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Amanda Sterna
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WHAT ARE THE ELEMENTS OF A STRONG RATIONALE TO SUPPORT THE
DEVELOPMENT AND CREATION OF A RAIN GARDEN IN MY SCHOOL DISTRICT?

Amanda K. Sterna

WA capstone submitted in partial fulfillment of the requirements for the degree of Master of
Arts in Education: Natural Science and Environmental Education

Hamline University, Saint Paul, Minnesota

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Primary Advisor: Susan Manikowski

Secondary Advisor: Vivian Johnson

Peer Reviewer: Britney House

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“The best classroom and the richest cupboard is roofed only by the sky”
-Margaret McMillan

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Chapter I: Introduction

This paper will address the question; “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” I came upon this question through my personal teaching experience.

After participating in the Natural Science and Environmental Education (NESS) biomes class, I found myself wanting to learn more about what is in rain gardens; their benefits and the environmental impacts of having one. I realized that I have not seen a rain garden at the schools in my district, which inspired me to create this proposal. Through all of my experiences in this master’s program, I finally found what I was meant to do and my true passion, which is environmental education. I learned about myself and how to go outside my comfort zone, as well as make some lifelong friends and a community of networking. Through my research, I will seek to demonstrate the importance and need for rain gardens in schools. I will specifically do this through research, as well as speaking to naturalists and various professionals in the fields of engineering. My ultimate goal would be to have my school district review my research on this topic and see the value of allowing us to implement in one of our schools.

Professional Experience

Since 2014, I have had the opportunity to host family nature club with co-teachers where we give families the opportunity to connect to nature. Family nature club is ran by the three nature preschool teachers and is hosted at different outdoor learning centers around our school each month. It is open to all ages, as we encourage the whole family to attend. The goal is to provide a free family friendly event that engages all learners through hands on experiences in nature. It has been an important piece of connecting more people with the environment and

seeing the benefits of environmental education. Nature club starts with a game, followed by a nature hike of the area, and then leads into nature play or seasonal activities such as; fishing, snowshoeing, sledding. Our main goal is to provide new experiences and opportunities for families of our students to do activities together, while getting outside all year round. Through nature club, students are able to demonstrate their knowledge to their families, while showing them all the benefits and concepts learned through nature play. In addition to nature club our school also is fortunate enough to have partners that helped build our district two great environmental centers and preserve land for the benefit of our students and environmental education.

One of our partners is the Jeffers Foundation, who helped fund the McColl Pond Environmental Learning Center (ELC). This facility is within walking distance from the school. There is a butterfly garden that draws a lot of interest for its color, as well as the insects you can see and observe. My students' interest in the butterfly garden and the learning opportunities it creates are another piece that lead to my idea of a rain garden proposal, as I want to give our students an opportunity to have natural spaces on school grounds which is where my idea of developing a proposal for a rain garden developed from.

Rationale Behind My Question

My reason behind why I want to create a rain garden is due to the general idea that all students should have places on school grounds that provide extended learning outside the classroom walls. Creating a rain garden on school grounds would do two things. One, it would create a space for the extension of learning outside for all grades. Two, the common space of a rain garden would provide an opportunity to integrate stewardship for the environment in our

curriculum. As a teacher, stewardship for the environment means creating opportunities for students at my school to care about the environment and how to appreciate it. This stewardship is a lifelong skill and is one that my parents instilled in me while growing up.

Personal Experience

As a child, my family went on yearly summer camping trips in various parts of Minnesota, Iowa, and South Dakota. One task on our camping trip was to set up camp, which included putting the tent up, gathering firewood, and collecting water. Meals were cooked over the open fire. We took turns cooking and washing dishes. Days were spent playing family games, hiking, exploring, fishing, boating, swimming, and participating in state park events. If you went fishing, you had to learn how to bait, take off, clean, and cook the fish you caught. This was where my love for fishing developed. Another piece of the camping trip was daily hikes. I was not a big fan of hiking, however, my appreciation grew each year. One of the best memories I have was when we went hiking in South Dakota and ended up hiking close to bison, hundreds of them, in the field. This is where the idea of hiking finally became exciting to me.

Our family's annual camping trips carried on until I was in high school and they are the best memories I have. Nature hikes have a meaning to me of excitement, adventure, and endless opportunities for exploring. This is something I share with my students and try to spark their excitement for our daily nature hikes. This is where my love for being outside came from. I always lead a very active lifestyle and would do anything I could outside. My parents were big on keeping us outside in all weather growing up. Our after school days were spent playing with the neighborhood kids outside until dinner time.

When in college, it became a bit harder to continue that, however, I found a new connection to nature when I discovered a quiet river trail near my college that I started to walk or rollerblade on each day. It was a hidden path that started along the back of a school and followed the river through the woods. I personally benefited from this connection with nature in many ways. The benefits I experienced included being mentally calm, my anxiety levels were lowered, I had more energy, and I had a new appreciation for nature. I went to school for Early Childhood Education at a university that is part of the state system and is located in a rural area outside of a major metro city in the upper midwest. I always thought I wanted to teach Kindergarten prior to my first teaching job. My first teaching job outside of college was in preschool and this is where I felt I found my passion as the children love to learn and love coming to school.

Through my highschool and college years, I never took a huge interest in the required science classes and found myself disconnecting when in these classes, except for one, an environmental science class in high school. I would relate my disconnect to science to the fact that, while I am a hands on learner, I had a hard time becoming excited about the content. However, while taking environmental science, I felt a sense of belonging that I did not feel in the other science courses. Science classes had an element of memorizing and testing, and drilling, and for me that was not an exciting way to learn or retain information. I had never given any thought that I would like to teach about the environment. It was not until the academic year of 2013-2014 when I accepted my first district preschool job where I saw a need for a change in education.

Teaching Experience

In my first teaching experience I had a class of all day preschoolers and was only allowed 15 minutes to go outside with them. The curriculum we used was from a Basil form where interventions and small groups were to be used with these four year olds. This is where I started to get creative and bring certain lessons outside when I could. I would take our story outside and started having them do daily journal drawings outside. When learning about science concepts, such as movement, I would take objects outside and let students experiment with how they moved. I saw a change in students' interest and behavior, and I personally felt like a better teacher. I felt like I was giving my students a second opportunity to be outside, while providing hands on learning experiences. I also noticed that in my neighborhood children were not outside playing after school, or were so focused on technology that the connection to the outdoors was lost. My experience as a teacher coupled with my own background are the primary reasons behind my advocating for environmental education and opting to teach my lessons outdoors where children could interact with the natural environment along with playing and getting exercise.

Nature Preschool

I was lucky enough to accept a job teaching nature preschool within a E-12 school district in the academic year 2015-2016. Nature preschool is within the school district's preschool program and the focus is on the environment. Nature preschool, as defined by our district, is inquiry based learning and the curriculum is based around the seasons. At first, I was hesitant as it was outside my comfort zone, and not knowing much of what was expected. I quickly learned it was the best decision and opportunity I could be given. I reconnected with the

environment and found my true passion when I was not looking. I am able to share my love of the outdoors with my students and allow them freedom to explore. Their learning is centered around inquiry based learning and giving students the chance to connect with the environment and spark their interests.

