Ecology.Architecture.Education.Design

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DEDICATION

I want to say thank you to people who have helped me over the last year. Though I may try, I can never truly express my gratitude.

To Mom, Dad, Michael, Elizabeth, and David. Thank you for you love and support and encouragement.

To Richard. Thank you for your support and making sure I didn't study too late every night.

To all of my friends who haven't seen me this past year. I should be free soon!

To the faculty and staff at the School of Architecture. Thank you for your support and dedication. The education students receive would not be what it is without you. Thank you.

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ABSTRACT

In current practice, the primary and secondary education process in many ways is dictated by rigorous, quantifiable state or federal objectives that must be achieved. While these objectives may be realistic and obtainable, they can have the effect of limiting the manner in which subjects are actually taught in a classroom. However, there are a variety of teaching methods as well as spaces in which lessons can be taught to children. Alternative teaching methods and alternative learning opportunity areas incorporate materials and lesson plans that do not occur in the average classroom on a daily basis.

Alternative teaching methods and learning opportunity areas that focus on ecology often take advantage of the natural occurrences outside as the basis for the learning content. By incorporating these methods, the building hopes to achieve a sense of enlightenment and a sense of place. It is the goal of this thesis to create an elementary school that shuns the typical classroom arrangement and focuses on an ecological curriculum. It would be ideal for the design of the building to create a seamless environment from site to building to interiors to instructional content.

Through the design of the school and site, students, parents and teachers will have endless opportunities to learn about the use and reuse of water, how daily activities impact energy consumption and ways to reduce their impact on the earth, all of which will be incorporated into lessons that deal with conventional subject matter. With today's increasing population and diminishing natural resources, the next generation will know how to consume less of these vital resources.

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Building, environment and teaching will become one collaborative effort in an educational institution for elementary school students. This school will by no means be another conventional design based on a classroom lined hallway. The design of the building and site will inspire educators to utilize alternative teaching methods in alternative teaching spaces. The art classes can use Belle Isle as inspiration for a project. The science classes could plant vegetation near the Riverwalk and study the lifecycle and learn how to care for living organisms. The math classes could calculate the angle of the sun during the different seasons by gathering and comparing data about shadows throughout the year. Spaces will encourage lessons that do not adhere to the standardized methods. Free-form thinking and learning based on environmental sciences will be the primary goal of this alternative-method educational facility. The program for this elementary school will also help teach the next generation of decision makers that the environment is not something to be ignored, but should be integrated into one's lifestyle.

The physical requirements outside the school are just as important as the activities that occur inside the school.

• First and foremost, there must be enough space for a student to learn. It could be argued that there are an infinite number of places a child could learn. However, in the context of a school, specifically an alternative method school, these spaces will be defined. These spaces could be for individual or group learning which could mean niches and crevices for one student and larger alcoves or dugouts for a group.

• The climate must also be taken into consideration. A temperate climate in which there are cycles of weather or seasons would be preferable. This would allow for cyclical precipitation which could be examined for a science or math class. It would also allow for the lessons of water conservation, reuse, recycling and collection.

• The site should be open to all the elements nature has to offer. This requirement goes hand in hand with the climate. The site should not be located at the bottom of a valley or canyon, nor should it be located at the peak of a mountain. This would allow for a variety of teaching spaces and topics to study. An open location near a body of water would be ideal.


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INTRODUCTION

In current practice, the primary and secondary education process in many ways is dictated by rigorous, quantifiable state or federal objectives that must be achieved. While these objectives may be realistic and obtainable, they can have the effect of limiting the manner in which subjects are actually taught in a classroom. However, there are a variety of teaching methods as well as spaces in which lessons can be taught to children. Alternative teaching methods and alternative learning opportunity areas incorporate materials and lesson plans that do not occur in the average classroom on a daily basis.

Alternative teaching methods and learning opportunity areas that focus on ecology often take advantage of the natural occurrences outside as the basis for the learning content. By incorporating these methods, the building hopes to achieve a sense of enlightenment and a sense of place. It is the goal of this thesis to have an elementary school that shuns the typical classroom arrangement and focus on an ecological curriculum. It would be ideal for the design of the building to create a seamless environment from site to building to interiors to instructional content.

Through the design of the school and site, students, parents and teachers will have endless opportunities to learn about the use and reuse of water, how daily activities impact energy consumption and ways to reduce their impact on the earth, all of which will be incorporated into lessons that deal with conventional subject matter. With today's increasing population and diminishing natural resources, the next generation will know how to consume less of these vital resources.

This thesis is an exploration of the possibility that the building and its surroundings can be used as a source of content for the curriculum in the classroom. If the building and site can be designed in such a way that it reveals natural phenomena to the children, then those lessons could be incorporated into all kinds of traditional lessons about math and science. So from the student's point of view, the building becomes a kind of living laboratory.

EDUCATIONAL THEORY

Currently, there are several different approaches to primary education. The fundamental difference between all methods is pedagogy; that which sets the pace of the education. There are beliefs that the child should progress at an individual rate, being the leader of the educational intensity. Other practices believe in uniform conformity and progressing the group of students rather than the individual. All methods have their advantages and disadvantages. Through this thesis, the combination of parts of these methods will be integrated with the design and architecture of a building to create an alternative teaching environment.

The Montessori Method of teaching was created by Italian educator Maria Montessori in the late 19th and early 20th centuries[1] and operates primarily in preschool and elementary school settings, though some Montessori high schools do exist. In this method, based on child development theories, the child self-directs their activity while the "director" or "guide" monitors and observes. It stresses the importance of altering the child's learning environment to his or her developmental level. The role of physical activity in absorbing academic concepts and skills is also altered to fit the child's ability.

[1] Hayes, William. The progressive education movement : is it still a factor in today's schools?. 1st ed. Lanham, MD: Rowman & Littlefield Education, 2006.

Waldorf education (also known as Steiner or Steiner-Waldorf education) was established on the principles of the educational philosophy of Rudolf Steiner, the founder of anthroposophy. The premise of the pedagogy is for the learning to be interdisciplinary, with the integration of practical, artistic and intellectual elements and is harmonized with "natural rhythms of everyday life".[2] Waldorf education is based on the creativity and spiritual development of the teachers themselves, who must respond spontaneously to each child and situation. When children relate what they learn to their own experiences, they are interested and alive, and what they discover becomes their own. Waldorf schools are designed to foster this sort of learning process.[3] The first Waldorf School was established in 1919. Today, there are over 1000 independent Waldorf schools with 1400 independent Waldorf kindergartens across sixty countries.

Public education is a more streamlined delivery of educational methods established by the government, whether national, regional, or local and paid for in part or whole by taxes. The term is generally applied to primary and secondary education, levels K-12. Public education is inclusive, both in its treatment of students and in that it has broad and general requirements related to the governmental politics that administrate. Public education is typically provided to a group of students in classrooms with a number of groups of students clustered in a school. [4]

Private schooling is most commonly administered by private organizations such as various religions or ethnicities. Since these schools are privately funded, operated and organized, they are not required to adhere to government established education regulations yet are only successful if they equal or succeed the requirements for the public education schools.

Homeschooling is yet another avenue of child education. Commonly referred to as home education or home school, is the education of children at home, typically instructed by parents or guardians as opposed to a public or private school. Prior to the introduction of compulsory school attendance laws[5], most children were educated within the family or community. Only a small percentage of the community attended schools or were able to have private tutors.

An emerging educational practice is the hands-on approach. This engages the children more activity in their educational process. Similar to the Montessori and Steiner-Waldorf methods but with the instructor as the navigator of the education, hands-on is based with more small-group based learning. Still arranged in a larger classroom setting with a single instructor and possibly several parent aides and volunteers, the children break off into small groups were they interact with each other and aide in each other's learning development.

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[2] Trostli, Robert. Rhythms of Learning : What Waldorf Education Offers Children, Parents & Teachers / selected lectures by Rudolf Steiner. 1st. Hudson, NY: Anthroposophic Press, 1998.

[3] Trostli, Robert. Rhythms of Learning : What Waldorf Education Offers Children, Parents & Teachers / selected lectures by Rudolf Steiner. 1st. Hudson, NY: Anthroposophic Press, 1998.

[4] National Center for Education Statistics, Public elementary and secondary education statistics. Washington, D.C.: National Center for Education Statistics, 1994.

[5] Compulsory education is education which children are required by law to receive and governments to provide. The compulsiveness is an aspect of public education. In some places homeschooling may be a legal alternative to attending school.

This tendency to hands-on teaching method is becoming more prevalent in public and private school curriculum. Steiner-Waldorf and Montessori teaching methods have noticed this shift in education but have not applied it to their methods in the mainstream practices.

The "hands-on" approach is a method of teaching where the students make the discoveries- learn the lessons- by themselves with minimal direction from an instructor. The classroom as a whole progress forward together with each child physically using their hands while learning the lesson.[6] This method is a progression towards the teacher teaching the students how to teach themselves. The Association for Experiential Education regards hands-on education "as a philosophy and methodology in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge, develop skills and clarify values."[7]

It is through these many different teaching philosophies that this school takes fruition. Students learn in a variety of different ways and it is yet to be proven which one is most effective or even if there is a clear leader. It is the position of this thesis to acknowledge that each individual learns in a different way but the needs of each student is to be met.[8]

BUILDING PROGRAM

Through this thesis, a developed hybrid of the aforementioned educational theories with an emphasis on ecology will be the focus of the elementary school. Grasping the individuality, self-guided learning and self-motivation of the Steiner-Waldorf and Montessori methods and combining it with the structured curriculum and established goals of the Public education, Private education and the Homeschooling methods, the fusion will be implemented in the elementary school. This new method of education will incorporate the building and the surrounding environment as a teacher. The focus of the curriculum will include the traditional reading, writing, arithmetic but also focus on the ecology and the status of the surrounding environment.

With the world's exponentially-increasing population, demand for natural resources, and severe dependency on limited energy sources, the current state of humanity will be shifted in the future. The way people live their lives and their consumption of natural resources is damaging the earth at an alarming rate.[9] By providing the generations to come with a learning environment focused on sustainable living this inevitable shift can be less significant that what is predicted. An elementary school with the curriculum focused on ecology and the state of the surrounding environment will furnish the future generations to make wise decisions that impact the world environment.

BUILDING PARTICIPATION

By designing a fully-integrated building that participates in the educational process, students will be able to learn from other instructor sources and adapt to the ever-changing world. The building and site will become a learning tool that will amplify and reveal lessons in nature. This is

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[6] Johnson, LouAnne. Teaching Outside the Box: How to Grab Your Students by Their Brains. 1st ed. San Francisco, CA: Jossey-Bass, 2005.

[7] www.aee.org

[8] Jones, Phyllis, Judy F. Carr and Rosemarie L Ataya. A Pig Don't Get Fatter the More You Weigh It: Classroom assessments that work. 1st ed. New York: Teachers College Press, 2007.

[9] http://water.usgs.gov/

achieved through effective and integrative design. All spaces will be designed from the viewpoint of a child and how it can be integrated with ecological features. “An architect must not waste space by the way he organizes his material, on the contrary he must add space, and not only in the obvious places that strike the eye anyway but also in places that do no generally attract attention.” [10]

An elementary school is primarily occupied by children. To design for this demographic would be ideal considering the design of the curriculum is already tailored as such. “We must take care not to leave any holes and corners behind which are lost and unless, and which, because they serve no purpose at all, are ‘uninhabitable’.”[11] The building will amplify and reveal lessons in nature.

Several architectural expressions have attempted this before. The stairway up to the entrance of the new primary school ‘De Evenaar’ in Amsterdam has been given an extra articulation to make the access from street level to the school more fluent. The juxtaposition of the two flights of step then suggested bending the railing components vis a vis each other.[12]

In Apollo School, Amsterdam, every kind of step or ledge by a school entrance becomes a place to site for children, especially when there is an inviting column to offer protection or to lean against. Here, it can be realized that form generates itself.[13]

The Catherine Ferguson Academy in Detroit is known for giving young mothers a chance at success. It is a school for pregnant teenagers and young mothers and their children. The primary focus is on success in academics and parenting skills. This academy offers young women who have not followed the societal pattern of attending school, getting married, and then having a child a chance to finish their high school education and continue on to a college or university. This opportunity is not typically offered through the traditional high school in Detroit.[14]

Sidwell Friends Middle School in Washington, D.C, has been renovated and an addition added to transform an awkwardly-sited, undersized, fifty-year-old facility into an exterior and interior teaching landscape. The Middle School project is LEED(tm) Platinum certificated as a demonstration of Sidwell Friends' commitment to environmental stewardship through high-performance building design and operations. The landscape and building will co-exist within, and demonstrate, a broader network of systems. Human systems - our inter-relationships with resources - are embodied by the landscape and building as natural systems.[15]

SUND, WIND, WATER, EARTH

These are the four elements that are impacted, either positively or negatively, with every decision a person makes that concerns the environment. By giving great concern and taking

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[10] Page 186. Hertzberger, Herman. Lessons for Students in Architecture. 1st ed. G.J. Thieme bv, Nijmegen, 1991.

[11] Page 186. Hertzberger, Herman. Lessons for Students in Architecture. 1st ed. G.J. Thieme bv, Nijmegen, 1991.

[12] Hertzberger, Herman. Lessons for Students in Architecture. 1st ed. G.J. Thieme bv, Nijmegen, 1991.

[13] Hertzberger, Herman. Lessons for Students in Architecture. 1st ed. G.J. Thieme bv, Nijmegen, 1991.

[14] www.catherinefergusonacademy.com

[15] www.kierantimberlake.com

care of the impact of these elements will help ensure the continuity of the quality of life and the quality of resources.

The Sun is the primary source of energy for the entire planet.[16] Its powerful rays hit the earth and release energy along the way. By collecting the sun's rays, a school can supplement its need for power from the grid. The primary source of illumination will be daylighting. The north walls of the building have large spans of glazing that allows the north light to come into the building and light up the central interior street. The glazing on the south side of the building is smaller in nature and has horizontal shading devices on the exterior of the building to block direct heat gain. The building angle is specific in that it is angled to capture the most of the sunlight during the school days throughout the year. The angle of the roof is such that during the summer, sun will be blocked from directly entering the building on the south side. During the winter, the low angle of the sun will be able to penetrate the envelope of the building to provide heat gain.

Wind is southeastern Michigan is primarily from the southwest during all seasons of the year. With integral design of the sun's rays, natural ventilation will be used as the primary source of ventilation in the building. This is used through stratification in the large gathering space in the central street of the building. It is also utilized through solar chimneys. There is also a small farm of wind harvesting fans located on the site. The location is an open area surrounded by few trees. When the wind blows, the placement of the blades are high enough above the trees that they will catch the wind and generate energy to be used in the building.

Fresh water is the fastest decreasing natural element. Ways to carefully consume, conserve and purifying water are vital lessons to be learned and methods to be practiced for the future. Water harvesting will be collected from the angled roof planes and stored in the water cisterns on the south side of the building. To purify water many avenues may be pursued. On a large scale operation such as an elementary school, a living machine will clean the water used within the building. It will also cleanse the water that is collected from the roof and stored in the water cisterns. The primary lessons of water will be use, reuse, recycling, and purifying water.

There is an old saying that goes "there is only one earth- be careful how you use it". This statement is very true to its nature. The lessons the students will learn will be consumption, horticulture lessons, and care and maintenance. To help students learn these lessons, two greenhouses will be located on site. A smaller greenhouse is located inside the building, on the south side, vertically adjacent to the eating area. This greenhouse will be maintained by the children. The vegetation grown will be vegetables and fruits that will be used in the eating area below. This not only provides the opportunity for the children to grow their own food but also provides a sense of ownership and responsibility. For children to grow their own food and provide for themselves is a truly empowering lesson.

CONCLUSION

The design of the building and site will inspire educators to utilize alternative teaching methods in alternative teaching spaces. The art classes can use Belle Isle as inspiration for a project. The science classes could plant vegetation near the Riverwalk and study the lifecycle and learn how to care for living organisms. The math classes could calculate the angle of the sun during the different seasons by gathering and comparing data about shadows throughout the year. Lessons will not be restricted to a classroom with desks but will be given the opportunity to explore the environment through the building and the surroundings.

