

A Wet Pond Stormwater Management Practice and Beauty
by

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Wet Pond SMP at the Home Depot, Brewster, New York

Abstract

Stormwater Management Practices (SMPs) are important to the health of our watersheds because they provide opportunities for infiltration and pollutant removal of storm water. One type of SMP is the wet pond which is a visible landscape element with an open water component. The major purpose of a wet pond SMP as outlined in the New York State Stormwater manual is to improve water quality while controlling quantity. The manual has a list of guidelines on how to design the wet pond SMP but there is no discussion of how to create a beautiful pond landscape. EPA studies have determined that if these ponds are designed and sited correctly, their value to the community is expanded. This study intends to determine what visual elements of the natural pond landscape contribute to its scenic beauty and if those visual elements are incorporated into the design of the wet pond SMP will the result be a predictable preferred water landscape.

The first step of this study will be to develop a design criteria for altering a wet pond SMP utilizing results from previous study work regarding scenic beauty and wetlands. This design criteria will be incorporated into views of existing wet pond SMPs utilizing computer photosimulation software. Using a mixed methods research design, forty respondents will then be asked to review the unaltered photographs of the wet pond SMPs and the photosimulations in order to assess their visual quality. The respondents will then answer a series of questions designed to determine what elements of each photograph influenced their assessment of its scenic beauty and if the altered wet pond SMP has become a preferred water landscape. The anticipated results are that if an SMP is designed with beauty in mind, it becomes a preferred water landscape and another community resource.

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Introduction

Water is a limited fundamental resource for human survival yet less than 1% of all water on the planet is available for human consumption and is located within rivers, lakes and shallow aquifers. Unfortunately, as land has been developed and regions have become more urbanized, water has been treated as a waste product. The resulting runoff from the streets, suburban construction and agriculture is a form of non point source pollution which degrades the quality of our urban streams (Nichols et al. 1999) and creates large energy demands, floods, erosion, fish kill and contaminated drinking water (Tourbier 1994).

Since the enactment of the 1972 Clean Water Act, the Environmental Protection Agency has been charged with improving the health of rivers, lakes and coastal waters in order to make them “suitable for fishing and swimming”. Point source pollution from factories and sewage treatment plants was the main focus of early clean water efforts because they were easily identifiable. The result was only a reduction from 60% to 40% of all of the rivers, lakes and coastal waters that were too contaminated for fishing or swimming (CQ Researcher 2000). The EPA then focused on reducing non point source pollution from the runoff of city streets, suburban development and agriculture. The EPA is now issuing permits for cities to control the runoff from their streets. The EPA and the Center for Watershed Protection have developed a menu of options to choose from called Best Management Practices or more recently Stormwater Management Practices (SMPs) to deal with the problem. (CQ Researcher 2000)

SMPs come in two forms: non structural and structural. The non structural are methods for

sustainable development such as limiting disturbance in order to create riparian buffers and minimizing impervious surface. (United States Environmental Protection Agency 1995) The structural SMP is a built structure for controlling runoff. One such structure as described in the New York State Manual for Stormwater Management is the stormwater wet pond which has a permanent pool of water and can have extended detention above the permanent pool capable of treating the water quality through settling and biological uptakes. Other general characteristics of the wet pond SMP are: an embankment with emergency spillway, a bottom elevation 2 feet higher than the groundwater, a stabilized inlet, a forebay before each inflow point in order to prevent sediment from contaminating the pond and a liner if the pond is located in permeable soils. The pond should be configured with a minimum 1.5:1.0 length to width ratio and a minimum 1:100 surface area to drainage area ratio. Long flow paths and irregular shapes make the most effective ponds. A 15' wide safety bench is required around any practice with water four feet deep or greater and with side slopes greater than 4:1. The outlet orifice size for each practice must be designed by a professional engineer in order to provide the appropriate release of water as per the various volumes and to prevent erosion. A trash rack should be included in the orifice design to prevent large debris from clogging the pipe. If the designer follows all these guidelines as outlined in the manual, the resulting pond will function as a successful Stormwater Management Practice but it will not necessarily be considered beautiful.

