

UNIVERSITY OF MICHIGAN, SCHOOL OF NATURAL RESOURCES AND
ENVIRONMENT



Sierra Nevada Journeys
Strategic Expansion Plan 2016
Phase 1 - Environmental Education Center

Prepared by: Camila España, Taylor Markward and Terence Wang

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Faculty Advisor: Dr. Sara Adlerstein-Gonzalez

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2. Executive Summary

Sierra Nevada Journeys (SNJ) is an outdoor education organization that has grown substantially since its founding in 2006. The organization offers a variety of programs to students in California and Nevada, but currently lacks the infrastructure necessary to meet increased demand and provide optimal outdoor education experiences for its students. As the organization prepares to receive a large land donation from their parent organization, the Sierra Health Foundation, they reached out to the University of Michigan's School of Natural Resources and Environment to receive guidance on how best to approach their expansion.

Originally, the organization sought guidance in deciding how they should proceed with meeting increased demand, whether this should be completed through physical campus expansion or instead through curriculum expansion to host students throughout the year (later referred to as "winterization"). As the project evolved, the organization gained a better idea of its needs and available resources, including a future donation by Sierra Health Foundation of the land where Grizzly Creek Ranch (GCR), their 1,500-acre outdoor education learning center, is located. With this new information, they decided to proceed with a physical campus expansion that would allow them to better serve the students who attended programs at GCR and instructed us to explore this avenue for the expansion.

In the new scenario, we aimed to provide a plan to enable SNJ to grow their programming through the addition of classroom space and curriculum, as well as an improved landscape design to match their educational needs. To begin shaping their recommendation, the team conducted background research to understand the history and trends in outdoor environmental education. After gaining in-depth knowledge of the area of interest, further research in the form of case studies and qualitative interviews were conducted with experts from best-in-class outdoor environmental education organizations from the United States and Canada. The results of this primary research included information on how environmental education center leaders utilized their classrooms, planned their expansions, embraced their mission, and implemented their curriculum. Pairing this newly acquired knowledge with our knowledge of SNJ's needs and resources, we ultimately developed recommendations that included curriculum adjustments, landscape design to enhance environmental education programming, and types of structures that would not only meet their needs, but also help them to embrace their mission.

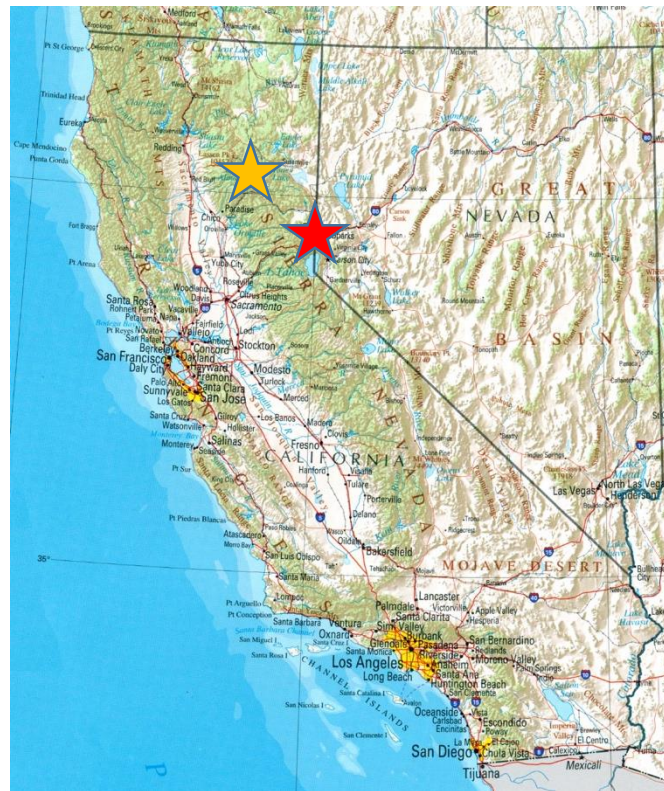
The final recommendations provided by our team will propel the SNJ campus and the on-campus learning experience to the next level of outdoor education, and include 1) the addition of an indoor learning space (classroom) designed as a modular building with sustainability features and 2) a landscape design that includes the addition of physical features that both enhance current curriculum (e.g. forest ecology, pond ecology, water cycle) and also create opportunities for new curriculum (e.g. soil ecology, land forms, sustainability challenge, food cycle). We ultimately provided a design proposal that put SNJ's mission of environmental education at the forefront. Each

aspect of the recommendation puts SNJ's mission first, offering a best case scenario without monetary or regulatory restrictions. Ultimately, the team was able to apply the perspective of their individual specialties (Landscape Architecture, Sustainable Systems, Behavior, Education and Communication) to provide a sustainability-driven solution to SNJ.

3. Introduction

Sierra Nevada Journeys (SNJ) is an American Camp Association-accredited non-profit education organization that was founded in 2006. The organization's founder, Jonathan Mueller, established the camp with the vision of promoting environmental and natural resources stewardship through education (Sierra Nevada Journeys, 2013). This program is headquartered in Reno, Nevada, (Figure 1) and boasts a sizeable footprint across the border, in Portola, California, where its outdoor education campus, Grizzly Creek Ranch (GCR), is located (Figure 1).

Figure 1: Locations of Sierra Nevada Journeys Organization: red star = headquarters; yellow star = Grizzly Creek Ranch



Their programs target elementary school-aged children in an attempt to instill the importance of our environment in early childhood. Moreover, as the organization firmly believes that this type of education should be universal, SNJ attempts to attract students from lower-income schools who may not otherwise enjoy this type of exposure to nature (Sierra Nevada Journeys, 2014).

Over the course of the nine years that the organization has conducted outdoor education programs, SNJ has grown and adjusted their offerings to meet the dynamic changes that have occurred in science education in elementary schools. From 2010 to 2013, SNJ transitioned the curriculum to meet Common Core State Standards and Next Generation Science Standards. This shift ultimately culminated in the development of

curriculum that could fit into the yearly learning goals of elementary school teachers (Sierra Nevada Journeys, 2014). Aligning the programs in this way allows the SNJ team to provide services that not only assist with standardized tests, but also build long-term interest in the environment.

In 2014, SNJ was considering a strategic expansion of its GCR campus due to increased demand of its on-campus, Overnight Outdoor Learning (OOL) program. This expansion could potentially take two different forms: 1) a physical expansion of the campus which would increase its maximum capacity and allow them to host larger groups during their busiest season (in the summer months) or 2) an expansion of its offerings into the low season (winter months) which would allow them to increase their total year-round capacity. With this question in mind, SNJ approached the University of Michigan, School of Natural Resources and Environment, in the hopes that a Master's Project team would be able to adequately assess the situation, develop case studies on best-in-class organizations, and ultimately provide a recommendation as to which option better suited their needs and how best to approach that type of expansion.

The following year, SNJ learned that their parent organization – the Sierra Health Foundation – would soon be gifting them the land upon which GCR is located. This was an incredible and groundbreaking announcement and affected SNJ's opinion of how to best proceed with their expansion accordingly. As soon-to-be-owners of the land, SNJ decided that a physical expansion would make the most sense and instructed our team to explore this avenue and provide a recommendation on how to best proceed accordingly.

In this report, we provide a background on the project itself, the outdoor education field generally and SNJ specifically, explain the current state of the organization and their needs, and discuss both the process for and results from our qualitative interviews with best-in-class outdoor education organizations. We conclude with our proposed recommendation for an infrastructure expansion, in the form of landscape and classroom designs, as well as possible additions to SNJ's curriculum based on our recommended physical additions to the GCR campus.

4. SNJ's Strategic Expansion - Project Details and Parameters

4.A. Project Details

SNJ is well-positioned, after years of continued growth, to make improvement and expansion of their program a priority. When SNJ first approached us with this project in 2015, the main objective of the project was for our team to explore two different growth options and subsequently provide a recommendation for SNJ to pursue one of the two paths to expansion. One of these options, conducting winter programming at Grizzly Creek Ranch, was originally a high priority growth strategy for SNJ. However, as the project progressed, new information came to light and their organizational priorities, causing our project to change focus from broader growth options to a specific opportunity area. This change was prompted when the leaders of SNJ were notified that the land used for Grizzly Creek Ranch would be gifted to them, making them the full-owners of the property. As future owners of the land, they are in a position to vastly improve and upgrade the infrastructure to match the specific needs of their organization. Accordingly, they requested that we assist in the first stage of their strategic growth initiative – developing more classroom-specific space.

SNJ is at the beginning of an expansion period for their campus, organization and the clients that they serve. One area that can truly propel their educational offerings is the incorporation of indoor learning space. It is vital that this space is well-located and designed to meet the specific needs of their students and teachers, and that it is meant to supplement and improve the outdoor portions of the SNJ curriculum. The campus expansion is an especially exciting undertaking, as “creating new spaces allows an institution to address the changing needs and expectations of students and faculty” (Herman Miller, 2008). As such, we are very eager to provide a recommendation to help SNJ design and implement the best learning spaces for future generations of Grizzly Creek Ranch attendees.

4.B. Project Parameters

An extremely important aspect of the campus expansion design and recommendation process is the parameters within we should operate, namely, understanding the needs, restrictions, and desires of the SNJ team. This was very important as we aimed to develop a design recommendation that would suit the organization as it is now and also meet the needs of the organization in years to come.

Throughout the project, the team interacted with various key stakeholders within SNJ to better understand the needs and constraints of the organization. Specifically, we spoke with the Chief Executive Officer of the organization, the Development Director, the director of Grizzly Creek Ranch and the team member responsible for curriculum development and execution.

As we sought to develop a tailored recommendation for GCR's expansion, we were in constant communication with SNJ personnel to ensure we fully understood their needs. These conversations guided us from thinking their problem was simply one of increased

demand and limited capacity to later understanding it as a way to best utilize the organizations resources to provide an improved outdoor education learning experience to more students with improved and expanded infrastructure. As expressed by SNJ leaders, funds are becoming available for this type of expansion in the near future, so it is crucial to their immediate and long-term health.

Additionally, the guidance received in these discussions was that the team should ignore potential constraints and instead think creatively of the best possible solution. The team at SNJ instructed us to think of what the ideal solution would look like without resource constraints. This allowed us to use our learnings from the best-in-class organizations we spoke to in our interviews to design a solution that both increased SNJ's capacity and improve their program offerings. Our proposal focuses specifically on the elements of landscape and classroom design that would allow SNJ to offer an experience on par or exceeding those at the outdoor education centers they considered to be the gold standard. Accordingly, it addresses changes to the structures and outdoor areas around GCR, as well as the addition of indoor classroom space and modifications to the curriculum.

Additionally, as an outdoor education organization whose main goal is to instill respect for natural resources and the environment, we incorporated elements of sustainability into our proposed designs. These elements will allow SNJ to use the buildings and systems themselves as teaching tools and to display the organization's values in a physical, tangible form.

To address current organization needs, the team conducted research using qualitative interviews, and reviewed existing literature on outdoor educational center features and curriculum (detailed later in the report). Ultimately, the goal of this research to understand the current trends in this area, the resources needed to develop viable systems, and the benefits associated with their use – both environmentally and academically.

5. Part 1: Understanding Outdoor Education and its Benefits

The education techniques utilized by SNJ are based in the concepts of outdoor and place-based education. These techniques, founded in an attempt to connect students to the local environment and ecosystem through hands-on experiential learning are a proven way to connect with students in a holistic manner (Brookes, 2004; Woodhouse and Knapp, 2000; Ford, 1986). Specifically, this type of programming is shown to have positive impacts on overall educational performance, individual attributes, and environmental stewardship – all of which are areas of emphasis for Sierra Nevada Journeys.

The prevailing research on outdoor environmental education states that there are topics better-suited to be taught outside of the classroom, surrounded by real-world examples of the area of study (Adkins and Simmons, 2002). This concept is not new – in fact it has well documented use that began over 100 years ago (Wagner, 2000). For example, Sharp (1943), one of the earliest advocates of modern outdoor education, once said, "That which can best be taught inside the schoolrooms should there be taught, and that which can best be learned through experience dealing directly with native materials and life situations outside the school should there be learned". Taking this a step further, another early advocate for this theory, Julian W. Smith, stated, "Outdoor education means learning "in" and "for" the outdoors. It is a means of curriculum extension and enrichment through outdoor experiences" (Adkins and Simmons, 2002). Overall, modern outdoor education it is an attempt to move past simply learning facts about a topic, and instead experiencing it firsthand. This transitional step is not to be seen as a way eliminate or derogate the importance of classroom-taught subjects (Woodhouse & Knapp, 2000). In fact, as emphasis on the sciences grows in our education system, the trend to move class outside to focus on hands-on learning is likely to increase (Ballbach, 1995). Outdoor education is a way to supplement the educational process through the ability to focus on core concepts and skills that are needed for action (Adkins and Simmons, 2002). Moreover, it provides the ability for a student to develop a sense of understanding of the greater environment and the impact of specific actions or inactions (Payne, 2006). Ultimately, outdoor education provides a demonstrated value to the learning of students and their perceptions of the environment.

Some of the positive impacts of outdoor education are tied directly to students' increased environmental stewardship and understanding. Studies show that participation in outdoor activities can lead to a stronger knowledge of and empathy toward environmental issues and willingness to protect the environment (Palmberg & Kuru, 2000). This is partially due to the fact that outdoor, hands-on learning can "breathe real authentic life into the processes of learning and the nature of educational experience" (Payne, 2006). Beyond that, it helps to shape students' perceptions of nature and their place within the system (Thomashow, 1995). According to Ford (1986), the philosophy of outdoor education comes down to four premises: 1) a commitment to human responsibility for stewardship of the land; 2) a belief in the importance of the interrelationship of all facets of the ecosystem; 3) a knowledge of the natural

environment as a medium for leisure; and 4) an acknowledgement that outdoor education is a continual education experience.

Another main point of focus of place-based education is the importance of the specific location where it takes place. By tying in various cultural and historical aspects of the ecosystem, it is possible to ensure that students have a better understanding of how we, as humans, use nature (Ford, 1986), hopefully, inspiring a long term relationship with the natural environment. Lastly, it is important to consider the secondhand impacts of inspiring such thoughts in youth. For instance, studies show that parents of children who have attended outdoor environmental education become more conscious of their environmental impact (Vaughan et al., 2003). Also, as John Dewey promulgated in his theories, outdoor education can create a lens of disciplined engagement for students' local ecosystem and the sustainability of their culture (Woodhouse and Knapp, 2000). Ultimately, outdoor education has tremendous positive results in terms of perceptions on the environment, however the benefits of this programming move past the environment and science curriculum in general.

Numerous studies have shown the wide-ranging impacts of outdoor education on students in both the educational and personal realms. In terms of educational performance, a study that compared student test scores of eight place-based classes in California with eight equivalent classes without outdoor education programs found that Environment as an Integrating Context for learning (EIC) students outscored their peers in all academic areas (State Education and Environment Roundtable, 2000). Additionally, a national study found that after adopting place-based approaches, seven schools saw improvements in standardized test scores (Glenn, 2000). Another study showed that outdoor education improves critical thinking skills in 9th through 12th graders (Ernst and Monroe, 2004). The positive transfer brought on by outdoor and place-based education continues past test scores and grades – one study found that students in place-based classrooms scored significantly higher in achievement motivation compared with students in non-place-based classrooms (Athman & Monroe 2004). Achievement motivation is one indicator of students' engagement in schoolwork, which subsequently affects academic performance. Moreover, students exposed to place-based education programs have fewer instances of disciplinary issues in school (Falco, 2004; Lieberman and Hoody, 1998; Glenn, 2000; State Education and Environment Roundtable, 2000) and exhibit more responsible behavior inside and outside of the classroom (Bartosh, 2003). Additionally, students' attendance rates at their "home" school generally improve (State Education and Environment Roundtable, 2000). A survey of fifty-five schools nationwide (Duffin et al., 2004) and an evaluation of ten middle schools in South Carolina (Falco, 2004) showed that teachers perceived students involved in place-based programs to exhibit greater engagement in and enthusiasm for learning (Bienick et al., 2013). These conclusions were confirmed in an Indiana study that stated that learning broad ecological concepts in a hands-on environment improved enthusiasm and teamwork skills (Alexander, 1991). The above-stated benefits not only show the myriad reasons why outdoor education is important, but specifically, why organizations such as Sierra Nevada Journeys (SNJ) provide important services to their communities. On average, 90% of participating students increased comprehension on state science standards and over 55% of students served

come from lower-income school districts who serve children that might not otherwise have early childhood experiences with nature (Sierra Nevada Journeys, 2014).

With America's children now spending an astounding seven and a half hours indoors, the importance of outdoor education has never been more critical. Time spent playing and learning outdoors has shown significant benefits, both inside and outside of the classroom, but time spent playing outside has dwindled to a measly few minutes per day (Rideout et al., 2010). The consequences of this new "indoor childhood" are clear, and range from increased health problems to reduced ability to relate to others to more aggressive and antisocial behaviors. Some public health professionals even think this might be the first generation whose lifespans are shorter than their parents'. Luckily, the benefit of time spent outdoors is also evident: it requires a child's many types of intelligence, increases student motivation to learn, improves classroom behavior and performance, allows students to concentrate better and for longer, has a positive impact on a child's self-esteem and attitudes, and strengthens social effectiveness and ability to work in teams (Coyle, 2010).

While children's average daily indoor time has increased steadily, funding for education in the U.S. has dropped, consequently decreasing budgets for outdoor education and field trips. As states across the country continue to receive less funding, more "creative" subjects, like the arts, and field trip opportunities are the first to get cut (Thomas, 2012). Despite understanding the many benefits of outdoor education, administrators and teachers across the country are faced with decreased budgets and more rigid state curricula, leaving many without the opportunity to engage their students in learning outside of the classroom. The trouble, then, lies in the fact that educators are often forced to decide between teaching to the state's specified curriculum and staying within their budget, or providing unique and fruitful learning opportunities for students to learn and develop outside of the four walls of their classroom. This exact issue led SNJ leadership to develop programming that paired outdoor and place-based education with state education standards (Sierra Nevada Journeys, 2013).

Outdoor education through programs like those offered at Grizzly Creek Ranch (GCR) - Sierra Nevada Journey's campus in Portola, California - provide a unique learning environment in which students can develop their cognitive abilities, understanding of and appreciation for the environment, and enhance the subjects they have learned in the classroom. Simultaneously, teachers are granted the opportunity to forge stronger relationships with their students and are no longer faced with deciding between teaching state curricula and providing field trip opportunities. With science-based curriculum adapted to the California state standards and many fully-credentialed educators, SNJ allows for students in the northern California region to have a life-changing experience at a young age far richer than that which he or she would receive in a classroom. SNJ's programs focus on Common Core subjects, as well as Next Generation Science Standards (NGSS), and range from half-day class field trips (Classrooms Unleashed) to overnight adventures lasting up to five days (OOL). Moreover, by matching their offerings with the school curriculum they improve the likelihood of successfully reaching students (Cooper, 1999). SNJ also works with educators from each school to tailor the curriculum and experience to the school's individual needs, further reducing the tension

between novel outdoor learning experiences and teaching the required curriculum (Sierra Nevada Journeys, 2013).

