

2010 Project Abstract

For the Period Ending June 30, 2012

I. PROJECT TITLE: A Citizen-Based Approach to Stormwater Management: Raingardens to Improve Impaired Waters

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FUNDING SOURCE: Environment and Natural Resources Trust Fund

LEGAL CITATION: ML 2009, Chap.143, Sec.2, Subd. 5e

APPROPRIATION AMOUNT: \$ 279,000.00

The long term success in reducing impairments to local water bodies will require better citizen-based approaches to increase public awareness and affect behavior change. This project demonstrates a fast-paced approach to citizen engagement for the installation of raingardens within a 28-acre area that drains to Powderhorn Lake (Minneapolis). A paired watershed study was undertaken to evaluate the effectiveness of raingardens in reducing runoff and pollutant loads generated solely on private property.

230 community members participated in project installation events and activities demonstrating the connection between runoff and water quality of Powderhorn Lake. Approximately 50% of homeowners in the test neighborhood received a free raingarden for a total of 125 project-installed raingardens. Two congregations also installed raingardens and permeable pavement strips in their parking lots. Youth and young adult job programs excavated and planted the majority of gardens. More than 70,000 sq. ft. of impervious area was redirected to a stormwater best management practice (BMP). Additionally, 50% of participants also exhibited behavior change by taking voluntary steps to reduce run off from their property (redirecting downspouts, installing rainbarrels, or additional raingardens).

Performance was measured by monitoring the quality and quantity of stormwater discharged to Powderhorn Lake from the test and control sites and comparing results. Minneapolis Park and Recreation Board installed and maintained equipment for three years, providing stormwater runoff characteristics before and after raingarden installation.

Fewer water quality samples were collected than planned due to challenges posed by the urban storm sewer system and climatic conditions. While the paired watershed analysis results do not show a statistically significant outcome, the few water quality samples collected in 2011 provide promise that the test neighborhood efforts could have reduced pollutant loads when compared with the control area. Continued stormwater monitoring is planned in both areas (funded by the City of Minneapolis).

Project Results Use and Dissemination

The project has continued to engage others in similar efforts across the Twin Cities metropolitan area, including 14 additional Neighborhood-of-Raingardens style projects led by Metro Blooms and another 170+ raingardens installed.

Neighborhood of Raingardens is also a film produced by University of Minnesota's Mark Pedelty, and funded by the Institute on the Environment. The film gives an introduction to raingardens and stormwater runoff and highlights the Powderhorn Park project. It aired on the MN Channel (TPT MN) on April 22, 2011 at 7:30pm, with repeats on April 23, 2011 at 1:30am and 7:30am, and during the month of June. The film has been shown at neighborhood events and co-ops and is available to be viewed online or for download at www.raingardenmovie.org.

Metro Blooms has created a Powerpoint presentation on the project, which has been presented to the Watershed Partners and Blue Thumb partners, as well as staff of the Ramsey Washington Metro Watershed District. We will be presenting our project at the 2012 Water Resources Conference, a state-wide event that showcases innovative, practical, and applied water resource engineering solutions, management techniques, and current research about Minnesota's water resources.

All project partners received a copy of the final report and executive summary. All project participants received a copy of the executive summary with accompanied raingarden maintenance brochure. The full report and executive summary are available on our website at www.metroblooms.org/neighborhood-of-raingardens.org. Additional copies of the executive summary will be made available at outreach events and upon request, while supplies last.

Environment and Natural Resources Trust Fund 2009 Work Program Final Report

Date of Report: August 31, 2012

Final Report: June 30, 2012

Date of Work Program Approval: June 16, 2009

Project Completion Date: June 30, 2012

I. PROJECT TITLE: A Citizen-Based Approach to Stormwater Management:
Raingardens to Improve Impaired Waters

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Location: *Powderhorn Park Neighborhood, Minneapolis, Hennepin County*

Total Trust Fund Project Budget:	Trust Fund Appropriation	\$ 279,000.00
	Minus Amount Spent:	\$ 276,159.56
	Equal Balance:	\$ 840.44

Legal Citation: ML 2009, Chap.143, Sec.2, Subd. 5e

Appropriation Language: \$279,000 is from the trust fund to the commissioner of natural resources for an agreement with Metro Blooms, in cooperation with Minnehaha Creek Watershed District and the city of Minneapolis, to install and evaluate the effectiveness of raingardens on improving the impaired water of Powderhorn Lake in Minneapolis. This appropriation is available until June 30, 2012, at which time the project must be completed and final products delivered, unless an earlier date is specified in the work program.

II. FINAL PROJECT SUMMARY:

Education and action influenced community members to improve Powderhorn Lake water quality.

Citizen Engagement Methods Key to Successful Outcomes

- Enlist local champions of stormwater management to reach out to community members.
- Use a combination of outreach methods: workshops, mass mailings, door knockers, neighborhood home meetings, and canvassing.
- Include multi-lingual staff and community members to engage non-english speaking community members.
- Use a non-profit organization for outreach and implementation to offset skepticism associated with a private firm or city-led effort.
- Provide an economic incentive and a well-crafted, educated message.

Project Vision

The long-term success in reducing impairments to urban lakes and waterways will require better citizen-based approaches to increase public awareness and effect behavior change. A coordinated plan is also required that focuses efforts on areas and stormwater management practices providing the best benefits to the impaired receiving waters. This project evaluated community outreach approaches through a pilot study of the fast-tracked installation of over 100 raingardens in a 28-acre sub-watershed draining to Powderhorn Lake, Minneapolis. Stormwater best management practices (BMPs) were restricted to installations on private property. Stormwater monitoring was also integrated into the project to assess whether reductions in pollutant loadings or volume could be detected and provide support for future water quality improvement plans for Powderhorn Lake.

Citizen-Based Approach to Stormwater Management – Neighborhood of Raingardens

The term “Neighborhood of Raingardens” was created to define the collective approach to implementing stormwater management practices clustered in neighborhood areas. The goal is to educate citizens on the ways they can have a positive effect on the local water quality through a variety of methods such as: raingardens, permeable pavers, green roofs, rain barrels, native plantings, boulevard plantings and yard maintenance. Raingardens serve as a visible tool and ‘hook’ to gain citizen interest and encourage neighbor participation. The large-scale community participation process not only teaches participants about water quality protection, but it also builds a stronger and more beautiful community through increased community outreach.

Methods

The project was developed through three phases: citizen engagement, design, and installation. Measurement activities preceded and occurred throughout the project.

Participant Process

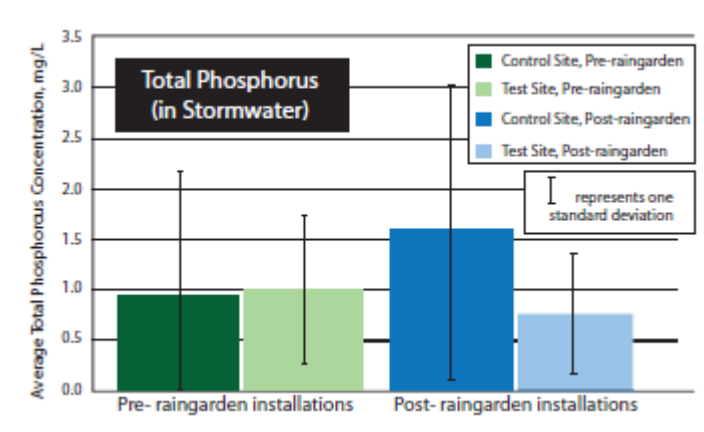
Metro Blooms’ general approach to citizen-based stormwater management projects involves the property owner throughout the process. For this project, the property owners were presented the large incentive of free design and installation services, as well as free garden plants and materials. Because this was a fast-paced project, it was difficult for most property owners to be involved in the installation process, but local youth teams assisted and institutional properties held events that engaged numerous community members.

Measurement

Performance was measured by monitoring the water quality and quantity of stormwater discharged to Powderhorn Lake from the area with raingardens (test site) and a neighboring watershed without raingarden installations (control site) and comparing the results from the two sites. Minneapolis Park and Recreation Board (MPRB) installed and maintained equipment for three years to provide stormwater runoff characteristics before and after the raingardens were installed. Surveys, site assessments, and maintenance activities were also used to evaluate the effectiveness of the Neighborhood of Raingardens in improving Powderhorn Lake water quality.

Results

Monitoring in urban storm sewers has its challenges and coupled with the climatic conditions for the project period, fewer water quality samples were collected than planned. While the paired watershed analysis results do not show a statistically significant outcome, the few water quality samples collected in 2011 provide promise that the test neighborhood efforts could have reduced pollutant loadings when compared to the control area.



Other project measurements demonstrate that education and action influenced community members to improve Powderhorn Lake water quality. Over 230 people participated in project events and over 130 large bags of debris were collected in maintenance activities. In addition, post-survey results of participating property owners indicated that 76% enhanced their garden with additional plants, landscape materials or art. Over 50% implemented additional BMPs in their yard, such as adding a rain barrel or additional raingardens.

Future Plans

- Continue stormwater monitoring (City of Minneapolis is funding 2012 monitoring by MPRB).
- Further develop Metro Blooms' volunteer-based, raingarden evaluation program to provide added incentive for continued maintenance of raingardens.
- Focus new urban projects on maximizing backyard runoff capture with multiple types of BMPs.

IV. OUTLINE OF PROJECT RESULTS:

Result 1: Neighborhood and Institution Approach

Description: Promote and host Neighborhood of Raingardens approach through construction services for residential, faith-based and educational organizations.