This is what had me pursue going to get my environmental education certification. I wanted to be more knowledgeable for my students sake, as well as be able to educate fellow teachers. Through that certification, I realized how much I was enjoying the classes and learned that Hamline had an Natural Science and Environmental Education masters program.

Continuing Education

Getting my masters was next on my list of my personal goals. I knew I did not want to get my masters in reading or math due to the fact that it does not apply to my licensure nor the grade I teach. I wanted it to be in something that I could apply in different areas and this is how I settled on the Natural Science and Environmental Education (NSEE) masters program. I wanted to be more confident in the knowledge I was sharing with students, as well as be an advocate for environmental education and creating new ways for students to learn and connect to the environment. I started out wanting to get my environmental education certification in hopes to bring more knowledge to my students. This then lead to me looking further into environmental education as I saw the benefits the environmental setting was having on my students. My students were interacting with the environment in ways I never thought. One day, a student found a bug and so the lesson became about what makes an insect and insect while incorporating math, science, observation skills that need to be taught through hands on experiences.

Supporting me in developing my expertise in environmental education is an amazing co-worker who founded the nature preschool program in my district. My colleague is also a naturalist that I have had the ability to grow and learn from each day. Through her guidance, I am able to foster student's learning in the outdoor setting. Prior to starting my masters NSEE program she was my resource and literature provider. I am forever grateful for her guidance. A fellow co-worker has also been a huge influence on my decision to go for my masters and go for it in environmental education. I can say I look up to her confidence, knowledge, and passion for outdoor education and hope to reciprocate that one day as well. As I complete my NSEE program, I am excited to contribute to environmental education committees and ideas and gain confidence in my decisions. The students interest and questions inspired and encouraged me to continue on this environmental education journey leading me here.

In looking ahead at the significance of this project there are at least three potential beneficial outcomes. One is how a rain garden would allow for extended learning opportunities of core concepts. Two, our students would have more opportunities to do outside observations with nature journals that would support the development of literacy and science and inquiry. Three, the rain garden would increase opportunities for our students to engage in field based inquiry based learning related to plant and flower identification, animal identification and behaviors, seasonal changes. It provides students experience real life science that can support the development of environmental and science literacy.

Conclusion

My research question, "What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?" is driven by the evolution of

my own personal interest with nature through various courses, experiences, and relationships. Environmental education has become a personal and an important topic to me. My hope is that more elementary students will have opportunities to connect with the environment through hands on experiences in the outdoor setting. I hope these experiences foster a connection to the environment, engage and inspire them to learn more about the natural world, and leave an impact on them. In the Chapter Two I will focus on a literature review about the rationale behind creating a proposal for a rain garden and what design components will need to be incorporated. In Chapter Three, I will review my methods of research and how I analyzed my research. With the intent of proving my research question to be beneficial to all students and the positive effect on their learning. Chapter Four will be my reflection on my project and the capstone process.

Chapter II: Review of Literature

The following literature review is supportive of my investigation that will look at the question: “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” I will first examine the history of environmental education to identify themes and the significance of environmental education to the world around us. Next, I define a rain garden. I will also examine the benefits of experiential learning opportunities. Having a understanding of what a rain garden is gives a background into seeing its importance. Knowing its purpose defends the why behind the need and depends the rationale behind this proposal. Finally, I will discuss what the design process is for a rain garden and factors to be considered in the design process.

History of Environmental Education

In the most recent decade, “environmental education” has been a new phrase that has been widely used. According to US Environmental Protection Agency (EPA) (2017), environmental education is defined as “a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment” (p. 2) and after certain education, “individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions” (EPA, 2017, p. 2). An increase in social attention on environmental education started in the 1970s, when people started to realize the importance of building the connection between human and nature, raising the knowledge and understanding towards the biophysical environment, as well as offering solutions to the environmental issues.

According to research from McCrea (2006), environmental education owes its origins to the influence of philosophers such as; Jean-Jacques Rousseau, who felt that education should maintain a focus on the environment, or Louis Agassiz, who encouraged students to “study nature, not books” (p. 1). Another thought expressed by McCrea (2006) is that perhaps environmental education has its roots in the nature study movement of the early 1900s. The National Environmental Education Act of 1990 is acknowledged by North American Association for Environmental Education (2017) as an important effort by the U.S. Congress to nurture the field of environmental education. This multifaceted history is one reason for the diversity, resilience, and inclusive nature of environmental education today according to McCrea (2006). Kovarik W. (1999) provides the following timeline of environmental education impacts up until 1999, and Scott, D. (2009) provides events from 2000 on. See Appendix A.

After reviewing that long history of environmental education there is a strong case that this is just the beginning and that environmental history and education is only growing. Reviewing the environmental education timeline supports the idea that –The environmental timeline provides support for my goal of to increase environmental education and outdoor education at my school. -In the chapter overview it stated that“identify themes and the significance of environmental education” and I think that should also be a part of this concluding paragraph. Having established why environmental education and outdoor education should have a place in our school’s curriculum the next section will describe the attributes of a rain garden.

Rain Garden

What is a rain garden? According to the The Rain Garden Network (2003-2017) a rain garden is defined as “A garden of native shrubs, perennials, and flowers formed on a natural slope to temporarily hold and soak in rainwater run off” (What is a rain garden, p. 1). The Ground Water Foundation (2017) cites two important functions of a rain garden. One is rain gardens are effective in removing 90% of nutrients and chemicals and 80% of sediments from rainwater run off. The second function is by installing a rain garden on your property or even using the principles of a rain garden in the landscaping. You can greatly increase your contribution to preserving clean rainwater, creating habitat and preventing local flooding. and water pollution. These are all very positive outcomes. Instead of sending clean rainwater to the sewer, it can be absorbed to help ground water systems and prevent house flooding. See Appendix B.

According to the University of Minnesota Extension (UMN Extension) (2017), how a rain garden works is that “during a rain event or snow melt, fast-moving runoff washes the nutrient-rich debris and other harmful pollutants away, often directly into lakes, rivers, and wetlands” (Rain Gardens, The Benefits of a Rain Garden, ¶ 2). The UMN Extension describes how “the greater amount and increased speed of water flowing off hard surfaces can erode soil and carry it into our surface waters” (Rain Gardens, The Benefits of a Rain Garden, ¶ 2). In relation to my question “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” the above idea plays well into finding the right location on my school property to then create a proposal for a rain garden. A large plus to rain gardens is the ability to make it your own with no limitations. A large benefit to having rain gardens is that they are only limited by the time and resources you want to put into it.

Environmental need and benefits.

Rain gardens are infiltration systems that provide volume and water quality control, recharge enhancement, as well as landscape, ecological, and economic benefits. According to Aravena, Jazmine, and Dussaillant (2009), urban storm-water management is increasingly using best management practices, or BMPs, that provide multiple benefits: technical, economical, ecological, and recreational. Aravena et al. (2009) also expresses that in new suburban growth areas, there is concern that traditional stormwater practices have been unsuccessful.