With so many benefits offered and an ability to adapt educational offerings to the state's curriculum, it is evident why SNJ's continued growth and improvement is vital to the communities they serve. SNJ firmly believes that all students should be granted the opportunity to get outside for hands on learning experiences, and has worked to make the program affordable for all students, evident through its sliding fee scale and increased focus on enrolling more low-income students (Sierra Nevada Journeys, 2013). While outdoor education benefits all students, low-income students are positioned to benefit even more because of the general lack of green and outdoor learning spaces in urban areas. As described by an inner-city teacher,

“as a result of the blight and crime that surrounds my school, students rarely have the opportunity to spend time outdoors. Because only about 30% of their families have cars, it is not unusual for my students to spend the vast majority of their lives within a four-block radius of their homes. They are actively encouraged to stay close, not explore, and avoid anything that looks new or different” (Keteiyan, 2015).

SNJ's effort to support underprivileged and minority communities is a crucial part of their mission. Research shows that schools in low-income areas are being left behind in important educational opportunities such as outdoor, environmental, and experiential learning (Mayeno, 2000). One positive and realistic solution to address this gap is through the efforts of camps like SNJ. Due to the important, positive, and widespread impacts of outdoor environmental education, we believe SNJ's mission is one that is worthy of support and feel confident that our design recommendation for campus and curriculum expansion at GCR will allow SNJ to further improve its value proposition and continue to share this life-changing experience with an even wider number of students.

6. Part 2: Assessing the Current Organization

6.A. Mission

Sierra Nevada Journey's mission is "to deliver innovative outdoor, science-based education programs for youth to develop critical thinking skills and to inspire natural resource stewardship" (Sierra Nevada Journeys, 2013). To achieve this mission, SNJ offers a range of programs in northern California and Nevada, including a mixture of classroom and field training, residential education programs, teacher training, family events, and team building and leadership development.

6.B. Programming Overview

Programs span from half-day class field trips to overnight adventures lasting up to five days. Currently SNJ offers four types of programs:

6.B.1. Classrooms Unleashed

This program offers educators the chance to get their students into a completely different learning environment. It includes three ninety-minute in-class lessons taught by fully-credentialed teachers and a half-day field-trip to a nearby nature area designated and led by SNJ instructors. These programs are tailored to schools' individualized teaching needs, and SNJ staff works with educators to plan their time together. Additionally, the fees for this program are flexible and take into account a school's financial abilities. The program is open to 1st through 5th graders, with each grade's curriculum tailored to the Common Core and NGSS. Specific courses within the program include:

- *Nature's Transformers* (1st grade): Four-lesson unit students to build literacy skills while learning about biomimicry – the process of using nature to help solve human problems. Students work collaboratively to read informational text, gather information, practice asking questions based on their observations, and discuss ideas with peers to develop solutions to human problems using the natural world as a guide.
- *Matter Matters* (2nd grade): Students work collaboratively to explore properties of matter and apply their understanding to solve a problem. Students discover the relationship between the properties of matter and its uses.
- *Habits and Habitats* (3rd grade): Students learn about habitats, survival of organisms, and patterns of environmental change.
- *Our Amazing Earth* (4th grade): This unit focuses on patterns of change found on the earth's surface, including those caused by plate tectonics, weathering and erosion, and human impact.
- *Hands in the River* (5th grade): This program takes students through a hands-on investigation of the earth's systems related to the hydrosphere, and students collect data to analyze the health of the watershed system.

6.B.2. Overnight Outdoor Learning

SNJ's capstone offering, this program gets students out of the classroom for overnight adventures at Grizzly Creek Ranch, SNJ's 1,500-acre outdoor learning center.

- The programs span from one to five days and the lessons taught aim to build critical thinking skills and are tracked with assessments before and after attending to ensure their long term impact and success.
- The programs are held in GCR's facilities and are customizable to the educators' needs.
- Program topics span from forest ecology to engineering to campfire storytelling. However, some of the most common courses offered include: Forest Ecology, Pond Ecology, Astronomy, Geology, Engineering, and Night Hike. Before attending the program, both teachers and parents are invited to information nights. The educational aspects of this offering are customizable to the needs of the class or school involved.
- The programs address the Common Core and Next Generation Science Standards.
- The cost of the program is on a sliding scale and depends on a school's resources and ability to pay.

6.B.3. Family Science Night

This portable SNJ offering involves the whole family in exciting and interactive STEM (science, technology, engineering and mathematics) activities at their children's' school. The events take place at the school site over the course of one evening and include a scavenger hunt of STEM challenges, an engineering competition, and language-neutral activities that allow all family members to participate. Specific programs and activities include:

- A scavenger hunt that includes both math and science challenges
- An engineering competition (e.g. who can build the most stable bridge or best catapult)

6.B.4. Professional Development

This SNJ program takes place at GCR and is designed for educators rather than students. It is oriented towards expanding their toolbox through new teaching methods, by gaining an increased knowledge base and exploration of new areas of content while learning best-practices from fellow educators. This program was important to the development of our recommendation, as it forced us to also consider elements that would allow educators to best benefit from their time at GCR. The components of this important program include:

- *The Daugherty Science Internship*: This program is meant to increase science teaching experience in elementary education. Stipend interns participate in a blended student teaching experience which includes seven weeks at a traditional school placement and seven weeks teaching science with SNJ, all to take place during students' teaching semester. It also includes two weeks of training on

science instruction with SNJ, including working with and observing UNR College of Science researchers to experience cutting-edge, hands-on STEM research.

- *NGSS Bootcamp*: The goal of Sierra Nevada Journeys' NGSS Boot Camp is to help elementary school teachers better understand and implement Next Generation Science Standards. This program takes place over the course of three days and is free of charge for up to 50 teachers.
- *Curriculum Extensions*: These additional resources allow teachers to continue to build on the experiences and learnings gained during SNJ-lead programs. This facilitates continued science, environmental, and outdoor education.
- *Project Learning Tree*: Project Learning Tree (PLT) is an award-winning environmental education program for teachers and non-formal educators. Through hands-on interdisciplinary activities, PLT helps young people learn how to think, not what to think, about environmental issues.

6.C. Student Demographics

Total Students Served by SNJ

In total, SNJ served 17,429 students in calendar year 2015. Of these students, 6,779 (38.9%) were taught in programs at the Grizzly Creek Ranch (GCR). The remaining students were trained in the vicinity of the students' school through the Classrooms Unleashed program.

Of all the students who attended an SNJ program, 55% (9,586) were from low-income schools, as were 55% of those who specifically attended a program at GCR underscoring the importance of the program's reach and the fact that an expansion would allow them to reach an even wider audience.

Additionally, SNJ has seen growth in the number of schools who participate in all four major program types. This increase in Whole Schools (those who participate in all of SNJ's programs, at GCR and at their own school), from five to eight represents a 60% increase year over year. Of these schools, three are high-income, one is considered middle-income, and four are low-income.

Programs and Attendance at GCR

GCR is used throughout the school year for Overnight Outdoor Learning (OOL) as well as for Professional Development programs. The GCR campus is at its highest utilization during the summer when the camp is used as a traditional, overnight summer camp. However, the busiest time for the OOL program, when elementary schools come to GCR for overnight stays and up to five days of outdoor learning, is between the months of April and October when 94% of the year's schools that participated in OOL are at GCR.

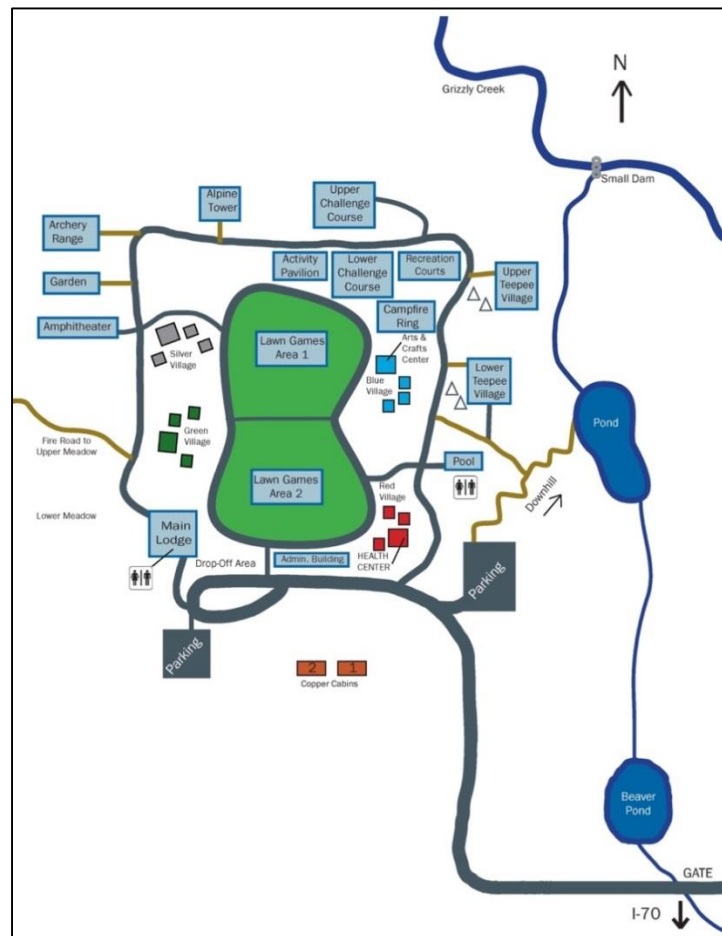
6.D. Achievements

Over the course of the nearly ten years that the organization has served the community, the programs have reached tens of thousands of students. As SNJ continues to expand and develop their programming, demand for their services continues to rise. Specifically, the number of students participating in the Classrooms Unleashed program grew by 68%. The main achievement of the program is that an average of 90% of participating students increased comprehension on state science standards (Sierra Nevada Journeys, 2014).

6.E. Grizzly Creek Ranch Site Description

The campus which SNJ hopes to expand is their main outdoor education center, Grizzly Creek Ranch (GCR). The campus is located in Portola, California, forty-five minutes outside of Reno, on a 1,500-acre plot within a yellow pine forest. It is made up of several structures and unstructured outdoor education and recreation areas. The structures include administrative buildings, both hard- and soft-structured sleeping areas, a health center, arts and crafts centers, an amphitheater, and a climbing tower (Figure 2).

Figure 2: Overview of SNJ's Grizzly Creek Ranch



Existing Structures and Outdoor Areas

The GCR camp facilities can accommodate up to 204 overnight students in several “villages” and two dormitories. The sleeping accommodations consist of four modern Cabin Villages, a summer Teepee Village and two large stand-alone dormitories. The Cabin Villages consist of three modern cabins that accommodate up to ten students and two adults in separate alcoves, and its own restroom. Additionally, each village has an activity center used for group gatherings or meetings, and activities, such as arts and crafts. All of the buildings are air conditioned in the summer and heated in winter. Cabin Villages are situated around a large meadow and are connected to the Dining Lodge and other facilities with wide, hard-surfaced walkways. GCR also offers campers Teepee Villages in the summer. Two large stand-alone dormitories round out the sleeping options on campus. The dorms have a modern design with en-suite bathrooms, accessible showers, air conditioning and heating.

The campus also includes additional infrastructure that is capable of serving approximately 350 overnight students. These areas include one large dining facility that is co-located with the main lodge and all of the indoor education space.

The ranch’s most important features are its many outdoor recreational and educational areas. These consist of both natural and built environments whose purposes include education, team building, developing critical thinking skills, and recreational activities. These landscapes and structures allow SNJ to offer a wide variety of programs that allow for both opportunities for outdoor education, and activities that fit the more traditional role of summer camps. Some of the key natural areas include the lawn, pond and forest ecosystem areas, numerous trails and hiking paths, and a garden (Figure 2). The outdoor built structures include the Challenge Course (low and high ropes), Alpine (climbing) Tower, swimming pool, archery range, and basketball and volleyball courts. These features allow for flexibility across the programs that SNJ offers.

Importance of Indoor Learning Space

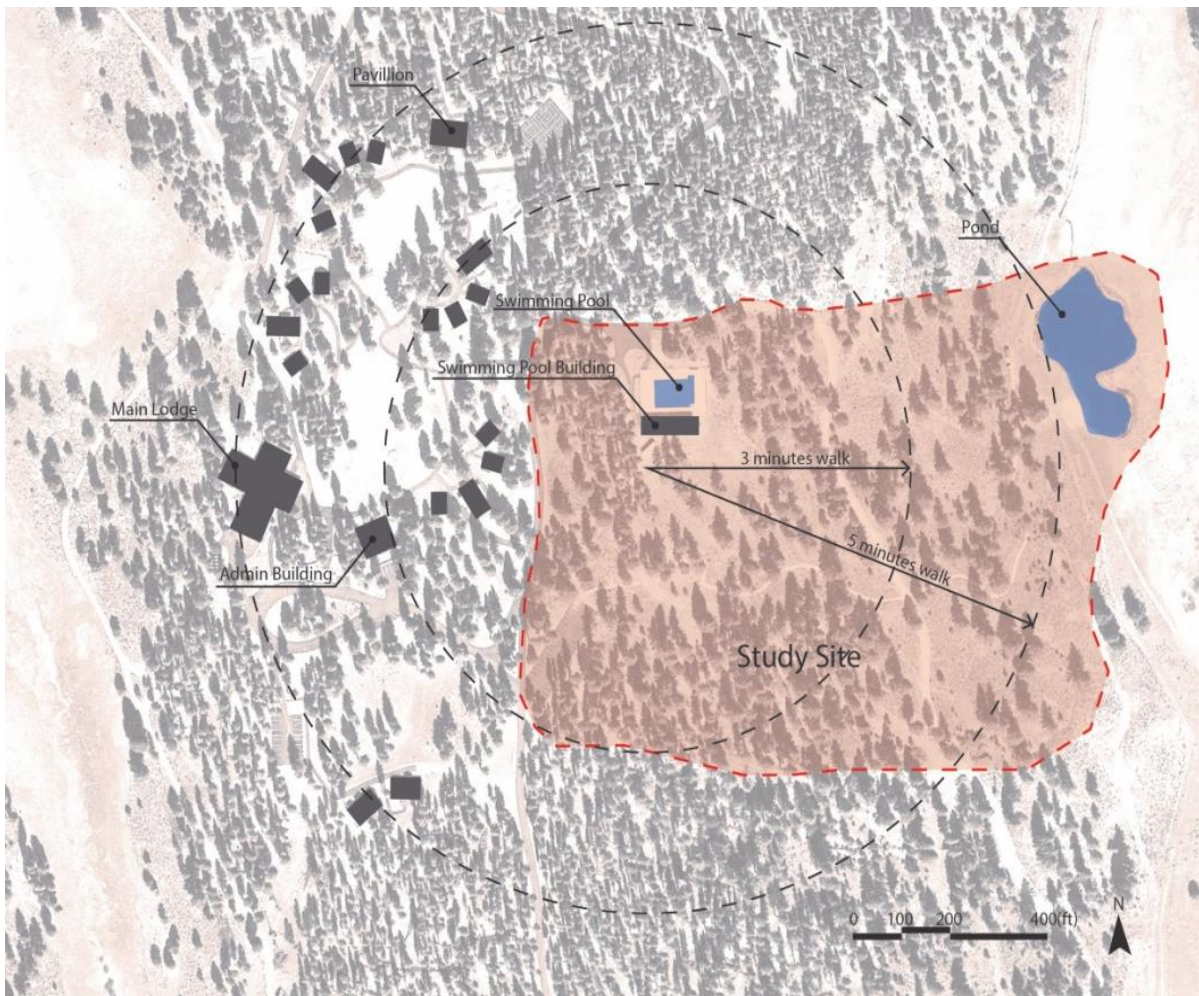
The issue of classroom expansion is a priority to the SNJ leadership team for several reasons. First, they currently do not have space that was specifically designed to be used as a classroom. Instead, they have transformed cabins, the cafeteria, and shelter areas to serve as classrooms when needed. Secondly, while most outdoor environmental education is meant to take place directly interacting with the outdoors, many of the classes could be improved by having access to a laboratory space to analyze specimens and samples collected around GCR, which do not currently exist on campus. Although many of the classrooms do not require state of the art equipment, the curriculum would benefit greatly from the inclusion of a space for conducting analysis with microscopes and other basic lab equipment. Lastly, as their buildings are currently arranged, they do not have large-scale options to conduct hands-on training indoors in case of adverse weather. The climate conditions in this area do not make this a large priority, however as the leaders of SNJ look to transition

to year-round programming this type of indoor space is important. Moreover, as none of the current infrastructure was designed to be used as a classroom, it lacks the design, space, and equipment to provide a first-rate learning environment.

6.F. Grizzly Creek Ranch Study Site Details

In order to provide a reasonable and feasible growth plan for GCR, it is important to define the site where SNJ will be adding infrastructure to their campus. Based on SNJ's needs for a new classroom and our desire to use the campus additions to provide students with an enhanced learning experience and our knowledge of the campus' features (namely the pond and the swimming pool facility), we suggest a 2.6-acre area as the location to implement our plan (Figure 3).

Figure 3: Grizzly Creek Ranch Proposed Expansion Site



To effectively design an expansion plan, it is also necessary to understand the site conditions in terms of weather, plant and animal species, water resources and human scales. General characteristics of GCR, which apply to the study site, are as follows:

- The highest average temperature is 23 degrees Celsius in July and the lowest average temperature is 3 degrees Celsius in January.
- The highest average precipitation (about 25 inches) generally happens in December and rain water is very limited during the summer.
- According to our discussion with staff on the campus, this area experiences short and hot summers and moderately cold winters with some snow.
- The main plant species in the area is the yellow pine and animals such as Tule elk (*Cervus canadensis nannodes*), Northern harrier (*Circus cyaneus*), ground squirrel (*Marmota sp*), Grey fox (*Urocyon cinereoargenteus*) and Black bear (*Ursus americanus*) have been spotted around the campus.
- To the east of the site, there is a 0.85-acre pond which is considered a key feature on this site, especially for programs like Pond Ecology.
- Within the bounds of the study site, there is also a swimming pool and an associated building on the west side.
- The site is to the east of the living area and it takes about five minutes to walk between the (existing) main lodge and the pond area.

7. Part 3: Analyzing the Competitive Landscape: An Analysis of Benchmark Organizations as Context for Best Practices in Infrastructure Expansion

7.A. Overview of Actions Taken

In order to provide a proposal for the expansion needs of SNJ, we built upon the context provided by SNJ with several other lines of inquiry which allowed us to understand the situation more broadly. First we reviewed literature on outdoor and place-based education, outdoor environmental curriculum, sustainable infrastructure, and landscape design. Then, to gain a comprehensive understanding of the field of outdoor education and what actions experts are taking to drive a high quality, engaging processes, we conducted interviews with leaders of ten benchmark outdoor education programs concerning strengths and weakness to expansions conducted in their organizational history. These interviews were qualitative in nature and were conducted with leaders of organizations identified by SNJ for known excellence in the field of outdoor environmental education. We also conducted a site visit to Grizzly Creek Ranch, which allowed the team to gain a better understanding of the environment in which SNJ operates. Using this information as a foundation, a landscape design was constructed to meet the expansion needs of SNJ and the best practices learned from the interviewed conducted. Next, the team explored how the proposed facilities could be incorporated into the existing courses provided by SNJ, as well as to project additional ways that classroom and landscape expansions could be utilized in the future. In order to do this, the team leveraged information from background research on the organizations selected for interviews as well as the interview results themselves. By collecting information on several classes offered by organizations interviewed, the team was able to focus its research efforts on courses similar to SNJ's offerings and provide further perspectives or additions to their lesson plans.