[16] http://www.energyquest.ca.gov

Site Precedents

Program Precedents

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MUNICIPAL OCEAN SWIMMING POOL
LECA DE PALMEIRA, MATUSHINOS, PORTUGAL
ALVARO SIZA

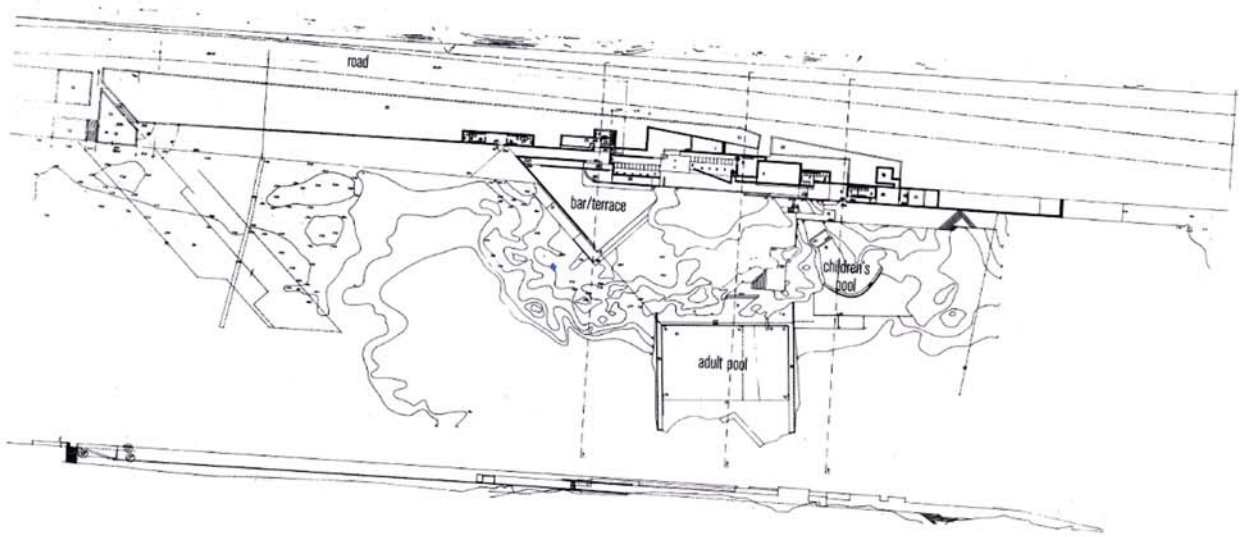
This municipal facility was a design challenge in that the site is only a few kilometers away form the industrial district. Siza was unable to have the literal transition from pool to ocean because of the proximity. He was able to salvage the narrow coastline though with a longitudinal design. For protection from the road beyond, he buffers the shoulder with changing facilities, a terrace and the housed mechanical equipment.

MUNICIPAL OCEAN SWIMMING POOL

(above) A view from the beach over the adult pool and onto the Atlantic beyond.

(below) site plan an site section.

Siza does an amazing job with integrating these two swimming pools into the rocky terrain of Portugal's Atlantic coastline. He marries the transition between built and natural not only with design but also with materials. With the rolling ocean so close, the pools seems as though they are remnants of the tide going out.



QUERINI STAMPALIA FOUNDATION
VENICE, ITALY
CALRO SCARPA

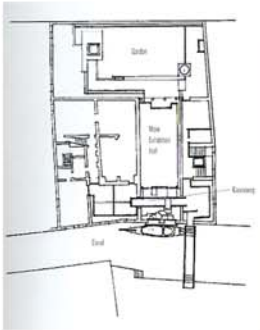
Built in Venice, Italy, unique building conditions were taken into consideration for the Querini Stampalia Foudation building designed by Carlo Scarpa in 1959. The tides of Venice often rise and fall-occasionally rising high enough to flood Piazza San Marco and other walkways. There are also secret gardens and green spaces that are enclosed by buildings and hidden from public view.

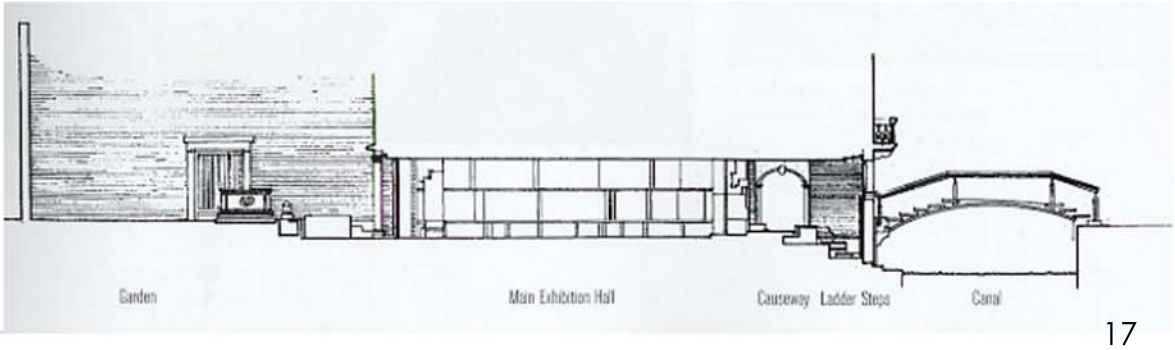
Scarpa focused on the natural phenomenon that occurs between the landscape and architecture. Entering the building on an asymmetrical bridge, one sees the effects of the ever changing tide in the causeway area. "The steps convey the visitor from the gondola to the causeway that connects the entrance hall with the exhibition space." [1] The water in the garden is not connected with the tidal waters. The water is also in constructed pools-not natural occurring pools.

QUERINI STAMPALIA FOUNDATION

The dichotomy of the two water sources is clear. The water in the gardens is man-made and artificial in nature. The lapping of the tidal waters on the canal steps creates a more natural and integrative design between architecture and landscape. Scarpa is clearly stating the canal water is more "natural" than the garden beyond.

Carlo Scarpa's work with the Querini Stampalia Foudation is a relevant precedent to this thesis because it captures the true sense of a natural element and only enhances it. The waters from the Mediterranean Sea that flow through the city of Venice are embraced and welcomed. Scarpa went further and welcomed the waters into the building. The integration of natural and built is celebrated in the building.





IGUALADA CEMETERY
IGUALADA, SPAIN
ENRIC MIRALLES & CARMEN PINOS

This site is particularly interesting in that it both restrains and encourages the natural landscape. Miralles and Pinos are able to weave the program of a cemetery through the rough terrain of Igualada, Spain.

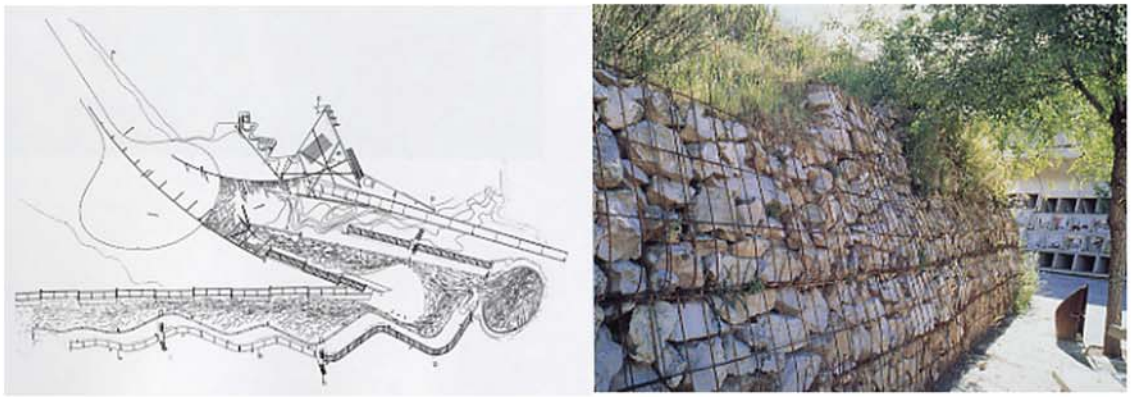
The retaining walls are constructed of excavated rubble from the construction process. It is then restrained by steel mesh. First the ground is ravaged during the excavation, liberating the rocks only to gather them together and confine them into rigid retaining walls.

IGULADA CEMETERY

(upper left) Construction view looking north.
(lower left) The circular plaza from the second level.
(right) Existing site conditions show the layers of exposed geology.

The material treatment of the ground opens up thresholds of meaning in many directions. "Ground" is a concept that unifies past and present, site and program in a myriad of real and invented traces that the architects have developed.

(left) Site plan of the entire cemetary, which only a portion has been built.
(right) The loose rock gabion retaining wall in their rusting cages are like threads that stitch the breaks in the earth without attempting to hide them.



HOLOCAUST MEMORIAL CENTER
FARMINGTON HILLS, MICHIGAN
NUEMANN SMITH ARCHITECTS

The first national museum dedicated to the events of the Holocaust is anything but a museum. The Holocaust Memorial Center is the reliving of an experience. Housed in a truly symbolic building, one will be taken on a memorable journey not only by the information on display, but also by the path one travels, and the intimidation of the spaces created by the materials and sounds of the exhibitions. The Holocaust Memorial Center in Farmington Hills, Michigan has truly captured a feeling in the architecture. Its uninhibitedness could effect any viewer; similarly to that of the Jewish history in the 20th century.

The initial attraction of this memorial is largely due to its external material use and design. Located just off a busy highway in the business district of Farmington Hills, the use of heavy materials, elongated pyramids that pierce its main facade, and the binding of the entire building in a heavy metal wire will cause even the most cautious driver to momentarily break their concentration on traffic.

The heavy masonry stripes are meant to resemble the striped uniforms the Jews were obligated to wear in the concentration camps. The heavy gauge metal wire that wraps the building is there as a reminder of the wired fences that surrounded the camps. It is important that these materials are so prevalent on the exterior to offer an experience of the tragic events of the Jewish Holocaust. Once inside, the design and scale of the exhibits similarly demand your attention.

Once inside, in the introduction to Judaism section, the exhibits are once again uncensored. The piece that will strike any attentive observer is the sculpture entitled "Family Model". The caption recalls a Jewish family gathering for the Sabbath meal. Although based on the title, one might recall a pleasant picture of a family dining together, this is not the case. They are all unabashedly staring over their shoulders at the Anti-Semitism display that is highlight by Nazi-red backlighting. This display is hardly preparation for what is to come.

Once you turn the corner into the World War II exhibit, you are greeted by none other than an eighteen-foot-tall picture of Adolf Hitler. He welcomes you to manipulation, hatred and humiliation of the Jews.

He escorts you through a cave that can only be described as a passage through a caterpillar's legs that immediately expels you on the threshold of a Jewish work camp. Involuntary imprisonment would have been a better description. This is the first of several

uncomfortable exhibits. Standing inside of staggering masonry walls topped with barbed wire, you get the impression that these people were brought and kept here unwillingly. Across the way is an imitation of a ghetto. You could be fooled by the materials of the walls and the dim lighting to believe that this was a prison of involuntary servitude as well.

There are more physical exhibits that are encountered before one enters the gravest of all.The Post-War room is a truly horrifying experience, just as the Holocaust itself was.

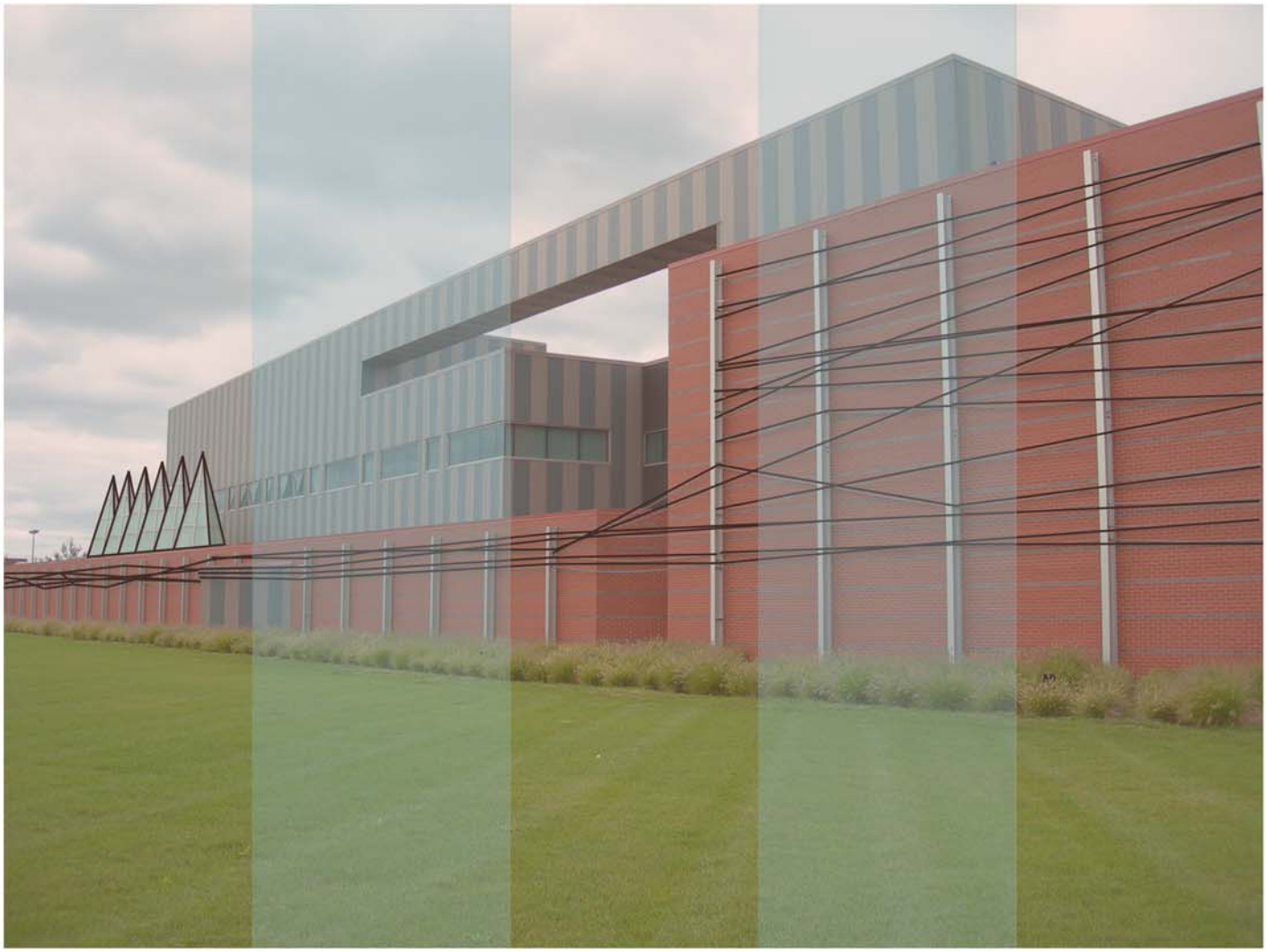
Blinded by the black walls, ceiling and floor, you are drawn towards six large projection screens that have graphic historical footage of the opening of the Concentration Camps. This room is by far the most uncomfortable. One is required to walk along a narrow path. There is nothing to stop you except the screens and their images. This room is designed to detain the viewer long enough to see the horror or just barely long enough to walk quickly down the narrow aisle that exits the room. The only thing that brightens the room is the Memorial Flame at the end of the pathway. Once you approach it though, you will find that you cannot reach it yet. Again, this building is supplying a micro-experience of the history of the Jews. Once the Nazis were defeated and the War had ended, the light at the end of the tunnel, the Memorial Flame, is close but not within reach.

HOLOCAUST MEMORIAL CENTER

Next is the debriefing room as there would be in any mission. There are movies of survivors, personal experiences and the Nuremburg Trials. The rooms are getting lighter not only with more natural light being supplied but also with the colors and materials of the building. Above the area that highlights "Those Who Helped" are the six elongated pyramid skylights. These really do offer light and hope and peace for those who suffered. All are grateful for those that helped. Here you can also read their contribution and be thankful. Then you will confess your thankfulness in an extraordinary large gathering space appropriately called "The International Institute of the Righteous". You have the chance to list that which you are grateful on the cards provided in the room.

The Holocaust Memorial Center honors the reality of the history.

The building honors the experience of the history.



The strengths of the HMC are obvious in that its design is stellar. There is not a visitor that misses the message of the history of the Holocaust. The Holocaust Memorial Center is a prime example of how a builing- not the contents- **can tell a story**. The design by Nuemann Smith & Associates is truly exceptional and provides valuable **integration between program and building**.

The HMC falls short in that it is a second hand experience. During the 1930's and 40's, the public at large did not know the details about the Holocaust until after Hitler died, the war ended and the camps opened. This information was disturbing and was not all released to the public immediately. Over the years, more information was discovered and released.