The goal of establishing additional natural landscapes by creating rain gardens is because in a natural landscapes there's very little stormwater runoff. The reduction in stormwater runoff is because the native plants allow for most of the rainwater to filter down through the soil or evaporates rather than become runoff. There are a myriad of options for plants that can used in a rain garden ranging from perennials to grasses to small trees and shrubs. These are maintenance free plants that provide a visual appeal as well.

According to The Rain Garden Restoration (2017), it states that these plants have the ability to tolerate wet roots for the amount of time that it takes the rainwater to drain, which can be anywhere from a few hours to two days. The perennial plants selected for a rain garden must be both. There are hundreds of selections from which to choose from, but it depends on your location and preferences. These native plants can be arranged in formally designed gardens or planted into a more natural meadow. Because native plants, once established, can require minimal irrigation, mowing, and chemical treatments, native landscaping is presumed to offer substantial savings and environmental benefits compared with conventional landscape designs.

Compared to conventional landscape designs, Huszka (2017) describes how rain gardens increase in habitat for wildlife, increase biodiversity, and attract dragonflies as they eat mosquitoes, therefore reducing the mosquito population. These benefits will take some time to appear, as the plants need to become established, however, “After two or three years, the native plants’ roots will be established and the rainwater that feeds the garden will be enough to support their growth and development, eliminating the need to irrigate” (Huszka, 2017, p. 1).

The four environmental benefits associated with rain gardens has caused interest in creating them over the past few years. These benefits include:

- holding water to decrease erosion
- filtering water,
- providing habitat, and
- adding a unique element to almost any landscape.

An additional benefit to adding a rain garden to a property is that they are for the most part maintenance free, requiring little attention after the initial installation and planting. The Rain Garden Restoration (2017) states that Prairie Restoration Inc. (PRI) crews have provided all the subsequent maintenance for these gardens. They also provide an aspect of curb appeal when located properly into your landscape, so there is an aesthetic benefit in addition to the ecological benefits.

Given all the beauty and benefits of rain gardens why are they not as common as lawns? First, let's look at some basic misconceptions as stated by The Native Prairie Herald. (2017) in regards to rain gardens;

1. standing water breeds mosquitoes- the water drains in less than 48 hours, not enough time to create a breeding environment.
2. Only plants that require wet growing conditions will thrive in a rain garden- Plants located in the lower part of a rain garden may stand in water on occasion, but they must also tolerate long periods of drought. Plants on the sides of the garden will vary between occasionally wet soil and dry conditions. Plants at the highest points may never experience standing water.
3. Rain gardens look wild and weedy- Gardens look weedy when: plants grow too tall, there are too many plant varieties. By using plants in scale with the garden size, placing taller plants in the middle of the garden, and creating attractive plant groups, rain gardens can make beautiful additions to already existing landscape.

Adding rain gardens to school grounds can provide not only beauty to a school but it also provides many benefits to students as well.

Benefits for a school setting.

It is most probable that we do not learn anything unless we have a clear personal motive for doing so (Adkins & Simmons, B. 2008). In reflecting upon the above statement, it is my personal motivation is to support our school's mission to give students environmental educational learning opportunities by using the rain garden to increase hands on outdoor learning. Other benefits for having a rain garden in a school setting include:

- Support students being less sedentary for which there are associated health benefits
- Outdoor learning can have a positive impact on learning

- Locating a rain garden on in a school setting can reduce the school's ecological footprint.

Suzuki (2015) writes there is research to support that “Kids who spend time outside every day are healthier, happier, more creative, less stressed and more alert than those who don't. Several recent studies even show time in nature or green space helps reduce ADHD symptoms” (p. 1). Another researcher, Maria Volkova (2017), also describes how getting outside supports being healthy. According to Maria Volkova (2017) being outside leads to the following positive outcomes:

- Increases melatonin helping you sleep better at night
- It increases your creativity
- You become more resourceful
- It increases your mood and self-esteem
- Positively impacts your health

However, in a podcast by Partnership for Environmental Health (PEPH) (2017) it describes a shift toward a sedentary lifestyle for many children that results in children spending less time outdoors than in prior generations and more time indoors using electronic media.

According to PEPH this shift to a more sedentary life is the major contributing factor to the decline in children's health resulting in increased incidences of the following:

- obesity
- diabetes,
- asthma,
- attention deficit disorders.

Supporting PEPH description of the negative impact on children's health is the the American Journal of Medicine (2010). The American Journal of Medicine (2010) reports that childhood obesity affects 17% or 12.5 million of America's children, contributing to the rise in children's health disparities. Among Children type 2 diabetes, asthma, vitamin D deficiency, and attention-deficit/hyperactivity disorder have also increased over the past few decades. The American Journal of Medicine also states that all of these conditions can have negative long term on one's health. But, the podcast PEPH (2017) also discusses how spending time in nature can increase physical activity, reduce the risk of chronic disease, and improve children's sense of emotional wellbeing.

In addition to reducing a sedentary lifestyle Sobel (2013) links being outdoors to other positive learning outcomes. Sobel (2013) advocates the idea of exposing children to the environment is important so that they can develop a sense of ecological awareness and appreciation for the natural universe. In the following quote from the book *Beyond Ecophobia* David Sobel (2013) describes why the sedentary lifestyle of children can negatively impact their environmental awareness.

While children do seem to be spending less time physically in natural surroundings, they also seem to worry more about the disappearance of nature--in a global sense--than my generation did As a boy, I was intimate with the fields and the woods behind my house, and protective of them. Yet, unlike these children, I had no sense of any ecological degradation beyond my small natural universe. (Sobel, 2013, p. 5). Rivkin (1998) goes into focusing on what appears to be optimal development for children and suggest that intense urbanization and industrialization and their follow-ons have deprived children of outdoor, in particular

nature-based, experiences. So, as you can see, as we become more urbanized and industrialized children are not enjoying the great outdoors as did previous generations and are not able to reap the benefits of what an outdoor education could provide. What role could schools have? Outdoor learning in schools provides opportunities to counteract this trend.

A study (Suzuki, 2015) out of the UK's King's College London suggests teaching outdoors makes educators more confident and enthusiastic about their work, and more innovative in their teaching strategies. By extension, schools benefit from the leadership and influence of their teachers who take students outside (Suzuki, 2015). According to Suzuki (2015), if teachers are happy and connected to nature, they can pass that on to their students, after all, those who learn to appreciate and love nature are more likely to protect it. If one agrees with Suzuki's ideas (2015) that when one appreciates the world around them they are able to connect to it and see the value in having access to it, then it makes sense to have natural areas on school grounds. The popularity in environmental education has shifted educational pedagogy and has increased access to green spaces. By providing natural gardens, it allows a space for all students to have access to. Student and school benefits of having a rain garden on school grounds goes deeper than just being outside to visit it.

Rain gardens are also ideally suited for schools as they can reduce the school's ecological footprint. The environmental movement's focus on endangered species has made us aware that loss of habitat is a primary cause of species extinction (Evans, 2011). In other words, if there is not a place to live, life does not flourish or even occur. However, rain gardens incorporate native vegetation that can help support wildlife and reduce habitat loss. Having wildlife and habitat on the school grounds makes it easier for teachers to support a school's

environmental? mission. Our school's mission to give students environmental educational learning opportunities and can be accomplished by using a rain garden to increase hands on outdoor learning.