In order for these SMPs to be embraced by the community, they must transcend the limitations of a necessary infrastructure responding to government regulation to become a resource that provides an opportunity for an aesthetic experience, an improved quality of life and an increased awareness of environmental systems and processes. If people are to be a part of the sustainable equation,

natural and cultural processes must have equal footing in the development of any ecological design. (Baird, 2003) These ecological designs must combine environmental technology and aesthetics into works of natural art that become visible and enjoyable design elements. (Dreiseitl 1999)

Furthermore, for these new systems of water management to be successful, they must be considered valuable. Land development is an economic enterprise, and these practices need to fit into a cost/benefit analysis of any new or renovated community. (Simon 1999) EPA studies indicate that commercial space leases faster next to well designed SMPs and residential land sells at a premium if next or within view of a well designed SMP. The studies also show that properties next to traditional detention basins or poorly designed wet ponds sell for less than the surrounding lots. “When designed and sited correctly, artificial lakes and wetlands can help developers reduce negative environmental impacts caused by the development process and increase the value of the property.” (USEPA 1995)

This study intends to determine what visual elements of the natural pond landscape contribute to its scenic beauty and if those visual elements are incorporated into the design of the wet pond SMP will the result be a predictable preferred water landscape. The anticipated result is that these well designed wet pond SMPs will become environments that are considered beautiful. If the SMP is beautiful and well designed it is anticipated that it will increase the value of the project and the quality of life of the community.

Research Design

“Take thought, when you are speaking of water, that you first account your experiences and only after your reflections” Leonardo da Vinci (France 2003).

Although aesthetics has been the topic of art, writings and philosophies for centuries, beauty as an environmental concern is a recent phenomenon. In 1965 a White House conference on Natural Beauty was convened by President Lyndon Baines Johnson in order to address the increased concern that the landscape of the United States was becoming ugly. A basic concept of the conference was that the “beauty of our natural landscapes provided a yardstick for assessing the visual quality of the built environment and the impact of humans on the landscape”. (Zube 1986 12) The implication was that the impacted landscape would never measure up to the natural landscape and therefore the visual quality was degraded. This increased awareness of the deterioration of the environmental quality of North America culminated in 1969 with legislation called the National Environmental Policy Act (NEPA). Visual values were now a part of the interdisciplinary planning process. (Zube 1986)

Unfortunately, since there were no credible methods available to identify visual values or impacts, methods were developed quickly to respond to legislative mandates. But two decades of research engaged in by a multi disciplinary group of individuals from an array of professions including forestry, geography, landscape architecture, psychology, environmental studies and recreation have questioned the early methods’ validity and have developed different methods and theoretical orientations. Zube, Sell and Taylor (1982) identified four paradigms for assessing landscape perception in their paper on landscape perception: expert, psychophysical, cognitive and experiential. The expert paradigm involves skilled or trained observers evaluating the quality

of the landscape. The psychophysical paradigm involves the general public either randomly or purposively selected to assess the landscape with the assumption that the external landscape properties bear a correlation to the response from the observer. Both of these paradigms have been used to develop practical applications to a specific landscape context. The cognitive paradigm searches for the human meaning with a landscape and the experiential paradigm examines the interaction as the basis for landscape values. These paradigms, which are grounded in the human context, have a more direct application in developing theory of landscape perception (Zube et al. 1982). Since this study intends to discover practical applications for the specific landscape context of a wet pond SMP, the research design will be a combination of expert and psychophysical paradigms.

Zube, et.al., when reviewing 160 articles, used a core foundational framework of analysis that perception was a result of the human interaction with the landscape. The human component was identified as the past experiences, knowledge, expectations and socio economic background which creates a unique experience called landscape perception. The landscape component was identified as individual elements that create a unique landscape entity (Zube et al. 1982). These individual elements can become clues used to explain preferences for landscapes (Arriaza et al. 2003). This study will identify the individual elements of preferred natural pond scenes as clues in transforming a wet pond SMP into a preferred water landscape.