As much of the research conducted over the course of this project concerned the built environment and classrooms, our team was in a unique position to understand how other organizations incorporate infrastructure into their learning environment. One important aspect of this research was understanding “alternate” activities that take place indoors in times of unfavorable weather. The team also looked at courses offered at other organizations not currently at SNJ to understand how SNJ could utilize a new classroom to improve their current program and continue to build toward the future.

7.B. Interviews: Learning from Leaders in Outdoor Education

Organizations Included in the Interviews

The team conducted qualitative interviews as a primary method of research to understand successful growth strategies in the realm of outdoor environmental education. Initially, our goals included gaining perspectives from our interviewees on expanding the SNJ program through offering programs in the winter months (currently not done at SNJ) and through infrastructural expansions. In meeting these objectives, we hoped to distinguish which of the two options was best for SNJ and take away key learnings from the experience of the interviewees. Ultimately, allowing us to provide a

strategic plan to our client founded in the experiences of the leaders of our benchmark organizations. This would provide a roadmap to apply key learnings where possible and, when paired with literature, a course of action that delivers the best chance for organizational success. The above-listed goals made interviewing especially helpful for our project (Rubin and Rubin, 2012).

In order to conduct our interviews with peer organizations, SNJ provided us with a list of fifteen non-profit outdoor education centers identified as “best-in-class” organizations (Table 1). We added one additional school to the list due to its proximity to us here in Michigan, and began reaching out to each of the organizations through email messages approved by SNJ.

Table 1: Target Outdoor Education Centers Selected for Interviews by SNJ and Name of Experts Interviewed

Name	Location	Name
1) Wolf Ridge Environmental Learning Center (WRELC)	Finland, MN	Pete Smerud
2) The Ecology School (TES)	Saco, ME	-
3) Yellowstone Association (YA)	Yellowstone National Park, WY	Jenna Vagias
4) Frost Valley YMCA	Claryville, NY	-
5) Pocono Environmental Education Center (PEEC)	Dingman’s Ferry, PA	Jeff Rolasky
6) Glen Helen Outdoor Education Center	Yellow Springs, OH	-
7) Great Smoky Mountain Institute at Tremont (GSMIT)	Townsend, TN	John DiDiego
8) Teton Science Schools	Jackson, WY	-
9) Cheakamus Centre (CC)	Brackendale, BC, Canada	Vic Elderton
10) NorthBay Outdoor School (NOS)	North East, MD	Richard Garber
11) IslandWood	Bainbridge Island, WA	-
12) Audubon Center of the North Woods (ACNW)	Sand Stone, MN	-
13) McDowell Environmental Center (MEC)	Nauvoo, AL	Maggie Johnston
14) St. Christopher Camp and Conference Center (SCCCC)	Johns Island, SC	David Gardner
15) North Cascades Institute (NCI)	Sedro-Wooley, WA	Jeff Giesen
16) Howell Nature Center (HNC)	Howell, MI	Richard Grant

The outdoor environmental learning centers included in the list provided by SNJ have demonstrated success in this field through sustained activity and participation in national conferences of leaders in field of the outdoor education. The dominant factor of defining success for this list was the client's insider knowledge of other outdoor environmental education programs and which organizations have a model that best fits their learning needs. Several other factors and considerations make this sample an appropriate group for our research needs, as described below.

- These outdoor education centers conduct or have conducted outdoor education programs in winter (cold weather) months. This is of importance as the use of indoor classroom spaces is more likely in this type of climate, which informed our ideas of classroom spaces for GCR.
- These outdoor education centers are located across various regions of the country and represent regions that include the Northwest, West, Northeast, Southeast, and Midwest, which ensured that any trends identified transcended unique regional characteristics.
- These organizations have different revenue streams and funding sources, which allowed us to explore a variety of program structures and possible future uses of GCR by SNJ. Some, like GSMIT and YA are part of large national parks and receive funding from the national park system. Others, such as the Ecology School and WRELC, are independent organizations that rely on different resource types. This diversity is important as it ensured that any trends found in the data were not unduly influenced by the type of funding the organization receives or the organizational structure they use.
- These organizations represent a variety of climatic regions. This is important as it provided some context to the most extreme winter weather situations that a camp is likely to face (in places like ACNW, TES, CC) while also providing context in more mild settings (like at GSMIT, IslandWood, NOS, and the MEC). This climatic variation assisted the team in matching ideal programs for SNJ's location while also providing insight on extreme temperatures and weather events for planning purposes. Additionally, the differing climatic regions represented provided a wider range of programming and activities for consideration.

Information on the outdoor environmental education centers that were included in our interviews provide a frame of reference to consider when preparing our design and expansion proposal for SNJ. General characteristics of the campuses and programs are as follows:

Wolf Ridge Environmental Learning Center (WRELC) is an outdoor environmental education program that is located in Minnesota. It is located on approximately 2000 acres, slightly larger than SNJ's Grizzly Creek Ranch. Each year, it serves approximately 18,000 students – well above SNJ's totals. They employ thirty-five full-time employees and have operated for over 44 years. The campus has nine separate types of buildings – including two that are designed specifically for educational purposes.

The Pocono Environmental Education Center (PEEC) is a forty-three year-old program located within the Delaware Water Gap National Recreation Area. The organization's campus is thirty-eight acres, however it sits amongst 300 more acres of property which they are able to access and utilize for learning. Each year, they see over 25,000 students of which 10,000 participate in residential programming. They employ ten full time employees and have nearly forty buildings on site. The majority of these structures are used for sleeping with the remaining buildings used specifically for instruction. Two of these are smaller "cabins" and one is a pavilion. The last building is a large nature center that has several indoor classrooms as well as a sizable "ecozone". The ecozone is a classroom area that uses an active and hands-on learning environment to provide a contingency plan to address the weather concerns of outdoor education. Also of note, PEEC is continuing to look at newer techniques and technologies for buildings in the future. They are committed to ensuring that their facilities utilize a variety of sustainable design techniques and leverage these functions in the education process.

Yellowstone Association (YA) is a unique case study as it is an environmental and outdoor education program that is partnered with the National Parks Service and Yellowstone National Park. This provides unique opportunities and demographics for the programs. Each year, they serve around 6,000 students (on par with SNJ) and do so with a smaller footprint of approximately 100 acres, though they do have access to the larger park for certain program at different times of the year. They have been providing their service for the past thirty-nine years and have a significant number of adult education programs in their curriculum. The Yellowstone Association does not have any space set aside for indoor classrooms; all of their teaching takes place outdoors. If weather is a concern, they still conduct training outdoors, but take appropriate breaks at shelters when needed.

McDowell Environmental Center (MEC) is a sixty-eight-year-old organization located in Alabama. It is a unique school in that it conducts both environmental education and is a farm school. These programs require approximately fifty employees to operate and draw just over 10,000 students per year. The campus is approximately 1,150 acres and consists of approximately fifty buildings. The majority of these buildings are cabins and lodges used as living spaces. They have five other structures set aside as "meeting spaces" that are used for a variety of purposes, including teaching in instances of severe weather. The camp emphasizes that they conduct their class outdoors – rain or shine – unless there is truly extreme weather.

St. Christopher Camp and Conference Center (SCCCC) is a forty-five-year-old outdoor education program on the coast of South Carolina. They have approximately twenty-five full-time employees who participate in the education of more than 8,000 students per year. The 314-acre property serves multiple purposes beside environmental education, most notably as a conference center and retreat location. As such, there are twenty-five buildings that make up its infrastructure, ten of which are cabins and lodges. The remainder is highly flexible spaces of a variety of sizes that can

be used for meetings, classes, and large presentations. None of these spaces are specifically designed to meet educational needs.

North Cascades Institute (NCI) is a thirty year-old outdoor and environmental education organization that is based in Washington. Although small – less than 1 acre of owned property – they are able to utilize the natural environment of northwest Washington and excellent infrastructure to draw both adults and children. Of their sixteen buildings, the majority of them are used for administrative purposes and the living needs of their clients. However, the remaining structures include two labs, a library, classroom, and three learning shelters. These facilities provide them with a mixture of formal spaces designed specifically for certain classes with easy access to the natural environment, as well as more flexible classrooms for general purpose use or adverse weather conditions.

Cheakamus Centre (CC) is an overnight outdoor learning center located in Canada. The campus is on 420 acres of ecological reserve and is owned by the North Vancouver School District, which provides them with a steady flow of attendees. The center has been around for over 45 years and offers programs for both children and adults. Its flagship program is its Outdoor School, which serves K-12 students. This program includes “field studies, youth leadership, outdoor recreation” and other experiential learning opportunities (Cheakamus Centre, n.d.). On average, the center employs thirty employees who manage the campus’ fifty buildings.

NorthBay Outdoor School (NOS) was founded in 2005 and is located in North East, Maryland that offers various programs ranging from on-campus learning programs for school-aged students to team-building programs to summer camp experiences to group retreats. Unlike SNJ, NorthBay uses its outdoor learning center to teach almost all school subjects, from language arts and social studies to math and science. Similar to SNJ, the curriculum taught at NorthBay is tied to the common core and Next Generation Science Standards. As one of the larger programs of its kind, NorthBay has about 130 full-time employees and twenty to thirty part-time employees at any given time. The campus itself boasts an impressive thirty-six cabins for attendees, as well as seven other freestanding buildings.

Great Smoky Mountain Institute at Tremont (GSMIT) is part of the greater Great Smoky Mountain National Park and works with the National Park Service to provide programs that “increase the awareness, appreciation, and understanding of the natural and cultural resources of the Great Smoky Mountains and promote stewardship of these resources” (Great Smoky Mountain Institute at Tremont, n.d.). They serve park-goers of all ages with programs ranging from private school trips to adult workshops to family and youth programs. Sharing SNJ’s desire to reach a wider audience, GSMIT offers financial aid to its attendees and has found great success with this initiative, drawing students from over thirteen states. With an emphasis on science and social studies, GSMIT also works with schools to customize their curricula. With a staff of twenty-eight employees, GSMIT focuses on serving students February through November with its single dormitory and surrounding natural areas.

Howell Nature Center (HNC) is located in Michigan on a much smaller area than SNJ – approximately 280 acres. They use this space well interacting with approximately 45,000 students each year. They have been serving their community for thirty-eight years and have conducted several infrastructure expansions throughout their history. Their campus is composed of eight buildings, the majority of which are designed as lodges. As a smaller campus, they rely heavily on the flexibility of the space they have to conduct a broad range of services. This need for flexibility extends to their building-use, enabling them to serve schools, community groups, businesses, and families.

Interview Process

Due to availability, we were unable to speak with personnel from every organization included in our initial list. (Table 1), A total of sixteen organizational leaders were contacted and ten made themselves available to be interviewed. Summer is generally the busy season for outdoor educational programs and each expert interviewed was at their respective education center.

The team conducted these interviews using a semi-structured method. This technique was selected as there were specific topic areas investigated. Additionally, as we had limited knowledge and experience in the field of outdoor environmental education, having several pre-screened questions allowed us to ensure that the information that we desired was solicited while leaving room for probes and follow-on questions (Rubin and Rubin, 2012). Also of note, the tone, demeanor, and general conduct of the interviews were guided by insights taken from several leading scholars on interview methods (Miles et al., 2014, Patton, 2002, Rubin and Rubin, 2012, Weiss, 1994).

The interview questions addressed three main topics to guide expanding the SNJ programming at Grizzly Creek Ranch. We asked eight questions related to expansions during winter, eight about the types of infrastructure needed to expand programming in general and two about the criteria driving expansion decision-making (Table 2).

All of the interviews were conducted between the months of May and September of 2015. Initial introductions and outreach were achieved through email messages sent to the recipients. This allowed the subjects to choose the time of the interview as well as the setting in which they answered our questions. Interviews were conducted by phone or video conference.

The typical interview took between thirty minutes and one hour. The difference in the discussion time was mostly driven by the fact that not every person interviewed had relevant knowledge in the area of infrastructure expansion. The typical interviewee was not only comfortable with the process but excited to assist another outdoor education program. This allowed the team to ask many clarifying questions and record the interviews.

All interviews were recorded and later transcribed by the team member who conducted each interview. The team members then coded the transcripts in order to organize the

data and analyze the information as laid out in research study methods by Miles et al. (2014). Using this method allowed us to sort through the data of the interview in order to find the core content. Each of the transcripts was coded and summarized by members of the team. This ensured that nothing of value was overlooked while also providing a second level of scrutiny to all of the transcripts.

Through interviews with ten of these organizations, we gained insight into the best practices for providing outdoor education (which includes curriculum and building uses). During the interviews, the team focused on questions related to the organizations' winter programs, the types of structures used to support the educational process and built to expand the amount of courses offered (both in terms of quantity of students and classes), and about the importance of the organization overall mission in relation to expansion experiences (Table 2). Additionally, we asked questions designed to gain information on the learning tools incorporated into the structures and sustainable features of buildings within the facilities. Questions were also included to gain key learnings from issues and shortcomings that the organizations encountered during and after their expansion efforts.

Table 2: Semi-structured interview guide

<p>Topic A: Strategy for running their program in the winter</p> <ol style="list-style-type: none"> 1. Would you start by describing the various winter programs that you conduct with school groups? 2. How do you compare your spring/summer/fall programming into your winter curriculum? 3. How do you compare your spring/summer/fall programming into your winter curriculum? 4. What type of winter programming do you conduct with the public at large? 5. What is the greatest strength of your winter programming? 6. What is the greatest weakness of your winter programming? 7. What are some specific challenges of conducting outdoor environmental education in the cold weather/winter environment? 8. How do you staff your winter programs? 9. If budget were not a constraint, what would you change about the winter program?
<p>Topic B: Information about infrastructural expansions</p> <ol style="list-style-type: none"> 1. What physical expansions has your school undertaken in the past ten years? 2. Prior to making this expansion, what structure types did you consider? 3. Can you describe the type of physical structures that your program developed for the expansion? 4. How did you incorporate the building into your curriculum? 5. How did your program measure the success of the expansion?

<ol style="list-style-type: none"> 6. What was the largest “hiccup” in the expansion process? 7. What do you know now, that you wish you knew before the expansion project? 8. What do your customers – students, teachers, etc. – most enjoy about your new buildings?
<p>Topic C: Overall mission and practice of running outdoor education centers.</p>
<ol style="list-style-type: none"> 1. How important is the underlying mission of environmental education to decisions made at the camp? 2. How important is "sustainability" features into your expansion planning?

7.B.2. Interview Results

Our response rate for the interviews was 63%. Our ability to reach personnel from the sixteen organizations was affected by their limited availability during the “high season” (May through September), as this is the busiest time at most outdoor education centers. The information is broken down by question category (Table 2) which includes the strategy employed to conduct outdoor environmental education in winter months, the strategy implemented when developing and executing an infrastructure expansion, and the overall mission, vision, and practice of running an outdoor environmental education program. Despite the shift in scope of the project from a winter program expansion to a general facilities expansion, the results related to winter expansion are included for potential future use by the client. However, winter programming is not discussed beyond this section.

Topic A: Winter Programming Results

One important aspect of our interviews was to gain an understanding of how many of the selected “expert” organizations conduct programming year round. The results of the survey indicate that an overwhelming majority (93%) of the interviewees teach winter classes. The only program that did not offer winter classes was NCI, an organization that in the past had attempted to provide winter courses. The main obstacle as expressed by Giesen of NCI, was the risk of being stranded on the campus due to heavy snowfall. With that context in mind, the key takeaways on winter programming are broken down in the following sections.

Type of Winter Program and Courses Offered

There are two main factors that influence the type of activities that take place in the winter. The first is the location of the camp. If the camp is located in a setting that generally receives a mild winter, then they are more likely to continue with their standard curriculum and programs year round. This allows the education center to continue throughout the year with the same services offered with little disruption. This is supported by the quotes by Johnston of MEC located in Alabama “We are in the south and we barely have snow. So we don’t have much difference between winter and other seasons” and by Gardner of the SCCC in South Carolina “...it’s not too difficult to do this because we don’t really have snow in winter”.

The second aspect that influences the type of winter activities is the popularity or demand for winter courses. In some schools, such as WRELC or the Pocono Environmental Education Center, there is a heavy demand for winter outdoor environmental education. This demand allows them to continue to run residential programs despite often extremely cold weather at their locations (Minnesota and Pennsylvania respectively). For example, Smerud, the Executive Director of WRELC, stated that “Our winter season is truly one of our busiest times of the year... (local schools) are unable to or are really fearful of doing something in the winter, so they really rely on expert facilitators to do that for them.”

Organizations such as HNC, WRELC, MEC, SCCCC, PEEC, and YA continue with their residential programming in the winter, but supplement the lack of demand with other offerings. This helps the centers to justify staying open to serve schools by bringing in excess funding through incorporating other programs. Examples of these programs include expanding to adult outdoor education in the winter (YA), renting the facilities to groups for retreats (all), and conducting programming with the public at large (PEEC, MEC, SCCCC, HNC). For example, Gardner from SCCCC stated “We do have an environmental education walk on the weekend for anyone who wants to sign up.” Additionally, Grant of HNC provided the following example of facility rentals, “we rent our conference center out in the winter to church groups or any other organizations in the winter time. Usually in January corporations are looking to do some planning for the rest of the year, so if the facilities that you are looking at have any type of conference facility or any type of room they could look into providing space to groups.” Opening up the services provided in the winter may allow SNJ to serve schools in the winter, despite a demand point that is lower than what is needed to break-even on costs.

Winter Curriculum Modifications

Outdoor environmental education is based on using the natural environment in the vicinity of the camps to teach science and natural resource stewardship. This means that as the seasons change, the course material must adapt with it. The general consensus of the organizations that were interviewed for this project is that the majority of the lessons taught in the winter are simple adaptations of the summer curriculum. The schools must take time to update the type of examples that are prevalent in the winter season, but the thought process and class outlines are generally the same. For example, a school that teaches pond ecology nine months of the year, such as WRELC, can transition that class to Frozen Pond Ecology. Another option discussed by Gardner of SCCCC in a more temperate climate (South Carolina), involved adjusting how samples are taken due to the changing locations of insects and animals as the air, ground, and water cool. Ultimately, with simple modifications, normal curriculum can be successful in the winter months. In fact, some schools believe certain classes are better taught in the winter. The following quotes truly set the framework for the opportunities available in winter curriculum.

“I would say that almost everything we do in May, we do in the winter,” Richard Grant.

“The concepts of some of the activities may differ, but the lessons are primarily the same. Some things are better in the winter,” Jenna Vagias.

“In the winter, generally, it brings us new course opportunities that we don’t have in the summer time. We do lose some things – like we don’t do geology in the winter, because everything is covered up by snow, but overall winter provides more opportunities,” Pete Smerud.

Challenges and Concerns for Winter Programs

It is important to understand that there are challenges associated with running an outdoor education center in the winter. Our interviews revealed three main areas of concern when conducting winter programming. The first is transportation issues. As mentioned above, one program eliminated winter programming due to this constraint. Three other organizations list it as the primary reason that classes would be cancelled or delayed. This is a limiting factor from multiple angles. First, it could restrict the ability of school and students to reach the camp. Second, transportation at the camp could limit access to various locations within the nature area. Last, issues in this realm could restrict the ability to return students to their home following the courses. The following quotes provide some context to the challenges associated with conducting winter programming in areas that get heavy snow fall.

“It is probably the transportation issue. The chance of a big storm going through when someone has book a four-day trip. Can they get here?” Jeff Rolasky.

“[The park] is only accessible through snow vehicles” Jenna Vagias.