The Minnesota Department of Natural Resources (DNR) describes the following four reasons for why native vegetation is incorporated into rain gardens and is important for the environment/ecosystem:

1. Native plants work well for many landscaping and wildlife habitat plantings, because once established, they seldom need watering, mulching, protection from frost or continuous mowing.

2. Native plants provide nectar, pollen, and seeds that serve as food for native butterflies, birds and other animals.

3. Many native grasses and wildflowers protect soil with their deep and spreading root systems, helping to prevent erosion.

4. Native plant communities are vital components of ecosystems. In order to be healthy and sustainable, an ecosystem needs to be filled with a wide array of native plants and animals. In addition to providing food and shelter to birds and animals, a healthy ecosystem provides many services to society.

As educators in this ever changing global community, the North American Association for Environmental Education (NAAEE) (2017) states, it is our jobs to instill nature-based experiences into children's school day providing them equal opportunities they they might not have outside of school due to time spent transporting children among institutions. North American Association for Environmental Education (NAAEE) (2017) also encourages that

children have time for outdoor exploration and play has transitioned from free play to organized play with little time left to explore or appreciate the environment. As educators, it is important to that we find a way to make nature based opportunities available to all children so they are able to make a connection with play in the outdoors.

Design Features of a Rain Garden

According to Dussaillant (2004), a rain garden is “a landscaped garden in a shallow depression that receives the stormwater from nearby impervious surfaces, focusing recharge” (p. 1). The rain garden should be integrated into the existing school landscape, so one will need to consult with proper school faculty before moving ahead. Once the concept has been approved, consider involving the entire school community in some form throughout the process to give a sense of ownership. When one has a sense of ownership over something they have more of a drive to keep it going and make it work.

When determining the location of a rain garden, it is also important to kept in mind the following standard features described the Northern Virginia Soil and Water Conservation District (2009):

- Placed near an inflow structure.
- A basin to collect water in.
- A thin layer of mulch lies on the rain garden’s surface.
- Incorporates native plants.
- Acts as an overflow area.

In addition to these standard features, the Northern Virginia Soil and Water Conservation District (2009) and Lutz (2017) describe the following key factors that should guide the decision making process for the location of a rain garden.

- Needs to be at least 10 feet from a structure.
- Locate the rain garden outside of a tree's drip line to avoid cutting roots.
- Do not place a rain garden near a septic system.
- Keep the rain garden away from utility lines and any easements.
- Do not place a rain garden in a spot where water pools after a storm.
- Do not build a rain garden in soil that has a high water table.

In addition to the general features and location guidelines, it is important to determine the site of the rain garden.

According to Lutz (2017) from the Bay Journal the ideal size of a rain garden is related to the size of the area that drains into the garden. With that being said, the ideal size of the garden will depend on the size of the drainage area. A good thing to keep in mind is that a home rain gardens range from 100 to 300 square feet. Once the location and size have been determined, the next step is to determine the nature of the soil at the proposed location.

The Nature Conservatory (2017) recommends the following three steps once a proposed location has been identified:

- Determine the type of soil at the proposed rain garden location.
- Calculate the infiltration rate of the soil at the proposed rain garden location.
- Define the perimeter of the rain garden.

To determine the type of soil at that location, The Nature Conservatory (2017) recommends adding and mixing in a small amount of water to make the soil pliable, but not enough to turn it into mud, and form the soil into a ball. The type of ball formed indicates one of three types of soil at the location.

One, if the soil will not hold shape as a ball, the soil is sandy. Two, if the soil forms a tight ball and does not easily break apart, it is clay rich. Three, if the soil forms a ball but falls apart easily, it is silty. Knowing the soil is key to the survival of the plants in your rain garden. Conducting a soil test will let you know if the location is good for the plants you have selected to be in the rain garden. See Appendix C.

Once the nature of the soil at the location has been determined, the next step is calculating infiltration rate in the general area you have decided to locate the rain garden. To determine the infiltration rate The Nature Conservatory (2017) suggests digging a hole about 10 inches deep and 6 inches wide. Fill the hole with water. Leave the water to soak into the whole to saturate the surrounding soil. After one hour, measure the depth of the water and record how much it has dropped from the marker. This is your infiltration rate: the amount the water drops/hour. To confirm the rate, repeat measurements every hour for a day.

The rate of infiltration should remain about the same. If the rate of infiltration is one-half in or more/hour, you can amend (make minor changes in order to make it more accurate, or more up-to-date) the soil as needed for planting. If the rate of infiltration is one-quarter in or less/hour, you may need to further investigate the soil. Your local extension agency is a good source of information about soil amendment. Now, define the perimeter of your garden. You can put stakes or rope out. A rule of thumb is to make the length about twice the

width—consider a kidney or teardrop shape. The wider side should face uphill so it can catch as much water as possible. Once the type of soil, the infiltration rate, and the perimeter of the rain garden has been established it is time to determine the construction time frame

Although a rain garden can be installed anytime the ground is not frozen, spring and fall are the best times to start your garden. In spring, the soil is easier to dig and the rainy weather means less initial watering. Perennials often do best when planted in fall when they have sent all of their energy to their roots for winter (Rain Garden Alliance, 2009). You can stretch out the flowering season by using plants that bloom at different times and mixing plant heights, shapes, and textures which gives the garden depth and interest. Consider adding sedges, rushes, and grasses to create root competition, as well as to encourage plants to follow their normal growth patterns and not outgrow other species. This diversity not only adds beauty, but also creates a thick root system that keeps the entire garden in balance (Rain Garden Alliance, 2009). The second step of creating a rain garden after determining the location is to research native plants for use in the rain garden.

Minnesota DNR (2017) defines native plants as plants that occur naturally in a particular region. In Minnesota, plants are considered native if they occurred here at the time of the Public Land Survey (1847- 1907), which was conducted prior to and during the early stages of European settlement. The Minnesota DNR describe the following four reasons why native vegetation is important for environment/ecosystem:

1. Native plants work well for many landscaping and wildlife habitat plantings, because once established, they seldom need watering, mulching, protection from frost or continuous mowing.

2. Native plants provide nectar, pollen, and seeds that serve as food for native butterflies, birds and other animals.

3. Many native grasses and wildflowers protect soil with their deep and spreading root systems, helping to prevent erosion.

4. Native plant communities are vital components of ecosystems. In order to be healthy and sustainable, an ecosystem needs to be filled with a wide array of native plants and animals. In addition to providing food and shelter to birds and animals, a healthy ecosystem provides many services to society. Given how valuable native plants are to maintain the health of the environment/ecosystem, it is understandable why they are used in rain gardens. In addition to the the use of native plants in the rain garden, Ripple (2000) also makes recommendations about how to successfully plant them.

