition, permeability, drainage possibilities, etc.
For instance, with soils of a low permeability, the use of technologies based on permeable paving or on infiltration trenches will need a more detailed technical analysis that facilitates the guaranteed establishment of their technical viability, since these systems must not affect the soil stability. In these cases, there must be considered to provide permeability to that soil, for example, using drainage pipes to evacuate the runoff harvested by those systems and lead it to retention areas, with sufficient guarantee that neither will floods be generated in urban areas, nor in the surrounding urban zones.

C. Contamination of water

Another important point for the analysis, which is also going to be essential for the selection of water treatment systems and techniques, is the type and degree of contamination. To this end, there are two actions that must be considered in the analysis methodology. On the one hand, the type of contamination must be characterised and its levels of contamination must be measured, and, on the other hand, it is important to see which treatment is appropriate for the purification of the water and for the elimination of contaminants.

C.1. Characterisation of Contaminants

First of all, it is important to consider that, as a general rule, in rain events on urban soil, the accumulated contamination on the surface during dry weather (sediments, organic matter, nutrients, hydrocarbons, pathogen elements, metal, pesticides, etc.), is washed down and drawn towards the systems designed to harvest water.
Moreover, depending on the advance of the flow, the harvested rainwater not only grows in volume in terms of water, but also in its contaminant load. Therefore, in order to assess or

exploit the rainwater, the more advanced the harvesting point is located within the cycle, the more necessary the techniques of minimisation or of treatment of this contamination become. And, although the techniques used in the SUDS can be sufficient to achieve a reduction in the pollution associated to the surface runoff [11], since different types of ‘natural’ treatment are incorporated, such as sedimentation, filtration, biodegradation, and particle absorption, the water of superficial runoff in urban areas can have a sufficiently high degree of contamination that the use of highly complex minimisation techniques or of contamination treatment are required.

Since this project involves the development of water rehabilitation with access to sustainable urban drainage systems, in order to characterise the contamination flows of the rainwater, several control points must be distributed throughout the urban route, , from its first contact with the surface (urban rainwater), its path along the selected surfaces to access the SUDS up to the areas where storage and retention systems are located. With the appropriate tools, the volume and contamination can be measured through taking samples or sounding lines present in the runoffs.

The tools used for the analysis depend on the type of control and the methodology of sampling. First, it is essential that all the points of the analysis to have handy access to a pluviometer to assess the rain (histograms) and to identify those episodes of minimal intensity and volume necessary for the creation of runoff, which may vary according to the point of control. Flow or level gauges must be available at the points where the SUDS are expected to be located, in order to collect samples and, especially, to monitor the course of the contamination during rain episodes (polutogram).

The taking of samples can be carried out manually in a cumulative way for their laboratory analysis, although automatic equipment to this effect is available. In this case, the points of control can be fitted with the tele-supervised instruments necessary for the analysis of rain episodes. There are models of the number simulation of flows and contamination, such as SWMM software and Infoworks. These models are recommended by GEAMA-EHS, a company of reference in Spain on measurement and characterisation of mobilised contamination in sewer and drainage systems in rainy weather.

Organic matter (COD and TOC) and nutrients (total nitrogen and total phosphorus), are suitable indicators for the determination of whether there is any contamination. Normally, in the first phases of the urban route, they remain undetected, but, in the urban superficial runoff, an increase of organic matter is usually registered. However, in the case of nutrients, these usually remain undetected unless a contact with waste water takes place [12].

It can also be necessary to control microbiologic contamination, especially concentrations of *E-coli* and intestinal *enterococcus;* the evidence of the concentration of solids itself, especially that of solids in suspension, already provides a major indicator of the presence of general contamination in rainwater. This is reasonable because the majority of contaminants are related to sediments and, more precisely, to the finest particles [13]. In fact, the mobilisation of sediments can be related to that of the rest of the contaminants through certain factors of proportionality with the fractions of solids in suspension [14].

In this project, apart from using manual instruments to analyse the mobility of emergent contaminants of the rainwater collected in urban surfaces of the neighbourhood, further outside laboratory tests have been planned to analyse runoff and lixiviation. To this end, a series of tables, of 2.5 metres long by 2 metres wide, on which a layer of soil of around 5 cm of thickness is spread out (which supposes about 350 kg), since it is considered that such thickness retains the contaminants by deposition. The layer of soli is placed on an impermeable board which has been given a gradient of 5% in its surface. In this way, it is possible to collect, the rainwater runoff in suitable recipients, while the lixiviation collected on the board is poured into other recipients (Figure 2).