There will be three phases to the method. The first phase will use an expert approach to

determining the individual elements of a natural pond water landscape that contribute to its scenic beauty. The data collected from this phase will be used to inform the development of visual representations of wet pond SMP's. The final phase will be to use the wet pond photosimulations as the stimuli for a survey and questionnaire in order to assess the visual quality of the resulting images and to determine what visual elements contribute to the scenic beauty of the resulting SMP. The results will be analyzed to determine if incorporating the visual elements that make a natural pond beautiful into the view of a wet pond SMP, the wet pond SMP will be considered beautiful.

It was the researcher's original intent to perform a qualitative research design to ascertain the visual elements of a preferred water landscape. She employed that design in a pilot study called *Water is the Answer* in 2004. Although the data was compelling, it unfortunately did not yield any concrete design elements that could be incorporated into a photosimulation. Therefore, she determined that utilizing results from past studies and her own expert skills from 28 years of professional practice would be a more credible method to determine a palette of visual elements.

Visual elements of a preferred water landscape have been identified in several studies to include complex edge, enclosure, visual penetration, access to the water, complex yet legible vegetation, manicured "nature" (Asakawa et al. 2004; Hammitt 1983; Kaplan 1985; Lee 1983; Litton et al. 1974; Nasar and Li 2004; Palmer 1983). The researcher will study the natural pond as depicted in art, in research, and in its physical state utilizing such techniques as observation, journaling and document review in order to determine a palette of visual elements that comprise a preferred

natural pond landscape. The researcher will review these elements with her committee to determine if the resulting elements are credible tools for photosimulation .

Photosimulation has been utilized as a credible method to illustrate impact of development (Bliven and Kelty 2005). The researcher will research and visit several installed wet pond SMPs to determine if they first meet the criteria of the New York State Stormwater Management Manual. It is assumed that if they meet that criteria, the SMP functions effectively for water quantity and water quality. The researcher will take several photographs of each SMP using similar guidelines for lighting, time of day, exposure, etc. These pictures will be reviewed with the committee to determine which are the best for photosimulation. The researcher will utilize Adobe Photoshop to combine the visual elements of the natural ponds into the view of the wet pond SMP. These images will be printed on 8 ½ x 11 photo quality laser color paper. The researcher will review the images with her committee for opinions on accurate representation, quality of image and quality of printing. Although the researcher has utilized this technique in the past, her computer graphic capabilities are not expert. If it is acceptable to her committee, she may utilized the expertise of her firm's CAD manager to assist in developing the photosimulations.

The respondents' recruitment will be purposive rather than random hoping to provide a stratification of participants that represent people directly involved in the design and implementation of SMPs to ordinary citizens of different genders, race, education and economic situation. The potential participants will be identified using local construction, real estate and professional organizations along with community groups. (Dakin 2003) They will be chosen

from the greater Danbury, Connecticut area, which has a diverse socio economic community.

The goal is to have a minimum of 40 respondents from a variety of professions, gender, and socioeconomic backgrounds. Since the researcher is a member of several boards and committees in the area, it is expected there will be a strong response to assist her in this study. The limitation is that the respondents may try to please the researcher in their assessments knowing the researcher's background and opinions.

The last phase will employ a mixed methods approach to a three part visual assessment procedure of the photo simulations. The visual assessment will be part of a water event that will be held in the researcher's office; a pleasant, neutral colored space with a lot of light and high ceilings. Refreshments (including water) will be served. There will be soft music in the background.

The respondents will be asked to review each image and evaluate using a 5 point Lickert scale. The respondents will then be asked to fill out a questionnaire that will attempt to ascertain the reasons for the respondents preferences of the photographs. Questions will include why they liked/disliked a photograph, what elements of the photograph they liked/disliked, what emotions did the photograph evoke, and would the respondent like to live near the water landscape depicted in the photo.