This task involved the following activities: 1) Workshop coordination and facilitation, 2) residential site review and Raingarden design, 3) Raingarden installation, 4) pre and post-installation stormwater audit, 5) assessment products, including participation records and year-end surveys to citizens installing a raingarden (Result 2 incorporates these products in project reports), and 6) Project management related to coordinating workshops, landscape designers, installation, and record keeping.

Final Report Summary:

This project evaluated community outreach approaches through a pilot study of the installation of over 100 raingardens within a five-week period in a 28-acre sub-watershed draining to Powderhorn Lake, Minneapolis. Stormwater best management practices (BMPs) were restricted to installations on private property. In addition to directing over 70,000 square feet of runoff from impervious surfaces to bio-infiltration areas (raingardens) the project engaged 230 community members and increased their awareness of how their

actions affect the water quality of their neighborhood lake. Community members were involved at various levels of commitment, including: reading literature distributed as part of the project, attending or hosting a workshop, door-knocking in the neighborhood to recruit project participants, meeting with a designer, and participating in installation, maintenance and community clean-up activities. Findings of this project can be applied to similar urban areas and provide a basis to target citizen-based improvements of highest benefit to our water resources.

The term “Neighborhood of Raingardens” was created to define the collective approach to implementing stormwater management practices clustered in neighborhood areas. The goal is to educate citizens on the ways they can have a positive effect on the local water quality through a variety of methods such as: raingardens, permeable pavers, green roofs, rain barrels, native plantings, boulevard plantings, yard and gutter clean up and maintenance. Raingardens serve as a visible tool and ‘hook’ to gain citizen interest and encourage neighborhood participation. The large-scale community participation process not only teaches participants about water quality protection, but it also builds a stronger and more beautiful community through increased community outreach.

The Powderhorn Lake Neighborhood of Raingardens project specifically explored several different techniques to recruit residents and institutional property owners to install raingardens and implement other stormwater management practices on their private property. For example, one method is to have resident host a neighborhood raingarden party. A small workshop-style presentation introduces stormwater and water quality concepts, and residential practices to improve water quality. In the case of this project, significant incentives included free consultation, design, installation and plantings funded by this project. In addition to citizen engagement, this project required specific design and installation processes, which are also documented in this report.

The Powderhorn Lake Neighborhood of Raingardens project was developed to reach several goals. Foremost was to evaluate methods of citizen engagement and maximize community involvement. Given the “free” incentive of a raingarden, the focus of the best management practices was on the installation of a raingarden and education about water quality protection. In most cases, a raingarden provided a BMP with a high runoff capture volume for a specific property. For some properties, other practices may have been more effective, but were not implemented because of site, budget, and homeowner constraints, except at institutional and specific properties during the second year.

Another project goal was to maximize runoff capture. This goal was restricted by the requirement to install raingardens and other stormwater practices exclusively on private property. The inability to capture runoff from sidewalks and streets limited the stormwater runoff pollutant load and volume reduction possible with this project.

Amendment Request July 1, 2010: Upon revisiting their budget, the MPRB monitoring crew identified \$10,000 more in their budget than needed to complete the planned monitoring for this project. At the same time, the MPRB identified that an additional \$10,000 was needed to allow us to contract with the Mississippi River Green Team program to plant approximately 70 of 100 test area raingardens. This amendment will improve the quality of installed raingardens. The original plan for the property owners to plant raingardens was problematic for a number of reasons: 1) Scheduling plantings around work schedules required was not possible in most cases, and 2) Scheduling, training and supervising the work of the Green

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Team helped ensure a timely planting, and the quality of planting in terms of placement and health of the plants. This change compromises our goal to involve property owners, but we are compensating by making property owners aware of the scheduled planting time, asking them to participate if they are able, and coordinating one volunteer planting date for the final 30 raingardens -- inviting the whole neighborhood to participate in a planting celebration lead by Metro Blooms landscape designers and Hennepin County Master Gardeners.

Amendment Approved: August 25, 2010

Amendment Request December 31, 2010: After reaching our goal for number of installed gardens, we are revising our budget to request an additional \$5,084 for Ecoscapes. This budget increase will allow us to perform work that requires expertise and equipment that the MCC crew does not have including installation of permeable pavers, channel drains and curb cuts to allow rain to flow to installed raingardens. By targeting our resources on a few properties with large impervious surfaces, we expect to achieve significant reductions in stormwater runoff.

In our planning for this project we had identified that a large percentage of the test area was impervious (more than 90%), with large parking lots and rooftops. We had not identified a solution for disconnecting these surfaces. The installations that we have planned for 2011 represent the solutions that we have identified. They are a result of closer inspection of each site and on-site consultation with a property owner that expressed an interest in finding a stormwater solution.

Amendment Approved: March 31, 2011

Amendment Request: June 1, 2011: After conducting a thorough onsite evaluation of the test watershed, combined with outreach to engage select property owners for additional installations on their property we created an installation plan and budget that will accomplish the final project installations.

Our amendment request is to transfer the \$16,437 from Result 2 to Result 1 for the completion of installations that will have a significant stormwater capture capabilities.

Amendment Approved: June 14, 2011

Summary Budget Information for Result 1:	Trust Fund Budget:	\$ 204,877.00
	Amount Spent:	\$ 201,046.68
	Balance:	\$ 830.32

Deliverable	Completion Date	Budget
1. Neighborhood of Raingarden installations (0 – 75 raingardens) October 2009 (50 – 150 raingardens) October 2010 (0 – 50 raingardens) October 2011	Oct 2011	\$197,677
2. Participation records	October 2012	\$ 4,200
3. Year-end survey results w/onsite evaluation	June 2012	\$ 3,000

Deliverable 1. Neighborhood of Raingarden Installations

Workshop Coordination and Facilitation

Raingarden Workshops in Powderhorn. During the stormwatershed audit we distributed flyers to almost every household in the test area – we had a total of 5 people at two workshops. Of those five, three agreed to host parties in their yards. After this experience we decided to refocus our promotions to canvassing and raingarden parties.

Raingarden Parties. Over the summer we scheduled 4 hosted raingarden parties, where a property owner/participant agreed to invite their neighbors to their yard for our one hour introduction to the project, raingardens, and to sign up participants for an onsite consultation.

Canvassing. We scheduled four nights in August. Michael Keenan, Carlos Zhingre and Metro Blooms staff led groups of Landscape Design Assistants and volunteers as we canvassed the neighborhood – knocking on doors, and talking with residents in their yard and on the streets about the project. We asked them to sign up for an onsite consultation.

More than half of the conversations were in Spanish. Educational materials were translated our adopted tag line for this project. Construye un Jardin de Liuvias. Restaura el Medio Ambiente. Colabora con una “Minga”, which means: Build a raingarden, Save the environment and Join a Minga. A Minga is a group that gathers to do charitable works for the community.

Residential Site Review and Raingarden Design

Of the 63 property owners identified in our final test area at December 31, (20 were just outside the final test area), our Landscape Design Assistants were able to complete 56 onsite consultations, stormwater management plans, and raingarden designs. Each participant will receive a copy of their stormwater management plan (SWMP) and raingarden design. The SWMP provides a variety of options, in addition to our planned raingarden installation, that the participant may adopt to manage their stormwater onsite. Our assumption and goal is that once participants learn about stormwater runoff's role in the degradation of their local water body, Powderhorn Lake, and learn their own role in improving the water quality of the lake, they will voluntarily adopt additional practices. This assumption will be tested at the end of the project period through a follow-up stormwatershed assessment.

Raingarden Installation

Native Plant Propagation: We started working with the MPRB Teen Team Works and the Mississippi River Green Team to propagate native plants for our raingardens. We purchased some native perennials and received a large donation of both cultivars and natives. Metro Blooms Landscape Design Assistants directed the youth crews to propagate through cuttings and thinnings of the donated plants. All plants were planted in organic potting soil in one gallon pots to allow them to grow and develop their root structure for planting in 2010.

Michael Keenan led the crew to build a shade structure for our nursery at the Minneapolis Park and Recreation Board's JD Rivers Children's Garden on Glenwood at Vincent Avenue North (just east of Theodore Wirth Park). The supports and shade cloth will protect our shade loving natives from the harsh sun in the open field. Much of Powderhorn is shady, with many trees. The new transplants were bedded in 2 inches of mulch and then tucked in all around with mulch to the rim of the pot in an effort to protect them through the winter.

In the late fall we received two additional large donations of perennials – approx. 250 flats (4,400 – 1 inch and 4 inch pots) of cultivars from Dragonfly Gardens and approximately 40 gallon pots of natives from MN Native Landscapes. These are over-wintering in staff's backyard with instruction from Dragonfly on how to overwinter plants in their nursery pots – covered in two feet of mulch. We expect approximately 10 – 15% die-off and will do an inventory again in the spring at/after transplanting to gallon pots.

By December 2009, we were over-wintering approximately 4,600 raingarden perennial natives and cultivars for the project (approximately 30 per garden). We will continue to seek donations and plan to buy more natives to add to the mix, but hope to use the funding we don't use on plants to purchase more landscaping supplies – especially materials for downspout redirection and channel drains to divert water from hard surfaces toward our raingardens.