The release of information to the public in the HMC does not hold true to the actual release of information during WWII. For weeks and months at a time, people did not know where thier relatives were of if they were safe. The feelings of uncertainty and the constant state of fear is not emulated in a trip to the HMC.

CATHERINE FERGUSON ACADEMY
DETROIT, MI

The Catherine Ferguson Academy in Detroit, Michigan is not known for its architecture. It is known for giving young mothers a chance at success. It is a school for pregnant teenagers and young mothers and their children. The primary focus is on success in academics and parenting skills.

The CFA is of particular interest to the thesis study because of its alternative curriculum and teaching methods. This academy offers young women who have not followed the societal pattern of attending school, getting married, and then having a child a chance to finish their high school education and continue on to a college or university. This opportunity is not typically offered through the traditional high school in Detroit.

The curriculum options are most accommodating to those mothers who are balancing the juggle between school, motherhood, and work. The typical school week is four days long instead of the typical five. This offers the mothers a chance to make up missed days on Friday or they are rewarded with a long weekend if classes were attended Monday through Thursday.

The "Externship Program" is offered through local businesses to all students interested in a particular profession. A student has the opportunity to work in that field for up to eight weeks to see how compatible it is with their interests. If the students decides they would like to continue with that particular profession, then CFA will help with job placement for the young mother.

CFA offers many other services to the mothers and their children. Mental, physical, and emotional health care is provided at no extra cost to the mothers or children. This is a benefit that only assures the mothers that their child is receiving the proper care while they are receiving their education.

The CFA delivers alternative teaching methods not only through alternative curriculum but also through its science program. There is a voluntary program called "Agriscience". This is an interactive science program where the young women get involved with the school farm. They learn about the life cycle and the needs of a living animal through the phases of conception, infanthood, childhood, adulthood, and death of the animal. This helps not only with the understanding of a mature and full life cycle but it also allows the girls to relate to the process of loosing a loved one.

The academy's dedication to the students and children does not stop at graduation from the academy. CFA sees to it that every woman goes on to a two- or four-year degree program. They even assist with the financial planning of the college education.

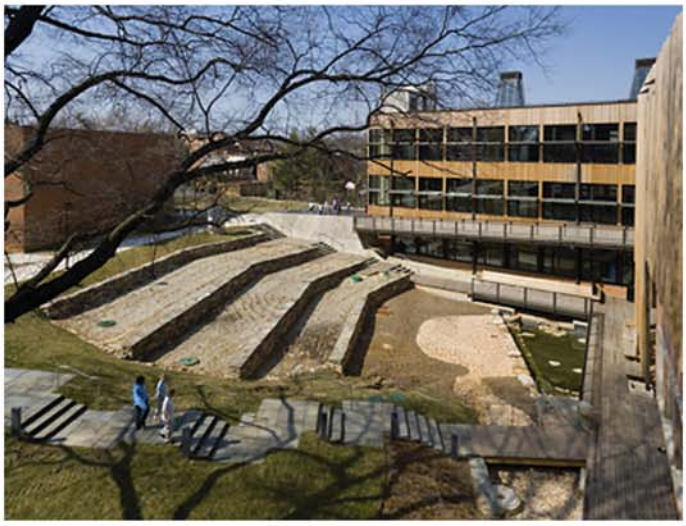
SIDWELL FRIENDS MIDDLE SCHOOL ADDITION AND RENOVATION WASHINGTON, DISTRICT OF COLUMBIA

(above) The main entrance into the Middle School, showing the new addition and the existing masonry foundation.

Sidwell Friends Middle School is in the midst of a bustling urban environment on the Wisconsin Avenue campus in Washington, D.C. The Master Plan and renovation, completed in 2001, focus on establishing the landscape as the anchor between the existing buildings and the future additions. The Middle School renovation and addition transforms an awkwardly-sited, undersized, fifty-year-old facility into an exterior and interior teaching landscape.

SIDWELL FRIENDS MIDDLE SCHOOL

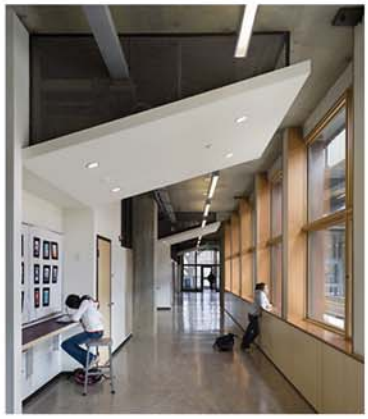
Several design factors contribute to the building's energy economy. Siting and orientation of the building optimize the use of daylight. Solar chimneys are designed for mechanically assisted natural ventilation to minimize the need for artificial cooling. South-facing glazing at the tops of the shafts heat the air within, creating a convection current which draws cooler air in through north-facing open windows. Classrooms were designed to optimize natural lighting as the primary daytime illumination source. A constructed wetland at the campus-side entry forecourt treats and recycles all building wastewater for gray water use within the building. The collection and diversion of rainwater through the vegetated roof demonstrate the interconnection and complexity of the natural

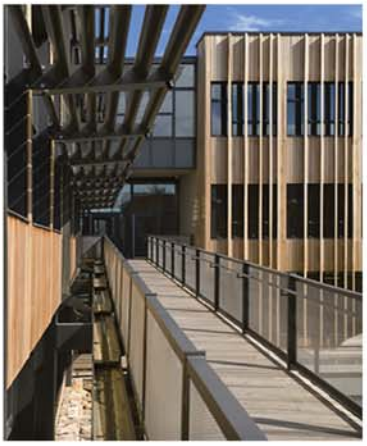


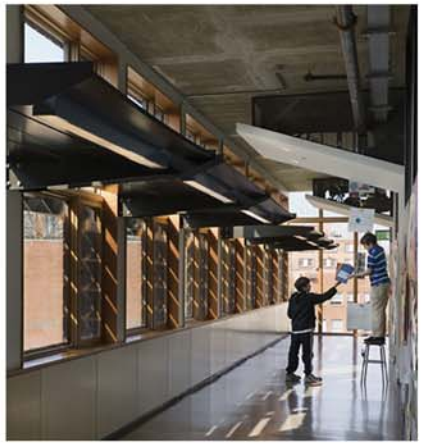
(above) View from the gangway onto the constructed wetland at the campus-side entry forecourt.

(right) The courtyard is developed as a constructed wetland designed to recycle wastewater from the building for reuse.

SIDWELL FRIENDS MIDDLE SCHOOL





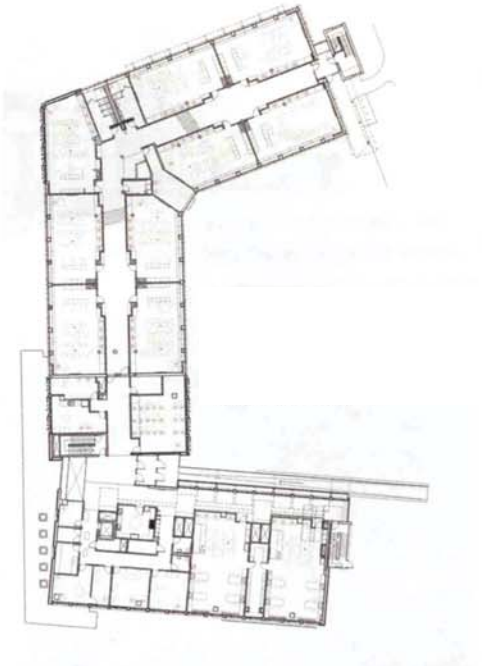
watershed. Rainwater is held and filtered through the vegetated roof on the addition. All water on both existing and new wings is diverted to the courtyard side of the building. The courtyard is developed as a constructed wetland designed to recycle wastewater from the building for reuse.

The building uses its orientation to maximize sunlight. The north facade has no screening and fully allows diffuse light. The south screening is placed horizontally above windows. The east and west vertical sunscreens keep out glare when the sun is low.

Solar chimneys are designed for passive ventilation. South-facing glazing at the tops of the shafts heat the air within, creating a convection current which draws cooler air in through north-facing open windows. The solar chimneys are also intended to be used in mechanical ventilation and air conditioning modes, demonstrating the response to both passive and active systems.

Building materials are largely reused, recycled, rapidly renewable and/or regionally acquired. The wood is western red cedar, selected for its high durability and appearance, which will weather naturally to a silver gray.

SIDWELL FRIENDS MIDDLE SCHOOL



Architects transform an undersized, awkwardly sited middle school by renovating the existing 1950 building (1) and adding the 39000 SF extension (2) that more than doubles the total space.

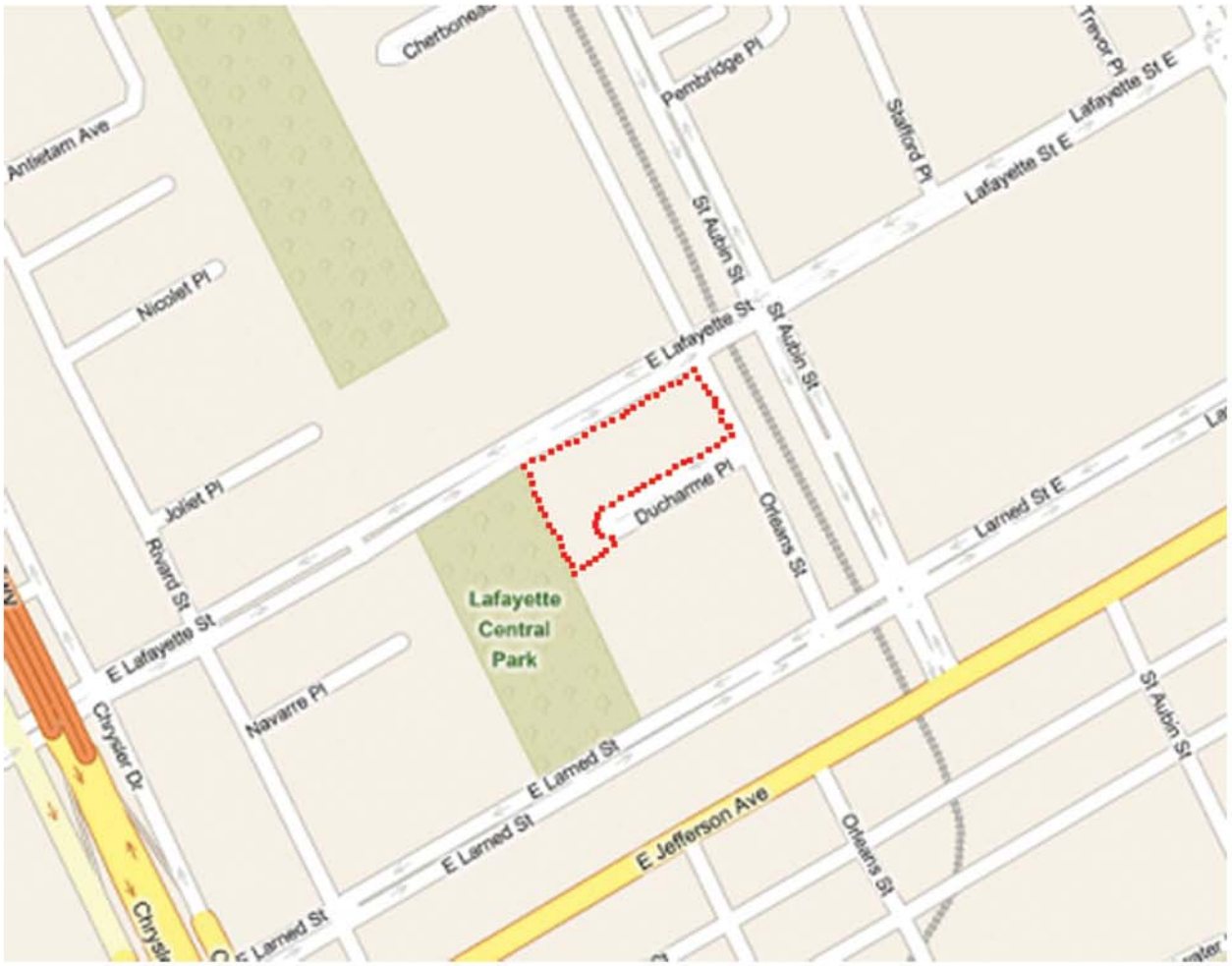
Development is focused on the north part of the campus to minimize the impact of new construction on the land, a scarce urban resource. The Middle School addition forms a courtyard which addresses the campus as a place and destination. The courtyard is one end of a planned route along the northern edge of the campus, linking each of the primary structures and exterior spaces.

Initial Research

Final Site Analysis

Ecology.Architecture.Education.Design

Site Option - Detroit, MI "Dequindre Cut"



Detroit is certainly in need of new educational facilities. Currently, there are no existing high schools that emphasize alternative teaching methods or ecology.

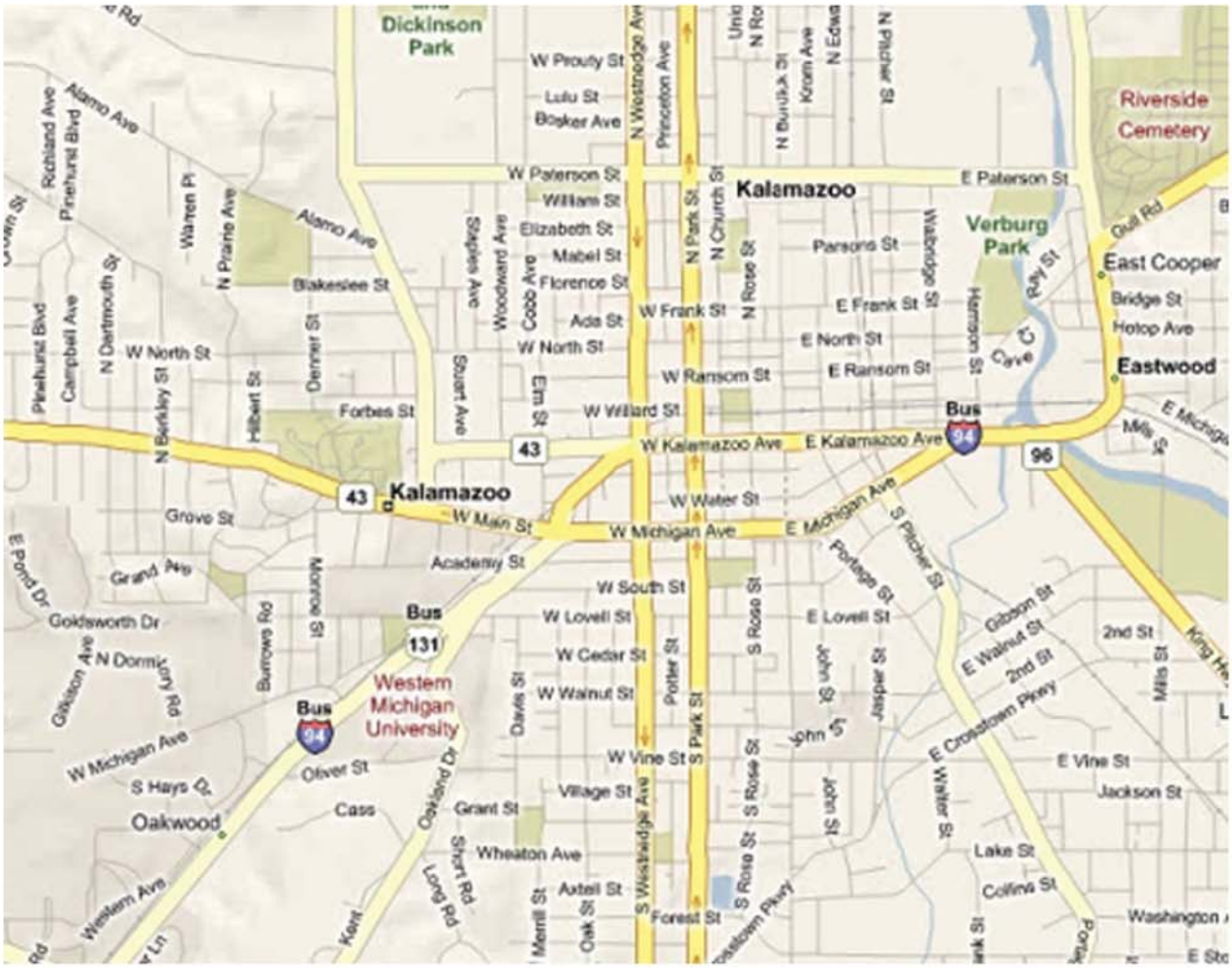
This area near Lafayette Central Park is an optimal location, however it is physically too small. It was considered though because of the history of the adjacent area known as the "Dequindre Cut". This would have supplied the school with an opportunity to examine the natural environment next door.