“We have been stuck for anywhere from a day to eight days. So we have chosen at the moment, according to our risk management, to not conduct kids’ program up there during the winter” Jeff Giesen.

The second major challenge for winter programming is ensuring that the outdoor education center has the appropriate equipment on hand. In this case, equipment refers to two distinct things. First is items needed to successfully transition outdoor activities in snow. Items such as snowshoes, skis, and over snow vehicles are important depending on the amount of snow received at the camp. This was addressed as a concern, because in general there is very little equipment needed to perform outdoor education programming in the other seasons of the year. So, as one extends into winter, campuses require a sizable investment in equipment to ensure that it is successful. Moreover, these items will need to be stored for a large portion of the year, adding to the complexity of the issue. The second concern as it relates to equipment is attendees having sufficient warm articles of clothing (gloves, hats, scarves, boots, etc.). In general, the majority of students will show up well prepared for the elements, however from time to time additional resources may be needed, particularly if the organization is serving low income populations. Based on our interviews, four of the nine programs that offer outdoor education keep at least a small supply of this equipment on hand to share with students as needed.

The last concern that was uncovered during the interviews was safety, and the perception of safety at the camp. Seven of the ten camps that we interviewed are located in climates that have temperatures below freezing and expect snowfall throughout the winter (WRELC, YA, PEEC, CC, NOS, NCI, and HNC). This type of weather can expose students to cold weather injuries if the appropriate precautions are not taken. According to four of the programs, this begins through ensuring that the teachers, parents, and students know what to expect, and as such, ensuring that they have the equipment needed to be safe in the environment they will face. Another key safety issue that was addressed in the interviews was ensuring that the camp has protocols to monitor and protect the students. This included ensuring that there are a sufficient number of shelters in the vicinity of the outdoor classes and empowering staff members to seek shelter or take breaks depending on the needs of the individuals in their class. Four of the individuals interviewed mentioned how difficult it is to overcome the perception of risk in outdoor winter education. Quotes such as the one by Giesen of the North Cascade Institute, “It is a great place to be during the winter. But it’s difficult to get people believe that it is safe to be there” and by Smerud of WRELC, “the greatest challenge is managing people’s perceptions of the winter” show this challenge.

Ultimately, responses from interviews revealed that there are many benefits and challenges associated with outdoor environmental education in winter months. Through knowing the market, preparing the clients, and modifying the curriculum, winter programs can be successful. The overarching perspective of the interviewees is best summed up by the following two quotes by Grant of HNC, “It’s cool to be outside having fun in the winter”, and by Smerud of WRELC, “I really feel that we are doing a really important service that people in the upper mid-west know that getting outside in the winter is truly an amazing and fun opportunity.”

Topic B: Infrastructure Expansion Results

Of the ten organizations that responded to our interview request only five had knowledge of or experience with a classroom expansion. Within each of the interviews, however, several themes emerged that provided insights into best practices for infrastructure expansion. These themes included incorporating sustainability features into newly constructed infrastructure, the importance of flexible and durable design in new buildings, directly linking the infrastructure to the outdoors, and the criteria used to make the final decision on the buildings. The results are broken down by category below.

Incorporation of Sustainable Features into Modular Classroom Buildings

The five organizations that had experience with classroom expansions are HNC, WRELC, PEEC, MEC, and CC. Among these, all named “sustainability” of the building as a crucial aspect of their expansion. The experts that responded to the interview from these institutions (Smerud, Rolasky, Johnston, Elderton, and Grant), mentioned the importance of incorporating the latest sustainability features and technologies in expansions for two main reasons. The first reason is that these organizations feel a responsibility to live out their mission in every aspect of their program. In fact, two

different executive directors used the phrase “walk the walk” when referencing their insistence on incorporating sustainability measures into any new buildings, even if this brought on a higher cost (Smerud; Rolasky).

The second reason to incorporate sustainability features and technologies in expansions is that these features are incorporated in curricular aspects. Each of these five programs that have conducted expansions have successfully incorporated their new buildings and the environmentally-friendly features as part of the educational experience. This “total immersion” in sustainability throughout the students’ time at camp is an important part of seven of the programs included in the interviews irrespective of expansion efforts (WRELC, PEEC, MEC, HNC, GSMIT, NOS, and NCI). One of the most important aspects of conducting outdoor environmental education on site over several days is the ability to show the students that it is possible to incorporate this philosophy into any aspect of their life.

Through the course of the interviews, several techniques for incorporating sustainability features into the programs were presented. Smerud and Rolasky discussed taking steps to develop any new building in alignment with LEED standards. Rolasky, of PEEC, focused his discussions on the use of materials or structure types such as insulated concrete corms, foam materials in place of concrete, or simply using yurts to reduce the overall costs and impact of placing the buildings. Each of the five experts also mentioned incorporating design features such as solar panels, solar-thermal water heating systems, and passive solar concepts (awning design, orientation of building, type of paint used). Another example of this type of course came from Giesen of North Cascade and Smerud of WRELC. Although the course is not related to a recent expansion, both outdoor education centers utilize water treatment facilities that function and provide services to the camp as teaching tools to discuss environmental education. Overwhelmingly, sustainable design features were important to all of the experts interviewed who had managed an infrastructure expansion. Moreover, incorporating these features in the buildings represented a re-enforcement of the mission of the organization as well as an opportunity to expand educational opportunities. Lastly, Smerud noted that in his experience, funders are much more likely to donate to a building that supports the mission and is cutting edge than one that simply fulfills a need. This is echoed through the below-listed quotations:

“So we don’t just upgrade to make it better for the guests, we upgrade to incorporate relevant sustainable building practices,” Pete Smerud.

“We have a compost building that we really talk about waste and in the kitchen we talk about the Foodshed Initiative and then the green building we talked a little bit about architecture,” Jeff Giesen.

“We also teach a lot of sustainability / sustainability energy classes, so high insulating properties were important to us. So we can ‘walk the walk’,” Jeff Rolasky.

Criteria Guiding Campus Expansions

The interviews revealed many factors that are considered important when an infrastructure expansion is undertaken. The availability of money, grants, or other sources of income is a consideration that everyone takes into account. There was also a clear and decisive view represented by the respondents when thinking about money for a building which was that there is no such thing as a cheap building. As Smerud of WRELC stated – “you either pay now or you pay later”. This sentiment was reflected by both Grant and Rolasky as well. This leads to the opinion that it is best to purchase the best structure possible upfront.

The second aspect of design that is represented in our interviews is maintenance and upkeep costs. When making the decision to undertake a major expansion or the addition of a building it is easy to think only of the costs associated with construction of that structure. Any building, though, will require upkeep costs that last through the life of the project. It is important to note that this is especially true if the building incorporates technology with which the organization is unfamiliar. Rolasky of PEEC specifically mentioned struggles with maintaining solar panels and the necessity of building knowledge on this area within the organization that he runs. This could lead to increased costs associated with hiring an external team for maintenance or classes to increase local knowledge. Another expert, Elderton of CC, expanded on the point of needing outside knowledge for expansion, stating, “One of the things I have learned in that process though is that I don’t know enough to run out and do it on my own.” He continued on to echo the importance of gaining outside assistance and understanding the impact on future operating costs. This point is further broken down by the five experts in two ways – simply accounting for the costs of maintenance and upkeep in the estimate and understanding the skill that is present in the staff at hand.

The responses over the last theme within the design section of the interview revolved around making any building that is added flexible to a variety of groups and situations. Each of the organizational leaders that we interviewed discussed the importance of being able to serve multiple customers with the same set of infrastructure. Additionally, within the realm of flexibility, Smerud and Grant, two of the five experts who had lead infrastructure expansion, mentioned the importance of incorporating proper storage in any new building. Grant stated that through his experience “storage is always a need” for his organization. Smerud, who operates a camp that does a high level of winter program, spoke to the need for storage from the context of the large amount of gear and equipment associated with winter courses.

Fit with the Curriculum

The literature on the topic of environmental education research readily points outdoor environmental courses as a classic example of best practices (Project Learning Tree, 2010; Outdoor Environmental Education, 2016; CCCYO, n.d.; Edwards, 2015). There are organizations, such as PEEC and WRELC that have found ways to take this type of course a step further. For PEEC, uniqueness of the programming comes in the form of their ability to use the ecozone as a smaller scale indoor activity as an alternative for

adverse weather (Rolasky). The ecozone is a large open room that contains life-size scale models of several environmental features for educational purposes. These include an eagle's nest, a beaver's lodge, and a bat cave. Moreover, they use replica animal bones to discuss physiology of local species. The large space within the ecozone and special equipment purchased also allow them to teach pond / wetland ecology no matter the weather situation (Smerud,). On the other hand, WRELC has excelled at broadening outdoor environmental courses through the use of their indoor classrooms. For example, they take a standard pond ecology class a step further than the basic water quality class. They use their classroom space to introduce and discuss amphibians and reptiles using local species. Also, WRELC uses their pond and lake access to connect other classes related to the water cycle, watershed, and even fishery management. They use their buildings to introduce and teach these classes upfront, prior to heading outdoors for the primary activities. Additionally, following the hands-on learning, WRELC uses their indoor spaces as a place to conduct calculations, investigations with microscopes and to conclude the learning sessions (Smerud). Both of these organizations have undergone infrastructural expansions and have found ways to utilize the new buildings to expand and enhance course offerings.

From our interviews, we also uncovered the importance of incorporating classes and educational opportunities into every facet of the “camp” experience, including the camp infrastructure itself. Examples of this include a “sustainability” challenge that takes place throughout the week at WRELC. They measure the impact of the students throughout their time on campus considering topics such as water use, energy use, and food waste. Ultimately, the impacts are measured and results are shared with the students. Additionally, the interviews identified opportunities to incorporate “mini” classes into otherwise empty spaces. An example of this is taking the time during transportation or transition within stations or areas to highlight topics or collect samples from differing areas to discuss variances (Smerud; Giesen). One last class course that was mentioned by two separate experts is food systems. Three of the example organizations have incorporated agricultural and food-related aspects to their programs that include campus farms, gardens, or discussions of food using their cafeteria (Johnston, Gardner, and Smerud).

Connecting the Building to the Outdoors

Another common theme that emerged from the interviews is the emphasis on making sure the students are outside as often as possible. These expert organizations truly do everything they can to use the natural environment as the class setting. 60% of the organizations including WRELC, PEEC, MEC, SCCCC, YA, and NCI have policies stating that classes will be held outdoors except in cases of severe weather. Although this philosophy seems straightforward, it is truly vital to the success of the programs involved. One specific way to attain the connection to the natural environment while also utilizing classrooms is through ensuring proper placement of new buildings. Smerud of WRELC discussed the importance of placing classroom locations near training sites. This allows the students to take breaks when needed in extreme heat or cold, while also remaining a short walk away from the hands-on portion of the classes. Orienting the classroom as such not only acts as a viable safety measure against weather related

injury, but also removes excuses that are tied to the distance from the classroom to the field sites. Overall, these learnings are best summarized by the following quote: “We go outside – period,” Pete Smerud.

7.B.3. Application of Findings to SNJ’s Expansion

The majority of the expert-level programs contacted in our interviews have been around for more than thirty years. That longevity provides each of these organizations with significant experience and time to have built and refined their infrastructure, and curriculum, as well as reputation in the field of outdoor environmental education. SNJ is just reaching the ten-year mark, and at such an early point in their existence, they have made significant progress and achieved many milestones.

In conducting qualitative interviews, our goals were to understand best practices in conducting winter programming and infrastructure expansion at outdoor education centers, and gain insights from experts on the running of outdoor education programs. These goals were all meant as a tool to assist in proposing a growth and expansion strategy to SNJ. Again, as the scope of the project shifted, the information gained on winter programming is no longer relevant and as such will not be discussed. Thus, in this discussion we include aspects related to our questions related to how to approach the construction of new classrooms, how to incorporate indoor classroom space with outdoor learning, the importance of sustainability and flexibility to the process, and how to link new indoor space to curriculum. Ultimately, these learnings drove the recommendations that we made concerning expansion of infrastructure and curriculum adjustment.

With respect to classroom expansion and the incorporation of features into the current curriculum, it is important to note that SNJ has made efforts to tie their classes to the California state requirements together with NGSS. MEC, WRELC, and PEEC are organizations that have a similar state standards alignment. Also, through providing flexible classes to match the needs of the students that attend their programming, they are advanced in matching their client’s educational needs as well. Overall, SNJ is in line with the best practices in the field on classes offered and driving toward meeting measurable standards, but as we considered the context of new classroom, opportunities for curricular expansion exist.

In comparing the interviewed organizations to SNJ’s current programming, natural assets and built-in features, several things came to light. First, SNJ teaches many similar courses to those across the case study organizations, taking advantage of the natural environment surroundings to drive hands-on activities. This is especially true in the case of pond ecology and forest ecology, as each of the case study organizations have versions of this class modified for their environmental features. That said, as described in the results section, outdoor education centers such as WRELC and PEEC have incorporated classroom spaces in a way that supplement the learning environment. The use of a classroom as a viable teaching space for adverse weather conditions is an important consideration when designing curriculum moving forward. PEEC’s ecozone is a feature that not only provides indoor space for effective

environmental learning, but it is also a draw for potential students. Moreover, the fact that it exists may relieve some of the tension associated with outdoor education in adverse weather situations. Although it is not our recommendation to recreate this feature as it risks going against the principle of keeping the natural environment as the primary learning space, it is an example of the benefits of indoor learning space and as such it is important to consider what is gained by PEEC – alternate indoor activities and a true back up plan for adverse weather. In the case of WRELC, we found an example of a school that uses their indoor space to augment the outdoor learning. This view of the classroom asset is a prevalent one in the outdoor education space, but WRELC is an example of excellence in this area. The classrooms are used to introduce activities, begin teaching, and prepare the students for hands-on learning. From there, the classes move outdoor to gather data or specimens, see real life examples, or observe the natural environment. Then, if the course requires it, they move back to the classroom to perform calculations, measure data, and use basic lab equipment. This structure ensures that the outdoors is still the most important classroom, but also uses the benefits of indoor spaces to improve on the outdoor learning. In no way is it meant to replace the outdoor environmental classes, instead to augment at key points in the curriculum.

Learning from the interviews provide a vision for the design of the indoor classroom expansion. An expansion should be a place meant to improve upon the classes being taught, but not replace the natural environment as the primary source of learning. Through having an indoor space dedicated to learning, the SNJ team can introduce new equipment and methods to students that they may not have access to otherwise. Moreover, it provides an established shelter in which breaks of the elements are given, but learning is still possible. In this manner, it serves both purposes discussed above – shelter and learning augmentation. As extreme weather may occur, the indoor classroom can provide a way to translate the outdoor classes into indoor substitutes. This will ensure that the time at the campus is well used, no matter the weather.

As mentioned by the experts in our interviews, it is important to understand the goal of the classroom within the context of outdoor education and how it can be utilized in concert with the environment as opposed to replacing it. For this reason, the design of classrooms should include easy access to the outdoors. Additionally, the location of buildings should be chosen based on its proximity to natural sites that can be used for examples and experiments. This was mentioned specifically by Smerud of WRELC not only as a safety measure during questionable weather, but also as a way to reinforce the priority of conducting the hands-on portion of the education sessions in the natural environment. The classroom, and truly any infrastructure expansion, should be designed as a way to supplement the outdoors, taking a class or experiment to the next level. Moreover, as an organization whose purpose is to educate students on the natural environment in the hopes of creating future advocates, how the building is constructed and what systems are in place absolutely matters. Across the board, this element was emphasized as being important to both serving the purpose of and providing additional teaching opportunities for the organizations.

Consensus among the leaders of environmental organizations interviewed for this project was to keep the students outdoors as much as possible. This narrative may be the reason why so few of the outdoor education centers have conducted classroom expansions, meaning, they are making do without designated classrooms. The organizations that were able to effectively integrate indoor and outdoor learning spaces – namely PEEC and WRELC – offered programs that far exceeded those of their peers. As such, they teach more and more in-depth classes, and reach a wider range of students.

Another key consideration for the building – sustainability – has impacts on both educational opportunities and the overarching mission of the camp. Through incorporating sustainable design into the building the organization is reinforcing its mission to the employees of the outdoor education center, the donors who support the organization, and the students who attend it. This mission alignment can help to assist the outdoor education center in distinguishing themselves from competitors as well as build a stronger marketing campaign around the mission. Perhaps more importantly, including sustainability measures into the building provides educational opportunities to the students. Examples of this are present across the interviews and include classes that are based on functioning aspects of the camp. Examples from WRELC, PEEC, SCCCC, and NCI show that water treatment plants, heating facilities, solar panels, and recycling/composting centers are functioning aspects of the infrastructure that are also used as educational opportunities.

Constructing a classroom that is in tune with the natural environment that surrounds it through effective use of landscape design and curriculum expansion is vital to the success of this project. This is accomplished by ensuring that the overarching mission of the outdoor education center is considered prior to the expansion. Knowing how the building impacts the organization in terms of perception, curriculum and opportunities, and fit with environmental education goals, is vital to ensuring that the classroom expansion is a success.

There are some limitations that could be present in the information collected through our interviews. To begin, there are certainly limitations to generalize from the data gained from our interviews as the sample size was small. Furthermore, it might also have been appropriate to expand outside of the list of experts provided by our client. The list was created based on insider knowledge of the field and our ability to gain access to this level of information was directly related to our relationship with SNJ. That said, there are more than likely insights that were not gained due to the limited selection of interviewees. With these limitations in mind, we still believe that the information gained from our interviews is reliable. It was gathered from experts who have several decades of experience in the field of outdoor education and truly fit the description of "expert". Learning from their generalized experience is an important way for SNJ to design their expansion. As SNJ moves closer to the execution of the expansion plan and considers the various merits of the proposal laid out in this project, it may be prudent for them to conduct further research organizations that have experience in the specific expansion

methods they choose. This will allow them to refine the question set to their specific needs, but also expand the number of experts interviewed.

Another shortcoming regarding the interviews came in the form of a shift in the project goals initially defined by SNJ to our team. Our team designed and implemented the survey with the goal of understanding expansion in terms of year-round programming. The goal was then redefined as to expand the current program offered. The initial goal certainly influenced the questions asked, the order in which they were asked, and answers given by the experts. The survey still contained questions pertaining to infrastructure expansion and the use of classrooms. As such, the team was able to utilize the transcripts of the interviews for the redefined project purpose. However, it is important to acknowledge that there was a late shift in priorities by the client and that had an influence on the project outcome.

Ultimately, the interviews served as vital tools that guided the team's recommendations for classroom expansion, landscape design, and curriculum modifications. Moreover, the interviews validated a strong network within the community of outdoor education programs. The potential of this network is very valuable as every expert that we spoke with was extremely open and helpful through the process.

8. Part 4. Planning and Building the Best Indoor Learning Spaces: An Assessment of Modular Buildings and Classroom Design

8.C. Literature Review

8.C.1. Understanding the Modular Building Market

Understanding the needs of the client, as well as successes at peer organizations, led to further investigation of modular buildings. This research was conducted primarily on modular buildings that were designed specifically for educational purposes. Upon learning more about this particular type of building, the team learned that there was a subset of modular educational buildings that were designed specifically for reduced environmental impact. This area turned into the focus of our research. Additionally, the team did engage in an informal interview with an architect that specializes in this type of building. The conversation did not have a pre-described interview guide or focus as it was achieved by happenstance.