According to Ripple (2000), the first step in planting is to dig a hole that is considerably wider and as deep as or just slightly deeper than the container or root system of the plant. It is not necessary to modify the soil, so use the soil you dig out to fill the hole back in once you have placed the plant. Ripple (2000) notes that if you modify the soil within the hole too much you might discourage the plant from extending its roots away from the hole and this would do what? Knowing the cause and effects of soil modification is a necessity to keep the garden healthy. Knowing where to place a rain garden and all the recommendations you are then able to move on to what you want to plant in the rain garden. In selecting what should go into your rain garden, you want native plants and grasses. Native plants are great for rain gardens as they are easy on the environment because most require no fertilizing or watering. They create a no-fuss, low-maintenance garden. Many native plants have deep and extensive root systems that help

loosen the soil so water can quickly infiltrate. Native plants are the hardest workers in the rain garden.

Creating a Rain Garden (2008) described native grasses as the workhorses of a rain garden. Below are the plants that are recommended to be planted for the proposed project location according to Creating a Rain Garden (2008) resources: Sweet flag, Giant Hyssop, Canada anemone, Swamp milkweed. Aster marsh marigold, turtle head, sneezeweed, oxeye sunflower, blue flag, blazing star, grass-leaved goldenrod, meadowsweet tall. As for grasses to plant they recommend the following for Minnesota: Big bluestem, Fringed brome, Blue joint grass Sedge, Canada wildrye Rush, Rice cut grass, Wool grass Indian grass Cordgrass. Now, not all of these need to be planted, as the designer, you choose what selection of the above list you would like to implement into your rain garden design plan.

The city in which the school is located also has the following suggestions for plant types and where to locate them in the proposed rain garden. The local city governments suggests that plants such as Joe Pye weed, Siberian iris, and Tussock sedge should be planted in the wet bottom of the rain garden. On the drier edges and side slopes consider grasses like little bluestem, or flowers like purple coneflower. Minnesota DNR (2017) states that if you plant milkweed, butterfly weed, purple coneflower, rough and meadow blazing star, and purple coneflower you will attract butterflies to your garden. They also suggest planting bergamot, as you might attract ruby-throated hummingbirds. The native plants you choose will determine what wildlife will visit. There are many great resources to use as guides in the design step.

Natureworkseverywhere.org (2017) provides resources for project based learning-building a rain garden. They have lessons designed to go with their video of what is needed for

a rain garden and construction. This is a great resource go to when starting the design process of a rain garden in your community or school.

How to Write a Proposal

To be able to complete my project, knowing how to write a proper proposal is required. The website Grantspace walks you through how to create a successful proposal, particularly for grant funding. In general, proposals from single parties should not exceed five single spaced pages with a cover letter and budget. according to Grantspace, successful grant proposals include the following;;

- Delivers an important idea/addresses a single issue.
- Shows that the applicant has innovated approach to the issue.
- Describes objectives with a detailed plan of achievement.
- Has a funding plan or demonstrates that applicant is capable in securing funding.
- Details the outcome of the project.

Ultimately, your proposal should be a compelling presentation of your project and your ability to achieve results. A proposal is a request for financial assistance to implement a project. The proposal outlines the plan of implementation. It describes the organization about the project, giving extensive information about the intention, the ways to manage it and the results to be delivered from it. A project proposal is a detailed description of a series of activities aimed at solving a certain problem. Dillion (2010) stated the following need to be present in the introduction of a proposal.

- Provide a logical presentation of a research idea.

- Illustrate the significance of the idea.
- Show the idea's relationship to past actions.
- Articulate the activities for the proposed project.

The project proposal should be a detailed and directed manifestation of the project design. It is a means of presenting the project to the outside world in a format that is immediately recognized and accepted. according to Dillon (2010) the process of getting the project proposal started should begin with the following;

- Decide what the problem is and develop a rough idea of a solution.
- Identify potential funding.
- Assemble a project proposal team.

Dillon (2010) provides the following outline of what a full proposal should have: (Adapted from NEBIU 2002);

- **Title page:** A title page should appear on proposals longer than three to four pages. The title page should indicate the project title, the name of the lead organization (and any potential partners), and the place and date of project.
- **Project title**
- **Abstract/Executive Summary:** The problem statement, the project's objectives, implementing organizations, key project activities, and potentially the total project budget should be included in the abstract. For a small project, the abstract may not be longer than 10 lines. Bigger projects often provide abstracts as long as two pages.
- **Context:** This describes the social, economic, political and cultural background from which the project is initiated.

- **Project justification:** A rationale should be provided for the project. Due to its importance, this section is sometimes divided.
- **Target group:** Define the target group and show how it will benefit from the project.
- **Project implementation:** The implementation plan should describe activities and resource allocation in as much detail as possible.
- **Budget:** An itemized summary of an organisation's expected income and expenses over a specified period of time.

Once a proposal is put together, the project is closer to becoming a reality.

Conclusion

My research question is, "What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?" This question is supported through the literature review. Environmental education is changing the way education is looked at. After completing my literature review, I am confident that I have enough support to back my research question and provide solid evidence of its importance and need. In Chapter Three, I will review my methods of research and how I analyzed my research. Also provided in Chapter Three will be the design of the rain garden complete with cost and plans accompanied with research. Chapter Four will be a reflection on my project and the capstone process.

Chapter III: Methodology

This project examines the elements of a strong rationale to support the development and creation of a rain garden in my school district. A proposed location will first be determined along with the dimensions of the rain garden, followed by a description of the plant and grasses selected for the proposed location. An estimated cost chart along with how many of each plant or grass is needed for the area is also included. Next, a timeline of completion for my project, as well as the participants, will be discussed. Finally, the rain garden design will be presented in a detailed drawing.

Location

To start the process of selecting the proposed location input from different stakeholders was essential, since each one bring a different expertise to the table in the decision making process. In October 2017, the initial meeting was with the school principal to describe the project and obtain support. During the meeting, the school principal also requested that a meeting with the head of grounds crew and the school naturalist was scheduled, the meeting was held in November 2017.

Prior to the meeting with the head of grounds crew and the school naturalist, information was sent about what was needed in terms of soil, slope, drainage, as well as how large of a potential space may be needed. A meeting was held before school in November 2017. During that meeting the head of grounds crew presented two locations on the school property that were pre-selected based on the information provided at an earlier time. The factors that were taken into account were; 10 feet from a downspout, proper soil that could hold water for

48 hours, soil depth, and an area of 100-300 square feet, in accordance to the University of Minnesota Extension guidelines. The selected location will allow for 100 square feet with some existing native prairie grasses. A summary of the three meetings held to determine the location of the rain garden at the school site are described in Appendix D.

Planning Meetings to Determine Location of Rain Garden See Appendix E.

Following the planning meetings described in Appendix E, a decision had been made to move forward in the process. Knowing the soil and proposed location is essential in determining plant selection to get an estimated cost.

Selection and Cost

According to the research in the review of literature, the native plants selected for this particular rain garden location are sure to thrive. The rain garden's location is in full sun, thus native plants and flowers need to be selected in order to thrive. In answering the question why native vegetation is important, the Minnesota Department of Natural Resources (2017) states native plants are adapted to the local climate and soil conditions where they naturally occur. Native plants work well for many landscaping and wildlife habitat plantings, once established they seldom need watering, mulching, protection from frost, or continuous mowing. Native plants provide nectar, pollen, and seeds that serve as food for native butterflies, birds and other animals Minnesota Department of Natural Resources (2017).

