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From Sod Farm to Wetland: An Urban Restoration for Education

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THE CATALYST FOR THE PROJECT

Water quality requires looking at land use within the whole watershed. The fact that a watershed crosses seven different city boundaries isn't discouraging a group in Minnesota from thinking about their watershed as a whole. This forward thinking group is collaborating on a project in the Phalen Chain of Lakes watershed in St. Paul, Minnesota. Group members include officials from the cities of Gem Lake, Little Canada, Maplewood, North St. Paul, Vadnais Heights and White Bear Lake as well the Ramsey- Washington District Watershed staff, the Department of Natural Resources and citizens of the watershed. Committee members recognize that water quality is an important issue to the residents in this urban residential watershed. Recreational opportunities and neighborhood identities are dependent on the quality of the water bodies in this watershed. The committee's goals for improving the water quality within their watershed are as follows:

1. Find and protect unique areas in the watershed,

2. Restore, connect and buffer these places, and

3. Enhance ordinary landscapes, such as yards, roadways, and businesses within the watershed.

The sod farm site was chosen for its close proximity to schools, its connection to a major recreational trail (the Gateway Trail), and its visibility within the neighborhood and from a major highway (Minnesota Highway 36). The site is approximately 17 acres within a 24 square mile watershed (the Phalen Chain of Lakes Watershed) which flows into the Mississippi River in St. Paul, Minnesota.

To help them develop a conceptual design plan that will achieve their goals on this site, the committee looked to the Department of Landscape Architecture at the University of Minnesota. A design group from the department joined the team in the summer of 1995 and will have developed a general master plan by the fall of 1996. Thus, this critique can only be directed at the initial design process and issues up to May of 1996, being the time of this review.

THE DESIGN PROCESS

A group from the University of Minnesota's Department of Landscape Architecture became members on this project as part of a Legislative Commission on Minnesota Resources (LCMR) grant they developed. The grant was entitled "Wetland Restoration and Enhancement to Create Community Amenity and Form". The sod farm site was chosen along with four other sites in Minnesota as case study examples of how wetlands can become amenities for the communities

around them. The University design group was interested in working at the sod farm site for the same reasons as the initial team, especially the site's potential for community education. The design group did an initial analysis of the site and its context, and then presented design concepts to be reviewed for additional ideas and concerns.

THE ANALYSIS

Due to the emphasis on developing the site as a community amenity, this analysis included both social and ecological aspects.

Site Location and Context

Water from 480 acres of mainly urban residential runoff moves through this site. Run-off enters through a cement culvert on the south side, traveling straight north for the length of the site within an old farm ditch approximately 6 feet wide by 3 feet deep. The water exits the site through a culvert leading under the highway and through more piping until it reaches Target Pond, 1400 feet further downstream. Target Pond was constructed in 1995 to retain water from large storm events. Two other smaller sources of run-off reach the site. The inlet at the south west corner is open-channeled along the southern boundary to the east side, where it joins the farm ditch. The other inlet is midway on the west side and crosses the site diagonally to meet up with the farm ditch at the outlet. This last inlet water course is separated from the rest of the site by a buried sewer line mounded with fill to allow for vehicular access. This 'peninsula' runs diagonally just south of the midwest inlet to the junction of this inlet with the northern outlet. This access must remain in the final plan.

The context immediately surrounding the site consists of Highway 36 to the north, businesses built on rubble fill on McKnight avenue along the east side, the State Recreational Trail (Gateway) on the south side, and residential lots on the west side. The site has mature cottonwoods on the perimeter which create some protection and enclosure. The strongest connection is the mature canopy of oaks within the residential lots to the west. There is little wildlife on the site. The best connection may be for birds.

Existing vegetation is dominated by reed canary grass (*Phalaris arundinacea*). Stands of cattails (*Typha sp.*) exist in areas with standing water. A shrub layer comprised of willow (*Salix sp.*) and dogwood (*Cornus sp.*) exists near the center of the east side. This upland includes a couple of mature bur oaks (*Quercus macrocarpa*), some prairie forb species, aspen (*Populus tremuloides*) and sumac (*Rhus sp.*) on the edge of the east property line. Mature cottonwoods (*Populus deltoides*) boarder the site on the east, north and partially on the west side. The sites vegetation analysis has been limited to casual observation, mainly due to extreme extent of the reed canary grass throughout the site. A more complete species composition and identification analysis should be done prior to construction on site in order to have a reference for the monitoring.

Site History

The site's history can be traced from inspecting sequential aerial photos available since the 1940s. In the 1940s photograph, row crops and pasture exist with a drainage ditch extending along the east side of the site. Mixed use farming continued on the site with few exceptions. The 1957 photograph depicts a very wet year, in which farming had ceased and the site had reverted to wetland. The 1968 photograph depicts the sod farm operating on the site, supplying instant lawn for the residential building boom. By this time, the watershed was full of impervious surfaces and residential lawns.