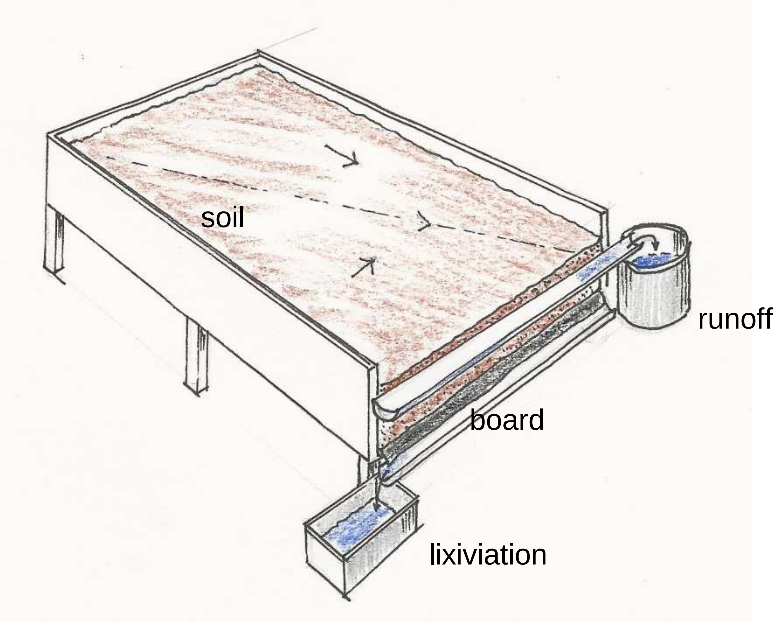

Figure 2. Table for the runoff and lixiviation test

The tables, covered with soil in which diverse contaminants have been included that were detected in the areas where the construction of the SUDS are planned, harvest rainwater in a minimal period of 12 months, in order to check, by means of a laboratory analysis, the model of behaviour of various contaminants.
For the inclusion of these contaminants, the procedure has consisted of watering the surface of the tables by means of a unique application through pulverisation that simulates the total amount of contaminants that would have been brought to the soil in the period of one year. In each rain event, samples of lixiviation and runoff water are collected and the concentrations of contaminants are determined by means of solid-phase extraction (SPE) and high-performance liquid chromatography (HPLC) with the detection of mass by electro-spray of triple quadruple [15].
These laboratory analyses performed with the runoff tables are compared with the data obtained *in situ* in order to check the efficiency of the drainage systems and viability of the use of regenerated or slightly purified rainwater.

C.2.Treatment and elimination of contaminants

According to the results obtained in the analysis of water quality, as well as those of the necessities or problems in every specific case, the design strategies of the SUDS can be focused on different purposes. For example, in cases where, in the controls, the contaminant loads are verified as low, then the planning can provide simple systems of drainage and very complex treatment techniques are not required. Conversely, when heavy metals or nutrients have been detected, the infiltration ditches can provide a system that minimises the contamination present in the urban superficial runoff [16].
To this end, in order to plan an appropriate selection of urban systems for use in this project according to the contamination of water, the most frequent techniques of treatment and elimination incorporated in the SUDS are explained below:

- Sedimentation: Procedure that consists of separating water impurities by means of the gravity effect. Solids are usually found dissolved, floating, or in suspension. With this physical method, sediment solids from those in suspension are separated.
- Filtration and bio-filtration: When contaminants are transported by sediments, they must be filtrated so as to eliminate these contaminants. In order to carry out the infiltration there are simple but efficient procedures, such as the use of vegetal layers, geotextiles or natural filters.
- Particle absorption: This is a more complicated procedure, in which contaminants are retained when they enter in contact with soil particles. The absorbents combine chemical and physical processes in order to eliminate organic contaminants and

those compounds giving colour, flavour and odour to water. Activated coal is a commonly used absorbent, since it attracts not only contaminants but also dissolved organic matter (much of which is innocuous)

- Biodegradation: In some cases, contaminant loads are high and require, for their elimination, conventional treatments based on chemical processes. However, these treatments run the risk of damaging the soil with the products used. However, biological practices of degradation can be used, even if they are less effective.
- Vegetal systems: Whenever possible, the use of natural plants is recommended. Certain plants have the characteristic of consuming nutrients and achieve the elimination of contaminants, which is the case of phosphorus and of nitrogen. For example, when the existence of ammonium (NH_4^+) is determined in the water, a system called ‘nitrification’ can be used; this consists of a process in which ammonium is transformed into nitrite (NO_2^-) and then into nitrate (NO_3^-), through the action of aerobic bacteria from the soil. Nitrates can be consumed by vegetal species.