Approx Size: 4 acres

Location: NE of I-75, West of the "Dequindre Cut"

< 1.0 mile from downtown area

Site Option - Kalamazoo, MI



Western Michigan University is nestled into the bustling city of Kalamazoo, MI. Intermingled with the college are busy restaurants, established business communities, an array of museums, and several award-winning ecological-friendly schools.

Kalamazoo was considered to be a possible location because of its pre-established city infrastructure. It was ultimately rejected because of the lack of need of an eco-friendly, alternative method high school.

Location: Southwestern Michigan

Population: 77145

Site Selection - Cheboygan, MI

Approx Size: 24 acres

Location: Directly East of Cheboygan Straits - water gateway from Mullet and Burt Lake to Lake Erie. Adjacent to downtown Cheboygan.

Climate: Temperate - Moderate to Severe

Average Wind Speeds:
Summer: 0-16 mph
Winter: 0-26 mph

Annual Percipitation:
Rainfall - 17 inches/season
Snowfall - 100 inches/season

Seasonal Temps:
Summer: 55-77 F
Fall: 42-59 F
Winter: 19-29 F
Spring: 27-46F

Cheboygan, MI

Cheboygan, Michigan is an optimal site because it meets the circumstance criteria.

The access to natural bodies of water is a sandy beach on Lake Huron to the north and boat access to the Cheboygan Straits to the west. This would allow for the opportunity for a hydropower supply. The temperate weather climate also allows for water access from year-round precipitation.

The parcel of land is physically large enough- 24 acres, and certainly allows for the development of a high school and its facilities. It also allows for outdoor alternative teaching areas. There is the possibility for agricultural areas or wetlands.

The land in Cheboygan is intrinsically pure. It has been vacant for years. There had been a building the site which was removed without scarring the land below. The ground has been restoring itself for years, returning to a natural state.

Since this land is on the water front, there is also the possibility of harvesting energy from the wind. This too allows for alternative lesson plans.

Because of the purity of he land and the open space it offers, this site would be easier to navigate than others. It would also accommodate a design that would minimally interrupt the site and the natural environment surrounding it.

DETROIT, MI

The new Riverfront Walk is under construction. Several residential and retail projects are on the drawings boards. Through on one site- the 44 acres parcel just west of the MacArthur Bridge to Belle Isle, known as the Uniroyal Site after the tire factory that once stood there. This and other occupants have stymied efforts at redevelopment.

Now there is hope that a resolution of one of Detroit's longest-lasting development puzzles may be closer. In spring 2006, the Michigan Department of Environmental Quality is expected to issue a judgment on which companies it believes should be responsible for cleaning up decades of industrial by-products that contaminate the site. The companies that have occupied the site are Detroit Stove Works, Olds Motor company, Northern Mfg. (autos), Morgan & Wright, Hypp Motors, King Motor Car Company, Gas Works, and U.S. Rubber-Uniroyal.[1] Under Michigan and federal environmental law, any company that ever operated the site or the company's successor, is liable to the State for all of the residual problems.

In the 1860's, when Detroit's stove industry took off, Americans made and bought a million stoves from two manufacturers located in three cities- Detroit, Cincinnati and Philadelphia. These cast iron stoves were how many American made it through the cold winters. From 1883-1930, the old Detroit Stove Works was one of the first occupants of the site. Before automobiles, stove manufacturing was Detroit's second major industry, after railroad and car building. By the early 1900's the Detroit Stove works employed about 1400-1600 men on site, the Michigan Stove Works about the same while the Pennsylvania and Art Stove Works were significantly smaller.[2]

Some of the earliest occupants were Peninsula Iron Works in 1884, Union Iron Works in 1884, and Michigan Ammonia Works in 1922. Work ethic and conditions during this time were oriented around production, not the quality of workshops or the bi-products of manufacturing. In 1901 Olds Motor Works burned to the ground. The cause of the fire is unclear but a junior engineer risked his life saving a prototype. Though it is uncertain as to what chemicals and pollution were dispelled into the ground and water then, it is known that the remnants of the building were removed while the underground levels were bulldozed over and buried in the ground.

Today, there are traces of tar, coal, PCB, mercury in the soil and groundwater. Regarding the laws established in 1995 to assign responsibility for contaminants on the site, the state law has "little power to force property owners to clean up pollution unless they're proven responsible."[3] Five years later, under pressure from industries and municipalities, lawmakers changed the law again, making sure that only those who cause the pollution were liable for cleanup costs. Oladipo Oyinsan, the Southwest Michigan DEQ, states "if you have a site where the nearby groundwater is contaminated, it will take years to clean." [4]

With this impeding pollution, it is the task of this thesis to propose a remediation plan for the Uniroyal site before a school could be built. It is a goal to have the future students utilize the history of abuse as a lesson as well as the remediation of land as a lesson in geology.

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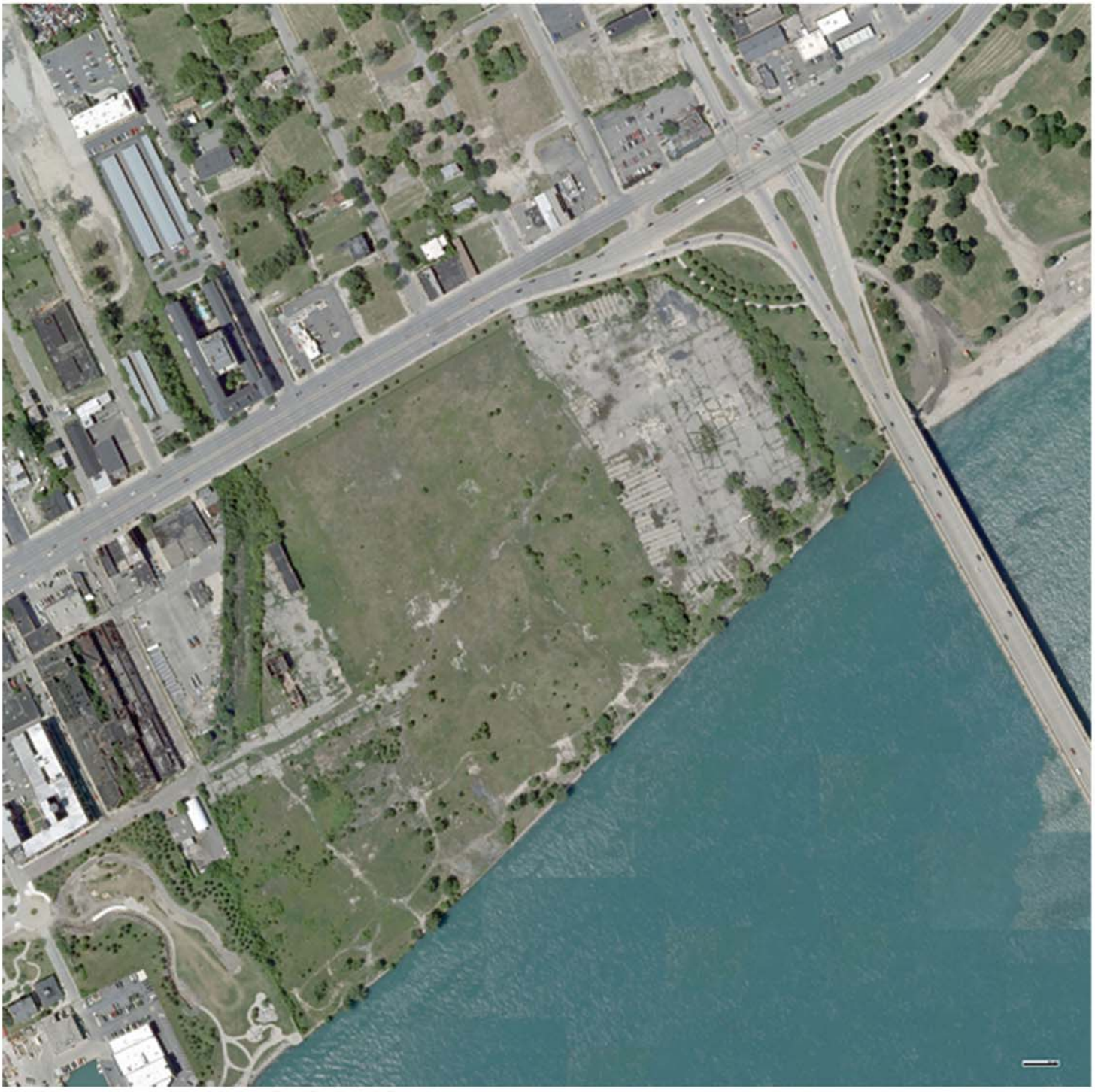
[1] www.atdetroit.net
[2] www.atdetroit.net
[3] Andrew Hogarth, the chief of remediation and redevelopment for the Department of Environmental Quality, http://environmental.jrn.msu.edu
[4] http://environmental.jrn.msu.edu

View from the center of the site looking west.

View from Belle Isle looking northwest onto the Uniroyal Site.



The Uniroyal site in its entirety, aerial view

The Uniroyal site inparticular the proposed site, aerial view

Environmentalists have referred to wetlands as nature's kidneys. Much interest has developed in recent years in using constructed wetlands to remove contaminants from water, whether it is effluent from municipal or private waste systems, industrial or agricultural wastewater, or acid mine drainage.

In a practical, low-cost approach, wetlands create a surface flow for the removal of contaminants from wastewater generated production operations. To design and develop a wetland for effective wastewater treatment, it is necessary to understand the processes that occur in wetlands. Primary processes include:

- Uptake and transformation of nutrients by microorganisms and plants
- Breakdown and transformation of pollutants by microorganisms and plants
- Filtration and chemical precipitation through contact with substrate and litter
- Settling of suspended particulate matter
- Chemical transformation of pollutants (i.e. ammonification of nitrogen)
- Absorption and ion exchange on the surfaces of plants, sediment, and litter.
- Predation and natural die-off of pathogens [1]

Using constructed wetlands to remove pollutants in wastewater is not for everyone but in some instances, it can be a viable alternative to or a component of a larger wastewater treatment system or plan.

Advantages: A properly constructed wetland designed to fit the topography has these advantages:

1. Provides a high level of treatment - Properly designed, constructed, maintained and managed wetlands can provide very efficient treatment of animal wastewater. Test results show that phosphorus, nitrate-nitrites, ammonia, BOD5 and suspended solids can be reduced to very acceptable levels.
2. Is inexpensive to operate - A constructed wetland requires little, if any, energy use and equipment needs are minimal. A well-designed wetland transfers water by gravity through the system. If topography limits the use of gravity, pumps will be necessary which increases the cost of operation. Once established, properly designed and constructed wetlands are largely self-maintaining.
3. Can be relatively inexpensive to construct - Each constructed wetland's design is site specific, taking into consideration such variables as topography, water supply, soil types, type of livestock operation, etc. Selection of a site with accommodating specifications keeps establishment costs low.
4. Reduces, if not completely eliminates, odor - Odor is a serious problem when handling and treating animal wastewater, especially if the farming operation is located in close proximity to residential housing. Unlike lagoons, Ohio State University Extension research on three constructed wetlands in eastern Ohio has shown that odors from wetlands are of very low intensity or are non-existent.
5. Is able to handle variable wastewater loadings - Properly-designed wetlands have shown great tolerance for varying amounts of wastewater loading. This is important because changing climatic conditions and modifications in management can alter loading rates significantly.
6. Reduces the land area needed for application of wastewater - Constructed wetlands reduce the concentration of contaminants. Thus, the land area needed for application of water from a constructed wetland is less than the land area needed for direct application of wastewater.

[1] Davis, L., *A Handbook of Constructed Wetlands A Guide to Creating Wetlands for: Agricultural Wastewater, Domestic Wastewater, Coal Mine Drainage, Stormwater in the Mid-Atlantic Region, Volume 1: General Considerations.*

7.Can be ascetically pleasing - Depending upon design, location, and type of vegetation, constructed wetlands can enhance the landscape with color, texture, and variety in plant materials.

8.Provide wildlife habitat - Wetlands attract some types of wildlife and can add to the usefulness and attractiveness of the area.

The proposal for this thesis project is a fifteen year remediation plan. Every three years, a different benchmark will be met.

CURRENT CONDITIONS:
Contaminated vegitation. 12 acres of concrete. Restrcited access.

+ 3 YEARS:
Remove concrete and damaged vegetation. Flood site with water resulting in a constructed wetland.

+ 6 YEARS:
Manipulate topography-slope for natural drainage to constrcuted wetlands. Add vegetation to remove toxins.

+ 9 YEARS:
Reduce acreage of constructed wetlands. Increase acreage of remediation vegetation.

+ 12 YEARS:
Manipulate topography. Reduce wetland acreage. Increase and seperate remediation vegetation acreage.

+ 15 YEARS-BUILDING PROPOSAL:
Constructed wetlands as natural boundary to the southwest. Serves as teaching instrument and ecological function. Sunflower field to the north of the site to serve as soil enhancer and aesthic value.

Project Identification

This project will attempt to develop a school for students between the ages of 5 and 11 with the focus of the curriculum and architecture on alternative teaching methods and the ecological environment. This will be attempted through custom design on the macro and micro scale. All interior and exterior spaces will promote creativity, ingenuity, and resourcefulness in the students.

The purpose of the elementary school is to avoid the traditional arrangement of a teacher at the front of the room with students in rows of desks. Alternative and interactive teaching and learning will be utilized in this school. With this theory in mind, the traditional classroom labels such as mathematics, science and music rooms will not be used either. Instead, areas will be designated for either a single or multiple lessons.

Articulation of Intent

It is the intent of this project to be a place of learning for elementary school children. The lessons taught in this school will not be conveyed through traditional delivery methods but through alternative methods based on an ecological framed curriculum. The interconnectivity of the sun, water, wind and earth elements will be integrated into the building system. Through these connections, the building will aid in the alternative teaching philosophy.

Components

The major components of ecology are earth, wind, water and sun. These four elements will be integrated into the building and curriculum. The students will have the opportunity to learn all lessons through alternative teaching methods in the following spaces.

<u>Spaces</u>
Indoor Learning Opportunity Areas (LOAs)
It is the intent of this program is to remove the typical classroom of desks as the primary area of learning. The indoor "classrooms" will be replaced with learning opportunity areas (LOAs). These differ from the typical classroom by the student's ability to inhabit nearly all spaces inside the building. Areas under tables or in a bookshelf will now become an area of exploration, a new home for the class fish, or a quiet sanctuary for a student to read. "The habitable space between things represents a shift in attention from the official level to the informal, to where ordinary day-to-day lives are led."[1] This attention to detail will help personalize the education a child receives.

Outdoor Learning Opportunity Areas (LOAs)
The intent of this program area is to allow students to explore and discover new lessons outdoors. The natural environment around us is a great teaching tool for lessons focused on the earth, wind, water and the sun. Areas such as a green roof, constructed wetlands and wind turbines make for interesting learning opportunities. These different LOAs will stimulate a students learning capability by delivering lessons through alternative methods.

Elements

[1] Hertzberger, Herman. Lessons for Students in Architecture. 1st ed. G.J. Thieme bv, Nijmegen, 1991.

Water

Clean water is needed by all humans to survive. Less than one percent of the world's fresh water is available for human consumption.[2] The sources of clean water today are reducing at noticeable rates. Lessons in reducing consumption, purifying and reusing water are vital in order for fresh water to be an available resource in the future. The following are various methods for children to learn about consumption reduction, harvesting, purifying, and reuse that are integrated in and around the building.