Modular construction would allow the expansion to fit into several of SNJ's goals. First, in general, these buildings have a much lower environmental impact than traditional buildings. This is because the materials used to construct them as well as the relative ease in which they are placed on the property. Moreover, a modular building fits the ever-evolving needs of SNJ as they can be moved or re-purposed as long term objectives shift. Finally, SNJ can add more of these buildings at a later time in a next phase of expansion if needed.

Research on Modular Buildings

In order to best understand the options available in the modular building space, we reviewed existing examples of modular education buildings and research on the subject. After gaining a baseline understanding of the field, the team researched firms that specialized in constructing modular buildings for educational uses who also incorporated sustainability and environmental considerations into their designs. Lastly, we considered the location of the companies in question. This is due to the fact that a large portion of the cost is expected to be due to material shipping, and knowledge of state and local regulations will be a vital part of the construction process. The majority of our specific research was conducted through company websites, but we also attempted to make direct contact with four companies. Of the four firms considered, only one was willing to speak with us – CleverHomes. The lead architect, Toby Long, spoke with our team and provided a better understanding of the benefits and drawbacks of erecting a modular instead of a more traditional classroom building, how that would be affected by the surrounding environment and how it could be designed to best fit our client's needs. Ultimately, our research led to the development of a list of four companies for SNJ to consider during their expansion and a broad understanding of the benefits modular classrooms offer.

Findings from Research on Modular Buildings

Given SNJ's geographic location and specific needs, we selected four firms from our research as viable options due to their locations, experience working with schools, and "green" practices. These firms – SEED Classrooms, Gen7, CleverHomes, and Project Frog – are familiar with constructing high-performing classrooms using modular designs. A brief overview of these companies is below.

Gen7: Gen7 is a California based company that specializes in constructing modular buildings for educational purposes. The company was founded in 1983 and has constructed classrooms and educational buildings across the state of California. Their primary focus is on designing the most effective learning space possible, however they rely on solar power and natural lighting to drive long terms costs of the building down. For an in-depth overview of Gen7's features, see the Appendix (Gen7, 2015).

SEED Classrooms: SEED is a Seattle based firm that was founded in 2012. Although not based in California, SEED has succeeded in spreading their construction into various states through the use of construction partners with local knowledge. The company focuses on providing sustainable/environmentally focused classrooms. They utilize a variety of features such as solar panels, water capturing mechanisms, compostable toilets, and green infrastructure to make the building self-sustaining. That said, SEED goes a step further, designing each of these aspects to function as an educational opportunity as well. For an in-depth overview of SEED's features, see the Appendix (SEED, 2015).

Project Frog: Project Frog is a California based firm that was founded in 2006. The company specializes in modular education buildings that focus on energy efficiency, speed in construction and durability. Although it is possible to get a variety of designs from Project Frog, it appears as though their modular buildings are meant as mostly permanent structures. For an in-depth overview of Project Frog's features, see the Appendix (Project Frog, 2015).

CleverHomes: CleverHomes is a California based company that was founded in 2005. They do not specialize in particular building function as they have built homes, education centers, and offices. The company focuses primarily on providing modular buildings that incorporate a variety of environmentally friendly designs, but each project is unique and designed to the specifications of each client (CleverHomes, 2015).

Each of these firms boasts particular strengths that would directly benefit SNJ's classroom expansion, but we are confident that any one of them could provide effective design and construction services to meet SNJ's needs.

Our research into these firms also provided more general information about the cost associated with modular buildings. Although costs are difficult to gauge without discussing specifics of the designs, one generic estimate given by CleverHomes stated that costs could be between \$300 and \$350 per square foot. This number includes an

estimate of all costs associated with the project (shipping of material, site preparation, construction labor, etc.). If we are only considering the structure itself, the cost drops to between \$100 and \$150 per square foot. Long also revealed that for some specific classroom projects, costs were reduced to \$50 per square foot. Additionally, Gen7's website provides an estimate that states the costs for building a modular classroom are lower than traditional construction by 30%.

Beyond upfront costs, research also indicated that modular buildings are less expensive to operate than standard classroom structures (SEED, 2016; CleverHomes, 2016; Gen7, 2016). Specifically, Gen7 claims that their classrooms are 70% cheaper than a traditional classroom. Additionally, through researching existing modular education buildings, we learned that these structures are built to last, with life cycles as long as standard construction buildings (SEED, 2016; Gen7, 2016). Lastly, this type of building can be outfitted with appropriate sustainability features such as water-reclamation devices, solar water heaters, and alternative energy powering systems (SEED, 2016; Gen7, 2016). As discussed in the interview results, the long term costs to operate and maintain the buildings as well as sustainability features are important considerations for SNJ moving forward.

Beyond cost, our discussion with Toby Long revealed that there are many upfront items that are vital to the process of constructing a modular classroom. These include a survey of the property, well tests, and many other regulatory issues including updating government agencies of the new structures (fire department, etc.) Gathering information on zoning, authorized usage, and permitting of the site are the first steps for any project and, often times, are completed and on file.

One of the areas of concern for Sierra Nevada Journeys was the criteria used to decide whether or not to invest in a building. The general sentiment from four interviews that specifically-mentioned criteria for building was that the need for the new building must be realized within one year to be worth the expenses incurred (Smerud, Rolasky, Johnston and Grant). Grant from HNC recommended that the building be used to 80% capacity within a year, while Smerud of WRELC suggested 66% would be a sufficient benchmark of utilization. In the words of Grant, "only build when you know you can fill it". Therefore, the investment should only be made if the program supports its use and it will indeed be utilized upon completion.

Beyond fulfilling a need, two other criteria were recommended by the experts. The first criterion is durability. This feeds back into accounting for maintenance costs discussed in the previous section, but goes a step further by recognizing that investments of this size are not readily available. Therefore, it is essential that the new structures are built to last. The second criterion is simplicity. This also relates to maintenance and upkeep concerns, but speaks more broadly to an inability to support complex or highly technical structures within these organizations. The building itself should be easy to maintain and should be as close to self-sufficient as possible, in terms of energy and resource needs. Ultimately, the criteria recommended by the experts were defined need, durable construction, and simple maintenance requirements.

Application of Findings to SNJ's Expansion

Our findings regarding modular buildings are very encouraging. With regards to SNJ's needs and resources, modular buildings seem like a great fit. Their ability to be customized to the particular needs of a client, expand into a larger network of buildings over time and ability to withstand adverse weather make them perfect as building blocks for the Environmental Education Center we are proposing. In addition, their emphasis on long term durability and incorporation of sustainability principles make them a good match for SNJ's mission and values.

In order to implement a modular building solution, SNJ will need to discuss further details with one of the firms we elected above. Because a majority of the costs are associated with the specifics of the site and needs of SNJ, detailed discussions and planning with the firm who will do the work are vital to gaining a clear understanding of challenges to the construction

8.C.2. Space Required for Effective Learning

In order to provide a complete recommendation, it is necessary to understand standards on classroom construction. This information is vital in assessing whether or not a modular building solution is viable and furthermore, if this is the best solution for SNJ.

Research on Classroom Dimensions

The first area of concern is the space available for the classroom itself and how to use it to most effectively to create the best possible learning environment for children. In order to provide the best recommendation for SNJ, we reviewed existing literature on guidelines for developing effective learning spaces. By reviewing a variety of articles on the topic, we uncovered general guidelines to follow when planning the classroom space at SNJ.

Findings from Classroom Dimensions Research

The California Department of Education believes that a classroom size of 960 square feet best suits the needs of a class of thirty elementary school students (California Department of Education, 2000). The department also mentions that a classroom size of 600 square feet is acceptable, but is considered a "small-classroom". Yet, there is little literature available that specifies the exact amount of space needed to form a "proper" learning environment. In fact, despite vast research on the impacts of class size, very little conclusive evidence beyond the importance of teacher-to-pupil ratio is agreed upon (Hanushek, 1999).

Moreover, there are several opinions that standardized best practices are not appropriate for use when developing a learning environment, but rather it should be specialized to the specific situation (Ohanian, 1999). Certainly, this would ring true for a program such as SNJs that is built upon providing a unique and lasting experience for students. Thus, SNJ may want to depart from the standards promoted by the state of California as they do not have the same constraints and efficiency concerns that push school districts to make space-related decisions (Andrews et al, 2002).

Application of Findings to SNJ's Expansion

SNJ has the prerogative to provide a unique and effective learning environment, however with the state numbers as a baseline it is also important to differentiate the needs of a standard indoor classroom versus an outdoor education classroom. The objective of the building proposed for SNJ is for it to be closely linked to the outdoor environment. The building, then, should not be the main teaching area, but rather a way to supplement the key events taking place in the natural environment around the building. However, in considering the importance of the topics that the indoor space will be used for – introductory lessons, data analysis, and alternate events due to extreme weather - it is prudent for the SNJ team to consider the state's square footage guideline moving forward. Although the class size for the various classes that attend SNJ depends greatly on the school group that is attending, the leaders of programming for SNJ have an understanding of the average and largest groups that are to be expected. Most importantly though, the leaders of SNJ must truly understand the learning environment GCR provides and SNJ's key tasks, then design the most effective space to meet those needs. Leveraging that information with the specialized needs of the mission should drive the size of the building and the classrooms within it.

8.C.3. Effective Use and Design of Learning Spaces

While the physical footprint of the outdoor classroom is important, we also wanted to consider how best to use the space inside the building to provide the most innovative and interesting learning experience to students attending GCR. This is essential in this case especially, as the camp aims to engage children on a deeper level than is sometimes achieved in traditional classrooms.

Research on Effective Learning Environments

Using the latest industry research created by leaders in the classroom design industry such as Herman Miller and AAA Solutions, we uncovered several ideas that shaped our recommendation guidelines. Though the topic of optimal classroom design for learning is relatively nascent, white papers by leaders in the field provided an excellent starting point for our recommendation.

Findings from Research on Effective Learning Environment

Our literature review revealed that while there are no golden rules for designing classrooms for outdoor education, there are certain general rules that can be followed to maximize student interest, engagement and collaboration while using the classroom. Main findings indicate that the following aspects should be considered when designing classrooms.

1. Planning the space:

- a) Involving stakeholders in the process will increase their feeling of investment since “teachers and students alike have a hand in shaping the learning environment” (Herman Miller, 2008).
- b) “Young children understand and appreciate the aesthetics of their near environment in both a complex and visceral manner” and “are passionate

observers of the environment and... their reports of preferences for interior design principles and elements are important to understanding their perceptions of the classroom environment (Read, 2010).

2. Creating a classroom vs. a “Learning Studio”:

- a) “Compared to traditional classrooms, learning studios permitted more relaxed, less intimidating group collaboration, while still providing academic challenge (Figure 4). When surveyed, students said they began to form study groups on their own or would turn to peers more often for help because interaction and participation became natural behaviors” (Herman Miller, 2008).

Figure 4: Comparing the features of traditional classrooms and learning studios

	Traditional Classroom	Learning Studio
Students	<ul style="list-style-type: none"> Boring Dry Dour Oppressive Restrictive Intimidating 	<ul style="list-style-type: none"> Inviting Welcoming Comfortable Open Clean Fresh Relaxing
Faculty	<ul style="list-style-type: none"> Bulky Furniture Long Tables Bolted to the Floor Institutional “Soldiers in a Row” Inefficient 	<ul style="list-style-type: none"> Interactive Modern Flexible More Aesthetic Easy to Move Around Better for Group Work Conducive to Learning

Source: Herman Miller (2008)

- b) As the National Training Laboratories found, only about 5% of information presented in a lecture is retained, as compared to 50% through discussion, 70% through hands-on activities and 80% when students are teaching others (Herman Miller, 2008).
- c) “Faculty...rated highly the ability of the space to teach students to take learning into their own hands” (Read, 2010).
- d) By removing the traditional classroom structure, we can remove the “tacit hierarchy” that exists in schools “in which the vocal and confident students sit forward and receive more individual attention while quiet or timid students find seats in the back and avoid interaction with teachers and other students” (Herman Miller, 2008).
- e) Students who collaborate with others can experience “increased achievement, engagement, pre-school achievement, and even

motivation”, which is easily facilitated by collaborative classroom furniture (Bonham, 2013).

- f) “Collaborative classrooms...should have: an open plan in a casual environment, a layout that supports effective communication, comfortable seating, and a place for students and teachers to jot ideas” (Bonham, 2013).

3. Designing the space:

- a) “A mix of shapes, patterns, colors, and hard and soft surfaces infuses the spaces with variety and surprise, and helps to create stimulating learning spaces” (Herman Miller, 2008).
- b) “Integrating characteristics of natural environments into the learning studios [should also be] a design goal” (Herman Miller, 2008).
- c) “Windows add visual interest with transparency, reflection, views, and spatial variation while providing views to the outside helping children with understanding of climate patterns, natural cycles, and different times of the year” (Read, 2010).

4. Building for the future:

- a) Gen7 buildings require “no pest treatments, exteriors never need painting and all materials are mold- and mildew-resistant” and “are virtually maintenance-free [with] high-efficiency systems [that] require fewer repairs and less cleaning” (Gen7, 2015). Similarly, Project Frog classrooms are “strong and durable...easy to maintain, adaptable to all climates and geographies, and designed to withstand the heavy wear and tear of time” (Project Frog, 2015).
- b) Gen7 buildings can grow with SNJ, “expanding to accommodate future growth, converting to a different functionality or upgrading to increase energy or cost efficiency” (Gen7, 2015).

Application to SNJ’s Expansion

Because SNJ is positioned to make an investment that will have long term benefits, it is important to apply the latest research in classroom design to ensure their new additions are best-in-class and provide the greatest added value. The design and furniture used in the classroom are fundamental to the usefulness of the space, as we learned, and we recommend that SNJ be very mindful in the planning of the space. In general, when designing and building the classroom spaces, SNJ should follow the below guidelines, as informed by our interviews and research of existing literature.

1. Solicit feedback from past SNJ participants (teachers and students), as well as potential attendees:
 - a) Collect information from teachers who have visited GCR several times. Ask what they would like to see in the new education centers, what works well in their classrooms at “home” and what types of setups, furniture and learning spaces their ideal classrooms would feature.

- b) Speak with older students who have attended to ask what types of hands-on activities they would like to be able to participate in at GCR based on the types of courses offered. Based on this feedback, start to consider what elements the spaces should feature (e.g. sinks for experiments, floors that allow for easy cleanup, etc.).
 - c) Ask children about potential design elements in the final design and planning stages to best understand their needs and desires, and also to ensure designs benefit the ultimate users
2. Consider these areas “learning studios”, not “classrooms”:
- a) The students in attendance are likely very excited to be outside their classrooms at home and GCR should fully embody the alternative learning experience outdoor education can offer. By referring to the spaces as something other than “classrooms”, the students will be more interested and engaged in the experience as it will feel less like school and more like a learning adventure.
 - b) Create spaces in which students are learning from each other and by doing, rather than learning from a teacher in a lecture-style. This allows students to feel ownership of their learning journey, and helps them better retain the information they are exploring (Figure 5).

Figure 5: Modular classroom furniture allows for group collaboration and adaptability



Source: Smith System (n.d.)

- c) Make conscious decisions about the aesthetics of the room to delight and intrigue students, making their visit to GCR a true adventure.
3. Design learning spaces that bring the outdoors in:

- a) Consider including elements of the outdoors inside, such as a living wall or terrariums.
- b) Given the gorgeous surroundings of the learning spaces at GCR, we strongly suggest using garage doors as side walls to maintain the outdoors as a focal point, even when students are learning inside (Figure 6). This will also remind students that they are in a very different learning environment than they are normally and should serve to excite them about their learning adventure.

Figure 6: Classrooms with garage doors allow the outside in



Source: Arkin Tilt Architects (2014)

4. Select furniture, equipment and a layout that allow for collaboration and flexibility of use.
 - a) Use small group tables or desks that allow for grouping rather than traditional individual desks that can be formed into larger groups and moved around the room.
 - b) Arrange portable white boards throughout the space for group learning as well as to separate the space into smaller spaces when needed (Figure 7).

Figure 7: Portable white boards can be used for group work and to divide spaces within the classroom



Source: Herman Miller (2016)

- c) Allow for students to use any and all surfaces as a space to learn and take notes. By using desks that also double as whiteboard spaces, students can better internalize the material and work with partners on activities right from their desks (Figure 8).

Figure 8: White board desks allow for immediate group collaboration



Source: Bonham (2013)

5. Build “classrooms” that are low maintenance, high efficiency and sustainable in the long term.
 - a) Before making final building and design choices, consider maintenance costs so as not to divert money that could be better spent on expanding curriculum or subsidizing additional student visits.
 - b) Select building types that are semi-permanent, but still allow for expansion further down the road. Selecting modular buildings with the expectation of future expansion allows SNJ to avoid any headaches related to trying to build around existing non-compatible buildings.

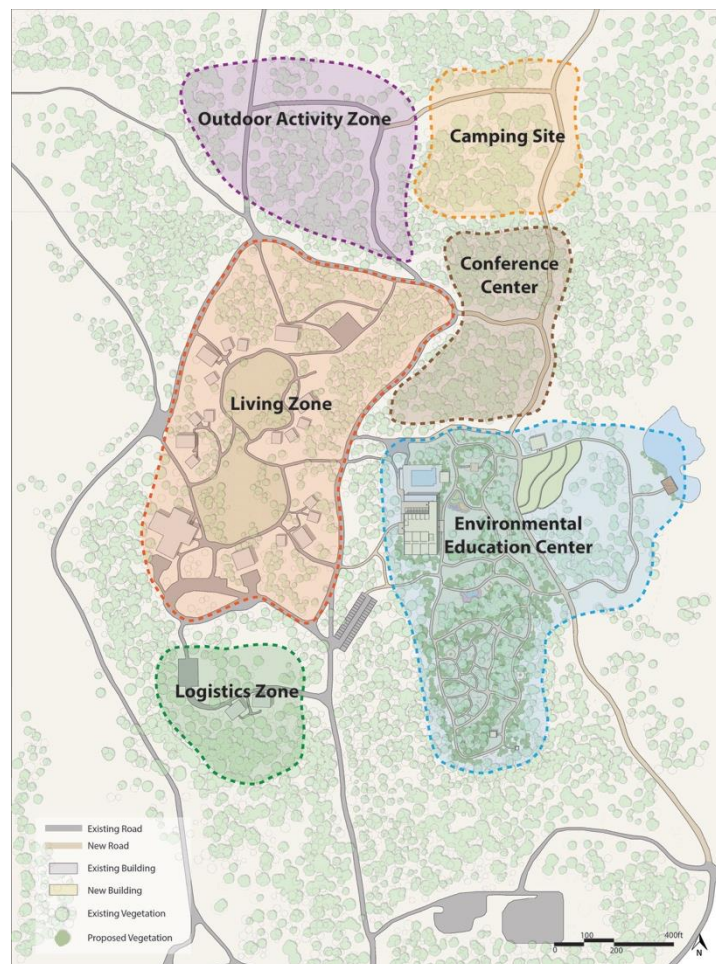
Based on the latest research and thinking in classroom design, we believe that these guiding principles will help SNJ to deliver the best outdoor learning experience combined with the benefits of a twenty-first century classroom.