More clues about site history were derived from Marshners map and discussions with local residents. One resident remembered hunting in the area prior to the 1940s. Accordingly, this area may have consisted of wetlands and prairie or savanna of bur and northern pin oak (*Quercus ellipsoidalis & Q. macrocarpa*).

Site Soil and Hydrology

The site's soil is classified as Rifle muck, a typical wetland soil, with infill at the edges from development. Depth to the surface ground water may be less than 4 feet. The aquifer for drinking water is the deeper Prairie Du Chien Jordon, located beneath two confining rock layers. The farm ditch contains water even through droughts, thus it may penetrate the high water table.

According to the Minnesota Department of Transportation's soil borings taken somewhere along the north side of the site in February 1968, the water table was at 6.5 feet. The Rifle muck depth was 18", with a layer of silty clay to 10 feet. More site specific soil borings for the project will be conducted this summer. These will give the design group more accurate information to work with.

Conclusions of analysis

After their initial analysis, the design group suggested a list of opportunities and limitations to reaching the goals for the site. (many of these goals were stated earlier) The opportunities include:

1. Education of the community.
2. Recreation for the community.
3. Enhancement of landscape structure across the region to begin to create connections.
4. Demonstration of storm water cleaning.
5. Demonstration of increased bio-diversity (suitable to be restored as an emergent marsh).
6. Demonstration of how a wetland can be an amenity to the neighborhood and city.

The limitations include:

1. Polluted storm water drains in from the residential watershed.

2. Large volumes of water pass through the wetland (more than could be filtered effectively).

3. The wetland is currently dominated by reed canary grass (*Phalaris arundinacea*) which must be eliminated in order to establish a diverse plant community.

Initial Design Concept and Discussion

The purpose of the initial design concept was to take the opportunities and limitations and give form to them in the context of the site. By having a plan of the site that incorporated all or most of the goals and issues brought up by the analysis, the committee could now have a tool to facilitate discussion. Many concerns and new ideas were sparked by the drawings. The discussion started with the sediment removal pond.

For the goal of demonstrating storm water cleaning, the following issues came out of the discussion. It is important to have a sediment catchment area at the inlet. The initial idea was to slow the water in a deep 4-6' pool. The issue of safety was addressed by discussing the use of a shallow perimeter around the pools, and slopes less than approximately 5%, to prevent accidental falls into the deeper pool. Fencing will not be used, because it could limit emergency access and may give the perception that the area is dangerous. The sediment pool must be accessible for vehicles implementing sediment removal every 5-10 years, and provide access for persons testing incoming water quality.

After most of the sediment is dropped in the catchment area, the design concept is to have the water meander through the length of the site in wide, shallow channels. The shallow channels would create varying water levels to support a diversity of plant species. The meandering channel would over- flow in larger rainfall events, filling the wetland basin and creating a dramatic, visible change for the community to witness. A concern was raised whether the channel would become straight over time and if it would need maintenance. The resulting sheet flow wouldn't be strong enough to cause erosion, and if it was, the channel wouldn't need to be maintained in its original form. The shape of the meandering shallow channels would be allowed to change.

Another concept involves the ability to adjust the water level through check dams, in order to experiment with water regimes. This idea caused concern with the city engineer, because some homes at the western edge of the site would be prone to flooding if the experiments weren't monitored carefully. A safety over-flow could be designed to prevent this, but this issue is still being discussed. Another concern raised by the city engineer was the elevation of basements in the neighboring homes, and the possibility of flooding. The decision was made to take specific site elevations across the site, including basements along the western edge of the site, to determine limitations on the maximum water level.

The initial conceptual design brought the meandering channel into a pool at the north end of the site before leaving the site through the culvert. This pool will be an area for monitoring water quality after it has passed through the site, and will need to be accessible for testing. This area could also be used for education, or for observing the testing. The area receiving water from the mid-west inlet is separated by the sewer mound and could be an area for smaller scale planting experiments in removing reed canary grass and establishing more diverse native vegetation. The varying water regimes of run-off and ground water found on the site provide opportunities for planting experiments. For example, native species could be planted diagonally across the path of the water flow and up the slope to test success in establishment within the regimes.

Since the reed canary grass is dominating the site presently, an important issue that hasn't been resolved is how and if to remove it. The team members have looked at past attempts and techniques in controlling this invasive species and have mixed opinions on the potential for success in removing the grass at this site. It will take a great amount of financial resources, which may or may not be available. The suggested technique is to remove excess dead vegetation in the fall, and as it re-grows, spray the new growth with Round-up®. This technique would be repeated throughout the first year, and planting would take place the next spring. Concerns about the neighbor's reaction to the spraying and the appearance of the site during treatment year are justifiable. An education effort coinciding with the reed canary grass treatment will be necessary to address the concerns of neighbors. No health risk is connected with the treatment.

Another technique discussed is to remove the top 18" of soil from the whole site in an attempt to remove all the root structure of the reed canary grass. This idea was estimated to cost $130,000 with an added concern that the contractors may not remove all the roots of the plant. There are also many sources of reed canary grass in the watershed, increasing the re-colonization potential. This unresolved problem will be the determining factor in whether the goal of increasing bio-diversity will be achieved.