Living Machine
Description: A living machine is a water filtration and purification system that can be integrated into a building. It can help to reduce water consumption, purify water and reuse it in various parts of the water system in the building.
Integration: This will be incorporated into the elementary school on the south side of the building to maximize the sunlight. Under supervision, children will be allowed to explore the Living Machine.
Location: Inside the building, located on the south side.
Quantity: 1
Size: 2000 sf,1.5 million gallon annual capacity
Capacity: n/a

Pond Art
Description: Sculptures and statues located near and possibly in the pond will be designed so that it catches the blowing wind and falling rain.
Integration: The lesson taught here will be about the sound the wind makes when it blows through metal sculptures, the sound when rain hits hard surfaces and how the varying speeds of wind affects the movement in the sculptures.
Location: interspersed around the Living Machine
Quantity: 5+ sculptures and statues
Size: range from 12" in height to 12' in height
Capacity: n/a

Barrel Collectors
Description: Large cisterns will be located on the site for the culmination of water collection from the various sources.
Integration: The water will be purified through the Living Machine and then reused throughout the building.
Location: Above grade, possibly on the roof of mechanical area
Quantity: 3-5 cisterns
Size: 12000 gallons/ each
Capacity: n/a

Hydro Power
Description: Electrical energy generated by harnessing the power of moving water is referred to as hydroelectric power. Any steady current of water from a river or other waterway can be converted to an electrical current.[3]
Integration: The flowing water in the Detroit River will provide the movement necessary to harness electrical energy. A water wheel will be located on the edge of the property at

[2] http://www.worrellwater.com/water_facts.html
[3] http://www.energyvortex.com/energydictionary/hydroelectricity__hydroelectric_power__hydro.html

the Detroit River. Students will be able to learn about alternative energy sources among other lessons.
Location: The water wheel will be adjacent to the property in the Detroit River. The mechanical equipment will be housed in a small structure near the southeast edge of the site.
Quantity: One water wheel, one small structure
Size: The structure will be no more than 200 sf to house the equipment. The area of the water wheel that occupies surface area of the river will be no more than 500 sf and will not extend more than 15 feet into the river.
Capacity: Water wheel- n/a
Structure- 5 adults, 40 students

Earth

Green Roof Space
Description: Inhabitable areas are not limited to inside buildings or on the ground. Areas on top of the roof can facilitate opportunities for learning.
Integration: Here, the children can study rainfall, water collection, solar panels, green grass roofs, the sun, heat gain and loss, and about solar chimneys. Several spaces on the roof will be designated as learning opportunity areas (LOAs).
Location: rooftop
Quantity: 1 area for the study of solar panels, heat gain/loss and the sun (LOA "Solar Space"). 1 area for the study of vegetation on roof tops (LOA "Grass Garden"). 1 area for the study of solar chimneys (LOA "Sun chimneys").
Size: LOA Solar Space – 1200sf
LOA Grass Garden-1000sf
LOA Sun Chimneys- 1000sf
Capacity: 50 students and 5 adults per LOA

Constructed Wetlands
Description: Due to the history of the site and the level of contamination, any pollutants currently in the ground and the groundwater need to be filtered and removed for the land to be safely inhabited.
Integration: During the "Rejuvenation Years" when the soil and groundwater is purged of toxins, the constructed wetland area will play an important role. It is designed to naturally remove these toxins.
Location: Varies throughout the site. Sample soil tests will be conducted to determine the locations.
Quantity: 1
Size: Approximately 12-20 acres for the duration of the Rejuvenation years. This translates to approximately 30-50% of the site.
Capacity: n/a

Wind

Wind Harvesting Turbines
Description: Large blade turbines are placed in open areas that are prone to wind. These large turbines will rotate when the wind blows which then turns a turbine and harvests the energy produced. This energy can be used to supply power to the building. Any excess power can be returned back to the grid and distributed to other buildings.
Integration: The wind will power the fans and the energy will then be harvested. This energy can be used in the building to power other utilities.
Location: Near the Detroit River, in the Detroit River near the site coast line.
Quantity: 4 on land, 4 in the water

Size: 40-50 ft in height, up to 30 ft in diameter
Capacity: n/a

Wind sock
Description: A tapering shape made of durable cloth that sits atop a building or flagpole. When the wind blows, it catches in the sock and it expands.
Integration: Observers will be able to tell which direction the wind is coming from. The sock will help identify the cardinal directions to children. The fervor with which the sock blows will depend on the direction of the wind and the intensity.
Location: Atop a flagpole located on the roof of a building onsite.
Quantity: 1
Size: approx 20 ft in length
Capacity: n/a

Natural Ventilation
Description: Natural wind currents, direction, building shape and orientation are used to naturally ventilate a building.
Integration:
Location:
Size:
Capacity:

Sun
Solar Chimney
Description: Ventilation chimneys run through the building in a continuous vertical stack. South-facing glazing heats the air within the shaft. This creates a convection current which draws cooler air in through north-facing windows.
Integration: Because wind is not visible, chimes will be placed in the chimneys to alert those that the passive ventilation process is working.
Location: An uninterrupted vertical space throughout the building.
Quantity: Minimum 2 per building
Size: Approx 150ft in cross section
Capacity: n/a

Sundial
Description: A sundial is a device that measures apparent solar time of day by the positioning of the sun. The sun casts a shadow on a flat surface marked with the hours of the day. As the position of the sun changes in the sky,, the position of the shadow indicating the time changes on the sundial.
Integration: This lesson will teach children about the revolution of the earth around the sun. It will also help those learn how to tell time.
Location: The sundial will be located on grade level- possibly in front of the main entrance to the building. This can also serve as a decorative piece integrated with the landscaping.
Quantity: 1
Size: Approximately 6 feet in diameter, no more than 3 feet in height.
Capacity: n/a

Daylighting
Description: Natural daylight will be the primary source of illumination throughout the building.

Integration: All spaces within the building will be illuminated with the use of natural light. When this option is not available, alternative methods will be used. Spaces that do not line the edge of the building will be lit through openings and interior windows.
Location: throughout the building
Quantity: approx. 40000 SF of translucent glazing
Size: n/a
Capacity: n/a

Shading Device
Description: Although direct sunlight is optimal for some tasks, indirect lighting or direct illumination is preferred. Through the use of screen, canvases and vegetation, the direct rays from the sun can be filtered. The illumination given off by these direct rays though can travel beyond these screens and light up a space beyond.
Integration: Horizontal shading devices will be along the south facing walls and vertical shading devices will be placed along the north walls.
Location: The screen wall will cover the south, west and north facing walls. A vegetative shade will cover the exterior walls of the Large Movement area.
Quantity: Material shades- approx 80000sf, Vegetative shades- approx 5000 sf
Size: n/a
Capacity: n/a

Indoor Spaces

Administration Activities

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
first floor administration offices	1	20	20	1800	1800
first floor faculty support area	1	12	12	500	500
second floor faculty support area	1	12	12	500	500
third floor faculty support area	1	12	12	500	500
fourth floor faculty support area	1	12	12	500	500
first floor waste removal	4	6	24	200	800
second floor waster removal	4	6	24	200	800
third floor waste removal	4	6	24	200	800
fourth floor waster removal	2	6	12	200	400
fire egress stairs	3			400	6400
vertical circulation-stairs	3			445	1335
vertical circulation-elevators	1			150	150
first floor "street space"	1		0	12500	12500
second floor "street space"	1		0	16700	16700
third floor "street space"	1		0	14670	14670
fourth floor "street space"	1		0	4500	4500
Totals	**26**		**152**		**14485**

Gathering/LOA's/Private Outdoor Spaces

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
first floor LOAs-size A	1	40	40	1000	1000
first floor LOAs-size B	1	40	40	840	840
first floor LOAs-size C	1	70	70	1800	1800
second floor LOAs-size A	1	60	60	1500	1500
third floor LOAs-size A	2	50	100	1260	2520
third floor LOAs-size B	1	40	40	1000	1000
third floor LOAs-size C	1	50	50	1240	1240
fourth floor LOAs-size A	1	60	60	1240	1240
fourth floor LOAs-size B	1	60	60	1500	1500
Large Gathering	1	200	200	2400	2400
Totals	**11**		**720**		**15040**

"Home" Areas

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
First Floor					
30x40	6	25	150	1200	7200
40x40	2	25	50	1600	3200
Second Floor					
30x40	2	25	50	1200	2400
40x40	2	25	50	1600	3200
special size	1	25	25	1800	1800
Third Floor					
30x40	7	25	175	1200	8400

special size		1	25	25	1500	1500
Fourth Floor						
30x40		5	25	125	1200	6000
	Totals	**26**		**650**		**33700**

Specialty Rooms

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
Daylighting	1	40	40	2600	2600
Direct/Indirect	1	30	30	600	600
Large movement	1	400	400	9300	9300
first floor-small movement	1	100	100	2700	2700
second floor-small movement	1	10	10	1150	1150
edible greenhouse	1	100	100	6500	6500
first floor- Living Machine	1	50	50	4500	4500
Living Machine Overlook	1	20	20	600	600
nourishment intake	1	600	600	6200	6200
making noises (music)	1	100	100	2700	2700
artistic expression (art)	1	100	100	2700	2700
geology	1	30	30	500	500
Totals	**12**		**1350**		**40050**

Mechanical

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
"artificial" mech room	1	15	15	2000	2000
"natural" mech. room	2	15	30	2000	4000
Totals	**3**		**45**		**6000**

INDOOR SPACES TOTALS	**78**		**2917**		**109275**

Auxilary Buildings

Wind Turbine Mechanical House

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
office	3	2	6	150	450
restroom	2	2	4	200	400
Mechanical Room	1	20	20	800	800
turbines	3			6	18

Green House

Room Name	No. of Rooms	Occupancy	Total Occupancy	SF	Total SF
mud room	1	5	5	150	150
restroom	2	2	4	200	400
vegetation area	1	50	50	1000	1000

AUXILARY BUILDINGS TOTALS	**13**		**89**		**3218**

Outdoor Spaces

Space	No. of Spaces	Occupancy	Total Occupancy	SF	Total SF
Ampitheater	1	500	500	3200	3200
Green Roof	1	100	100	9300	9300
Constructed Wetlands	1		0		7000
Water Cisterns	2				3950
Parking/ Drop-off areas	1				10000
Pond	1		0		7000
Dock	1				100 LF
Pathways	1		0		7000 LF
OUTDOOR SPACES TOTALS	**9**		**600**		**40450**
THE WHOLE ENCHILADA	**100**		**3606**		**152943**

Administration Office

- Quantities Required
    - Space Capacity: 2 people
    - Number of Spaces: 1
    - Net Square Feet/ Space: 500
    - Total Net Area: 500
- Purposes/ Functions: With relation to the interior street theme of design, the administration offices will act as the town hall and city offices of the elementary school. Here, students and parents alike will be able to interact with administrators.
- Activities: Secretary office, principal office, small conference area, staff work room, copy area, receipt and distribution of mail, staff mailboxes, audible public address system, school nurse office, private staff toilet rooms, small lounge area.
- Spatial relationships (both section and plan): Adjacent to main school entrance in plan. Must be visibly marked and easy to find within the building.
- Qualitative Considerations (particular conditions):
    - The administration offices should be an open and approachable area. The design should be an inviting and welcoming. This is important because of the unique quality of the school, parents, students, and visitors will come to the school and should feel welcome. The navigation of the building should match with a similar ease.
    - There are no specific environmental considerations. The administration is located on the north side of the building which will utilize indirect lighting and north facing windows. All electrical items in the area will be selected and designed with energy conservation in mind.
- Equipment/Furnishings
    - Office furniture: 1 secretary desk and file storage, 1 principle desk and file storage, welcome/sitting area table with 4 chairs, file cabinets, copy machine, scanner, fax machine, computers for all office staff.
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems: Energy saving bulbs, machines, outlets will be used. Natural ventilation will also be used. Operable windows will be placed along the north wall. Security system will be located in the area along with the primary access panel
- Site/Exterior Environment Considerations: Because of the location on the north side of the building, natural light will be used as the primary lighting source.

Administration Support Area

- Quantities Required
    - Space Capacity: 12 people
    - Number of Spaces: 1
    - Net Square Feet/ Space: 1000
    - Total Net Area: 1000
- Purposes/ Functions: This area will be a smaller support area for faculty to use on floors other than the main floor. It will be similar yet smaller in comparison to the main administration area located on the first floor.
- Activities: Small conference area, staff work room, copy area, private staff toilet rooms, small lounge area
- Spatial relationships: Adjacent to the main entrance of the building. This allows for easy access from the main entrance. Across the hallway from the Administration area. This allows for convenient access and communication with the principal and other administrators.
- Qualitative Considerations (particular conditions): This support area should be significantly less accessible and open to the public. It is intended to provide a convenient service to the faculty and staff not to welcome the public to the building. Area is intended for use by staff members exclusively.
- Equipment/Furnishings
    - Office furniture: file storage and cabinets, staff table and chairs, copy machine, scanner, dye cut machines, laminator, small kitchenette area with adjoining dining area
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems: Energy saving bulbs, machines, outlets will be used. Natural ventilation will also be used. Secondary security access panel locations.
- Site/Exterior Environment Considerations: Because of the location on the north side of the building, natural light will be used as the primary lighting source.

Waste Discharge- Public and Staff use

- Quantities Required
    - Space Capacity: 6/public, 1/private
    - Number of Spaces: 2 Male and Female Restrooms/floor, 2 unisex staff/floor
    - Net Square Feet/ Space: 1000/pubic, 100/private
    - Total Net Area: 4400
- Purposes/ Functions: Commonly referred to as lavatories or restrooms
- Activities
- Spatial relationships (both section and plan): Vertical adjacencies are considered for stacking plumbing fixtures and piping.
- Qualitative Considerations (particular conditions): Connection to the Living machine. Grey and black water from the restrooms will go the living machine and be directed from there. Grey water most likely will be cleaned and purified making it available for potable reuse while the black water will be cleaned and be reused for non-potable uses.
- Equipment/Furnishings: 54 water closets, 32 lavatories, 32 soap dispensers and hand driers, 54 toilet paper dispensers, sanitary napkins depository in private female staff toilet rooms.
    - Clearances: ADA accessible
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems
- Site/Exterior Environment Considerations

Vertical Circulation (Main stairs, egress stairs, elevator)

- Quantities Required
  - Space Capacity: 6 person elevator
  - Number of Spaces: 1 main stairwell, 2 egress stairwells, 1 elevator shaft
  - Net Square Feet/ Space: 445/main, 400/egress, 150/shaft
  - Total Net Area: 7885
- Purposes/ Functions:
- Activities
- Spatial relationships (both section and plan): Main and egress stairs will be stacked vertically. The elevator shaft will be one continuous vertical column in the building. Both the main stair and the elevator will be located near the Administration area on the first floor. Security of young children is a concern and access to both will not be readily available directly from the main entrance of the building.
- Qualitative Considerations (particular conditions)
- Equipment/Furnishings
  - Dimensions: 6.5" rise with 11" run on main and egress stairs. This is chosen because children have smaller bodies and are not always able to negotiate maximum rises-especially in emergent situations. Handrails will be used on both sides of all stairs.
  - Clearances: will comply with ADA guidelines.
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems
- Site/Exterior Environment Considerations

“Home” Rooms

- Quantities Required
  - Space Capacity: Small- 25 children and 2 staff and Large-30 children and 3 staff
  - Number of Spaces: 12 small, 6 large
  - Net Square Feet/ Space: Small-1200, Large-1600
  - Total Net Area: 24000
- Purposes/ Functions: Every child needs a routine to help create a sense of habit and pattern. Having a “home” area where students will go to first in the morning, place their shoes, coats and packs will allow children this sense of grounding. The learning opportunity areas will facilitate the main learning throughout the day.
- Activities: Student storage areas (coats, packs, shoes, etc.), individual teacher office, classroom storage, small and large
- Spatial relationships (both section and plan)
- Qualitative Considerations (particular conditions)
- Equipment/Furnishings
  - Size: Group desk each serving 6 students, chair for each student, table and chair for each instructor, white board, projector mounted to ceiling
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems: Natural ventilation with operable windows, natural lighting with exterior glazing and interior glazing for light pass trespassing into interior street.
- Site/Exterior Environment Considerations

Living Machine Room

- Quantities Required
  - Space Capacity: 30
  - Number of Spaces: 1
  - Net Square Feet/ Space: 1000
  - Total Net Area: 1000
- Purposes/ Functions: To cleanse water from water cisterns and waste discharge rooms. The white water will be returned to potable sources (drinking fountains, sinks, dishwashing machine, ice machine), the grey water returned to non-potable sources (toilets) and the black water transferred to the constructed wetlands.
- Activities: Student observation and limited hands on experience due to chemicals housed in the room.
- Spatial relationships (both section and plan): Must lie on an exterior wall adjacent to constructed wetlands.
- Qualitative Considerations (particular conditions):
- Equipment/Furnishings:
  - Size: 4-6 Large enclosed containers for water treatment, 500 gallons each. 4-6 Smaller open containers for vegetation water treatment, 400 gallons each.
  - Number: Total of 12 containers
  - Dimensions: 5' diameter
  - Clearances: Comply with ADA requirements
- Behavioral Considerations
- Structural Systems
- Mechanical/Electrical Systems: Connection from water cisterns and Waste Discharge rooms through piping in walls and floor systems.
- Site/Exterior Environment Considerations: Located on an exterior wall adjacent to constructed wetland.