The final native plant and flower selection proposal was based on research; butterfly Milkweed, Black Eyed Susans, Swamp Milkweed, Purple Coneflowers, Rough Blazing Star, Astillbies, Prairie Dropseed, and Canadian wild rye. They will be implemented into a

pre-existing area, no edging required, allowing the space to have a natural look to it. The native plants selected will provide various colors as well as attract various insects to the space.

The City of Maplewood (2008) has developed an equation, per 300 square foot garden space the wet zone should be about 100 square feet. If the seedlings are planted at one-foot intervals with a decision of 25% grasses and 75% flowers, there is a need of 100 plants for the wet zone (25 grass seedlings, 75 flower seedlings). Within the 100 plants needed for the proposed space, the positions of where they are planted within the area will be determined later. The estimated cost of the plants required for the rain garden is based on information provided by American Meadows.

American Meadows Inc. sells native plants and grasses as well as provided the cost for each native plant or grass selected in the design. Appendix D has the estimated cost of each plant or grass as of November 2017 is how American Meadows Inc. recommends calculating the cost. When compiling Appendix D look up each plant on the American Meadows Inc. webpage and compiled the chart based off of a 300 square foot garden for the number of plants needed. This was determined per the above paragraph equation from The City of Maplewood (2008). See Appendix D. Once the size, shape, and location of the rain garden has been decided and plants have been selected, a design plan can begin and then construction can begin.

To begin the construction process the best starting point is to mark off your area and lay out a rope or garden hose in the desired shape to use as a guide for digging.

See Appendix G for proposed location.

Participants

The participants of my project span across the school community. The participants that will be presenting my proposal to will be the following; building principal, Head of Grounds Crew, member of the Early Childhood Advisory Council, a fellow nature preschool teacher, the district naturalist, and a K-5 representative. Each plays a different role in the process and represents the school community. The building principal and the head grounds crew are the only two that can official make the decision to accept the proposed idea or not. The Early childhood advisory council can offer help in providing backing in the funds needed for the project and help fundraise. Fellow nature preschool teacher and a K-5 representative provides ideas and support for the benefits of children from the space. The district naturalist can help in the implementation process as well as providing follow up lessons with it for teachers, refer to?Future Project Proposal Timeline see Appendix E.

Conclusion

Chapter Two literature review provided a strong backing to my question. It helped identify the major benefits that nature and rain gardens will have and has had on students. It showed support of successful schools that have implemented rain gardens. I was able to find examples of designs as well and identify the plants that will work best for Minnesota at the location of the proposed rain garden that will attract the right animals. The proposal timeline was provided, while including an estimated cost, participants, design aspects, and gave guidance into what the design process is.

Chapter IV: Reflection

In this chapter I will reflect on what I learned about my question, “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” First, I will discuss what I have learned through the Capstone process as a researcher, writer, and learner. Second, the literature review and what resources proved to be the most valuable to this project will be revisited. Through the literature review and project proposal new connections and a deeper understanding has been developed. Implications of the project as well as recommendations will also be addressed. I will discuss the deliver of my project and finally, the benefits of this project to the education profession.

Learning through the Capstone Process

Through the Capstone process I have been able to acquire new knowledge as a researcher, writer, and learner. This process as a whole pushed me outside of my comfort zone and really challenged me as a researcher. I knew going into this process that it would not be an easy task. Researching was one of my weaker areas in my past educational experiences, but I am grateful to have been pushed to. The most challenging, in the research portion was determining how much of the context I needed to supply and which sections were better left in direct quotes versus paraphrasing. It became difficult to sort through information, as I felt like so much of the research was significant to this project. I started out by organizing research that was crucial into the literature review, and through many rounds of editing, was then able to narrow down what was of real importance.

Obtaining and determining credible sources was another challenge. It is easy to go to Google, type in what you're looking for, but may not produce a peer reviewed source most

times. I learned and became very familiar with Google Scholar, which is something I had not heard of prior to this process. It provided me with credible sources that made the researching process easier. It is of higher importance to have credible sources and peer reviewers.

Along the same lines as researching, I also grew my skills in source citation and reference formatting. I also learned more about how to incorporate block quotes as well as strengthening my paraphrasing. The area that I struggled the most with was in the area of editing. American Psychological Association (APA) style was not new to me, but it had been a while since I had needed to use those skills. It took some time to review r how to format and how to list references properly. This is where I spent a majority of my time editing, correcting, and having others review. Through this, I learned about the Hamline Online Writing Center. They were of great help in fine tuning my references. What I found to be of a challenge was in finding page numbers on webpages for citations, as well as full journal article volume and issue numbers. From the beginning I knew APA formatting was a weak point in my writing, I am very thankful to have had strong peer reviewers and a content expert, who were knowledgeable in this area.

My unexpected learning points were along the lines of my self-confidence in the writing process. Writing has always been one of my favorite subjects throughout school but also an area that I have grown in. . However, with that being said, writing free style is easier for me than research writing. I found through this process, that research writing can become very overwhelming and finding a starting point was a challenge. After synthesizing all the research

and benefits behind rain gardens, I have gained a passion to implement a rain garden into my home landscape.

Revisit of Literature Review

In revisiting my literature review, it is difficult to narrow down just one point that proved to be the most important for my capstone. I would have to say there are several main areas that provide utmost importance in relation to my capstone. The literature review focused on five components; history of environmental education, rain gardens defined, environmental need, benefits rain gardens provide, and factors to consider when designing a rain garden. This research included elements of all the above components. The main thing I have always enjoyed is taking students outdoors to expand upon learning through hands on experiences.

Literature Review Citations

In reviewing my research I found a few portions of the literature review to be the most important in supporting my question “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” One of the most influential and supportive sources was City of Maplewood, MN. (2008). Creating a rain garden in your yard. Retrieved from www.ci.maplewood.mn.us/DocumentCenter/View/247

This document provided the outline of what was needed for my project and the breakdown of what areas I needed to do more research on to be able to create a rain garden design. It confirmed and supplied the benefits of a rain garden and provided backing for the support of rain gardens. It also explained how to create one, which I referred to upon in creating my project. Another part of the literature review that was of utmost important was the

review on native plants and knowing what would survive in the location of this rain garden. A resource that helped supply these answers was

Minnesota Department of Natural Resources. (2017). Landscaping with native plants. Retrieved from <http://www.dnr.state.mn.us/gardens/nativeplants/index.html>

Another corresponding review of importance came from

American Meadows. (2017). Plants and seeds that grow in my area. Retrieved from <https://www.americanmeadows.com/>

They provided the pricing needed for the native plants to compile and estimated total cost.

The bulk of the literature review was gaining the understanding and documentation of how a rain garden works and its functions. “A garden of native shrubs, perennials, and flowers formed on a natural slope to temporarily hold and soak in rainwater run off” The Rain Garden Network (2003-2017). This information was supplied from two main sources;

The Groundwater Foundation. (2017). All about rain gardens. What is a rain garden.