Each data set for each image will include the image assessment and the questionnaire responses. Each image will be assigned a mean and standard deviation number. The questionnaire data will be indexed by themes, codes and connections between themes. It is anticipated that these two

stages of analysis will identify what elements are important to the participants perception and why these elements are important. The researcher will then compare these elements to the visual elements utilized in the photosimulations to determine if utilizing these elements in the design of a wet pond SMP could predict the creation of a preferred water landscape.

The anticipated time frame for this study is over two semesters. The visual elements that contribute to the scenic beauty of a natural pond will be part of an independent study taken in the Fall 2006. The photosimulations will be developed in the Fall, 2006. The SMP visual assessment, data analysis and the writing of the thesis will be done the Spring of 2007.

There are several limitations and biases apparent in this proposal, and ultimately the study, that will need to be recognized, resolved, or reconciled. First, the researcher believes that beauty has a value and that quality of life is important to most people. It remains to be seen if people really do care that the structure that treats the stormwater should also be beautiful. Second, the researcher has no background or understanding of statistical data analysis and therefore had to design a study with an elementary data analysis component.

Another limitation is the researcher's professional experience. The researcher has practiced landscape architecture for 28 years and has many preconceptions about the use and design of structural SMPs. The researcher, as a principal of a firm, has a good track record of selling ideas that she is very committed to. This study will require the researcher to modify her presentation style and interview process so as to not unduly influence the participants. Therefore, the researcher will review with her committee a script and presentation style that is appropriate for

an academic study.

The last apparent limitation is the researcher's writing style. Writing for business is very different than writing for the academic community. Although she has written many proposals and reports, their main function was to sell an idea or a service. For this study to be valid, it cannot be considered a sales tool. The researcher expects her committee to provide her with criticism and guidance.

As the proposal is developed, more limitations may become apparent. It is the researcher's intention to work with her committee to analyze and troubleshoot the problems and therefore develop solutions and/or strategies for dealing with these limitations.

Conclusion

Complex environmental problems require diverse and integrated solutions that engage people. The intent of effective ecological landscape planning is to balance ecological concerns with human use and preference (Ndubisi 1999) and “to infuse local place values with ecological content.” (Eisenstein 2003 18). Stormwater runoff is a complex environmental problem that has a wide range of effects on a water shed. It is a non point source of pollution that is treated utilizing several methods called Stormwater Management Practices (SMPs). A wet pond SMP is a structural SMP with a water component. The New York State Stormwater Management Manual has clear guidelines for how a wet pond SMP will handle increased water quantity and improving water quality but no discussion regarding its scenic beauty or impact on human use or preference. This study intends to investigate the human use and preference of a wet pond SMP by first developing a palette of visual elements that contribute to a natural ponds scenic beauty and then determine if those elements when incorporated into a wet pond SMP will create a preferred water landscape. The premise is that a preferred water landscape will be an amenity for the community and therefore increase the quality of life of the community.

There is evidence that the more amenities a community has, the more valuable it is. Real estate professionals report that when the natural surroundings are considered beautiful, the residences sell faster and at a 28% increased value over equal houses in a less beautiful surrounding.

(USEPA 1995) There are also studies that show that stress levels are reduced and quality of life is increased when there are opportunities to view and interact in a beautiful water landscape (Regan and Horn 2005). Therefore to incorporate beauty as a criteria for the design of a wet

pond SMP, can only increase the value and quality of life of a community.

This study is anticipated to be of great interest to ecological designers, landscape architects, ecological engineers, developers, political decision makers and government agencies. The anticipated dissemination of this study will be further research, journal articles, presentations and articles in professional periodicals. One anticipated result is a wider acceptance of the incorporation of the landscape architect as a member of the design team, to act as the mediator between the cultural and natural processes.

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