Geology Space

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces:1
  - Net Square Feet/ Space: 2000
  - Total Net Area: 2000
- Purposes/ Functions: This space allows for students to touch and feel and learn about different kinds of ground materials and how the human footprint leaves an impact.
- Activities: Hands-on learning with different ground materials, small rock climbing wall that doubles as a small gathering space for students to sit and listen to a speaker.
- Spatial relationships: (both section and plan)
- Qualitative Considerations: (particular conditions)
- Equipment/Furnishings: student desks, rock climbing/gathering area, 1 rolling cart to contain each ground material, white board, overhead projector, sink, cabinets, literature.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations: Access to exterior environment so lessons could be held inside the space or in outdoor learning opportunity areas.

Wind Space

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces: 1
  - Net Square Feet/ Space: 2000
  - Total Net Area: 200-
- Purposes/ Functions: This space allows for students to learn about the different effects of wind and how the human footprint leaves and impact.
- Activities: Learning about the pattern of wind through different climate types via hands-on experiments and videos, experiments with solar chimneys, operable windows.
- Spatial relationships: (both section and plan) Located on the southwest corner of the building allowing uninterrupted wind patterns to flow into the space. Should be located above grade so allow for maximum wind capture.
- Qualitative Considerations: (particular conditions) this space will have a solar chimney in the room which will be a main focus of the curriculum.
- Equipment/Furnishings: student and instructor desk and chairs, solar chimney, overhead projector, whiteboard.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations: Located on a southwest corner of the building. Must be above grade level.

Solar Chimney

- Quantities Required
  - Space Capacity: range of sizes from 1.5 sf to 7sf
  - Number of Spaces:7
  - Net Square Feet/ Space:
  - Total Net Area: 42 sf
- Purposes/ Functions: The solar chimney is a vertical shaft that suctions air from the interior of the building through the shaft and expels in through the top causing natural ventilation. There is glazing at the topmost part of the shaft on the south side that is heated by the sun.
- Activities
- Spatial relationships: (both section and plan) A vertical uninterrupted shaft with openings on the floors below.
- Qualitative Considerations: (particular conditions) A chime will be installed inside of each shaft. When the wind comes through this will sound the chime notifying everyone that the shaft is working.
- Equipment/Furnishings
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations:

Sunlight Space

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces: 1
  - Net Square Feet/ Space: 2000
  - Total Net Area: 2000
- Purposes/ Functions: The sunlight space will aid in the instruction of direct and indirect lighting, the effects of the sun and the different types of rays.
- Activities: Experiments with shadows, calculating the sun angle, mathematic equations, charting the pattern of the earth's rotation and revolution around the sun.
- Spatial relationships: (both section and plan) Must be located on the southern side of the building at the lowest level available.
- Qualitative Considerations: (particular conditions) Retractable walls on the south façade of the room. Other shading devices will be incorporated along the other facades.
- Equipment/Furnishings: Different shading devices, lumenometer, desks and chairs for students and instructor, overhead projector, whiteboard, blackout curtains.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations: Vegetation should not be positioned near this space of the building.

Nourishment Intake Area

- Quantities Required
  - Space Capacity: 200
  - Number of Spaces: 1
  - Net Square Feet/ Space: 6000
  - Total Net Area: 6000
- Purposes/ Functions: Similar activities of a cafeteria will occur in this space. Also used as a large gathering space for meetings, gatherings, etc.
- Activities: Children will eat lunches and snacks in this area. They will also learn about digestion, nourishment and how to care for one's health.
- Spatial relationships: (both section and plan) Should be located adjacent to Preparatory Kitchen
- Qualitative Considerations: (particular conditions)
- Equipment/Furnishings: tables and chairs for 200 children
- Behavioral Considerations: Rated as an assembly space (MBC 2003), it will need a separate egress stair/ door.
- Structural Systems:
- Mechanical/Electrical Systems: Preparatory Kitchen will require proper ventilation.
- Site/Exterior Environment Considerations:

Noise Experimentation

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces:1
  - Net Square Feet/ Space: 2000
  - Total Net Area: 2000
- Purposes/ Functions: Filled with an assortment of traditional musical instruments, alternative instruments will also be provided. Children will learn how different materials will make different sounds. They will be able to compare a wood stick and a metal rod when pulled along a metal fence. Or how different diameter and length of glass cylinders are filled with a volume of water.
- Activities: Children will learn how different materials produce different sounds whether in combination with another material or on its own.
- Spatial relationships: (both section and plan)
- Qualitative Considerations: (particular conditions)
- Equipment/Furnishings: Traditional musical instruments, chairs and desks for instructor and students, non-traditional noise generating items.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations: extra sound insulation will be added into the walls of the space that are inbetween this and another space.

Digital Exploration

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces: 2
  - Net Square Feet/ Space: 1500
  - Total Net Area: 3000
- Purposes/ Functions: Rooms will introduce students to the digital age of media. They will be able to experiment with digital technology ranging from computers, cameras, software, hardware, sound recording and mixing materials.
- Activities: Through various assignments, students will be able experiment with different types of digital media.
- Spatial relationships: (both section and plan)
- Qualitative Considerations: (particular conditions) Media should be used under supervision and under lock and key when not in use due to valuable nature of the items.
- Equipment/Furnishings: computers, chairs, cameras, audio and visual recording devices, software for using aforementioned equipment.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems: Increased amount of electricity will be required for power needs of media. Supply with energy efficient media and power sources.
- Site/Exterior Environment Considerations:

Large Movements

- Quantities Required
  - Space Capacity: 300
  - Number of Spaces:1
  - Net Square Feet/ Space: 8000
  - Total Net Area: 8000
- Purposes/ Functions: in addition to traditional arrangement of sport activities, there will be items available for use to explore large rage movements of an individual and of a group.
- Activities: Traditional recreational classes, large movement exploration, social functioning in a physical nature.
- Spatial relationships: Limited travel distance to lockerrooms and staff office.
- Qualitative Considerations: On the exterior of the building, the spaces below the bleacher area will be a play space. Children will be able to use this atypical building arrangement to their advantage. Swings will be installed on the south side of the Large Movement Space under the highest bleacher seat inside. This will allow for maximum swinging arc by a child.
- Equipment/Furnishings: Seating for 250, 84'x48' hardwood surface for movements.
- Behavioral Considerations:
- Structural Systems: Large span steel joists will be used as opposed to timber construction throughout the building.
- Mechanical/Electrical Systems: will be adjacent to a small mechanical room to supply heating and cooling needs when operable windows will not suffice.
- Site/Exterior Environment Considerations: Large vertical windows will be on both the east and west facing walls. They will not be entirely operable but only a portion will be. Exterior shading devices will also be installed to block direct sunlight and heat gain.

Large Gathering Space

- Quantities Required
  - Space Capacity: 400
  - Number of Spaces:1
  - Net Square Feet/ Space: 6500
  - Total Net Area: 6500
- Purposes/ Functions: This space will allow interaction between the lower and entry levels on the south side of the building.
- Activities: Lectures, gatherings, lessons.
- Spatial relationships: Adjacent to interior street, open to above and below.
- Qualitative Considerations: (particular conditions)
- Equipment/Furnishings: Stairs to act as seats for audience, overhead projector, retractable white screen for projections, mechanical window shades.
- Behavioral Considerations: Due to high levels of audible projections, sound baffles and absorbers will be applied to the ceiling as well as a ground covering.
- Structural Systems:
- Mechanical/Electrical Systems: audio assistance for voice projection.
- Site/Exterior Environment Considerations:

Reading Room/ Library

- Quantities Required
  - Space Capacity: 100
  - Number of Spaces:1
  - Net Square Feet/ Space: 2500
  - Total Net Area: 2500
- Purposes/ Functions: This space allows for the children to further their reading habits and explore the adventures that are books. An adjacent reading room is a quiet space for the children to practice on their own or to do other work. A small tiered gathering space is tucked into a nook of the library for children to gather and listen to an instructor.
- Activities: Mostly quiet activities including reading, book rentals and returns, small gatherings for group listening, tables for individual tutoring.
- Spatial relationships: (both section and plan)
- Qualitative Considerations: (particular conditions) Primarily quiet activities occur so adjacent spaces should also have a minimal level of noise.
- Equipment/Furnishings
  - Size:
  - Number:
  - Dimensions:
  - Clearances:
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations: Due to the nature of books, minimal amount of natural lighting will be desired. Placement should be on the north side of the building.

Artistic Expression Laboratory

- Quantities Required
  - Space Capacity: 40
  - Number of Spaces:1
  - Net Square Feet/ Space: 500
  - Total Net Area: 500
- Purposes/ Functions: For all to express themselves through a physical media.
- Activities: Children will be able to express themselves through an artistic way in this space. They will be able to draw, sculpt, construct, etc. according to their assignment.
- Spatial relationships: (both section and plan) Access to natural and artificial light sources.
- Qualitative Considerations: (particular conditions)
- Equipment/Furnishings: chairs, desks, pedestals, storage shelves for equipment and supplies, drying racks, sink, countertops.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations:

Artistic Expression Display Space

- Quantities Required
  - Space Capacity: 60
  - Number of Spaces:1
  - Net Square Feet/ Space: 500
  - Total Net Area: 500
- Purposes/ Functions: For rotating display of artistic expression material.
- Activities: Displays, events, galas, exhibits.
- Spatial relationships: Adjacent to Artistic Laboratory, open floor plan that has movable platforms, display cases.
- Qualitative Considerations: (particular conditions) Natural and artificial lighting and sound system will be used for displays.
- Equipment/Furnishings
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems:
- Site/Exterior Environment Considerations:

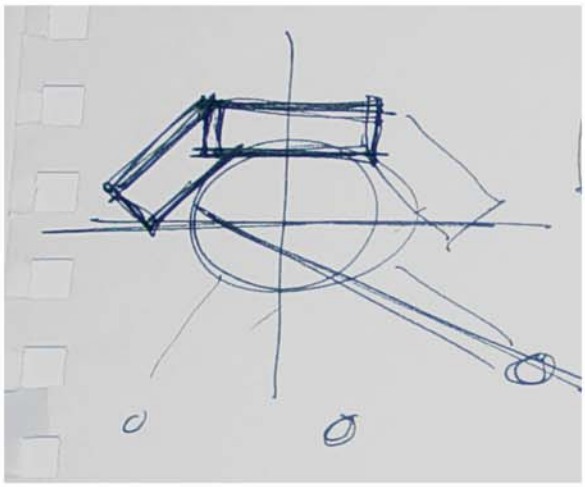
Edible Greenhouse

- Quantities Required
  - Space Capacity: 100
  - Number of Spaces:1
  - Net Square Feet/ Space: 7500
  - Total Net Area: 7500
- Purposes/ Functions: This space will be used to grow edible greens that are used in the Nourishment Intake Area directly below.
- Activities: Growing, harvesting, storing of edible greens for school. Lessons regarding effects of sunlight, life cycle, pollination will also be explored.
- Spatial relationships: (both section and plan) must be vertically above Nourishment Intake Area.
- Qualitative Considerations: (particular conditions) the south, east and west walls will be glazing along with the ceiling surface above the vegetation area.
- Equipment/Furnishings: Tables, garden tools, potting equipment, storage shelves, cabinets, counters, sinks, potting tables.
- Behavioral Considerations:
- Structural Systems:
- Mechanical/Electrical Systems: Operable windows, several hose attachments locations.
- Site/Exterior Environment Considerations: Must have uninterrupted sunlight. Vegetation should not interrupt direct light.

DESIGN PROCESS

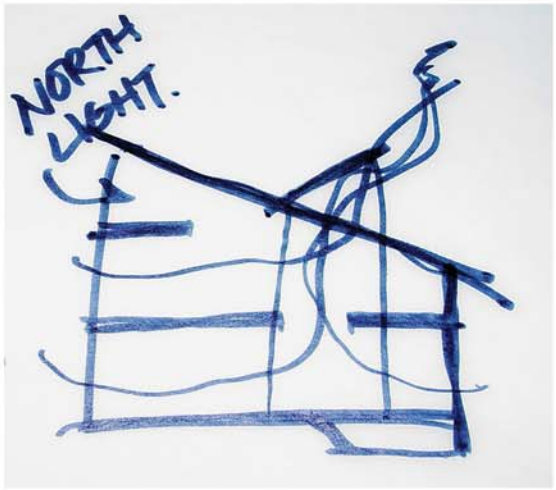
This being a building focusing on ecology, the interaction of sun and architecture were considered.

To take advantage of the south facing angled roof, solar panels could be placed to capture alternative energy.



An elementary school is filled with tiny bodies that produce large amounts of energy. Direct heat gain isn't necessarily desireable.

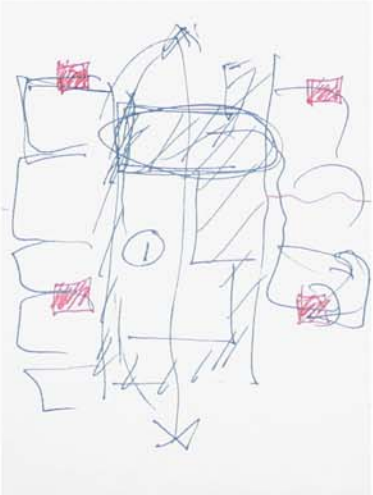
Using the sun as a source of illumination is desirable.

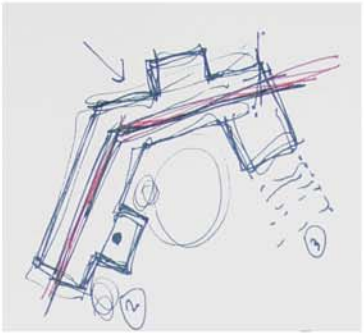


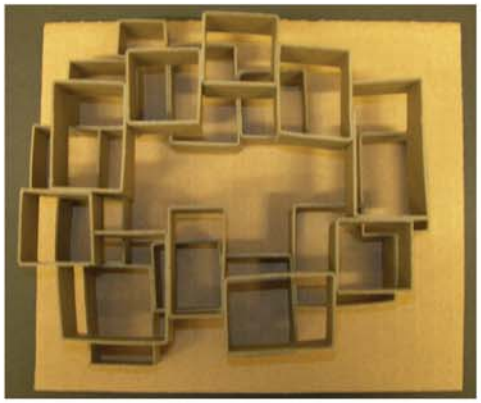
Glazing on the north side of the elementary school is a source of indirect lighting and illumination.

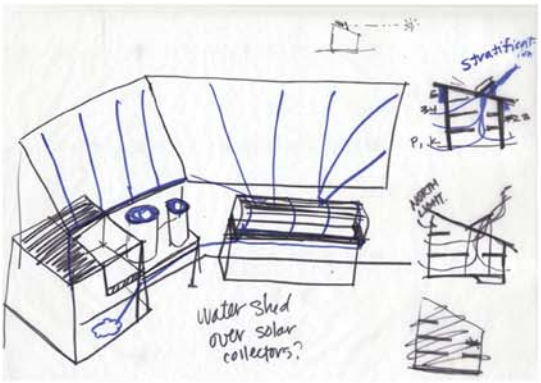
An underlying theme in this thesis is to avoid traditional teaching methods and the traditional classroom arrangement. Alternative learning opportunity areas will allow for students to focus on ecology in a non-traditional setting.

All children and students alike are in need of daily routines and patterns.[1] By offering each student a "home" room where they establish a sense of this routine. Each "home" room is not the traditional classroom but a place where each student will deposit their belongings and have a few lessons. This will not be the primary place of education for the student.