- **PHASE 4. Selection criteria for the SUDS**

From the data obtained from the previous phases which have provided contamination associated to runoffs, which in turn depend on the sources of diffused contamination detected in the urban area and on the expected uses for the recovered water, a selection of the most suitable systems and techniques for the neighbourhood can be developed.

In this phase, it is also necessary to ascertain the destination of the collected water that is not going to be reused in the neighbourhood, since it has no fluvial medium, no ecosystem of transition water with low periods of renewal, and no water table as its destination.

In order to complete this paper, it is recommended to follow a methodology of selection of the appropriate systems for the neighbourhood, from the different techniques of harvesting water, its drainage and filtration and later storage and treatment for subsequent use or to be poured. In this context, we have:

- Systems for the water collection in its origin: those found in origin or primary collecting areas of rainwater. Basically, they are formed by:
    - green surface
    - permeable pavement
    - infiltration wells and trenches
- Collection and transport systems: those located in the whole urban path, which aims to harvest the water and reduce the volume of runoff simultaneously they lead that water to the retention area. They can also treat water locally.
    - Filtrating drains
    - Sides or kerbs of grass
- Systems of retention or detention and storage. As an indicative date, at the ending level of the path of rainwater it is possible to consider the following storage systems:
    - Retention ponds
    - Detention tanks
    - Artificial wetlands
    - Drainage tanks
    - Bio-retention areas

- **PHASE 5. Initial proposal**

The next step is the development of a draft containing the proposal of systems and techniques to be built in the neighbourhood and their location proposal, so as to be used as the base for the phase of enquires with the rest of agents involved.

In this respect, apart from the technical solutions of the project, as development plan, there must be incorporated: a management and maintenance program of the designed systems, in order to guarantee their efficiency. As examples, it could be suitable to include:

- A programme of cleaning the streets of the neighbourhood in order to avoid soil contamination.
- A control of the contamination of runoff, especially if there are commercial or industrial areas.
- Public Education programmes.

- Waste Management programmes.
- Controls to check possible soil erosion.

6.- Conclusions

The growing interest generated with the study of the rainwater cycle in urban areas is favouring the use of Sustainable Urban Drainage Systems (SUDS), not only in strategies of urban planning, but also in 'water rehabilitation' of consolidated neighbourhoods.

Concretely, the establishment of the SUDS to manage rainwater introduces a series of improvements in the administration of the urban cycle of rainwater among which it is important to highlight:

- An improvement in the contribution of water to the subsoil, being closer to the natural process.
- A control of the superficial runoff, regulating the volumes in the rainy season and maintaining them with the appropriate quality for urban uses that do not require potable water.
- The reduction in the consumption of potable water for urban uses permitting the increase of water resources available.
- A decrease of the volume provided to the network of collectors, with the subsequent saving of investment to spread drainage networks.
- A control and treatment of contamination of rainwater, making it possible to be reused for urban purposes.
- A reduction of the contaminated volume of water that must be treated in plants for the drainage of waste water, resulting in energetic savings.

Moreover, another contribution could be included, since when urban systems from natural green elements are projected, they present an ecological character and make it possible to strengthen landscape effects of the zone adding simultaneously a social and environmental value to the intervened area.

As for the election of the urban neighbourhood, taking into account the suitable size to implement a project that improves water cycle, such neighbourhood presents as an advantage the fact that it is easier to establish management and administration techniques of water and its uses, as well as train the population on a rational and responsible use of it.

On the other hand, being a consolidated neighbourhood, it is possible to work together with social agents, providing an integral control of the water cycle, since for the preservation and reuse of rainwater, it is necessary to count with the collaboration of users, who are due to participate in the environmental education programmes and alter their consumption habits.

Apart from that, it is convenient to add that the development of a project integrating the SUDS as infrastructures in a consolidated neighbourhood, has enough magnitude to plan a design of urban regeneration of the neighbourhood, and from a project of water rehabilitation, to include innovative strategies making it possible the economic, social and cultural regeneration of the neighbourhood.

Finally, it is essential to conclude that, since our country is still in development related to this kind of interventions, and as it deals with complex projects in which environmental, economic and social factors interact, it is convenient to add experiences, especially of processes of analysis including signs allowing to check the viability of the project and be used as support to take decisions, as well as the design of models and tools to implement these new processes of the management of water in which it is necessary to incorporate methods for the participation of the involved social agents.

In this sense, we consider that our contribution, in which we explain a methodology to be followed in the process of previous analyses and data collection, it results useful to develop a project and the verification that the proposal of action is viable.

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