9. Part 5: Planning for the Future: Expanding SNJ's Offerings through Improved Landscape Design and an Environmental Education Center

9.A. Methodology

To develop a plan proposal for expanding the GCR campus, we combined findings of site conditions and potential programs from literary reviews, discussions with SNJ personnel and information collected during a site visit. As a general development plan we propose four phases of development based on future needs and the incoming financial support to SNJ. Phase 1 is to establish an Environmental Education Center. Phase 2 is to develop a Living Zone and a Logistics (Admin) Zone. Phase 3 focuses on the expansion of the Outdoor Activity Zone and Camping Site, and Phase 4 is to build a Conference Center. Our design focuses on Phase 1, the area we have defined as the Environmental Education Center (Figure 9). The goal for the expansion and improvements is to help SNJ become a well-rounded environmental education center where children, teenagers, adults and elders can enjoy their study, business and relaxation.

Figure 9: Zoning recommendation for Grizzly Creek Ranch

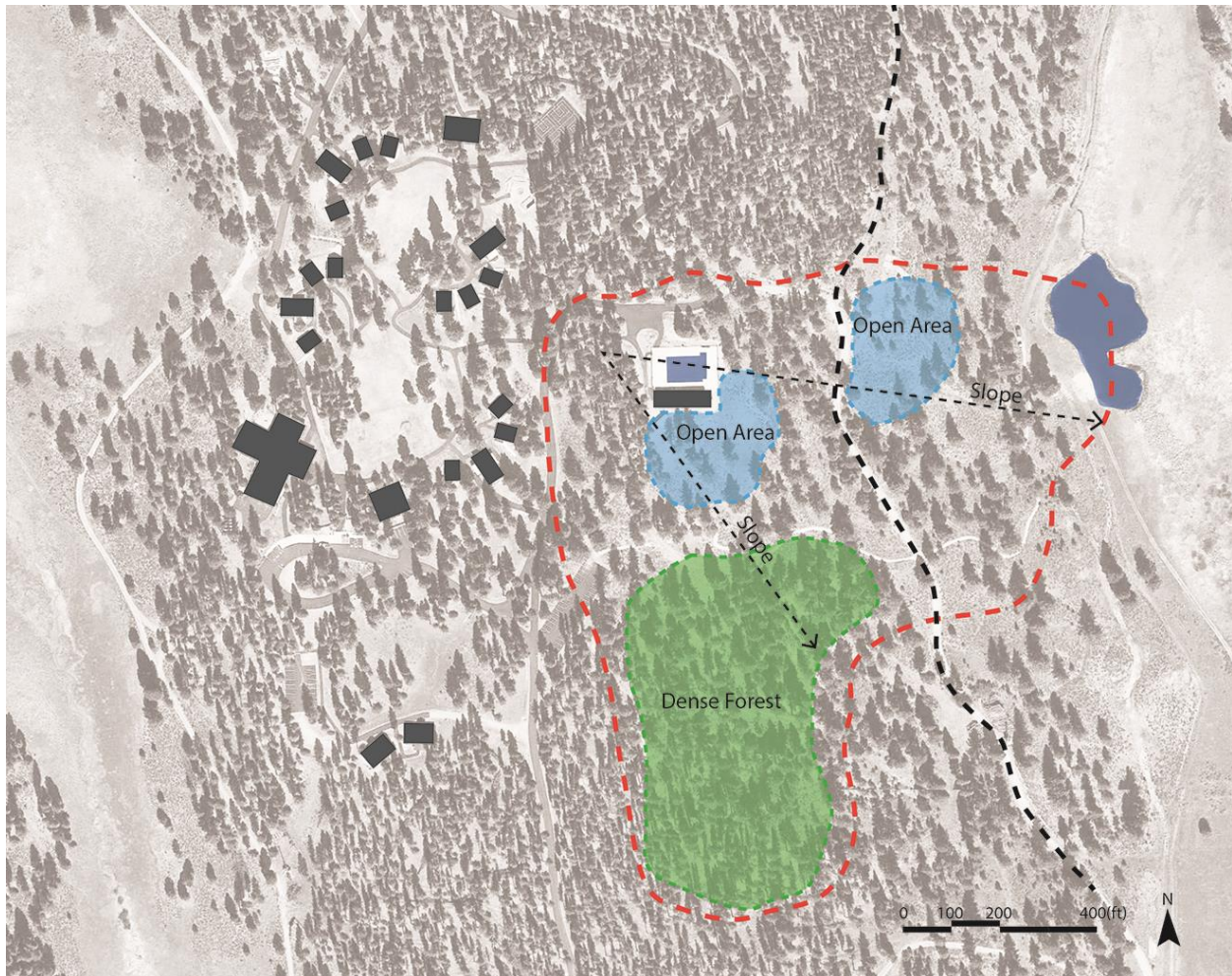


Since the plan of the Environmental Education Center is to be implemented in a forested area, we wish to build up on the opportunities offered by the characteristics of the area and respect the character and natural conditions and SNJ's missions. Accordingly, our design strictly adheres to the following principles:

1. The programs taught in this designated area must be related to environmental education. This area will provide students numerous opportunities to experience, sense and learn about nature. This means the design will include different learning sites, outdoor classrooms and infrastructure to maximize its ability to conduct environmental education.
2. All designs and expansion plans must take into consideration feasibility and the impact of/on the environment. Our design includes research about the programs we propose and evaluate how likely these programs are to succeed before SNJ implement them. Also, the location of different venues must be carefully chosen and organized to minimize potential damage to the natural surroundings.
3. The plan should combine technology and design to create a sustainable and ecological campus. The goals are to demonstrate how to reduce the use of natural resources in the campus and to generate the energy it requires. This way the campus becomes a tool to educate both children and adults to protect and preserve our environment. For example, we considered storm water collection and reuse on the site and solar energy and temperature control of the building. These designs will not only help SNJ improve their reputation in terms of environmental education, but also help them better maintain the campus and reduce costs in the long run.
4. The classroom expansion and learning spaces should feel incorporated into the natural setting. The whole campus is located in a forest and one of SNJ's missions is to let children feel closer to nature. Thus, the new environmental center should look as though it is built into the natural environment. That means all the structure, infrastructure and venues should be largely built with natural materials such as wood and stone.

After we decided out our site boundary, we did a site analysis (Figure 10). The highest point on the site is on the northwest corner. The slope follows the direction shown by the thin black dash liens. East beyond the thick black dash line, the area is relatively steep compared with the West side. The two zones marked by blue are fairly open space with fewer trees and we can use these two zones to propose new buildings and programs that require this open condition. Down to the bottom there is an area of dense forest which we identified as the main area to design environmental education programs such as forest ecology, soil ecology and bird observation.

Figure 10: Site analysis



9.B. Results

9.B.1. Landscape Design

The concept of landscape design of the environmental education center is to create an educational loop which incorporates all relevant environmental educational programs that will give children (and even adults) a better understanding of the importance of our environment. Below, we will discuss the proposed landscape design in further detail.

9.B.2. New Buildings

Based on our discussion with SNJ's Director of Programs, a new building, which might contain five regular classrooms and two laboratories, will be placed on the west side of the Environmental Education Center, where it will serve as an entrance to the greater environmental education center. This building will be connected to the swimming pool building for the purpose of creating a connection between the indoor spaces. The new

building will provide adequate space for indoor class and lab experiments where children can receive more systematic lectures and practices. The building, as a showcase of green technologies like green wall, solar energy roof and water recycle system will also serve as an example of sustainability and ecology. Children will be taught about how this building benefits from energy-saving and environment-protecting perspectives.

9.B.3. Water Collection and Recycle System

Because water is a valuable resource in the state of California, data about the rainfall and water usage at Grizzly Creek Ranch is particularly valuable for this campus.

Although no historical precipitation data is available for the Grizzly Creek Ranch, the closest precipitation measurements are captured at the Department of Water Resources (DWR) Beckwourth office, five miles east of GCR, where average annual precipitation of approximately sixteen inches is reported (Table 3). Given the elevation and westerly location of GCR from Beckwourth, we assume that the precipitation is probably greater than the DWR measurement. Climatic records from Lake Davis, a census-designated place in Plumas County, California, estimate the average rainfall is twenty-five inches per year at lake level, and up to 40 inches per year on surrounding ridges (Lindquist, 2006).

Table 3: Average rainfall at Beckwourth

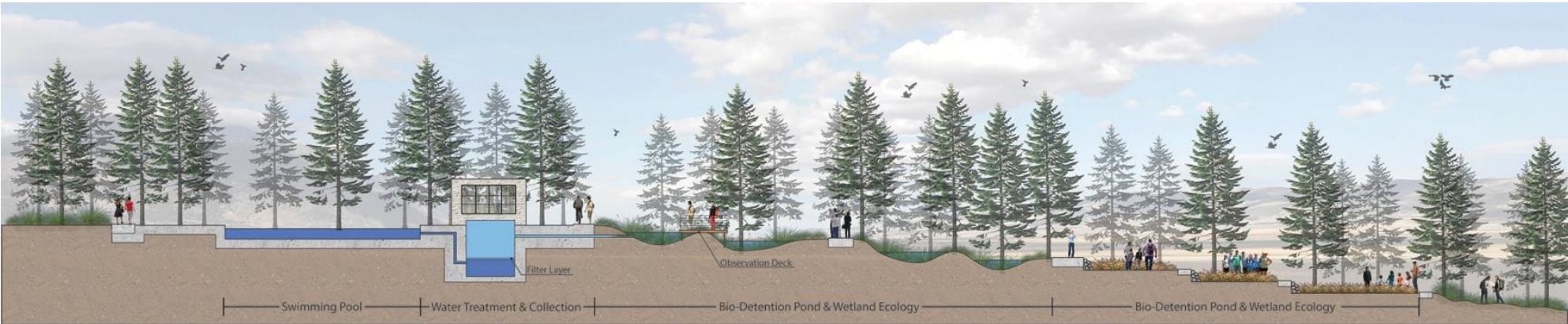
	Average Rainfall+ Snowfall (inches)	Percentage
January	3.64	11
February	8.01	24
March	9.76	29
April	3.76	11
May	2.66	8
June	1.49	5
July	0.12	0
August	0.08	0
September	0.13	0
October	0.54	2
November	0.88	3
December	2.4	7
Total	33.47	

Source: Lindquist (2006)

With regards to the water used at GCR, the swimming pool, which is used from Memorial Day (May 30th) to Labor Day (September 5th), requires a substantial amount. The facility is in use almost daily between June and August and is treated (i.e. chlorinated, filtered, softened) continuously. The pool itself is cleaned of debris, and the decks are washed, every morning. This indicates that there is high volume of gray water generated by the swimming pool. For this reason, we recommended a water collection and recycling system between the buildings and some sites on the top part of the Center.

The used water from the swimming pool and the water for washing hands from the new classroom building will be transferred to a water collection facility (Figure 11). After proper treatment, uncontaminated, treated water will be released to a wetland area which we proposed as an addition to the site and described in the next section. The wetland area will serve as an ecology study site. Also during periods of heavy rain, overflow water will spread to a terrace farm and pollinator gardens (directly following the direction of the slope) that are also proposed for the area as described in the next sections.

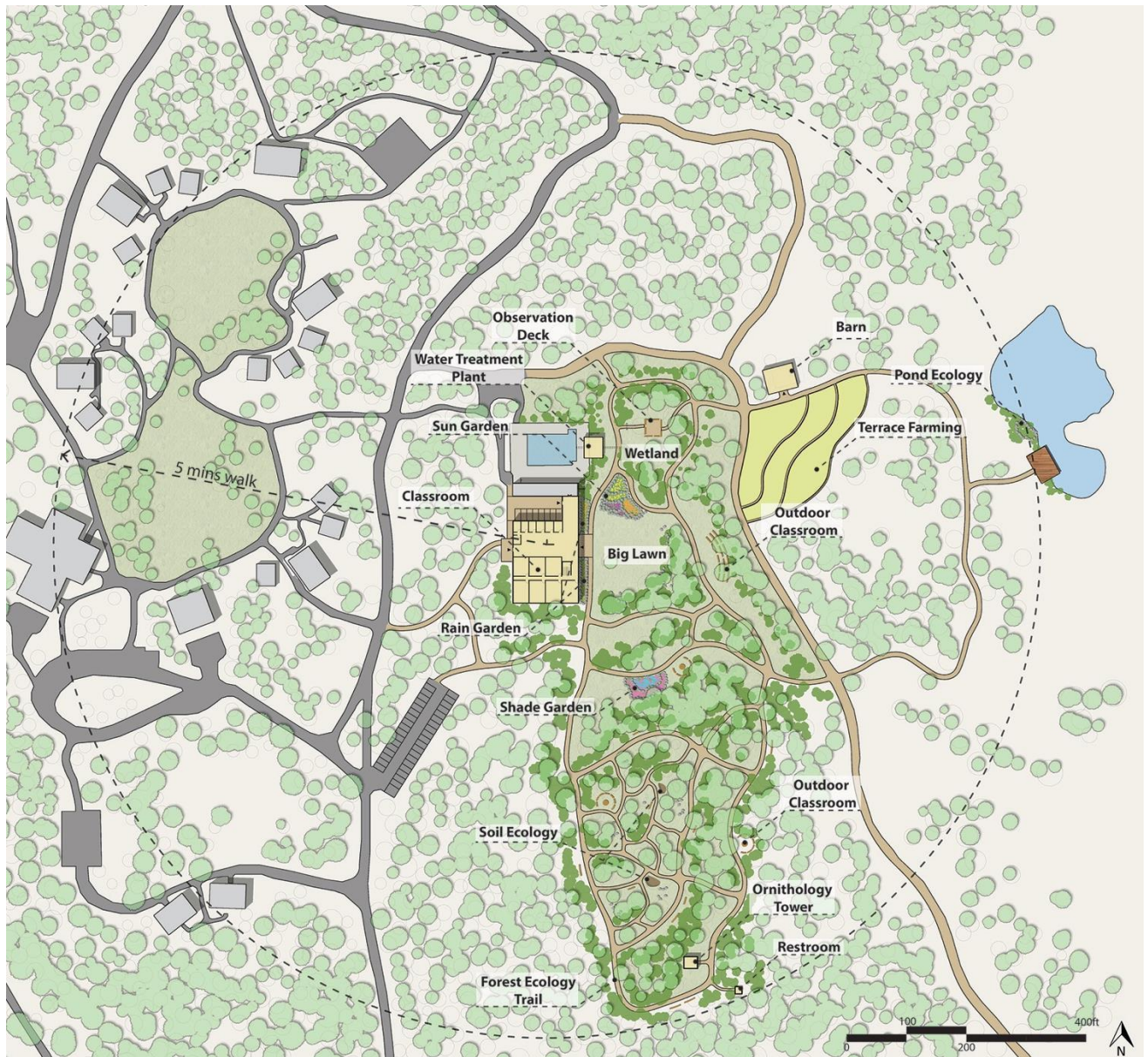
Figure 11: Proposed water treatment system for GCR



9.B.4. Outdoor Classrooms

One of SNJ's goals is to keep children outside as much as possible so that they can enjoy and learn to appreciate the natural environment. For this reason, the outdoor classroom plays an essential part in keeping children comfortable while they are either in class or taking a break. We propose four different sizes of outdoor classrooms in this area. There are two respectively close to the two pollinator gardens, one close to the soil ecology site and one along the forest trail (Figure 12).

Figure 12: Proposed landscape design and environmental education center at GCR



9.B.5. Proposed Environmental Education Sites

With the new outdoor learning space as depicted in Figure 12, we propose the following additional sites for the SNJ curriculum:

1. The **Outdoor Classroom** is very important to the students' educational experience, so we are proposing four outdoor learning areas on the site based on past attendance records and the projection of future student attendance. These four outdoor learning areas are all placed near proposed programming areas, such as the pollinator garden. These structures will allow students to stay in the vicinity of all of the outdoor learning features GCR offers while also offering a comfortable indoor learning environment for instruction and short breaks.
2. The **Forest Trail** will go through the existing forest to the south of the campus' center. Along the trail, we propose increasing biodiversity by adding more native trees and shrubs (each with its own appropriate name plate) so that students will have more plant material to study. This trail will facilitate curriculum in forest ecology to teach children how to recognize native trees and shrubs, as well as their identifying characteristics.
3. The **Wetland Ecology Site** is a recommended addition to the GCR campus because it could serve as a part of the water system and an asset of the environmental education. An observation deck will be installed in the middle of the wetland ecology site. This structure will support a course on wetland ecology that will mainly focus on the ecosystem components of a wetland and teach students how a wetland forms and changes over time. This wetland area will also serve as a critical component of the water collection and recycling system.
4. The **Soil Observation Site** will have several pre-dug depressions where the site's soil profile is visible. The site will be placed along the Forest Trail and will support courses on soil ecology that would focus on the soil profile of the region and explain the features of each layer. Children are expected to discover this soil feature on their own and teachers can provide additional information on both soil and forest ecology from the indoor classroom spaces later. If the classrooms are equipped with laboratory equipment, children can also collect soil samples and analyze their composition under microscope.
5. The **Pond Boardwalk** will be installed along the shore of the existing pond. The structure will be 5 feet wide and strategically-placed decks will serve as the gathering places. The structure will support a course on pond ecology and would offer children an opportunity to see some aquatic animals and amphibians such as fish, frogs and toads. Also, students can learn about aquatic ecosystems and how the system keeps working properly.
6. The **Terraced Vegetable Garden** is a feature based on a three-step terrace landscape. This feature would allow SNJ to teach students about agriculture and

food systems – an excellent addition to the courses offered currently since food is part of students' everyday lives, yet many children do not know where their food comes from. This feature could offer students a view of the continuous process from planting the vegetables, to watering and caring for vegetables, and finally harvesting them. The vegetables harvested from the garden can be used by the cafeteria and result in reduced food costs at GCR.

7. The **Pollinator Gardens** are features to be added along the Forest Trail. We propose the addition of one shady flower garden and one sunny flower garden. These features would offer students a perspective on the importance of ecosystems and the pollinators within them. These gardens will attract pollinators such as butterflies and bees, and would support a course in which children would learn how the different species adapt to their environment, as well as how the pollinators pollinate. They would also learn the different ways that flower propagate. Some suggested flower species for the shade garden are *Dicentra formosa*, *Heuchera maxima* and *Asarum caudatum*. Species suggested for the sunny garden are *Eschscholzia californica*, *Mimulus cardinalis* and *Monardella spp.*
8. The **Bird Observation Site** is a proposed addition to GCR where children would be able to observe birds more closely. We propose the addition of a bird observation site where wood birdhouses should be installed in the trees so that native bird species would move into this environment. Also, on-site telescopes can be installed for additional longer-distance observation. This feature would support general ecology courses and could be used as part of longer-term studies conducted at GCR related to bird and species counts over time.

9.B.6. Spacing Strategy

The new classroom building should also include ecological elements such as solar panels on the roof and living “green” walls (Figure 13). Attached to the building, we designed a rain garden in order to collect water both from the building and the big lawn and direct the water to the water collection facility. The big lawn and outdoor classroom respectively provide space for big group activity and small outdoor lectures. The forest in between serves as a buffer and prevents disturbance to the students.