Workshop Coordination and Facilitation

In March, the first episode of *A Neighborhood of Raingardens* a film produced by University of Minnesota's Mark Pedelty was previewed at the Institute on the Environment. The film gives an introduction to raingardens and stormwater runoff and highlights the Powderhorn Park project. It aired on the MN Channel (TPT MN) on 4/22 at 7:30pm, with repeats on 4/23 at 1:30am and 7:30am, and during the month of June. It has provided us a useful tool to introduce participants to raingardens and the project.

We continued to host raingarden parties at participants' homes - 4 parties from January through June with 46 in attendance, and generating 6 new participants for the project. More than a recruitment tool, these parties were raingarden educational events, and a chance to discuss installation details with property owners who were already signed up to participate. They also helped to build community among participants.

On April 24, 2010 Earth Day, we hosted an event at the Powderhorn Park Recreation Center. Project participants were invited to review their plans with Metro Blooms designers. We aired the *Neighborhood of Raingardens* film for about 25 residents.

Working with Blue Thumb, we hosted the National Geographic's Expedition Blue Planet in Powderhorn Park on July 4, 2010 to highlight water quality improvement efforts and the Powderhorn Lake project. The event was promoted to test area residents with an offer of a free t-shirt and native plants for all those who showed up at our booth. At the end of the day, the remaining native plants were donated to Metro Blooms for the project.

On July 19, 2010 we hosted a community meeting for Powderhorn Lake participants at All God's Children church (a participating congregation). About 40 participants showed up to discuss the logistics of the installations, view the film, review their plans with the landscape designers, and sign waiver forms.

Residential Site Review and Raingarden Design

By July 15, 2010 of 100 test-area participants signed up for installation in August, we've completed all of the onsite consultations, 85 raingarden designs, with 15 remaining designs needed.

We are experiencing a lot of no-shows for onsite consultations, which we have to reschedule. When we started the project, our onsite consultation sign-up sheets stated that

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property owners who did not show-up for their scheduled consultations would be ineligible to participate in the project. After struggling to identify participants over the past year, we eliminated this statement and were willing to reschedule appointments – sometimes multiple reschedules. Now that we have met a project threshold of 100 participants, and as we plan for 2011 installations, we will reconsider ways to reduce our no-show rate.

As the installation date approaches, we are hearing from participants who want to make plant changes to their designs. We try to accommodate as much as possible, and meet with many homeowners to discuss changes. Changes are possible when we can easily get the plant, or already have it in stock, but are not possible when the request is for something that is not native.

Additional design adjustments also happen when marking the garden, slightly moving it because the LDA who designed it didn't correctly place the garden. Having many different LDAs with varied experience on the project is good experience for our LDAs, but has created excess confusion and time spent reviewing and changing design and plant selection.

A lot of property owners do not have downspouts, and the landscape designers encourage homeowners to get them installed and directed to the raingarden. In 7 of the 16 gardens installed in June, homeowners re-directed their downspouts to the garden. Three of these, installed new or replaced old gutters and downspouts.

A portion of the people are interested in incorporating their new raingarden with other landscaping they are planning in their yard – which means more coordination for us, but we think it is a good sign in terms of long term maintenance of the gardens.

The soil condition seems to be very porous and relatively nutrient rich. It is ideal for hand excavation. Infiltration rates are very high to begin with.

Unfortunately, there have been few opportunities for raingardens in the back half of the properties, largely due to the fact that it is really built up with garages and driveways and most people are not willing to give up their driveway.

The church properties are receiving and deserving of more planning and resources. It includes involving the congregation in plan approval as well as attention and resources to drain a large parking lot into the raingarden.

At the July 4 Expedition Blue Planet event we received approximately 1,500 additional native plugs that were leftover from this event. These will also be used where possible in our Powderhorn gardens.

Raingarden Installations: Working with Ecoscapes for excavation and the Mississippi River Green Team for planting, from June 14 – 17 we installed 16 raingardens within the original test area, but just outside the final Powderhorn test area. These properties were signed up to participate in the project before the monitoring sites were changed in 2009. Project partners determined that we have resources to install these gardens without affecting our monitoring results. The installations have served as a model for residents of the test area, and also served as a test run for the installation of 100+ gardens in August.

Partners Meeting: On June 24, 2009 the Powderhorn Partners held a kick-off meeting for the project. We agreed to delay excavation of the raingardens until 2010 when we will have adequate pre-test data. A partner list with contact information is attached (exhibit 1). This group is the project advisory team and many have roles in the project implementation.

The partner group met again on December 9 for a project update and particularly to review the monitoring data and make a decision about timing for excavation in 2010. We agreed to delay excavation until August 2, which would allow time to install 150 raingardens in 2010 and still give us time to collect more rain event data that we felt we needed for an adequate pre-test analysis.

Outreach: Over the winter, Metro Blooms gathered address and other data and built relationships with the Powderhorn Park and Central Neighborhood Associations and used their help to establish an e-mail mailing list, gather address information and built a mailing list for the project. The initial outreach packets were mailed out in February with the intended project launch and initial on-site consultations scheduled to begin in April. This method got the outreach and planning process started and resulted in 50-60 initial participants. It also revealed the challenges involved in engaging a demographically diverse community. Outreach methods used to enlist participants in the project included the following:

- Door to door visits (in teams),
- neighborhood e-mail lists and web forums,
- garden parties,
- mass mailings (no name),
- direct mailings (using resident's names),
- project flyers and door knob hangers,
- face to face community events,
- dedicated Hispanic outreach,
- onsite consultations,
- neighbor referrals, and
- phone calls.

Florence Hill is a 90+ year old , long term resident of the neighborhood and an early project supporter who volunteered her time to promote the project. She hosted the first Metro Blooms garden party, which was also the most successful. She volunteered time as a door to door canvasser, and her presence as a neighbor helped many residents overcome their suspicions and concerns about the project. She also helped organize activities such as garden tours. Her involvement in the project generated participation from at least 30 of the 122 property owners who installed a raingarden.

Successes of each method

Direct door to door visits: Door to door recruitment took place in the early evening on weeknights and during the morning on weekends. The efforts took place in the 2 weeks prior to project meetings to attract new participants. There were four door to door recruiting efforts in Powderhorn that took place involving Metro Blooms staff and volunteers. Also U of MN Journalism students also canvassed the neighbor to generate participation (Student volunteers from UMN were helpful, but due to lack of detailed knowledge of the project, often led to the spread of misinformation). Each effort lasted about 3 hours and was able to reach about 20-30 homes per hour.

Out of 20-30 residences visited about 10-15 were home during those times and about 1 in 3 signed up. The survey indicated that others who did not immediately sign up at the door

were more likely to participate. There were 2-3 follow up attempts to recruit those missed in previous canvassing efforts before the final target number was met. Many homeowners were aware of the project before being visited. This made the canvassing more effective as it already had more legitimacy than other door-to-door efforts.

This method got the most people enrolled (according to the post-installation survey). We attribute this level of success to the preliminary mailings and e-mail efforts to spread the word about the project. Many of the residents were already aware of the project when the door to door teams arrived, meaning that this method resulted in prompting the decision to participate for many of the residents. Door knocking was the most effective approach but was also very time intensive. The greatest success resulted from pairings that included a neighborhood resident or volunteer and a Metro Blooms staff. This allowed for the neighbor to attest to the validity of the project and the staff member to answer questions about the process. Metro Blooms created hangers that rested on the doors of the homes visited during the canvassing.

We maintained a project database that kept track of whether or not contact had been made with specific homeowners and their reaction (excited, bothered, hostile). This meant that the homes were not canvassed multiple times.

Neighborhood E-mail lists and Web Forums were the least time intensive, but also did not prove to be particularly effective in generating support for the project. E-mail messages resulted in relatively low rates of return and were not a reliable way to communicate information to project participants due to language, age, and access barriers.

Mass mailings in the early spring of 2010 were the most costly process. This involved assembling a mailing list, printing materials hand stuffing envelopes, and paying for postage. This approach in and of itself was not particularly effective in generating participation, but as it preceded the door to door canvassing many participants were aware of the project when approached in person, resulting in greater openness to participation. We found that people disregarded form letters but were more likely to respond to letters that addressed them by name with a hand written envelope. This personal touch tended to take more time, but yielded better results.

Fliers and Door Hangers: These methods proved to be effective ways to catch the eye of neighborhood residents either as an advertisement on the door of a visited home or when the participant went to church or a commonly frequented establishment. This was a cheap method that required little labor, but also did not seem to yield striking results in terms of direct response from the door hangers.

Face to face community meetings: This method of engaging the community was most successful in communicating technical information about the project. Often, written communications or graphic mailings went unread or failed to inform the population about project timing and goals. Face to face meetings with church congregations, neighborhood groups, and garden parties proved to be an effective way to clear up misconceptions, answer questions, and clearly communicate technical information.

A large map showing the different lots participating in the project was the one that drew the most interest from community members. People reacted to the quantitative display of information on the map and were very interested in technical information that showed the connection between their property and the lake.

Garden parties, in which a resident invites their neighbors over for a party to discuss the project, had mixed results in terms of engaging people. The first party was hosted by Florence Hill, a well-known and long-term neighborhood activist. The party was very effective and well attended (28) with all property owners in attendance signing up to participate in the project. Subsequent events had very poor attendance overall (1-2 at each event). The characteristics of the host seemed to be critical in terms of whether the garden parties were a success or not. Low attendance may have been due to the hosts' lack of relationships in the neighborhood or lack of experience or effort to turn-out folks for an event.

Neighbor volunteers and referrals: The willingness of some neighborhood residents to become strong supporters and advocates of the project resulted in greater trust and legitimization of the outreach process as friends and neighbors proved more willing to trust and commit to the project when they knew someone that was invested in the project and its goals.