Additional Design Ideas

Another design concept is to experiment with the source and quantity of water coming through the site. The Target Pond was built to handle large storm water events, thus the sod farm site is not needed to retain water. This frees the sod farm site up for other water regime experiments. The first part of the rainfall (1-2") carries the most sediments, thus the site could retain that, while letting the additional amounts pass through an overflow to the Target Pond. With the unique sources of water available at this site, it would be interesting to create areas that are supplied with water from exclusively ground water, exclusively runoff , and a combination of the two.

The design group will continue to integrate upcoming ideas and concerns into the evolving design concept, trying to create a design that addresses both the ecological and social goals placed on this urban wetland.

Monitoring the Site

Discussion on monitoring for this site have been limited thus far, yet some unique possibilities exist. The High School science class will be active users of this site. The science teachers have resources to spend a year with a Landscape Architecture Graduate intern to develop their curriculum using this site. The intern will also help create a traveling display that will explain the reclamation process on the sod farm site and explain what we can learn from the site.

The students are qualified and enthusiastic about creating some valuable monitoring data that can be carried from year to year. These data collecting techniques will need careful testing to insure accuracy and consistency for any comparison analysis to be viable. The main diagnostics should include:

1. *Water quality,*(nutrients such as Nitrogen and Phosphorous, and possibly water temperature). A base line of incoming and outgoing nutrients will be necessary in order to determine if the site is performing the water cleaning function and to determine if the community is lowering nutrient run-off within the watershed.

2. *Water levels,* (both of the ground water and incoming run off through each culvert). A base line of water availability will help analyze reasons for plant and animal establishment success or failure.

3. *Plant diversity,* (including reed canary grass control). The teachers plan on monitoring plots from year to year for composition and numbers of species. This will monitor both species existence and location within the site where species succeed. There is a desire to have various groups in the community plant native plants on a ongoing basis as funding allows. This begins to give the site a garden like mood, which may be more suitable for this site because of the human focus on it and the hostile conditions it must exist in.

4. *Invertebrate samplings.* Samplings often increase remarkably with increasing in water quality, thus offering an positive and rewarding indicator of improvement.

CRITIQUE OF PROJECT AT THIS POINT IN THE DESIGN PHASE

Even though this critique can only examine the process and discussions leading up to, and including, part of the conceptual design phase, there are important issues to note. The project succeeds by looking at improving the watershed as a whole, by involving and encouraging the community, and by involving Landscape Architects for distilling design concepts in the early stages. The project may be less successful in achieving its goals of increased bio-diversity, and in advancing our understanding of reconstructing wetlands, although this is not an explicit goal of this project.

By looking at the watershed as a whole system, this site, along with other chosen sites, will have more of an effect on the community and the environment. Each one of these sites can be used in relationship to the other sites, and towards the shared goal of improving the water quality. For example, the Target Pond may be used to retain large amounts of storm water, leaving the Sod Farm site free for education of the community. In this way, each site is effectively developed or preserved to benefit the whole watershed community, both environmentally and socially.

Involving the community has been a important feature of this project. The design team's analysis was put into a booklet with text, diagrams and photos to explain the development process to the community. The presentation and discussion of the initial design concept was videotaped for broadcasting on the local cable channel. High School science teachers have participated in the project discussions and are sharing their ideas on what will make this site interesting and educational for their students. With this kind of citizen participation the project can hope to achieve its goals relating to education, recreation and community amenity.

The high level of community interest in this site requires completion of as many goals as possible. However, the goal of bio-diversity may be limited by reed canary grass. A complete wetlands restoration will not be attempted at the site, due to the problematic removal of the reed canary grass. What has not been made clear is how, or to what level bio-diversity will be attempted. The level of increased bio-diversity is linked to acquiring the financial resources to remove the reed canary grass from the site. Additional funding is still being sought at this time. As a result, the design team will be looking at design concepts that develop this site in stages, to allow for experimentation and additional funding as it becomes available later in the project.

At the last meeting, it has been suggested that a typical storm water treatment configuration consisting of a series of basin pools be tried. Additional funding from the MPCA, (Minnesota Pollution Control Agency) may be available for this style of storm water wetland. This design has been successful in other sites, but may limit species diversity and educational potential. These pools create great duck ponds and people respond favorably to the open water, but other kinds of wetland are under- represented and communities need to see how those wetlands fit into the watershed system. Compromises such as these demonstrate how importance of community perception and available funding may be directing the goals of the project.

Involving designers at the initial planning of the site was a great method for facilitating ideas and concerns early on in the project. The plan and its context gave people a vision and a new way of seeing the site. The drawings were also used to acquire more funding and to encourage involvement from the community. Additional exposure to the community will be accomplished through the traveling display explaining the project and up-to-date results of the monitoring to be done on the site.