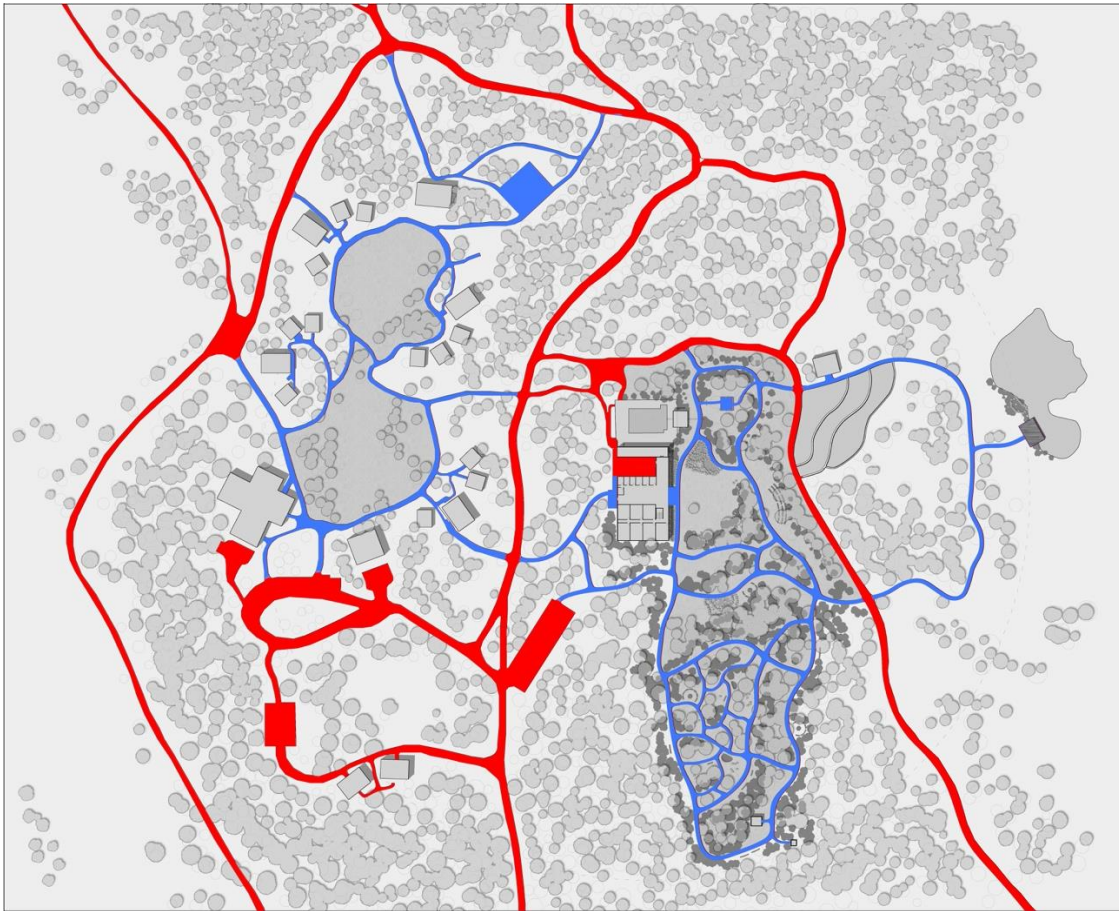
Figure 13: Classroom positioned near rain garden and big lawn



9.B.7. Circulations and Safety

The campus circulation will have two levels which are vehicle accessible (in red on Figure 14) and pedestrian only (in blue on Figure 14). This circulation system will make sure that children will not be disturbed by traffic through the campus. Speed bumps will be installed at specific points throughout campus to make sure vehicles slow down to a safe speed.

Figure 14: Circulation system



9.B.8. Infrastructure and Structure

Lights, signage, water fountains, shade structures, restrooms and emergency phones are essential to make sure GCR attendees are comfortable and safe. An appropriate number of these structures and infrastructure are proposed to be installed to the new center and then expanded to the whole campus, as designated by SNJ.

Application of Findings to SNJ's Expansion

The proposed landscape design aims to connect different environmental education programs and create a systematic, yet exciting, learning experience for children. We took into account many aspects, like possible curriculum changes, circulations, safety, and landforms when compiling our recommendation. In general, we obeyed the rules that we set up (and described in previous sections) and helped us to make our design less harmful to the existing environment and benefit the children's educational experience to the best of our ability.

The decision on the location and design of the new infrastructure and its landscape came with an understanding of the programs that SNJ offers as well as courses that could be incorporated in the future. In addition, through locating the building in an area that is central to the natural environment used for learning (forest areas and pond) we incorporated two important aspects from our research. First, the ability to connect the indoor classroom directly to the outdoor learning space to ensure that it stays at the forefront of the educational experience. Second, using the pond and forest as well as the classes related to their ecosystems allowed us to envision ways that the classroom could improve the current courses as well as incorporate alternate activities on the same theme in case of severe weather.

Currently, SNJ offers a series of classes that can directly relate to the pond – pond ecology, watershed, the water cycle, and species considerations. Incorporating an indoor facility such as laboratory in the vicinity of the pond allows these courses to continue while creating potential to build on them with the addition of classroom and equipment, and a location to analyze the samples taken (see “Microscopic Ponderings” and “Humans and the Water Cycle” examples in Appendix). There are also several alternate classes that require indoor space in case of extreme weather (Appendix). The addition of infrastructure in this area allows the SNJ team to focus additional effort in continuing to expand its course offerings. For example, courses such as “Frogs and Toads” and “Fisheries Management” (Appendix) offer ways to continue to develop use of the building and pond area while expanding the amount of environmental education that takes place. Lastly, as the pond is a short walk away from the main camp area, this is an opportunity to incorporate another new class during the transition to the pond. For example, the incorporation of a “Land Forms” (Appendix) type of class that requires students to take several measurements along the route of movement (temperature, slope, soil samples, etc.) culminating near the pond for the last samples. Then, upon returning to the classroom, the students can analyze the data and ultimately discuss the differences along the route and how they relate to various aspects of the environment.

The additions created through this design offer opportunities to improve other courses as well - namely the forest ecology class that is currently offered. The classroom offers the opportunity for improvements in the same manner discussed above in the pond ecology class, however, the development of designated paths through the forest enhances the educational opportunities. Beyond improved mobility, increased educational opportunities are possible through the inclusion of two distinct features. First, the design includes a specific area for a soil ecology course. This builds on the

current offerings by providing a space to hold discussions in the environment and take soil samples for further analysis. It also fits nicely with the addition of new classroom space as the inclusion of tools such as microscopes, scales, and ovens are effective ways to analyze the soil. Additionally, the classroom will supplement the soil ecology course by providing the ability to use alternative learning mechanisms during adverse weather conditions. Beyond the soil sample area, the design also includes a bird observation area. This elevated area will provide the SNJ team with a new offering that can either supplement the students' understanding of the forest ecology or could expand into a new course. An example of a new use for this observation area is to conduct a long term study on the bird species in the area. By allowing the students to track the species or numbers of birds in the area over time, they can learn about the native species while also being part of a larger study on the campus. Also, the sun and shade pollinator gardens are great assets for students to learn how flower benefits insect and in return how the insect pollinator helps flower propagate. The last design addition for discussion is the farm area. This area would provide a completely new class for the SNJ team, one that would allow the students to gain a better understanding of where their food comes from, what it takes to grow food, and what edible plants are native to their local area.

Although the above discussed plan is aligned with the research that was conducted for this project, it is not without limitations or shortcomings. For example, much of the discussion concerning how the classroom will elevate the training is based on the acquisition of specific equipment, such as microscopes. Certainly having a structure near the pond for classes will offer shelter from the weather, but it is unclear that it is much of a "game-changer" without the addition of new equipment. Additionally, enhancing the current courses and adding new classes is limited by the ability of the SNJ team to develop curriculum that falls in line with state standards and NGSS. Although brief outlines and summaries are included in this document, there will be time and effort required on SNJ's behalf to build out and test curriculum to ensure that it is in line with their high standards. Having recently reworked their entire curriculum, this step may not be an ideal use of resources in the near term. Lastly, there is question as to whether or not the new courses can be aimed at students within the lower range of SNJ's target audience (1st – 3rd grade in particular). Certainly, there are ways to incorporate a classroom into their experience, but is it useful enough to justify the expenditure? Overall, an infrastructure expansion is worth strong consideration as SNJ already has courses that utilize the ecosystem, yet there is room to grow. Moreover, with an addition of a classroom, added equipment, and the other design aspects such as the walking paths, simple, straightforward and worthwhile improvements can be implemented.

Although the landscape design plan has taken many aspects into consideration, there is still research that needs to be done before implementing this plan. First, feasibility is one of the biggest issues for this type of program expansion. For example, for the vegetable farming program, SNJ needs to select species that can adapt to the local weather. For pond ecology, SNJ needs to investigate if the current habitats are suitable for species that they want to talk about. Secondly, before implementing program

venues, SNJ needs to do some market research and forecasting in terms of how many children are likely to attend programs at GCR in coming years. This factor will determine the minimum capacity for accommodations and the size of the venues. Last, but not least, the suggested locations of different program sites are flexible. Under certain circumstances, SNJ could change the location of the site as often they feel appropriate. However, SNJ should still follow the principles set out previously. Overall, this landscape design and education center plan is high-level and requires further detailed research and design to make it a reality.

10. Conclusion

The potential of the site where the Environmental Education Center is proposed is greatly increased by the addition of an indoor learning space. It helps to ensure that classes can take place in the area on questionable weather days and it opens up the curriculum to expansion and improvement. Moreover, through the alterations to the curriculum and the intentional design of the landscape, the site changes are much more than just the addition of a building. Rather, it is a way to embrace the positives that come with having a space for analysis and shelter while continuing to emphasize the true classroom – the natural environment.

As mentioned above, is important to consider the limitations to this plan. The first of these is funding. To implement an up-to-date modular classroom with the landscape design as drawn is a significant investment. The opportunity cost of these funds is an important discussion that can only take place amongst the SNJ leaders. What other developments could take place with this funding? How else could the campus improve? A second concern is the lifetime of the design and building. Even modular buildings are capable of lasting for well over ten years. Therefore, it is important to consider the maintenance and upkeep of the complete design – not only in terms of cost, but also effort.

In light of these limitations, it is important to consider alternative options. For example, as the key is to continue keeping the natural environment as the primary education center, a much simpler shelter could be a more appropriate use of funds. This shelter could be built in a way that incorporates a similar landscape design to the one shown here, with the building itself being replaced by a shelter whose sole purpose is to provide protection from the elements. This might be especially prudent if SNJ does not consider the acquisition and use of microscopes and other lab equipment as valuable or very likely. Additionally, such a structure could be much more cost-effective, and might allow funding for other projects within the organization. With that said, this action would not advance SNJ's educational programming, as we have suggested, but rather it would be a "baby step" towards providing an optimal learning experience at GCR.

The final recommendation of a modular classroom that includes sustainability features and is located in the vicinity of the pond was developed after taking into account all of the various information sources, limitations and perspectives contained in the above sections. Certainly, funding, time, and effort are significant considerations for the realization of this plan, though we feel strongly that the expansion plan described above in its entirety best incorporates our primary learnings and very clearly advances SNJ's curriculum and mission.

11. References

- Adkins, Carol, and Bora Simmons. "Outdoor, Experiential, and Environmental Education: Converging or Diverging Approaches? ERIC Digest." (2002).
- Alexander, Phyllis. "The Outdoor Classroom. Experiencing Nature in the Elementary Curriculum." (1991).
- Andrews, Matthew, William Duncombe, and John Yinger. "Revisiting economies of size in American education: are we any closer to a consensus?". *Economics of Education Review* 21.3 (2002): 245-262.
- Athman, Julie, and Martha Monroe. "The effects of environment-based education on students' achievement motivation." *Journal of Interpretation Research* 9.1 (2004): 9-25.
- Ballbach, Joann. "Ohio Sampler: Outdoor and Environmental Education." (1995).
- Bartosh, Oksana. *Environmental education: Improving student achievement*. 2003.
- Bienick, Lindsay, et al. "Growing Our Place: Beecher Middle/High School Outdoor Classroom Project." (2013).
- Bonham, Stephanie. "Collaborative Classroom Furniture." Web log post. AAA Solutions. N.p., 20 Nov. 2013. Web. 15 Feb. 2016.
<<http://www.aaasolutions.com/blog/collaborative-classroom-furniture/>>.
- Brookes, Andrew. "Astride a long-dead horse: Mainstream outdoor education theory and the central curriculum problem." *Australian Journal of Outdoor Education* 8.2 (2004): 22.
- California Department of Education. "Guide to School Site Analysis and Development." – *Facility Design (CA Dept of Education)*. Web. 06 Mar. 2016.
- Carmel Green Classroom. Arkin Tilt Architects, 2014. Web. 4 Apr. 2016.
<<http://www.arkintilt.com/carmel-green-classroom>>.
- "CCCYO - Curriculum Abstracts." *CCCYO.org*. Web. 13 Jan. 2016.
http://camp.cccyo.org/documents/oedocs/Curriculum_Abstracts.pdf.
- "Cheakamus Centre". Cheakamus Centre. Web. 04 Apr. 2016.
<<http://www.cheakamuscentre.ca/>>
- "*CleverHomes Presented by Toby Long Design - Intro*". (n.d.). (T. L. Design, Producer) Retrieved 01 08, 2016, from Toby Long Design: <http://cleverhomes.net>

- Cooper, Geoff. "Changing Roles for Outdoor Education Centres." (1999).
- Coyle, K. J. (2010). *Back to school: Back outside*.
 <<http://www.nwf.org/pdf/Be%20Out%20There/Back%20to%20School%20full%20report.pdf>>.
- Duffin, M., Powers, A., Tremblay, G., and PEER Associates. (2004). Place-based Education Evaluation Collaborative: Report on Cross-program Research and Other Program Evaluation Activities, 2003-2004. Retrieved from http://www.peecworks.org/PEEC/PEEC_Reports.
- Edwards, Jane. *Socially-critical Environmental Education in Primary Classrooms*. Springer, 2015.
- Ernst, Julie, and Martha Monroe. "The effects of environment-based education on students' critical thinking skills and disposition toward critical thinking." *Environmental Education Research* 10.4 (2004): 507-522.
- Falco, Edward H. "Environment-based education: Improving attitudes and academics for adolescents." *Evaluation Report. South Carolina: South Carolina Department of Education* (2004).
- Ford, Phyllis. "Outdoor Education: Definition and Philosophy." (1986).
- "Gen7." *Gen7*. Web. 08 Jan. 2016. <<http://www.gen7schools.com/benefits/>>
- Glenn, Joanne Lozar. "Environment-Based Education: Creating High Performance Schools and Students." (2000).
- "Great Smoky Mountain Institute at Tremont". *Great Smoky Mountain Institute at Tremont*. Web. 04 Apr. 2016. <<http://www.gsmit.org/>>
- Hanushek, Eric A., Susan E. Mayer, and Paul Peterson. "The evidence on class size." *Earning and learning: How schools matter* (1999): 131-168.
- Herman Miller. (2008). *Rethinking the Classroom: Spaces Designed for Active and Engaged Learning and Teaching*. Retrieved 04 1, 2016, from Herman Miller: <http://www.hermanmiller.com/research/solution-essays/rethinking-the-classroom.html>
- Herman Miller, 2016. Web. 4 Apr. 2016. <<http://www.hermanmiller.com/>>.
- Keteyian, Linda. "Making the Most of Your Outdoor Classroom." *Science Scope* Sci. Scope 038.05 (2015): n. pag. Web. 4 Apr. 2016.
- "Kids These Days: Why Is America's Youth Staying Indoors?" *New Research Reveals*

- the Nature of America's Youth | The Nature Conservancy. N.p., n.d. Web. 24 Apr. 2015.
- Lieberman, Gerald A., and Linda L. Hoody. "Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning. Executive Summary." (1998).
- Lindquist, D. S. (2006). *Historical and Natural Resource Assessment for Big Grizzly Creek*. Grizzly Meadows Environmental Consulting.
- Mayeno, Amiko S. "Environmental Education Needs and Preferences of an Inner City Community of Color." (2000).
- Miles, M. B., Huberman, A.M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*. Los Angeles, CA: Sage Publications.
- Ohanian, Susan. *One size fits few: The folly of educational standards*. Heinemann, 361 Hanover Street, Portsmouth, NH 03801-3912, 1999.
- "Outdoor Environmental Education." *Residential (Overnight) Program: Outdoor and Environmental Education*. Web. 08 Jan. 2016.
<http://montgomeryschoolsmd.org/curriculum/outdoored/programs/residential.aspx>
- Palmberg, I. E., & Kuru, J. (2000). Outdoor activities as a basis for environmental responsibility. *The Journal of Environmental Education*, 31(4), 32-36.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publications.
- Payne, Phillip G. "Environmental education and curriculum theory." *The Journal of Environmental Education* 37.2 (2006): 25-35.
- "Project Frog." *Ed Overview*. Web. 08 Jan. 2016. <http://projectfrog.com/education>.
- "Project Learning Tree - Our Curriculum." *Project Learning Tree*. 2010. Web. 17 Jan. 2016. <https://www.plt.org/environmental-education-curriculum>.
- Read, M. A. (2010, 09). Contemplating Design: Listening to Children's Preferences about Classroom Design. *Scientific Research*.
- Rideout, V. J., Foehr, U.G., & Roberts, D.F. (2010). *Generation M2: Media in the lives of 8- to 18-year-olds*. Menlo Park, CA: Henry J. Kaiser Family Foundation. Retrieved from <https://kaiserfamilyfoundation.files.wordpress.com/2013/04/8010.pdf>.

Rubin, H. J., & Rubin, I.S. (2012). *Qualitative interviewing: The art of hearing data*. Los Angeles, CA: Sage Publications.

"SEED Classroom." *The SEED Collaborative*. Web. 08 Jan. 2016.
<http://theseedcollaborative.org/seedclassroom/>.

Sharp, Lloyd Burgess. "Outside the classroom." *The Educational Forum*. Vol. 7. No. 4. Taylor & Francis Group, 1943.

Sierra Nevada Journeys. N.p., 11 Mar. 2013. Web. 07 Apr. 2015.

Sierra Nevada Journeys. Annual Report 2014. Web. 07 Jan. 2016.

State Education and Environment Roundtable (SEER). (2000). California Student Assessment Project: The Effects of Environment-based Education on Student Achievement. San Diego.

Thomashow, M. (1995). *Ecological identity: Becoming a reflective environmentalist*. Cambridge, MA: The MIT Press

"Triumph Modular – Portable Classrooms" *Triumph Modular*. Web. 08 Jan. 2016.
<https://triumphmodular.com/classrooms/portable-classrooms>.

Vaughan, Christopher, et al. "The effect of environmental education on schoolchildren, their parents, and community members: A study of intergenerational and intercommunity learning." *The Journal of Environmental Education* 34.3 (2003): 12-21.

Wagner, Cheryl. "Planning School Grounds for Outdoor Learning." (2000).

Weiss, Robert Stuart. *Learning from Strangers: The Art and Method of Qualitative Interview Studies*. New York: Free, 1994. Print.

Woodhouse, Janice L., and Clifford E. Knapp. "Place-Based Curriculum and Instruction: Outdoor and Environmental Education Approaches. ERIC Digest." (2000).

12. Appendices

12.A. Additional Curriculum Summaries

Below are a series of course summaries that were taken from WRELC, Project Learning Tree, and CCCYO's. They are meant to serve as examples of the types of curriculum that SNJ can add to their current offerings or incorporate into expanded versions of the courses they currently offer. The inclusion of these classes by SNJ is meant to be paired with the proposed expansion discussed above.

12.A.1. Microscopic Ponderings

Students will: collect, observe, and classify aquatic organisms from a lake or creek □ Identify aquatic organisms based upon physical and/or behavioral characteristics □ Discuss the roles and needs of observed organisms in an aquatic ecosystem □ Use and care for a basic microscope Students collect specimens from Lake George or Salmon Creek. They are then able to use microscopes and field guides to classify and identify various organisms. This class is highly experiential and can strengthen students' observation and classification skills.