Phone calls as a tool for initial recruitment resulted in suspicions that this project was some sort of scam. Whereas, the use of follow up phone conversations was very effective in encouraging people to participate once they had heard about the project. It gave them a way to actively voice their concerns and have their questions answered.

Overall the best process seemed to be an initial broad outreach using electronic media, widely distributed fliers, and to a lesser extent - mass mailings. This mass outreach "primes the pump" by generating a baseline level of familiarity with the project and to reach early supporters. With this level of outreach we were able to reach engaged community members who then were able to provide referrals and access to audiences such as church congregations, community organizations, and gardening clubs. These groups are ideal venues for spreading the word of mouth information about the project and establishing true community engagement. Following the engagement of these key groups the next step is to conduct more targeted outreach based on analysis and mapping techniques. This can include direct mailings, and most preferably door to door canvassing.

Language was definitely a barrier to reaching members of recent immigrant communities. Metro Blooms produced materials for Spanish speaking individuals, but found that these materials did not generate good returns. Our experience indicated that there was greater suspicion of the mailings and community outreach materials, either as a scam or as a way to catch immigrants. Face to face outreach to Spanish speaking persons was much more successful.

Recommended approach to recruit property owners based on lessons learned.

- Start broad and then narrow the focus
- Clear and simple communications from a trusted source
- Use graphics not text
- Ensure that efforts are coordinated and are kept on track

Among the primary factors that influenced recruitment, a FREE raingarden was the largest factor, followed by concern for Powderhorn Lake.

The principle reasons property owners chose not to participate had to do with lack of interest in gardening, general disbelief in the premise of the project, concerns about long term maintenance, and unwillingness to give up space.

There were very few property owners (3) that initially agreed to participate and received an onsite consultation and then choose not to receive a garden. The primary reasons that gardeners backed out of the project was due to extenuating circumstances(a house burned down), difficult personalities (excessive demands, repeated design changes), or changes in homeownership during the project.

Onsite Consultation and Design Approval: Landscape Designers would first meet the homeowner with an onsite consultation, and spend an hour discussing what they saw with their property from a stormwater perspective as well as from a landscaping perspective. The designer also asked the homeowner individual questions about their property, (things they have seen during rainstorms, areas where water has ponded, drainage problems, water in the basement, etc.). From the information gathered from site observation and discussion with the property owner, designers would decide on a garden location before leaving. After the onsite consultation, designers would complete both a stormwater plan and a raingarden design for each property. Each would be sent to the property owner for approval. Almost all designs were approved. Certain homeowners required a little more diplomacy, in which case Michael Keenan, Metro Blooms Lead Designer, would usually provide another onsite consultation to ease their worries. Michael then marked the garden location on each property prior to installation. This also gave the property owner another opportunity to approve or disapprove the design. Installation usually followed the marking within a week. In most cases, Michael had a follow up conversation with each property owner to discuss notable details of the installation, maintenance requirements, and next steps in the project.

Installation:

The test watershed was comprised of an area 1.5 blocks long by 6 blocks wide with early 250 properties. We were planning to install 122 gardens. In an attempt to be as systematic as possible, we planned to move North to South on each block and from West to East (toward the park) across the test area. Communication with the homeowners about their planned installation date was critical. We created a prototypical process in June and we were now able to simulate the larger install and anticipate scheduling complications from several variables such as weather, truck problems, or crew scheduling issues. Originally, we wanted to include homeowners in the installation process, but this proved to be much too time intensive and too cumbersome to fit into our excavation window.

Limiting factors for the installation process

- All soil and turf were removed by hand, people can only remove so much
- All materials had to be delivered and transported by two 1 ton trucks and two hydraulic dump trailers
- Some of the installations were in very small spaces, limiting the crew's progress
- Many times the truck and trailer could not park very close to the excavation site, requiring long distances to be traveled with soil
- Soil excavation takes much longer than planting, which requires a head start for the excavation crew
- Time was wasted waiting for the soil truck and trailer to dump refuse soil
- Some excavations yielded unforeseen buried objects and lines (buried concrete, electric lines, compacted gravel)

The installation process

Two separate crews were utilized (a crew for soil excavation and mulching and a crew for planting). The excavation crew included 5-7 members of the Conservation Corps of

Minnesota supervised by myself. The planting crew included 20 members of the Mississippi River Green Team, a youth crew led by two supervisors and two landscape designers from Metro Blooms.

First, the sod was removed with a sod kicker. All sod was wheel-barrowed to the trailer. In some cases, the property owner requested to keep the sod to use elsewhere in the yard. Second, the soil excavation began. Shovels were used to remove the soil to a 6" depth on average. Some installations required creation of an earthen berm to hold water in the garden or a drainage channel to divert runoff to the garden. Each property possessed its own intricate requirements for drainage and water conveyance. The level and landform of each garden was checked by me with a laser transit. After the grades were close to finished, the bottom of the basin garden was de-compacted and amended with compost when necessary. Shovels were used to turn the soil over to a depth of at least 18" to insure adequate infiltration. Excavated soil was also wheel barrowed to the trailer. All soil and sod was trucked the MPRB tree and soil site at Fort Snelling, 5.5miles away. The garden was immediately mulched after excavation to avoid any problems with erosion.

After mulching, the garden waited to be planted. In some cases the garden would be planted as much as a week after excavation. Soil excavation took about 3 times as long as planting which required careful planning. As a result, we began excavation about one week prior to the start of planting to create a pool of gardens ready to plant. Additionally, the planting crew was scheduled in two separate periods which allowed the excavation crew to create another pool of gardens to plant after the planting crew had caught up halfway through the project. The excavation crew was able to excavate an average of 5 gardens per day while the planting crew was able to plant nearly 15 gardens a day.

The Planting Process

The 20 member crew was split into two, each with a supervisor and a Metro Blooms designer. Plants were delivered to each site either the morning of planting or the night prior. At each site, the designer would lay out the plants within each garden. After layout, the youth crew would begin planting the garden. This activity provided several insights for the youth crew. First, they learned about the basics of planting. Also, they played educational games with their designer and supervisor related to native plants and identification. The designer would check the planting for quality and the crew would move on to the next garden. Each member was also given opportunity to lay out a garden with the designer. By the end of the project, each youth crew member was able to lay out a garden and to identify nearly every plant in it.

System to track plants

We had to keep a running inventory of our stock and what was to be ordered at all times. After all designs were completed, we had a comprehensive plant list for the project. However, several property owners decided to change their garden's palette at the 11th hour. We tried to accommodate as best we could. We also had difficulty locating certain plants. Turtlehead *Chelone glabra*, and Blue Flag Iris *Iris versicolor*, became nearly impossible to find from a MN native nursery at the time of install. Lucius Jonett was the point person in charge of the plant inventory and delivery system. He kept a detailed inventory in his hands (literally) during the entire project. As Michael excavated a couple blocks to the east of the planting crews, slight changes in form and shape were constantly necessary for the gardens which often meant plant changes as well. Lucius and Michael were constantly communicating these changes. From the master inventory, Lucius would prepare a delivery ticket for each property. This was used to locate the plants at our nursery, load the truck, and deliver to each respective property. The ticket was left with the plants and was double

checked by the designer before planting. In certain cases, we had a surplus of plants and in other cases, plants were missing. This required a change ticket for the next day. We tried to create somewhat of a paper trail for each garden. This allowed us, as a team, to ensure that all required tasks had been completed before moving on.

Excavation by hand vs. heavy equipment

In the Powderhorn Park Neighborhood, many of the spaces where gardens were installed are very tight and excavation equipment simply wouldn't fit. When you bring large equipment onto a lawn, sod has to be replaced invariably, which would have slowed our progress. Also, heavy equipment has a soil compaction factor which would inhibit infiltration elsewhere. The goal of the project was to make the neighborhood more pervious. For the majority of the project, a crew of 5-7 people armed with spade shovels and sod kickers was the optimal tool.

Heavy equipment was used in a few instances. Five raingardens were built at churches to capture surface runoff from their parking lots. Three of these five were built with the help of an excavator. Much of the soil around a parking lot is heavily compacted and is very difficult to dig by hand. Also, the scale of these gardens was much larger to accommodate the scale of the much larger drainage area.

Soil removed, mulch applied, MN native plants planted

Overall, 200 yards of soil was removed. 175 cubic yards of shredded hardwood mulch was applied to 122 gardens. Nearly 15,000 plants were installed.

Final Installations and Maintenance

In June 2011, Metro Blooms organized events for volunteers and Powderhorn participants to get to know the project, receive training and assistance to install boulevard gardens to capture stormwater, and to check in to see how the gardens were doing. Volunteers and participants were asked to join us on Saturday, June 11th for a day-long event in the neighborhood to maintain gardens planted in 2010 and to install new boulevard gardens.

On May 28, 2011 we toured the Powderhorn project. Powderhorn participants and volunteers were paired with Metro Blooms Landscape Designers and given a list of raingardens to visit, talk about how their gardens are doing, and make appointments for June 11th installation and maintenance.

Then on June 4, volunteers were trained on how to install boulevard gardens, do downspout redirection, and other water capturing features. Volunteers also assisted Metro Blooms staff in marking project locations and conducting preliminary site visits and follow-up meetings.

On June 10, volunteers assisted in preparation for the Powderhorn raingarden maintenance event. We met at All God's Children Church and assembled boulevard garden packages for boulevard tolerant plantings that will have interest and beauty and are divisible by 100 square foot areas.