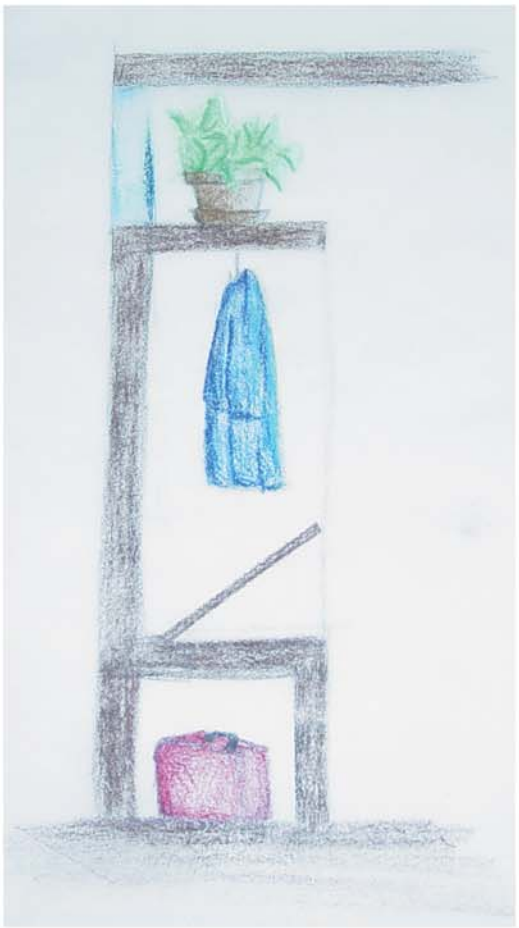


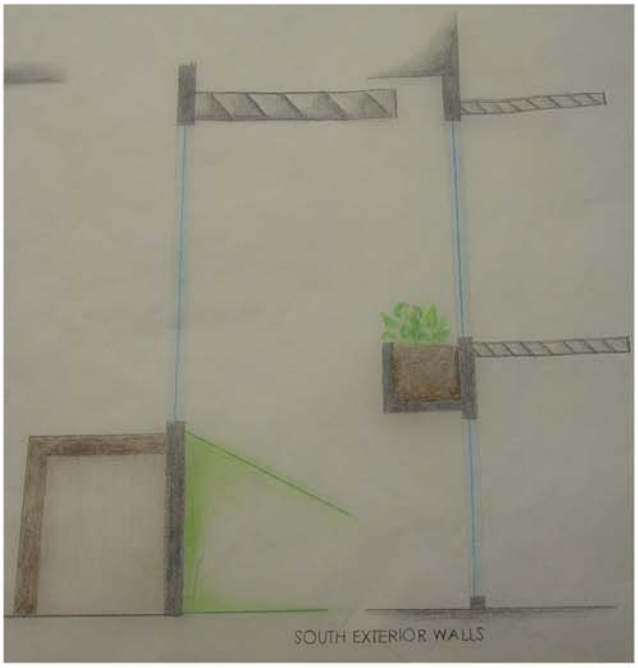




[1] Jones, Phyllis, Judy F. Carr and Rosemarie L Ataya. A Pig Don't Get Fatter the More You Weigh It: Classroom assessments that work. 1st ed. New York: Teachers College Press, 2007.

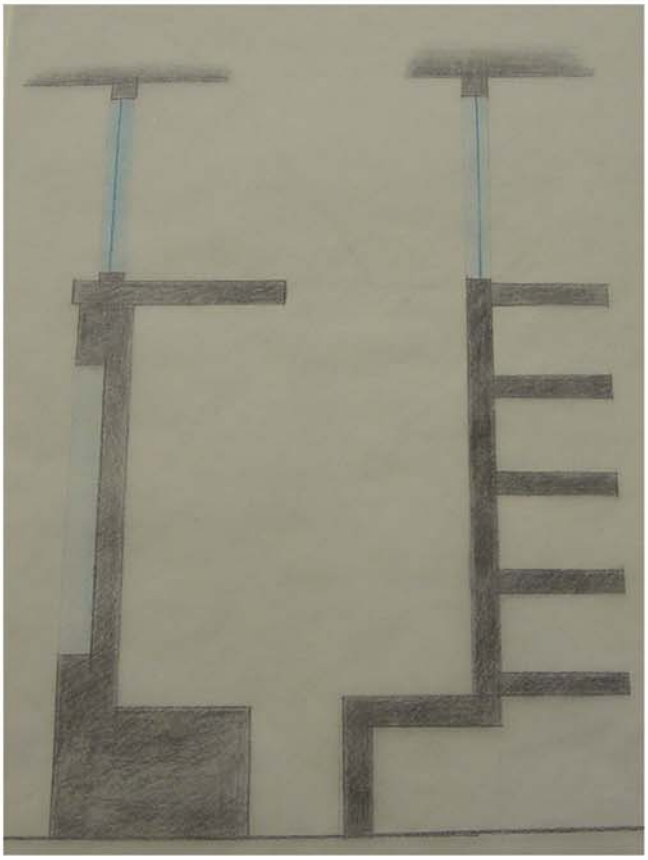
Initial wall sections were designed to inspire interaction. Interaction between studetnts, light, ecology and praticial applications.



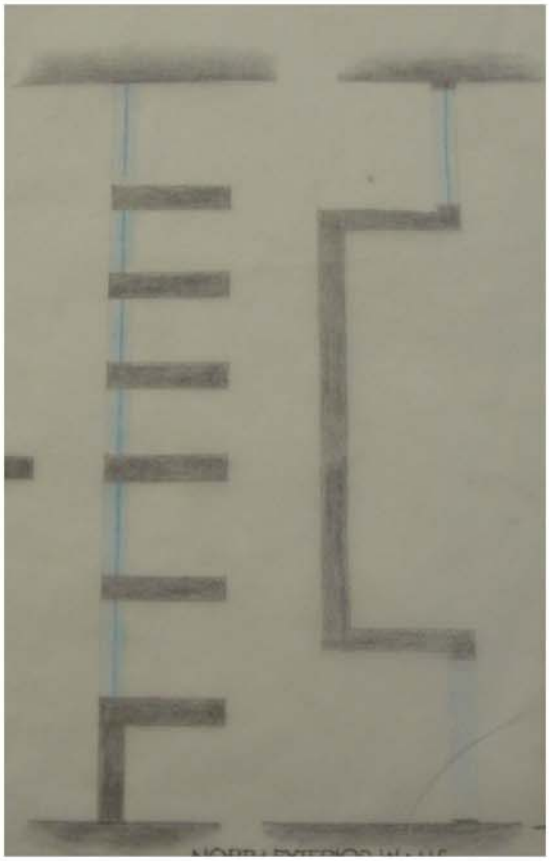


South facing exterior wall sections

The beginning gesture of a wall section is important when facing the conditionof light. How will the direct or indirect light transpire through the section? Is it possible to light a room solely on natural light? How can a wall be both a practical wall system and a lighting source in an elementary school?

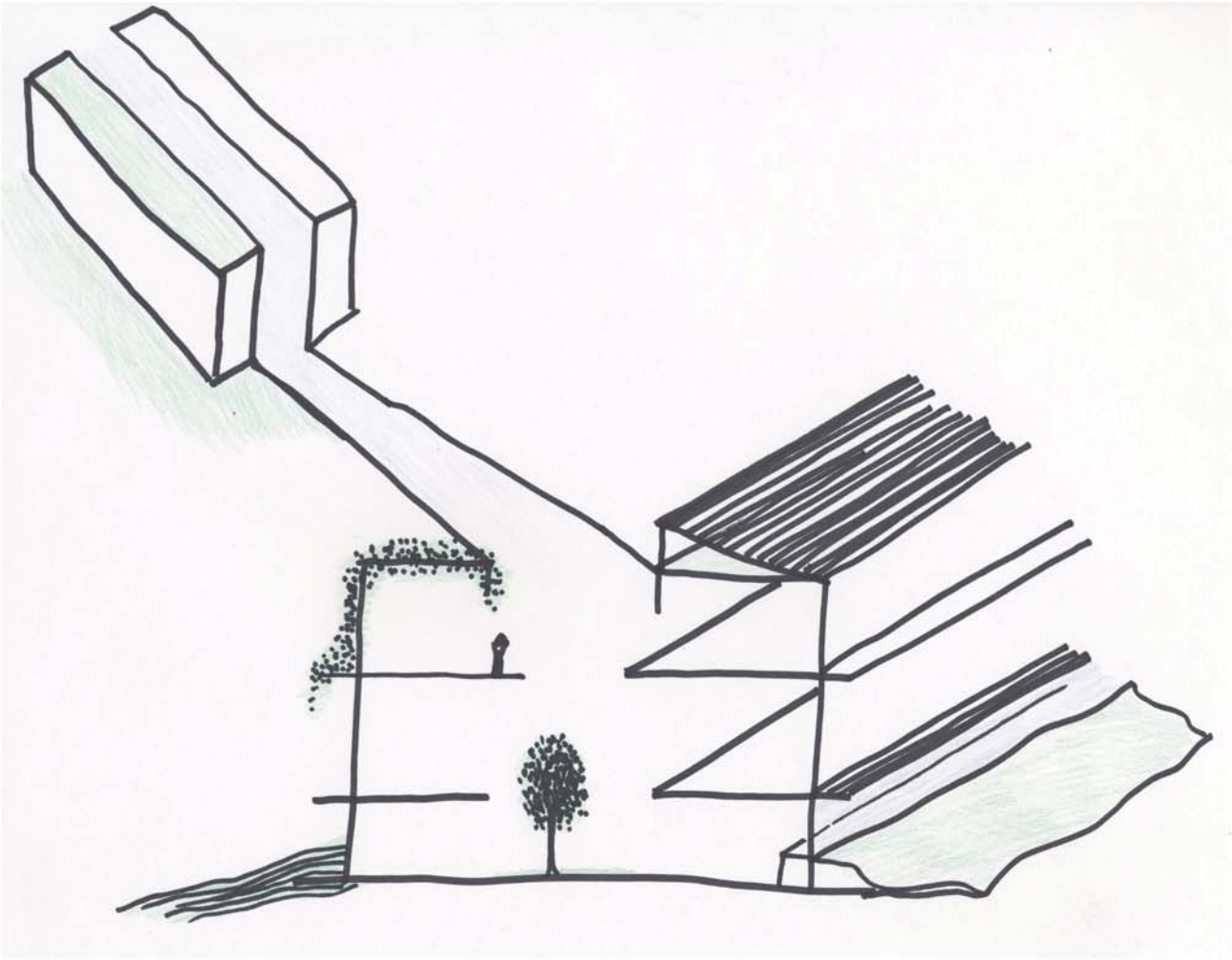


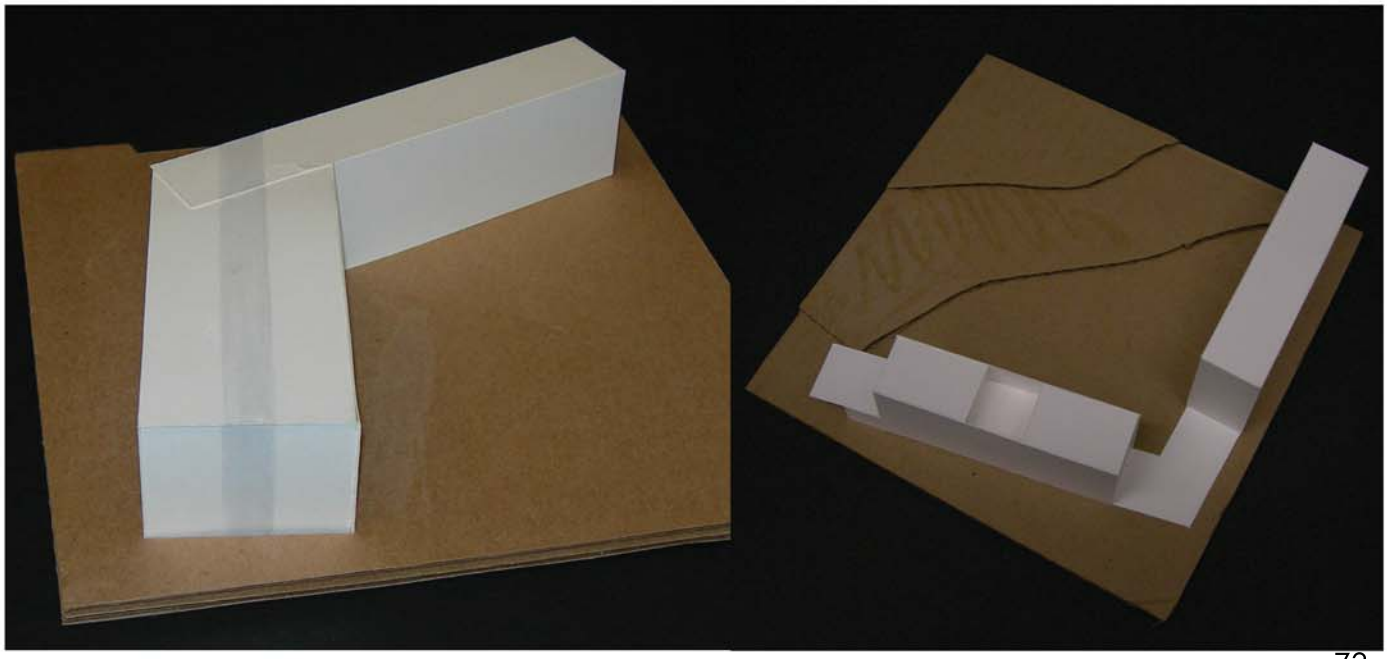
Interior wall sections



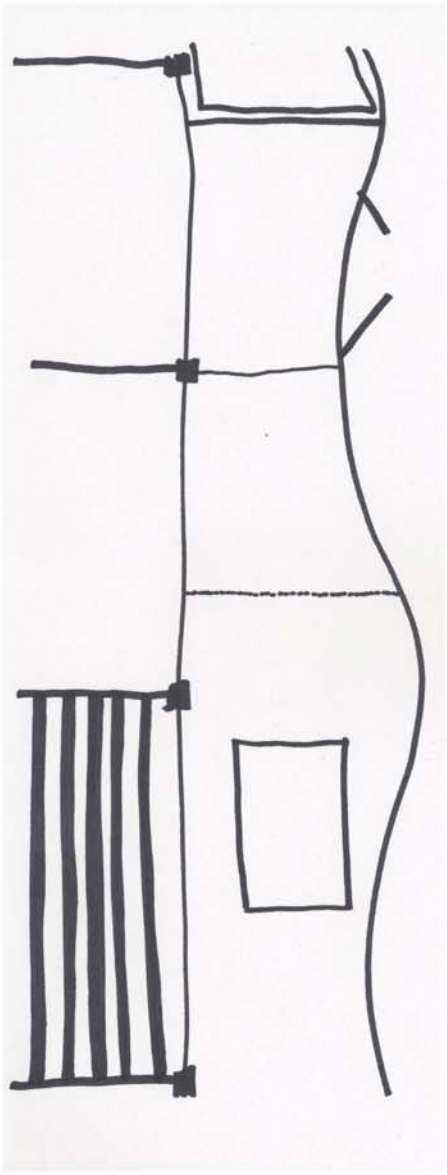
North facing exterior wall sections

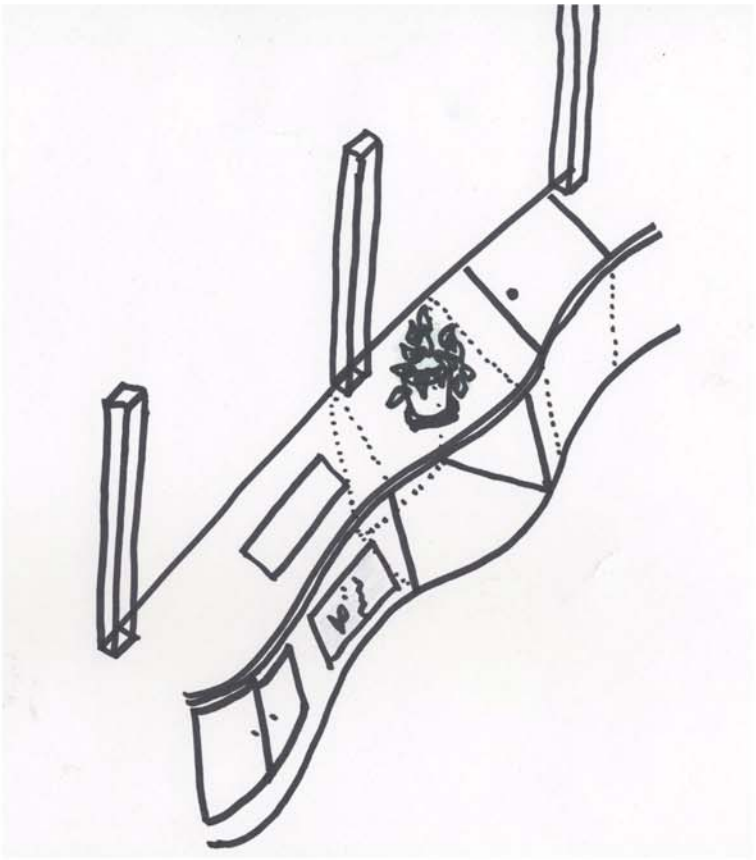
An interior Street became more prevalent in the design process. The connection between the exterior and interior had to be blurred. The feeling of being inside had to be comparable to the feeling of being outside.