Retrieved from www.groundwater.org/action/home/raingardens.html

The Rain Garden Network (2003-2017)

The last big piece of the literature review that I needed to go ahead with my project was knowing the student benefits from being outdoors.

National Institute for Health. (2017). Children, nature, and the importance of getting kids outside partnerships. Partnerships for Environmental Health. Retrieved from

<https://www.niehs.nih.gov/research/supported/translational/peph/podcasts/children-nature/index.cfm>

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National Institute for Health helped lay out the why behind my project and the importance of creating an outdoor space for students on school grounds.

New Connections

The new connections and understandings that I have made from the literature review is how all pieces of the review intertwine and are connected in multiple ways. I would not have been able to do this project without each piece of the review. Even though the research was time consuming, it all connected to the same point. The thing that remains with me the most is how important it is to get students outside daily and as often as possible. To be able to incorporate the outdoors into daily lessons holds an importance given all the health benefits it provides for children and adults.

Implication

In looking at the possible implications of my project, including policy implications, is the need for getting student outside and learning. The need for a rain garden on school grounds is supported in the literature review by the main points, a rain garden; reduces flooding, removes pollutants, replenishes groundwater, and provides native plant habitat for wildlife. Along those lines is also the implication of health benefits for students supported by taking learning outdoors.

In thinking of possible limitations for this project, funding seems to be the only limitation. For others who want to implementa rain garden, some limitation might be: funding, space, a location that has the right soil and runoff space, and school support. The proposed

location has the proper soil and drainage needed to supply native plants within the rain garden. The proposed design has a total estimated cost of \$489.60. In helping to reduce the cost limitation I provided some possible fundraising ideas if the proposal was to be implemented later on. Those fundraising ideas are; using the funds from the annual Boo Dash and or the Fun Run to put towards the rain garden, contacting local suppliers asking for donations, or creating a new fundraiser.

Recommendations

In incorporating my question “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” in relation to similar research projects for myself or others, it would all be in relation to outdoor spaces. A similar project proposal could be along the lines of “What are the elements of a strong rationale to support the development and creation of a Outdoor Classroom in my school district?”, “What are the elements of a strong rationale to support the development and creation of nature Kindergarten in my school district?”, or “What are the elements of a strong rationale to support the development and creation of creating an outdoor lesson plan curriculum for my school district or students?”

Recommendations based on my own findings is that there is more research available daily on the topics of outdoor education or the benefits the outdoors has on children and adults. It is a topic that seems to be ever growing and a popular one of conversation now. Google scholar was the best search engine in supporting my work. By setting up keywords, it provided new articles daily for me to review. I also recommend adding charts or pictures when needed. It also provides a visual for those who need to look at something to better understand the research.

Communication of Project Proposal

I created a Google slide for my project providing the following:

1. Rain garden defined.
2. Functions of a rain garden.
3. Student benefits.
4. Proposed location.
5. Native plants.
6. Design.
7. Cost.
8. Funding.

This overview of the proposal for “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” Through the slides, each of the above areas area addressed and backed by my literature review. Each area is defined on the slides and then elaborated on by me in the footnotes. The biggest component of this proposal is the rain garden design. I have created a mock design (not to scale) that shows the native plants, quantity, and placement of them throughout the 300 square foot rain garden proposed location. Among those slides are visuals describing; how a rain garden works, its functions, what a rain garden is, and the design.

Through a requested meeting, I will present the rain garden proposal to the following school members; principal, head grounds crew, district naturalist, and advisory council chairman in hopes of being able to gain the backing and support to take this proposal into action at a later point. Allowing for questions at the end will provide a next step.

How my project is a benefit to the profession

My project, which is a proposal for a rain garden, provided the basis for my question “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district?” is of significant benefit to the profession of environmental education and natural science. I say this because, not only does it provide an outdoor space to be used and studied by students, but it also supports the health benefits and current conversations of the importance of getting children outdoors. My rain garden proposal is mapped out in a way that anyone could take the design and implement in into their school already knowing the cost, soil requirements, and landscape needed to make it successful. Along with that, I also provided the types of wildlife that will be supported by the native plants I selected. My project provides opportunities for others to create something along the same lines. It also provides teachers with the information needed to extend learning in science, math, literacy concepts with hands-on outdoor experience.

Conclusion

My research question, “What are the elements of a strong rationale to support the development and creation of a rain garden in my school district? ” is driven by the evolution of my own personal interest with nature through various courses, experiences, and relationships. Through this chapter, I was able to reflect upon my experience in the Capstone process. I was able to share how I have grown as a researcher, writer, and learner. Through this chapter I was able to revisit my literature review and what resources proved to be the most important to my project. It also gave me a chance to share the new connections and understandings that I have made to the literature review. After completing my project, I was able to share implications and

recommendations for myself and others who choose to do something along the same lines. I concluded this chapter by sharing how I would communicate my project and ended with the benefits to the profession of environmental education and natural science..

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Appendix A

- 1762 -Jean-Jacques Rousseau publishes a novel stating education should include a focus on the environment
- 1891- Wilbur Jackman writes Nature Study for the Common School, which defined the nature study movement.
- 1920s- Ecology begins to develop as a scientific field.
- 1930s The “Dust Bowl” in the American heartland gives rise to the conservation education
- 1935 The National Education Association assumes a leadership role for conservation education in the schools.
- 1946 The University of Wisconsin-Stevens Point offers a degree in conservation education.
- 1948 Thomas Pritchard, uses the term “environmental education” at a meeting in Paris of the International Union for the Conservation of Nature.
- 1953 The Conservation Education Association is formed
- 1954 The Association of Interpretive Naturalists is formed. The Foundation for Modern Environmental Education
- 1969 The National Environmental Policy Act of 1969 (P. L. 91-190) is passed.
- 1970 U.S. Congress passes the National Environmental Education Act of 1970 (P. L. 91-516). The first earth day was celebrated in April.