Lastly on June 11, 2011, Powderhorn maintenance event volunteers assembled to assist participants with re-planting efforts, downspout redirection, and boulevard garden creation. Metro Blooms board and fundraising committee hosted a luncheon at Mount Olive Church: preparing bratwurst hot-dogs, chips, and sodas for all volunteers, neighborhood participants, and staff.

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Throughout the week of June 13th – 17th: Staff and volunteers provided assistance with re-planting, downspout redirection, and re-mulching assistance as they were available.

A total of 23 new boulevards were and 5 new raingardens were installed by residents and volunteers with staff oversight.

We also worked with contractor, Ecoscapes to install:

- At the home of Florence Hill, a rubber razor across the 300 sq. ft. of gravel driveway and 683 sq. ft. garage and redirect run off to a raingarden.
- At Mount Olive Church, a 480 sq. ft. permeable strip at the driveway entrance to the parking lot to disconnect 3,444 sq. ft. of parking lot.
- All God's Children: a 185 sq. ft. permeable strip to disconnect 3,348 of parking lot.

Raingarden Installation.

Following the final and maintenance event in June, landscape designers visited the gardens from time to time to deliver extra plants, conduct check-up visits, provide one-on-one maintenance training, and other follow-up with property owners regarding their gardens.

Information Consolidation and Presentation

The final weeks of the year were spent in gathering project data for the final report, preparing presentations for groups interested in learning more about the project, and creating maps for the final report. Michael Keenan presented the citizen engagement successes and struggles to staff of the Ramsey Washington Metro Watershed District who had struggled with a citizen engagement project of their own.

Final Project Planning

Also in late 2012, were looking ahead to 2012 to consider how best to utilize remaining funds, given the likelihood that there will be significant plant loss in some of the gardens.

Raingarden Workshop – Powderhorn Recreation Center

A raingarden workshop, sponsored by the City of Minneapolis, was hosted in June 2012 at the Powderhorn Recreation Center to introduce 33 property owners around the lake to the beauty and benefits of raingarden and how to install one in their yard.

Raingarden Maintenance Events

In May, we hosted a maintenance training event at All God's Children Church, with free replacement plants to attendees, as well as onsite consultations and maintenance assistance - 12 households participated. In addition, landscape design staff led a crew of Conservation Corps of Minnesota members to maintain and replant the parking lot raingardens of All God's Children and Mt. Olive Lutheran church.

Raingarden Maintenance Literature

A final report of the project results accompanied a Raingarden Maintenance Brochure that was mailed to all project participants, thanking them for participating in the project and asking them to maintain their gardens and to share their information with friends and neighbors.

Permanent Project Sign at the Artstop Gardens

Though our surveys indicate that some participants remain quite indifferent to the water quality benefits and beauty of their raingarden, others have become true water stewards and raingarden enthusiasts. Including our first Raingarden Party Hostess, Florence Hill, who allowed us to install a permanent project sign on the property adjacent to her home that she has set aside for the neighborhood, and which she calls “the Artstop Garden.”

“Hello...Just a update from the Artstop Garden...the raingarden sign is doing just fine and getting good attention! Thank you for all of your work in making this great contribution to our green space happens! -- *Florence and neighbors*”

Deliverable 2: Participation Records

Stormwatershed Audit. The Mississippi River Green Team also completed a Stormwatershed Audit of the test area. Michael Keenan presented a raingarden workshop to teach the students about raingardens. Rusty Schmidt trained the team on an audit tool modified for an urban environment based on a stormwatershed audit tool created by the Washington Conservation District (see attached). Metro Blooms Landscape Design Assistants led the Green Team as they completed the assessment of every property in our test and control area. A copy of the tool is attached. The data has not been analyzed, but will be used as another pre-test measure to determine the impact of stormwater education and participant initiated stormwater management practices beyond the project installed raingardens. As they walked the neighborhood, they also distributed flyers about the upcoming workshops to inform the community about the Neighborhood of Raingardens Project, and upcoming raingarden workshops in the area.

Participants: By year end 2009, the net result of our promotions, raingarden parties and canvassing was a total of 63 property owners who signed up to participate in the project, this included two congregations: Mount Olive Lutheran Church and All God’s Children, both on 31st Avenue in the test area.

We set July 15 as our deadline to sign up for participation in the August installations. Our numbers for August installations continue to go up and down, but remain around 100. Recent properties to sign up for participation include properties owned by Urban Homeworks, who were contacted by Councilmember Elizabeth Glidden to encourage their participation.

A small number of sites will receive two raingardens, so the final number of raingardens will be slightly higher than the number of participants. We assume that the number of participants will continue to dip as the last few designs and waiver forms will likely include the people who have been most loosely involved with the project. We expect numbers to go back up as wavering or skeptical residents see the gardens being installed.

Of participating properties, 11 are rental units, and 6 are owned by non-profit organizations. Another 3 properties are churches, which leaves about 80% of our participants as homeowners.

We estimate 75% owner-occupied properties in the test area, only slightly lower than the estimated 80% among participants. If these numbers are correct, we have a 50% participation rate among owner-occupied properties.

We estimate that 8 current participants are in primarily Spanish-speaking households. This is out of an estimated 36 Spanish-speaking households, or just under one quarter of the Spanish-speaking households in the test area. If the overall rate of Spanish-speaking households in the neighborhood is around 16%, our participation rate for this group is half that at 8%.

As anticipated, encouraging participation has been more challenging among rental property owners, non-profit property owners, businesses, and non-English speaking households.

Result 2: Monitoring, Data Analysis and Reporting

Description:

This task involved the watershed monitoring, data assessment, and reporting activities of the project. Monitoring was performed at two sites for the project duration. Monitoring activities included: installing and maintaining the equipment, collecting and analyzing samples, and managing the data, including quality control of reported results. The effectiveness of citizen-based stormwater management programs was documented through two reports: "Evaluation of Three Citizen-Based Approaches to Stormwater Management" and "A Citizen-Based Approach to Improve Powderhorn Lake Water Quality". The first report compares and analyzes the effectiveness of the existing, Neighborhood of Raingardens, and institution-based approaches. The second report documents the monitoring and paired watershed analysis results comparing targeted neighborhood Raingarden installations to a control area (no raingardens). Additional reports provided through this task included the biannual progress reports and final report to LCCMR. Project management of work and quality control/assurance for the assessment elements of the project are an integral part of this task.

Final Project Summary

Stormwater monitoring was the key driver for the project schedule. The three year period was selected to provide as much time as possible to collect an adequate number of samples to establish the runoff characteristics of the watershed in a test and control area before and after the raingardens were installed.

Monitoring in urban storm sewers has its challenges, and these sites and climatic conditions provided various issues resulting in insufficient data to statistically show that the Powderhorn Lake Neighborhood of Raingardens improved the water quality of the runoff going to Powderhorn Lake. However, the few water quality samples collected in 2011 provide promise that the test neighborhood efforts could have reduced total phosphorus and total suspended solids loadings when compared to the control area.

In the paired watershed analysis, same storm event data are compared in the calibration and the treatment period. The regression analysis results show that the BMP did not influence the runoff volume. The result is not surprising, given that only 10% of the impervious area was directed to a BMP. The impervious areas in the public right-of-way dominate the land use and the ability to redirect enough volume from private properties. There is not enough data to provide a statistically significant regression result for total phosphorus and total suspended solids.

The City of Minneapolis will continue to support the monitoring at the same test and control sites as in the past three years. The MPRB will be using new instrumentations to improve efficiencies in downloading data and checking for equipment problems.

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Amendment Request: 06/01/11: MPRB staff reviewed their remaining budget and planned expenditures that would be billed to the project. An estimated \$16,437 in unallocated expenses related to sample collection and administration of the project were included in the original budget, but will not be billed to the project. This will result in an in-kind contribution of the same amount from MPRB to the project. This amendment request is to transfer that amount (\$16,437) from Result 2 to Result 1.

Amendment Approved: June 14, 2011

Summary Budget Information for Result 2:	Trust Fund Budget: \$ 74,123.00
	Amount Spent: \$ 74,112.88
	Balance: \$ 10.12

Deliverable	Completion Date	Budget
1. Installation/maintenance of equipment (2 sites @ 3 yrs.)	May 2009 ¹ –Jun 2012	\$21,563
2. Monitoring data management	Ongoing ¹	\$ 2,000
3. Evaluation Report 1: Draft/Final, Evaluation Report 2: Draft/Final	May 2012/Jun 2012	\$50,560

¹Pre-project and portion funded in-kind by City of Minneapolis and MPRB

Background

The Minneapolis Park and Recreation Board was responsible for monitoring the storm sewers for flow volume and hydrograph sample collection for TSS (Total Suspended Solids) and TP (Total Phosphorus), and reporting the resulting data.

Deliverable 1: Installation/maintenance of equipment

Two locations were outfitted for monitoring on 9/11/09 at 31st Street East and Elliot Avenue South, and at 35th Street East and Columbus Avenue South in Minneapolis. The monitoring equipment was installed upstream in 24" reinforced concrete pipes (RCP) at these two locations.

The weather station data was measured using a Davis Weather Wizard III station located at 38th Street West and Bryant Avenue South and is downloaded daily.

Methods

Events measured for the project were defined as precipitation greater than 0.10" at the station.