12.A.2. Humans and the Water Cycle

What happens when we “borrow” water from the water cycle in our homes, schools and businesses? In this unit, students will learn how they participate in the water cycle every time they turn on their tap, run the dishwasher or even go to the bathroom. During the Humans and the Water Cycle program, students experience the treatment process first-hand, discuss water issues in our interactive exhibit hall, and participate in a hands-on lab focusing on three different water-related STEM careers.

This unit is designed for classes that are studying the water cycle, waste water, water usage, human water infrastructure, and STEM careers.

Upon program completion, students will:

- Understand how the water they use in their homes relates to the water cycle.
- Be able to explain how their daily water choices impact the health of the Puget Sound.
- Understand the strengths and limitations of the wastewater treatment plant in protecting the Puget Sound.
- Know why we treat our wastewater and what happens when we don't treat our waste properly.
- Be able to list human inputs and outputs in the wastewater stream and where those outputs ultimately end up.

12.A.3. Frogs and Toads

Students will be introduced to the adaptations and diversity of amphibians in northern Minnesota by focusing on frogs and toads. While exploring one of WRELC's ideal amphibian habitats, students will use all of their senses to observe our local frog and

toad populations. Other activities will focus on conservation and research of amphibian populations in Minnesota and around the world.

- o Concepts;
 - All living things acquire physical and behavioral adaptations to be successful in their environment.
 - Observation of direct and indirect evidence is a valuable skill and learning tool.
 - Humans have a great ability to alter natural systems, and a responsibility to consider the effects of our actions.
 - Awareness, knowledge and appreciation lead to an understanding of our impact on the environment.
 - Ongoing research yields important information on changing trends such as populations.

12.A.4. Land Forms

This field study connects with the in-class FOSS Landforms Unit, a high-use science unit taught in surrounding districts. Students collect data such as slope, soil moisture, soil type and air temperature in order to compare three different landforms in the Brightwater Natural Area (the wetland, stream and a hill). Each student is responsible for recording their data and observations in the prepared field journal.

This program is designed for students studying the FOSS Landforms Unit (or the STC Land and Water Unit). The program reinforces topics taught in the classroom related to physical land features, erosion, deposition, slope, and birds-eye view maps.

Upon program completion, students will:

- Be able to use tools to calculate slope and stream velocity as well as measure stream turbidity and soil moisture.
- Be able to apply what they have learned about landforms to a real world restoration site.
- Be able to draw conclusions about how different types of landforms and soil influence how water moves.

12.A.5. Birds

Students will use binoculars, paper and electronic field guides, visit feeding stations and play a migration game. Close-up looks at the birds are possible at the bird banding station and “Chickadee Landing.” All WRELC attendees will have the opportunity to experience this class. Participants might also visit the raptors during class (dependent on staff availability).

Upon completion of the Birds class students, will be able to:

- Describe adaptations that make birds unique.
- Demonstrate proficiency with a paper and electronic bird field guide.
- Demonstrate good binocular and bird watching techniques.
- Identify by sight or sound birds found in area.

- List ways people can have a positive and negative impact on birds.

12.A.6. Farming / Food Cycle

This class traces the steps our food takes from the farmer's field to the dinner plate. Students will sample seeds, learn the history of them and discover the difference between heirloom, hybrid and genetically engineered seeds. Grinding grains, baking cornbread and playing games will give the students a perspective on the different methods of farming and the implications of our global farming system.

Upon completion of the Seeds of Change class, students will be able to:

- Identify the many roles and importance of seeds in our society, past and present.
- Briefly describe the history of seeds as it pertains to human culture.
- Define hybrid, heirloom and genetically engineered seeds.
- Examine their food purchasing habits and suggest possible environmental and personal health impacts of their choices.
- Describe several methods of farming and the impact each has on the environment.
- Recommend actions necessary in creating a sustainable food system.

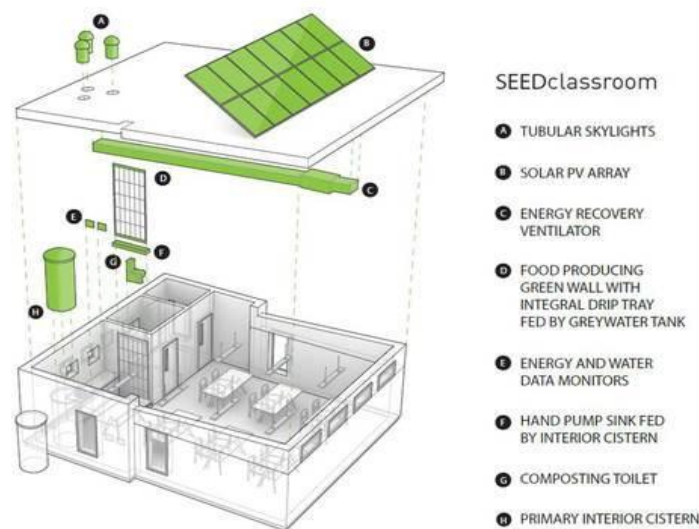
12.B. Classroom Specifications

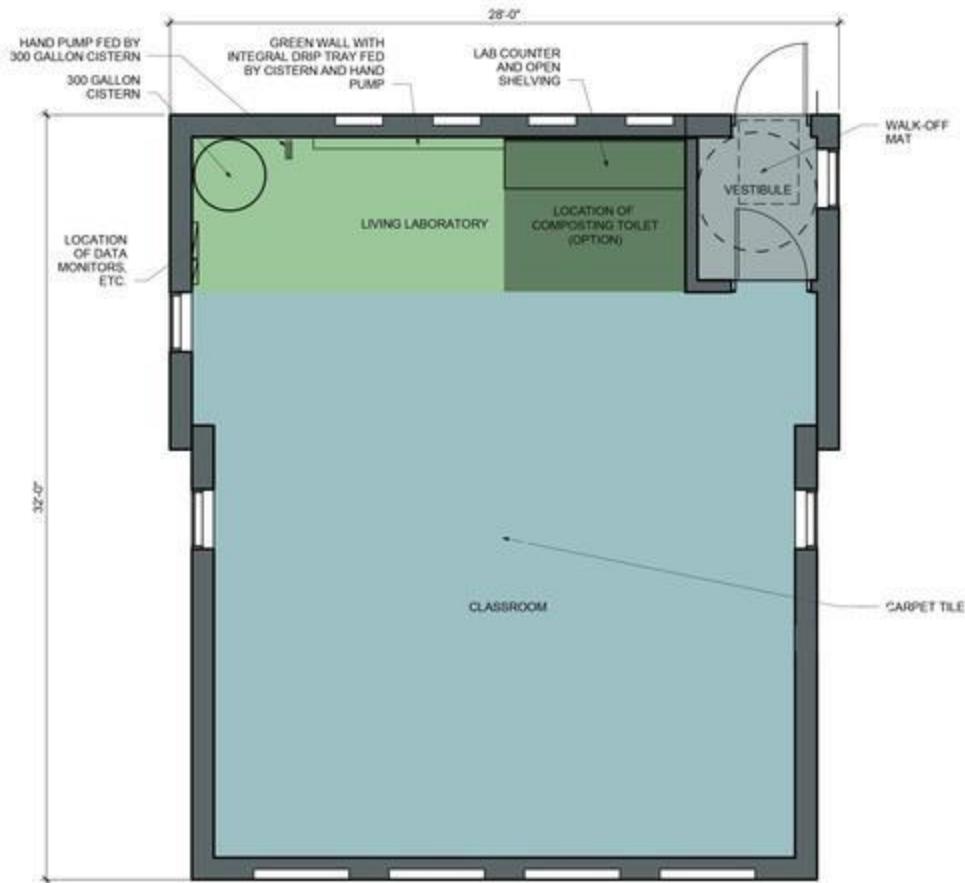
The below information is an overview of the benefits of the various modular building structures discussed in the paper. Each of the descriptions are taken directly from the company's website.

12.B.1. SEED Classrooms

- Net-zero water and Net-zero energy. Because we are a living building, we are required to meet all of the building's needs right on site. That means that over the span of 12 months the classroom will be so high performing that it will have produced its own water, through collection, and its own energy, through solar. Making our classrooms the most energy efficient and sustainable on the market.
- LBC materials Red List compliant. There are absolutely no toxic materials used in the building of our classrooms. The air is free and clear of all of the chemical toxins normally found in portables that make kids and teachers sick.
- Abundant natural day lighting. Triple-paned windows and transoms, plus 8 Solatube skylights, provide lots of natural light, fresh air, and a connection to the outdoors, without compromising insulation values.
- Solar photovoltaic array. Calculated to provide for the exact energy needs of each classroom, depending on climate and use, photovoltaics provide all the energy your classroom needs to be comfortable, well-lit and technology ready. Digital monitors and an online dashboard allow students to track the energy production and consumption of the classroom and change their behaviors to see what impact they have on the data.

- The most efficient mechanical systems available. Every SEED classroom comes with an energy recovery ventilator (ERV) for optimum ventilation and indoor air quality as well as heightened energy efficiency.
- Rainwater treatment for sinks. A potable water treatment system comes in every SEED classroom where sinks are a desired option, even if local codes won't allow it to be used quite yet. This allows students to see what such a system looks like and makes the SEED classroom plug and play when codes do change.
- Rainwater collection and filtering all of the rainwater that falls on the SEED classroom's roof is collected in a primary interior cistern and secondary exterior cistern, to meet all of the classroom's water needs. Gauges and a digital monitor allows students to track rainwater collection and use.
- Living wall fed by treated greywater. Imagine being able to grow your own classroom snacks, or have an indoor seed bed for your outdoor garden. However you use the living wall, it brings growing things right into the classroom and all the learning opportunities that come with it. The built in grey water system provides all the necessary water as well as the opportunity to understand how water moves and is collected and used.
- Ongoing performance monitoring led by students. Living Buildings must prove their performance to obtain certification. Supported by the SEED team students learn to monitor the building's energy and water usage over the course of a year.
- Composting toilet. Part of the net zero strategy, composting toilets provide high efficiency, and great learning portals for everything from microbiology to exploring alternative treatment systems from composting to living machines to city wide treatment options,
- Structural Insulated Panels (SIPs) R-49 ceiling + R-40 wall insulation. 30% above code, our classrooms are super insulated





- [Education-integrated features](#) Because we believe that the environment has the power to teach, we have wrapped each classroom with tools to facilitate STEM, common core and project based learning opportunities.
- [SEED packet](#) Every project comes with a comprehensive manual, that outlines the all of the systems in the building, and provides a framework we call the SEED education map for using the building as a teaching tool.
- [SEED patch](#) Our unique online platform allows students all over the world to record, compare and discuss the performance of their classrooms, and what they are learning.

Source: Seed, 2016

12.B.2. Project Frog Education Buildings

There are over 80,000 portable classrooms in California alone – nearly 1/3 of the State's total facilities inventory! The all-too-familiar sight of these ramshackle portable classrooms lining school campuses would make anyone ask, "don't our kids deserve better?"

That's why Project Frog created a building system that would let schools replace, expand or build new without compromising the quality of their learning environments. Now districts can deploy one and two-story, DSA-approved campus buildings that are far superior to what traditional construction would yield while shaving time and money off the construction process.

Project Frog buildings are bright, airy and comfortable. They're energy efficient and planet friendly. And for school administrators under constant budget pressures, they provide welcome flexibility.

Fast. Our system of components can be configured to meet your school's needs, then delivered to your campus over the summer and assembled in advance of the first day of school. Total elapsed time: 6-9 months from contract to completion.

Healthy. Our buildings can achieve LEED and CHPS certification, providing more natural light, cleaner air, and better temperature control than anything in their class. The result is uplifting spaces that are directly linked to the outcomes you want: faster learning rates, better test scores and higher attendance.

Affordable. Project Frog buildings are 40-50% more energy efficient than their traditional counterparts, resulting in lower operating costs and lower construction costs, so your resources can be focused on educating kids.

Built-to-last. Strong and durable, our permanent buildings are easy to maintain, adaptable to all climates and geographies, and designed to withstand the heavy wear and tear of time.

Inspiring. Students and educators alike flourish in Project Frog buildings. Our buildings are designed around the needs of 21st Century Learning, encouraging technology use and collaboration.

Source: Project Frog, 2016

12.B.3. Gen7Schools

7 Reasons to Choose Gen7

Gen7 takes green to the next level, leading the industry in technological advances that make schools a healthier, more productive learning environment for students throughout California. Unlike portable classrooms, Gen7 structures are permanent buildings, making them just as practical for tomorrow's students as they are for today's.

Gen7 classrooms are highly sustainable and energy-efficient, blending responsible, low-maintenance materials with cutting-edge technology for unsurpassed comfort and performance. Yet they're equally cost-efficient, delivering a sleek, custom look with the speed and convenience of a modular product.

1. **Speed - Prefab School Buildings**

Time is money.

Gen7 saves both time and money, with classrooms that are designed, built and installed in 90 days—60% faster than conventional construction. Gen7 is manufactured at our enclosed factory, then installed onsite, saving months, even years, of costly, disruptive construction time. And our streamlined process dovetails with a school's calendar, allowing construction to start when school closes and open to students a few months later. Without the wait and inconvenience of traditional construction, school districts can quickly and cost-effectively add as many new Gen7 classrooms as they need, expediting expansion plans as well as replacing old, inefficient buildings with healthy, sustainable structures.

2. **Affordability**

Precision manufacturing and production economies combined

Gen7 delivers all the benefits of conventional construction, yet costs 30% less to build and up to 70% less to operate. Precision manufacturing and production economies combine with fast delivery and installation to substantially lower construction costs and prevent pricey delays, while the high-performance design leverages the latest technology to control operating costs.

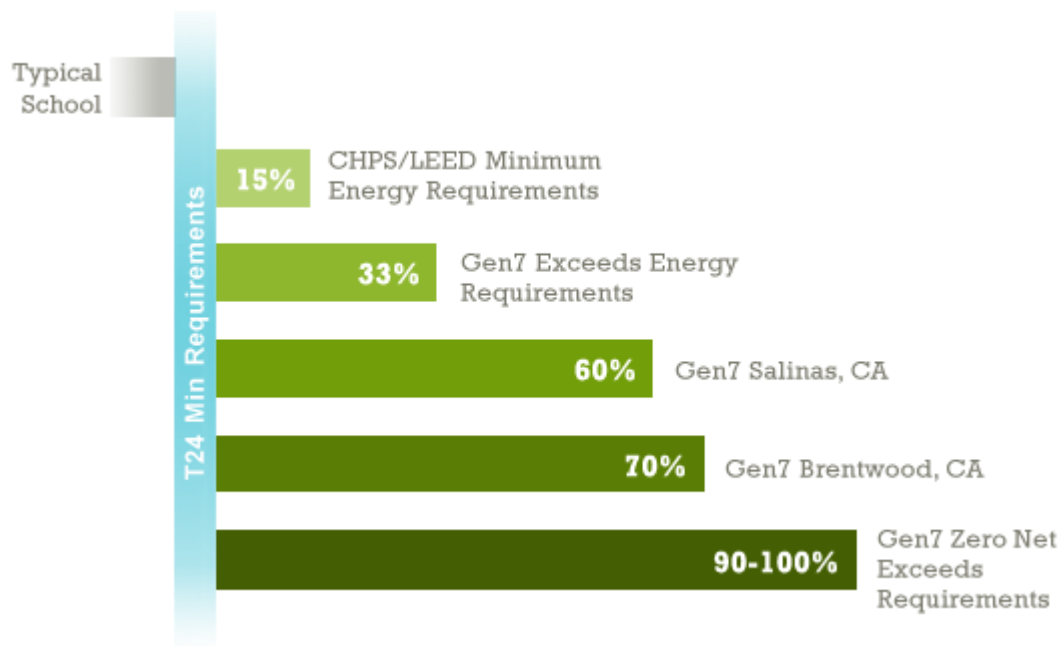
Gen7 continues to pay back every year in lower maintenance costs and increased energy savings— savings that can stretch a school's limited resources by redirecting funds into supplies, salaries and enriched programming. From the beginning of its lifecycle to the end, Gen7 is a sound investment, saving schools far more than it costs to build.

3. **Energy Efficiency**

Gen7 is a model of energy efficiency, proven to use up to 60% less energy than a typical school, while exceeding California energy code an average of 33% in all 16 climate zones. An ultra-tight building envelope includes high-R value insulation in the roof and walls and a highly efficient mechanical system uses natural ventilation to significantly lower heating and cooling costs. Daylighting partners with smart lighting and automatic sensors to conserve power and reduce Gen7's environmental

footprint. Add optional rooftop solar panels, and Gen7 becomes a Zero Net Energy classroom, producing enough power over the course of a year to supply 100% of its electricity needs. Onsite training and a proprietary Energy Management System ensure peak performance, helping schools to optimize their Gen7 classrooms and monitor them over time.

Gen7 is designed for measurable performance, with a proven efficiency rating four times higher than the most stringent green school standards.



4. Flexibility

Unlike most modular structures, Gen7 can be customized to fit specific needs and aesthetics, seamlessly integrating with an existing campus or complementing the architectural scheme of a new school.

The possibilities are endless, with a variety of multi-functional floor plans and facades adaptable to meet a diversity of uses, from classrooms and office space to libraries and labs—even eco-friendly restrooms. The scalability of Gen7’s core design allows school districts to meet their immediate needs, with an eye toward long-term value. Gen7 can evolve with a school, expanding to accommodate future growth, converting to a different functionality or upgrading to increase energy or cost efficiency.

5. Longevity

Constructed of durable, environmentally-friendly materials, Gen7 is a permanent, structurally-sound prefab building with the same 50-year lifecycle as conventional construction.

Unlike other modular and portable structures, Gen7 is installed on a thick 5” concrete slab foundation, with an all-steel “moment” frame construction that’s sturdy enough to withstand the rigors of climate and time. And Gen7 is the only modular structure that can be built up to 180’ wide without a seismic joint, providing a safer, more aesthetically pleasing structure. Engineered for California’s Seismic Zone 4, Gen7 blends smart building with seismic safety, yielding decades of use for a fraction of the cost.

7. Sustainability

Our best practices approach starts at the factory with an aggressive waste management plan that combines smart ordering and precision manufacturing with recycling and reuse of materials to divert 90% of waste from landfills. We conserve energy with daylighting and lessen the environmental impact of transportation by purchasing locally harvested materials. And every Gen7 is constructed from materials with high-recycled content and no-to low-VOC—a benefit that takes sustainability beyond the infrastructure into the curriculum. Gen7 teaches by example, showing students the value of recycling old, used-up products into new, productive ones, saving energy while conserving natural resources.

Gen7 is a complete sustainable solution, designed to meet CHPS® and LEED® standards for green schools.

8. Low Maintenance

Maximum Performance, Minimal Maintenance

Gen7 offers more while using less, saving you time and money year after year. High performance doesn’t have to mean high maintenance. We spend extra time selecting the cleanest, most durable materials for every Gen7 so you can spend less time maintaining them. Gen7 requires no pest treatments, exteriors never need painting and all materials are mold- and mildew-resistant. Gen7’s recycled all-steel construction and insulated building envelope are virtually maintenance-free, and our high-efficiency systems require fewer repairs and less cleaning, while our tough, long-lasting finishes hold up to generations of students.

Source: Gen7, 2016