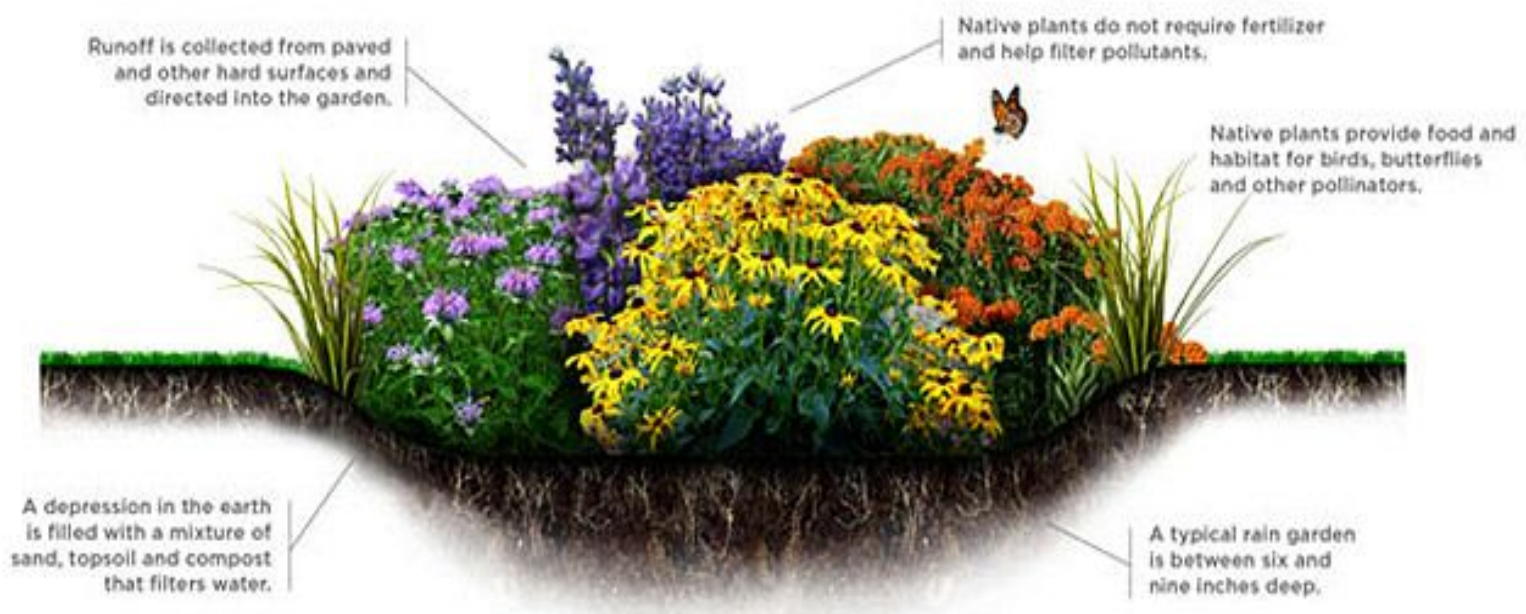
- 1971 The National Association for Environmental Education (now the North American Association for Environmental Education (NAAEE)) is founded.
- 1976 WREEC and the American Forest Institute (now the American Forest Foundation) develop Project Learning Tree.
- 1981 NAAEE's National Commission on Environmental Education Research publishes Research in Environmental Education
- 1983 Policies and Practices, the First National Congress for Environmental Education is held and WREEC and the Western Association of Fish and Wildlife Agencies develop Project WILD
- 1989 NAAEE initiates a cooperative program of affiliation with state and provincial environmental education associations.
- 1990 U.S. Congress passes the National Environmental Education Act of 1990 (P. L. 101-619).
- 1993 The North American Association for Environmental Education initiates the National Project for Excellence in Environmental Education. The Project works to create guidelines for environmental education.
- 1995 The U.S. Environmental Protection Agency awards the second Environmental Education Training Program to the North American Association for Environmental Education and NAAEE establishes the Environmental Education and Training Partnership (EETAP)
- 1999 The National Environmental Education Advancement Project produces a "Survey of Environmental Education in the United States

- 2000 NAAEE and the Environmental Literacy Council publish *Environmental Studies in the K-12 Classroom: A Teacher's View*.
- 2004 The University of Wisconsin-Stevens Point, with support from EETAP, offers the first Applied Environmental Education Program Evaluation online course for nonformal environmental educators
- 2005 The National Environmental Education and Training Foundation holds the first National Environmental Education Week (April 10-16, 2005). Richard Louv publishes *Last Child In the Woods*, starting a national conversation.
- 2014- Wilderness celebrates its 50 years.

Appendix B Rain Garden Defined

What is a Rain Garden?

Nature's Water Filter: Rain gardens are shallow landscaped depressions that capture, clean and absorb stormwater runoff from roofs, parking lots and roads.



Appendix C Rain Garden Sizing Worksheet

Evaluate Your Site

- Slope less than 4% --garden should be 3'5" deep
- Slope 5 to 7% --garden should be 6-7' deep
- Slope 8 to 12% --garden should be 8' deep

Your Soil Texture	General Soil Type
Sand	Not suitable for rain garden
Loamy Sand	Sandy
Sandy Clay	Clayey
Silty Clay	Clayey
Clay	Not suitable for rain garden
Sandy Clay Loam	Clayey
Silty Clay Loam	Clayey
Clay Loam	Clayey
Sandy Loam	Sandy
Silt Loam	Silty
Loam	Silty

United States Department of Agriculture (2018).

Appendix D Planting Budget for Rain Garden

Type	Price	Total # needed	Total Price
Butterfly Milkweed	\$14.98 per plant	12	179.00
Goldsturm Black-eyed Susan	\$4.00 per plant	12	48.00
Swamp milkweed	\$8.49 per plant	10	84.90
Purple Coneflower	\$19.95 ¼ lb seeds	1	19.95
White Coneflower	\$5.95 per plant	10	50.95
Meadow Blazing Star	\$4.95 seed packet	2	9.90
Blue Gamma Grass	\$11.95 ¼ lb seeds	1	11.95
Little Bluestem Grass	\$9.95 ¼ lb seeds	1	9.95
Brown Wood Mulch	\$3.00 2 cubic ft bag	25 2 inches thick	\$25.00 (2 in=12 sq feet divided by 300)
Total cost			489.60

Appendix E Project Timeline

Date	Attendees	Description of Meeting	Action Steps
September	Principal myself	I requested a meeting prior to arriving with a request to share my grad school project idea. Conversations were had about it and the support behind my idea	Suggested to follow-up with head grounds crew to get approval as well as school naturalist
October	Email sent to: School naturalist Head grounds crew	Email sent stating a request to meet in regards to a grad school proposal idea and in need of a location. Provided what is needed in the space for a rain garden location to be successful	Schedule meeting
November	Head grounds crew School naturalist	Upon arrival, head grounds crew had sought out two spots that he thought could work. I shared what I needed from this meeting and what my why and goal was. We walked to both locations and after discussing shade/sun, slope, drainage found 1 that would work better.	Take pictures of proposed location. Go for measurements and size.

Appendix F Project Proposal Timeline

Step	Description	Completion date
Register for Project Course	GED8490 Capstone Project	November
Determine Size of garden	The size of the garden can be 100-300 square feet dependant upon funds available. I based the estimate cost of a 300 square foot garden given it potential location has the space for it.	December
Determine what will be planted	<ul style="list-style-type: none"> -Researched native plants/grasses that can survive in MN -Determined which grow best in full sun as the potential location is full sun -Researching what plants attract what animals -How many plants are needed for an area of 100-300 square feet -how many grasses and how many flowers should be plants 	November
Estimate cost	<ul style="list-style-type: none"> - Based cost off of a 300 square foot garden - Estimate valued in November 2017 - Compile a list of selected plants and their cost as well as how many of each plant 	December-February
Compile design plan & put drawing together	<ul style="list-style-type: none"> - Take existing artifacts and adding to them - Lay out design size and shape - Identify each plant and grass and then map it out into the location space to get an idea of the overall colors and look of the space 	January-April
Compile all artifacts into proposal	<ul style="list-style-type: none"> - Compile artifacts - Make a powerpoint where it has: project question, why, definition, rationale behind it, benefits, proposed location, cost, design, and fundraising ideas 	March/April

Appendix G Proposed Rain Garden Location