Each pipe location was monitored with ISCO stormwater equipment:

1. 2150 datalogger (new)
2. 2105 control module (new)
3. digital low profile AV probe
4. 24 bottle multiplexed auto-sampler (either a 3700 or 6712) complete with 3/8" ID vinyl tubing and standard intake strainers.

Following installation flow pacing was adjusted for each watershed. Flow volume and hydrograph sample collection for TSS and TP were collected. Dataloggers were

downloaded every two weeks or whenever there was more than 0.10" of precipitation. This definition was loosened when the sites were moved in September in order to collect more samples.

The laptop database was de-fragmented and backed-up each month to the MPRB network.

Data Products

The data presented by the MPRB include:

- 1) A "raw" unedited electronic copy of the database of each site for the time monitored.
- 2) Copies of all field notes.
- 3) A copy of weather/precipitation measurements from the MPRB weather station along with a table of monitored events.
- 4) All laboratory values for the event (TSS and TP) samples monitored.

Data Collection Challenges

At the project initiation in May 2009, two 36" RCP were chosen at 33rd Street East and 10th Avenue South (test), and at 35th Street East and 12th Avenue South (control) in Minneapolis. Installation was completed on 6/3/2009. The test site was found to have significant problems with standing water, decaying organic debris and sand deposition in the pipe, which prevented accurate measurement of stormwater. Minneapolis Public Works attempted to remedy the problems by cleaning the pipe, but this was not successful.

In late summer, two new monitoring locations were chosen at 31st Street East and Elliot Avenue South, and at 35th Street East and Columbus Avenue South. The monitoring equipment was installed in 24" RCP at these new locations on 9/11/09. Once installed one of the brand new 2150 dataloggers with area velocity probe had to be sent back to the manufacturer for repair under warrantee. This necessitated borrowing like equipment from ISCO and re-installing it. Some storm events were missed.

In late fall heavy leaf litter or sand covered the area velocity probe at 31st and Elliot which necessitated switching from direct volume measurement to a Manning's equation for calculating volume. When uninstalling the monitoring equipment 11/30/09 it was noted that both of the new sites had significant sand accumulation around the AV probes. There was no sand noted at these sites during installation 9/11/09. In future monitoring it will be necessary to offset the AV probes approximately 1 inch to avoid sedimentation.

The problems with site conditions and equipment coupled with dry conditions resulted in few monitoring events of paired sites (control and test) in 2009. Efforts will be focused to clean monitoring sites and install equipment as early in the spring as possible to collect 2010 runoff data before rain gardens are installed.

In 2009 the number of site visits:

- ï 35th/Columbus (35th/12th) – 34 site visits
- ï 31st/Elliot (33rd/10th) – 32 site visits

For 2010, the monitoring equipment was installed on 4/7/10 at 35th and Columbus, and on 4/8/10 at 31st and Elliot. The tipping bucket rain gauge was installed mid-April on top of the Powderhorn Recreation Center. All the equipment appears to be working fine. The only notable event was 6/26-27/10 we had ~2.5" of rain and experienced surcharging in the pipes and flooded out some of the equipment which made collecting samples of the storm impossible. The good news is that nothing was damaged.

The 2010 storms we have thus far include:

Date (storms end)	31 st & Elliot	35 th & Columbus	Powderhorn Gauge Precip. (in)
3/1/10	X	X	-Snowmelt
4/15/10	X	X	~1.19
5/8/10	X	X	~0.71
6/2/10	X	X	~0.15
6/11/10	X	X	~0.90
7/5/10	X	X	~0.66

Installation

In 2010 the two locations were outfitted for monitoring on 4/8/10 at 31st Street East and Elliot Avenue South, and 4/7/10 at 35th Street East and Columbus Avenue South in Minneapolis. The monitoring equipment was installed in 24" and 30" reinforced concrete pipes (RCP) at 31st and Elliot and 35th and Columbus, respectively. Both sites were outfitted with two 2150 dataloggers, two low profile A/V probes, one 2105 control module and a flow paced ISCO auto sampler.

In 2010 the precipitation data was measured using an Onset Hobo datalogger and a Nova Lynx tipping bucket (1/100th of inch) located on the large flat roof of the Powderhorn Park Recreation Center, 3400 15th Ave South, Minneapolis. The equipment was installed on 4/12/10 and removed on 11/19/10.

Methods

Events measured for the project were defined as precipitation greater than 0.10" and separated by 8 hours.

Each pipe location was monitored with ISCO stormwater equipment:

5. Two (2) 2150 dataloggers
6. 2105 interface control module
7. Two (2) digital low profile AV probes (one invert, one offset)
8. 24 bottle multiplexed (96 samples) auto-sampler (either a 3700 or 6712) complete with 3/8" ID vinyl tubing and standard intake strainers.

Following installation flow pacing was adjusted for each watershed. Flow volume and hydrograph sample collection for TSS and TP were collected. Dataloggers were downloaded every two weeks or whenever there was more than 0.10" of precipitation and samples collected.

The field laptop database was de-fragmented and backed-up each month to the MPRB network.

Data Products

The data presented by the MPRB include:

- 5) A "raw" unedited electronic copy of the database of each site for the time monitored.
- 6) Copies of all field notes.
- 7) A copy of weather/precipitation measurements from the MPRB weather station along with a table of monitored events.

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- 8) All laboratory values for the event (TSS and TP) samples monitored.
- 9) All associated QAQC sampling data e.g. monthly performance standards, equipment blank, field blanks, etc.

Data Collection Challenges

In 2009 debris and sedimentation over the invert A/V probes necessitated in 2010 a second A/V probe to be installed but offset slightly up the side of the pipe. This configuration allowed the most accurate level data from the invert and velocity data from the offset probes to be collected. This set up appeared to work well for accurately flow pacing the samplers.

The persistent sedimentation over the invert area velocity probes may have added to excessive power consumption as the buried invert velocity probe continually searched for a signal. The datalogger batteries were changed both in June and August.

When uninstalling the monitoring equipment 11/12/10 it was noted again that both sites had significant sand accumulation around the invert AV probes. There was no sand noted at these sites during installation 4/7-8/10.

In 2010 the number of site visits:

- 35th/Columbus – 36 site visits
- 31st/Elliot – 35 site visits

Summary of the preliminary review of 2010 monitoring data for the test and control sites for the project.

Table XX. Precipitation event data and samples collected in 2010. A precipitation event is defined as being greater than 0.10 inches and separated by 8 hours. Rain gage located at 3800 Bryant Ave. S., Minneapolis, MN.

Event	Start Date/Time	End Date/Time	Precip (inches)	Duration (hours)	Intensity (in/hr)	Sample Type		
							31st & Elliot	35th & Columbus
+1	3/1/2010	n/a	n/a	n/a	n/a	grab	X	X
2	4/15/2010 200	4/15/2010 545	0.47	3.75	0.125	composite	X	X
3	5/5/2010 1645	5/8/2010 245	0.67	58.00	0.012	composite	X	X
4	6/1/2010 1515	6/2/2010 630	0.16	15.25	0.010	composite	X	X
5	6/25/2010 5:45	6/25/2010 7:30	2.05	1.75	1.171	composite	X	X
6	7/5/2010 14:00	7/5/2010 23:15	0.61	9.25	0.066	composite	X	X
7	8/12/2010 2030	8/13/2010 515	1.15	8.75	0.131	composite	X	X
8	8/31/2010 330	8/31/2010 615	0.46	2.75	0.167	composite	X	X
9	10/24/2010 145	10/24/2010 315	0.47	1.50	0.313	composite	X	X
10	10/25/2010 1615	10/26/2010 1615	1.01	24.00	0.042	composite	X	X
Totals			7.05				10	10

+ snowmelt event

n/a = not applicable

X = event sampled

Key Findings at Project Mid-Point

- Over 20% of the runoff from impervious surfaces in the test area was redirected to rain gardens.
- Data collected to date looks promising to provide the data required for a statistical paired watershed analysis. An assessment of the performance of the rain gardens to reduce runoff and pollutant loadings to Powderhorn Lake will require the 2011 monitoring season data.

Runoff Directed to Rain Gardens

- Over 20% of the runoff from impervious surfaces in the test area was redirected to rain gardens.
- Exhibit A shows the relationship of total area to impervious area in the test watershed and what has been redirected to rain gardens.
- Statistics
 - Total Test Watershed Area = 1, 241,500 sf
 - % of impervious area to total area = 58% impervious areas such as sidewalks streets, rooftops, driveways, and parking lots; source: City's GIS database)
 - Number of properties with rain gardens in test area = 102
 - Total area of properties with rain gardens = 550,000 sf
 - Impervious area in properties with rain gardens = 270,000 sf (49%)
 - Impervious area redirected to rain gardens = 56,000 sf
- The installation of rain gardens on 102 properties in the test area redirected runoff from approximately 56,000 sf of impervious surface. This accounts for a 21% decrease in impervious surface runoff from the properties that installed rain gardens. Extrapolating this to the total test area of 28.3 acres (1, 241,500 sf) and using the City's GIS-based estimate of 58% of total area as impervious, the impervious area redirected to rain gardens as a percent of the total impervious area for the test watershed is 8%.

Monitoring Findings

What we learned from the 2010 stormwater monitoring.

- Moving the monitoring location for the test and control sites provided us a more optimum test and control area to compare performance.
- Reducing the size of the test and control area watersheds will increase our ability to assess performance with the monitoring data.
- The test and control watersheds have similar runoff event characteristics as shown by comparing storm event flows for April 15, 2011 and September 22, 2011
- Having similar runoff characteristics reduces the inherent variability in comparing runoff from different watersheds and storm events which improves the ability to measure a difference in runoff between the test and control areas.
- The collection sites still contained sand/grit and debris, but the use of the invert and offset probes at the levels set in the pipe provided for accurate flow monitoring and sample collection.
- The new monitoring sites provide better site conditions for accurate data collection; however, there are still limitations at these sites with characterization of high intensity storm events. The 2010 summer and fall saw several 1-inch or greater storm events with intensities that caused the storm sewers to surcharge. The surcharge events prevented the ability to collect water quality samples during those events as water filled the manhole and submerged the equipment. The data loggers still recorded flow during this time.
- Flow during portions of the peak storm periods is not accurate during surcharging. For some events, estimated flows or total storm volume will be
- made, but some storm events will be excluded from analysis. Exhibit D summarizes the results from select storm events and Exhibit E provides the precipitation record.

Recommendations for 2011 Monitoring

It was recommended that our project team work with the MPRB to identify the optimum times to collect water quality samples. We should target storms with higher volumes with less intensity.

Methods

FlowLink 4 files obtained from the MPRB for 2010 sampling were merged with the rain gage data collected at the Powderhorn Lake center monitoring station. The data were reviewed to compare the readings obtained for precipitation, invert level, invert velocity, offset level, offset velocity, battery power, and sampling times.

The objectives of this preliminary data review included: (1) Review precipitation with flow monitoring and nearby precipitation records to confirm new rain gage is suitable for use in analysis, (2) compare invert and offset probe records and select method for all data analysis, (3) compare test and control hydrographs to expectations based on runoff area, and (4) compare selected pre- and post-rain garden installation (BMP) storm event runoff volumes. The pre-installation period is defined by Fall 2009 and April-August 2010 rain events and the post-installation period extends from September 2010 through 2011.

The analysis of pre- and post BMP runoff to compare the performance of the rain gardens cannot be performed until the 2011 monitoring season is complete. The analysis (paired watershed analysis) requires a significant number of rain events to make a statistically significant conclusion. Select hydrographs were compared to show the variability in rain events and the need to compare a range of rain events to assess performance. Metro Blooms staff reviewed the stormwater management plans for each property owner and compiled the impervious area redirected to rain gardens.

For 2011, 31st and Elliot flow data, MPRB discovered had a significant ISCO software issue mid-summer that kept the site from sampling and collecting accurate flow totals 7/15/11 to 8/24/11. The long downtime for the equipment occurred because staff did not know it was a software issue until they replaced all of the equipment -one piece at a time (and then waited for the next storm). After the problem was fixed it (by re-imaging the datalogger) we had a significant drought lasting through the end of summer and through the fall. As a result, very few paired data sets were captured following the final June installation and maintenance events.

A preliminary data check (10% data check) indicated that none of the 2011 chemical data should be marked suspect as the lab passed all of its monthly blind performance standards.

Deliverable 2: Monitoring Data Management

As monitoring data became available, Craddock Consulting Engineers (and later SEH Engineers where Patti Craddock became an employee) began preparation for efficient use of data provided by the Minneapolis Park and Recreation Board, and to prepare for analysis and use in project reports, including preparing precipitation data for incorporation with monitoring data.

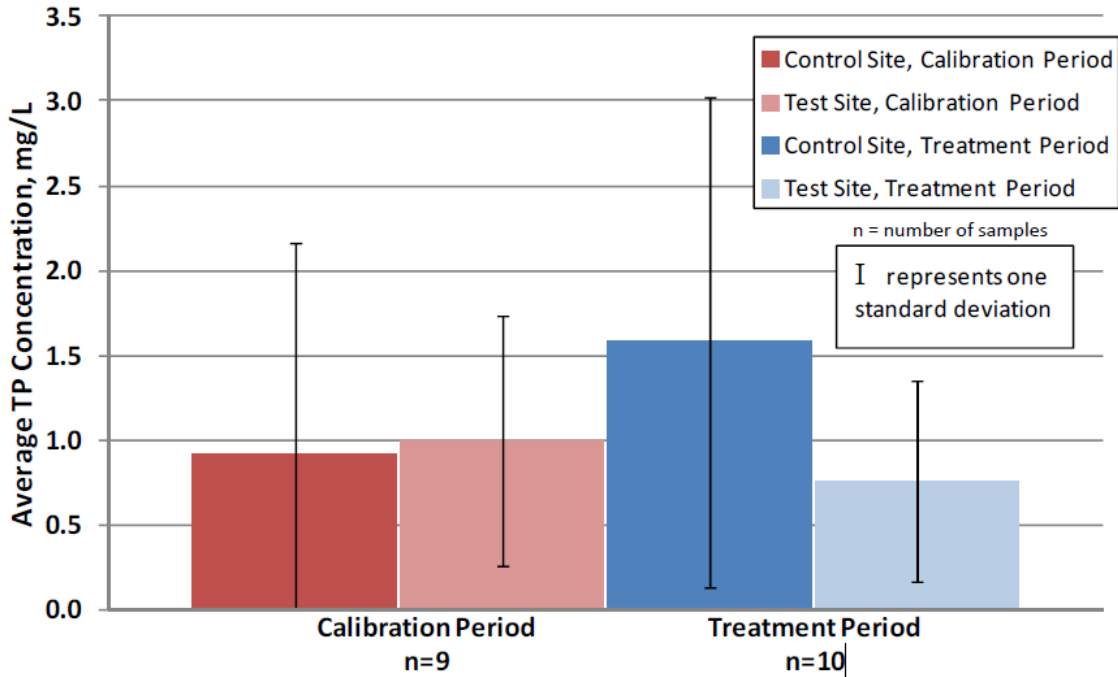
Deliverable 3: Evaluation Reporting

Performance was measured by monitoring the water quality and quantity of stormwater to see if there was a measureable difference in the pollutant loadings going to Powderhorn Lake from the area with raingardens (test site) and a similar watershed without raingarden installations (control site).

Measured Results

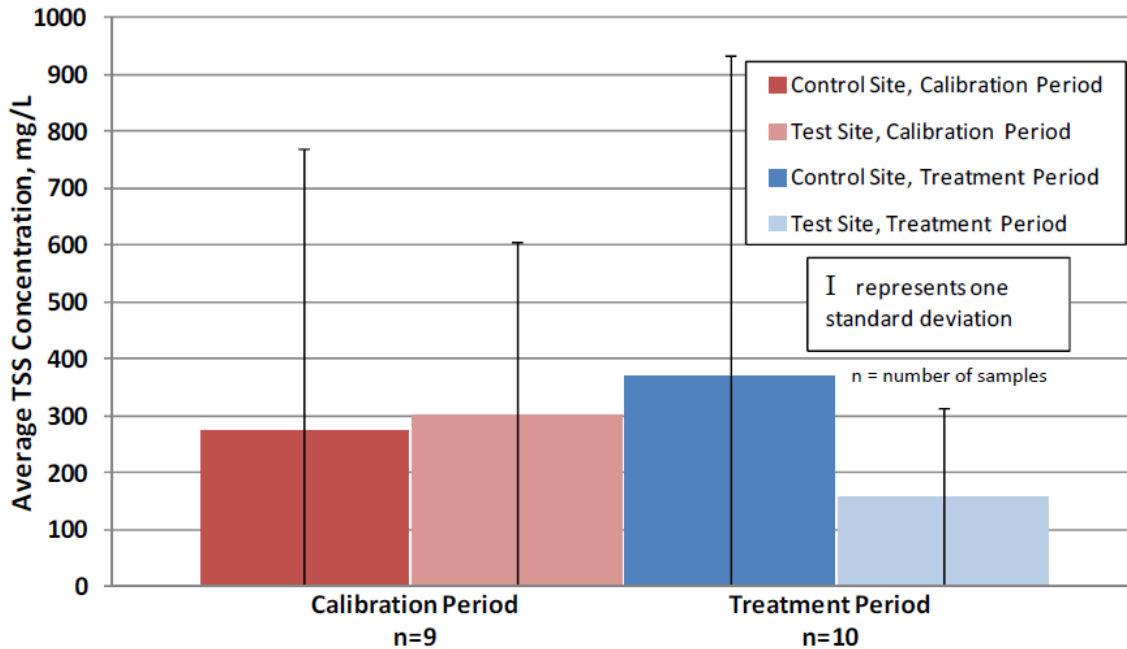
Monitoring in urban storm sewers has its challenges, and these sites and climatic conditions resulted in less samples than planned. While the paired watershed analysis results are inconclusive and do not show a statistically significant outcome, the few water quality samples collected in 2011 provide promise that the test neighborhood efforts could have reduced total phosphorus and total suspended solids loadings when compared to the control area. Figures 25 and 26 present the average total phosphorus and total suspended solids concentration results. As shown by the error bars, there is a wide variation in samples.

Figure 24 – Average Total Phosphorus Concentration



In the paired watershed analysis, same storm even data are compared in the calibration and the treatment period. The regression analysis results show that the BMP did not influence the volume of runoff. This result is not surprising, given that only 10% of the impervious area was directed to a BMP. The impervious areas in the public right-of-way dominates the land use and the ability to redirect enough volume from private properties. There were not enough data to provide a statistically significant regression result for total phosphorus and total suspended solids.

Figure 25 – Average Total Suspended Solids Concentration



While the monitoring data may not statistically tell the story, the fact that 45 households participated in maintenance days and over 132 bags of debris were collected is significant and indicates that education and action influenced community members to improve Powderhorn Lake water quality. In addition 76% of survey respondents indicated that they further enhanced their garden with plants, landscape materials or art. At least 56% implemented additional BMPs in their yard (e.g. adding a rain barrel or additional raingarden).

V. TOTAL TRUST FUND PROJECT BUDGET:

Personnel: \$ 77,140 – This includes \$30,540 for a newly created position of program coordinator at Metro Blooms. It is a part-time, 0.3 FTE position. The program coordinator monitored and recruited participants, monitored schedules and budgets. It includes \$13,400 for a newly created position as neighborhood coordinator (.125 FTE). It also includes newly created positions as Metro Blooms Landscape Designers. It was a part-time, .2 FTE position (\$26,000). The Landscape Designers provided onsite supervision at all excavations, raingarden workshop presentations, onsite consultations, raingarden design and oversight. Administrative Assistant this was an expansion of .05 FTE of an existing position for data entry and reporting for this project (\$7,200)

Contracts: \$ 156,773 - Partner contracts include identified partners: 1) \$27,750 - Minnesota Conservation Corps (Raingarden excavation – Mon - Thurs), 2) \$13,900 - Ecoscapes (Raingarden excavation), 3) Minneapolis Park and Recreation Board: Monitoring - \$ 23,563 and Green Team (youth crew for landscape services) - \$20,000, 4) \$20,400 – Landscape Design and Architecture (LDA) Students from U MN for landscape design services, 5) \$1,100 - Rusty Schmidt, for onsite consultation training and technical review, 6) \$48,000 - Craddock Consulting Engineers and SEH Engineers, data assessment, evaluation report preparation, and technical review, and 8) \$2,060 – Latino community workshop and installation organizing.

Educational Materials and Final Report: \$ 12,350 – Raingarden workshop educational packet, promotional door-hangers for Powderhorn residents, display materials, and raingarden signs, including a permanent interpretive sign for self-guided tours. Also includes evaluation report composition, printing and binding.

Native Plant Supplies \$11,250

Landscaping Tools/Supplies: \$15,737 – This includes shovels and rakes, mulch and compost, and periodic rental of excavation equipment, as needed. It also includes materials for the redirection of downspouts including pipe extensions, catch-basins, and grates, and materials for installation permeable pavement and channel drains and other materials to redirect stormwater to raingardens.

Travel: \$ 3,250 – Travel costs related to in-town mileage (\$.51- \$.585 per mi), primarily for staff and landscape designers traveling to the Powderhorn.

TOTAL TRUST FUND PROJECT BUDGET: \$ 279,000

VI. PROJECT STRATEGY:

A. Project Partners: Multiple project partners, many providing matching funds and in-kind services, delivered this project. Each partner brings invested team members looking for answers and sustainable programs to achieve their organization's water quality goals.

Metro Blooms is the lead organization with technical assistance and evaluation provided by Craddock Consulting Engineers.

The following organizations (contact person) will be significantly involved:

- City of Minneapolis - (Lois Eberhart), Technical review for the project was provided by Lois Eberhart, City of Minneapolis Surface Water & Sewers Administrator. The City will also provided GIS services and pre-project monitoring activities to provide an adequate pre-test data set.
- Minneapolis Park Recreation Board - (Tim Brown, P.E., Michael Perniel and Deb Pilger), MPRB, provided monitoring services for the Powderhorn Lake study.
- Minnehaha Creek Watershed District - (Udai Singh and Julie Westerlund), Technical review for the project was provided by Udai Singh, MCWD's water quality specialist, and by Julie Westerlund and Leslie Yetka, education and communications manager.
- Minnesota Conservation Corp - (Brian Miller), Young Adult Program excavated and assisted with the installation of raingardens.

B. Project Impact and Long-term Strategy: The organizing approach has had a direct benefit to Powderhorn Lake, an impaired water body in Minneapolis and within the MCWD. The study results have been integrated into adaptive management by the City, MPRB, and MCWD for achieving TMDLs. It was recognized in the recently adopted TMDL for Lake Nokomis.

The publicity for the Powderhorn Lake Neighborhood of Raingardens program led to similar effort in neighborhoods throughout the Twin Cities metropolitan area. Metro Blooms has completed smaller scale Neighborhood of Raingardens projects in the following Minneapolis

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neighborhoods: Victory, Cleveland, Diamond Lake, Linden Hills, Lynnhurst, Audubon, Holland, Bryant, and Bryn Mawr, as well as, the Schmidt Lake neighborhood in the City of Plymouth. We also have projects in-progress or planned in the Holland neighborhood, East Lake of the Isles neighborhood, with the City of Bloomington, around Lotus Lake in Chanhassen, and around Lake Nokomis in Minneapolis.

The project has increased awareness in the metro area about urban runoff and the impact the private citizen can have on water quality. The organizing approach has been applied to urban areas across the Twin Cities metropolitan area, and adopted by cities and watersheds who are implementing the approach without our involvement.

C. Other Funds Proposed to be Spent during the Project Period: \$115,500

Minnehaha Creek Watershed District: \$25,500 Matching Support (\$15,000 approved, year 1, \$5,500 approved year 2, \$5,000 approved year 3). Minneapolis Park and Recreation Board: (Green Team) \$10,000 and (Unallocated Expenses of data collection and project administration) \$16,437 Matching Program Support, McKnight Foundation: \$80,000 Operating Support

D. Spending History: not applicable

VII. DISSEMINATION:

A Neighborhood of Raingardens a film produced by University of Minnesota's Mark Pedelty was previewed at the Institute on the Environment. The film gives an introduction to raingardens and stormwater runoff and highlights the Powderhorn Park project. It aired on the MN Channel (TPT MN) on April 22, 2011 at 7:30pm, with repeats on April 23, 2011 at 1:30am and 7:30am, and during the month of June. The film has been shown at neighborhood events and co-ops and is available to be viewed online or for download at www.raingardenmovie.org.

Metro Blooms gave a presentation on the project to the Watershed Partners and Blue Thumb partnerships, collaborations of water resource professionals and private contractors. In addition, we will be presenting our project approach and study results on October 17 at the Water Resources Conference, a state-wide event that showcases innovative, practical, and applied water resource engineering solutions, management techniques, and current research about Minnesota's water resources.

All project partners received a copy of the final report and executive summary. All project participants received a copy of the executive summary with accompanied raingarden maintenance brochure. The full report and executive summary will be available on our website at www.metroblooms.org. Additional copies of the executive summary will be made available at outreach events and upon request, while supplies last.

VIII. REPORTING REQUIREMENTS: Periodic work program progress reports were submitted for the periods ending December 2009, July 2010, December 2010, July 2011, and December 2011. A final work program report and associated products was submitted between July 30 and August 15, 2012 as requested by the LCCMR.

IX. RESEARCH PROJECTS: not applicable

Reimbursement Request – Invoice Summary Spreadsheet - Part 2

Project Title: **CITIZEN-BASED APPROACH TO STORMWATER**

Legal Citation: Laws of Minnesota 2009, Chapter 143, Section 2, Subdivision 5e.

Budget for Results from Work Program Budget Item	Approach)			Reporting)			Project Total		
	Budget	Amount Spent	Ending Balance	Budget	Amount Spent	Ending Balance	Budget	Amount Spent	Ending Balance
	Neighborhood Approach			Monitoring, Data Analysis and					
BUDGET ITEM - Total for 3 Years									
Personnel: Wages and Benefits									
Sam Geer, MLA, project coordinator (0.2 FTE)	30,540	30,540.00	-				30,540	30,540.00	-
Bryan Pynn (.125 FTE neighborhood coordinator)	18,890	18,890.00	-				18,890	18,890.00	-
Michael Keenan, Lead Landscape Design Assistant (.2 FTE)	26,000	26,000.00	-				26,000	26,000.00	-
Deborah Jopp (.05 FTE), data entry and reporting	7,200	7,200.00	-				7,200	7,200.00	-
Contracts									
Minnesota Conservation Corp, excavation of raingardens	27,750	27,510.00	240.00				27,750	27,510.00	240.00
Ecoscapes, excavation of raingardens	11,900	11,900.00	-				11,900	11,900.00	-
Minneapolis Park and Recreation Board									
Stormwater Monitoring, Water Quality and Volume				23,563	23,563.00	-	23,563	23,563.00	-
Green Team, youth crew	20,000	20,000.00					20,000	20,000.00	-
Landscape Design Assistants	20,400	20,400.00	-				20,400	20,400.00	-
Rusty Schmidt, Onsite consultation training and technical review	850	850.00	-				850	850.00	-
Craddock Consulting Eng, Data Asees, Report Prep, Tech Review				48,000	48,000.00	-	48,000	48,000.00	-
Carlos Zinghre: Latino community experimental design, monitoring	2,000	2,000.00					2,000	-	
				60	60.00		60	60.00	-
Capital equipment over \$3,500⁸									
Educational Materials -	12,350	11,963.62	386.38	2,500	2,489.88	10.12	14,850	14,453.50	396.50
Native Plant Supplies - propagation and supplies	12,790	12,735.53	54.47				12,790	12,735.53	54.47
Landscaping supplies and equipment (less than \$3,500)	10,957	10,807.53	149.47				10,957	10,807.53	149.47
Travel expenses in Minnesota	3,250	3,250.00	-				3,250	3,250.00	-
Column Total	204,877	204,046.68	830.32	74,123	74,112.88	10.12	279,000	276,159.56	840.44