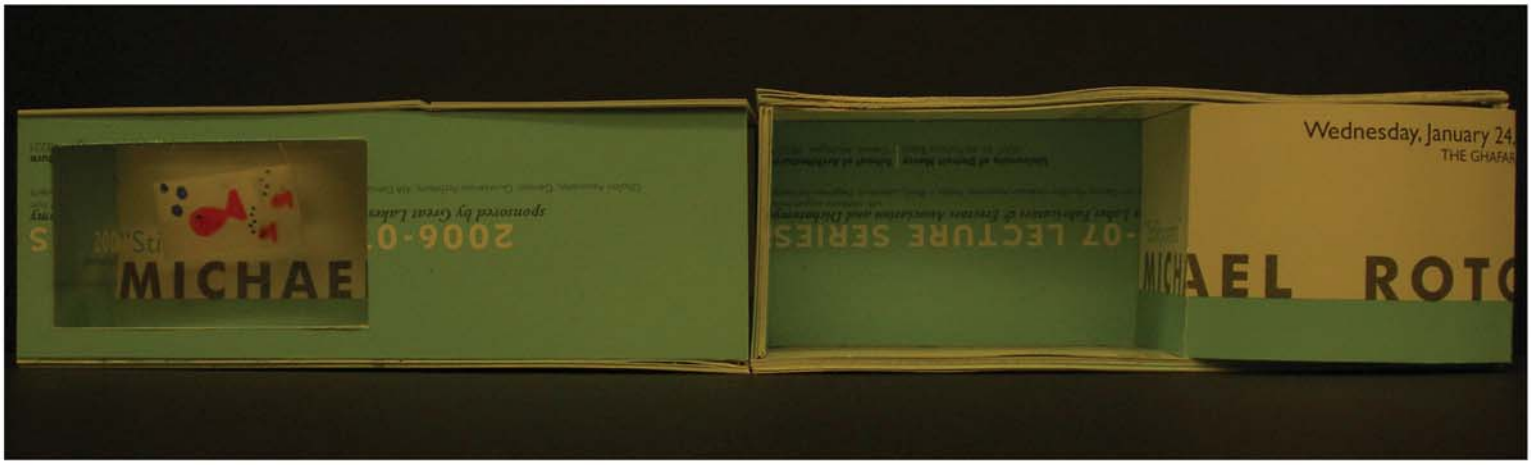




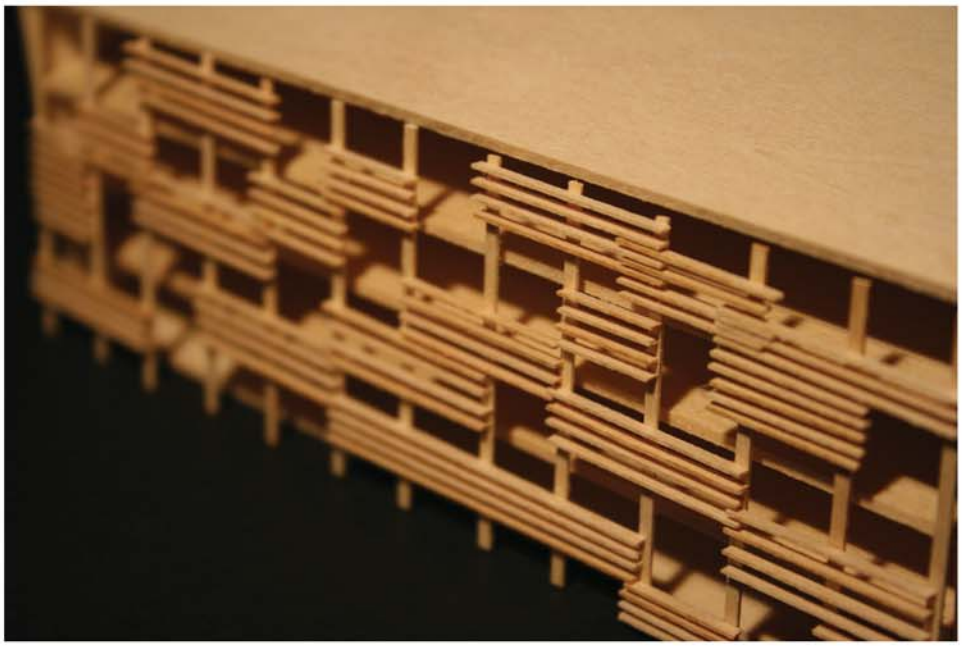
Make the children feel welcomed. Design for childlike spaces.

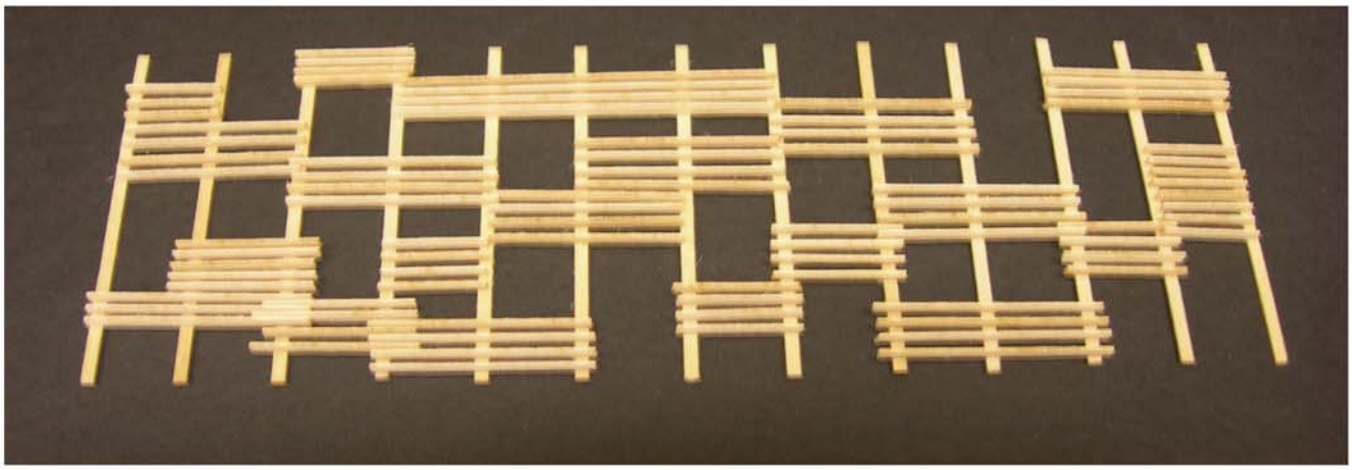


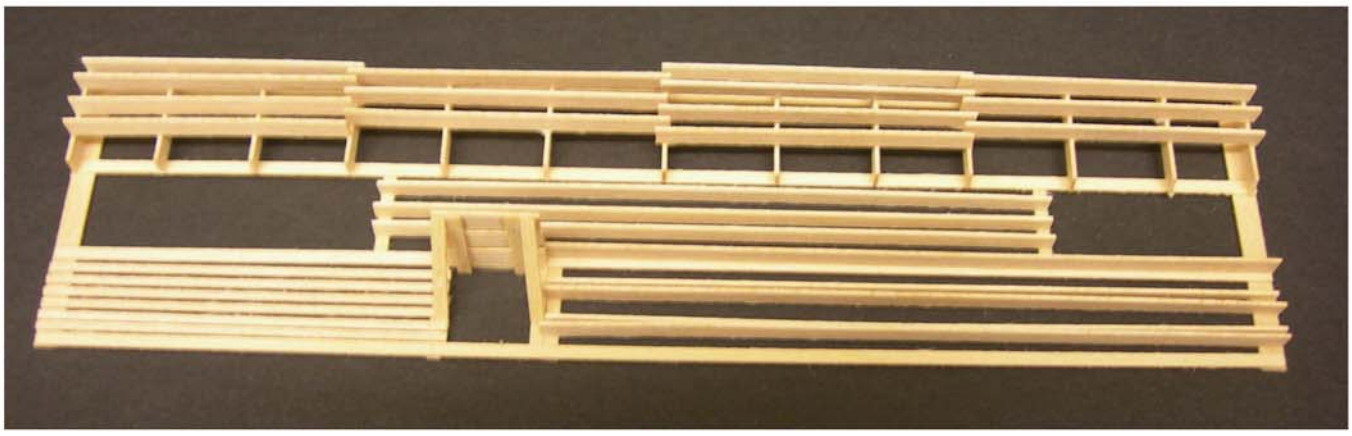


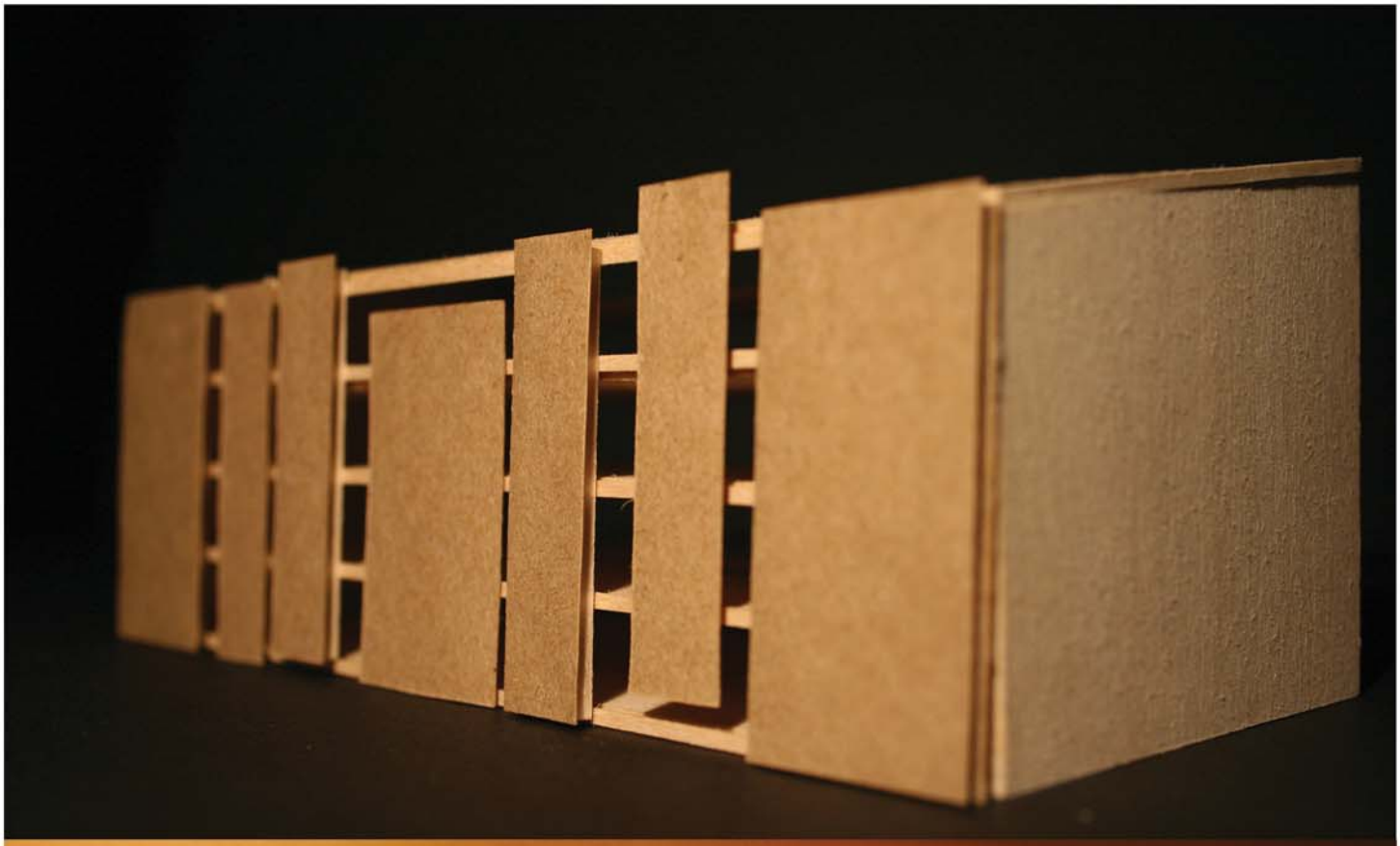


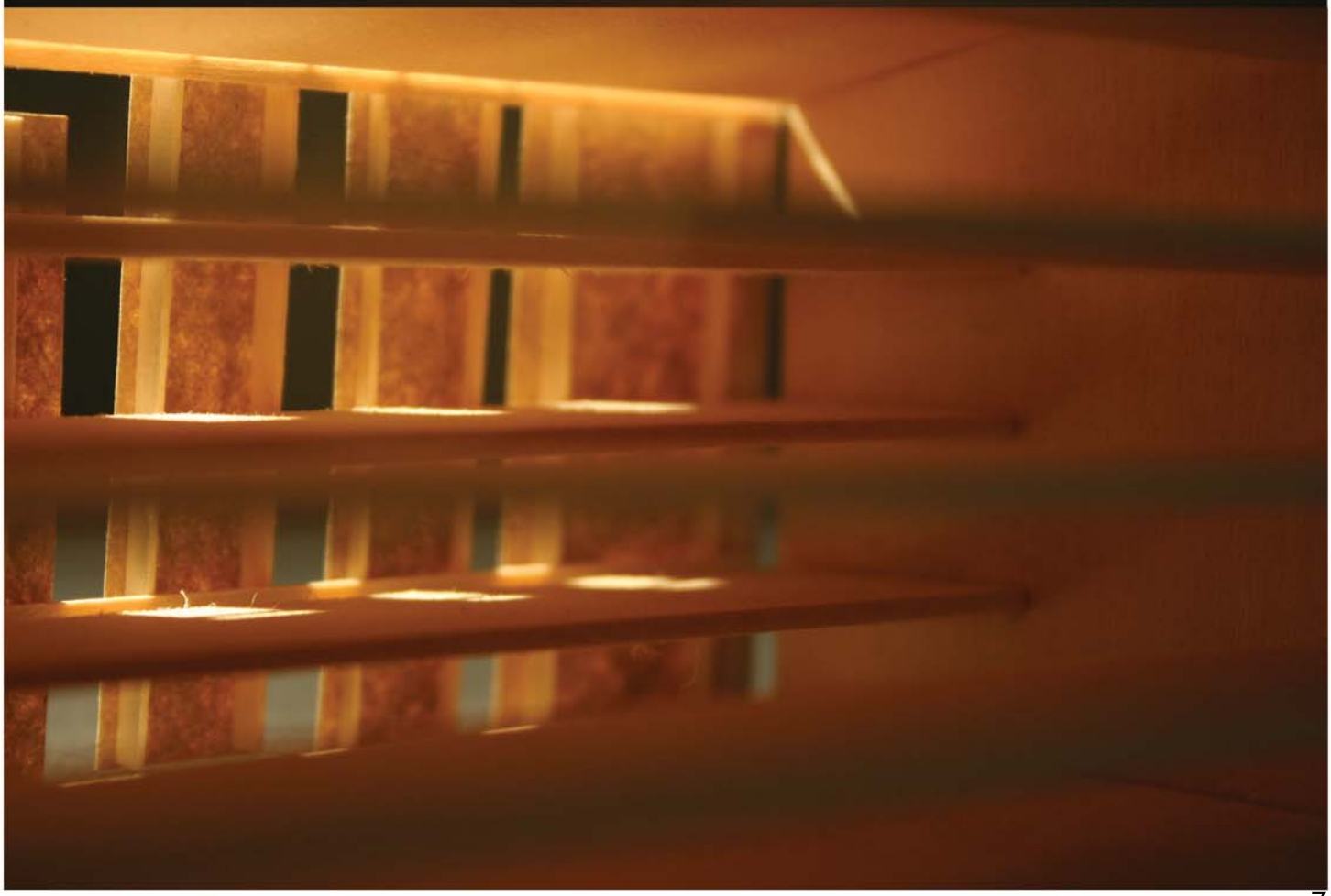
The beginning gesture of a facade is important when facing the condition of light. How will the direct or indirect light transpire through the skin? Is it possible to light a room with no artificial lamps? How can a wall be both a practical wall system and a lighting source in an elementary school? Below are samples of facae studies and shading devices on the exterior walls.



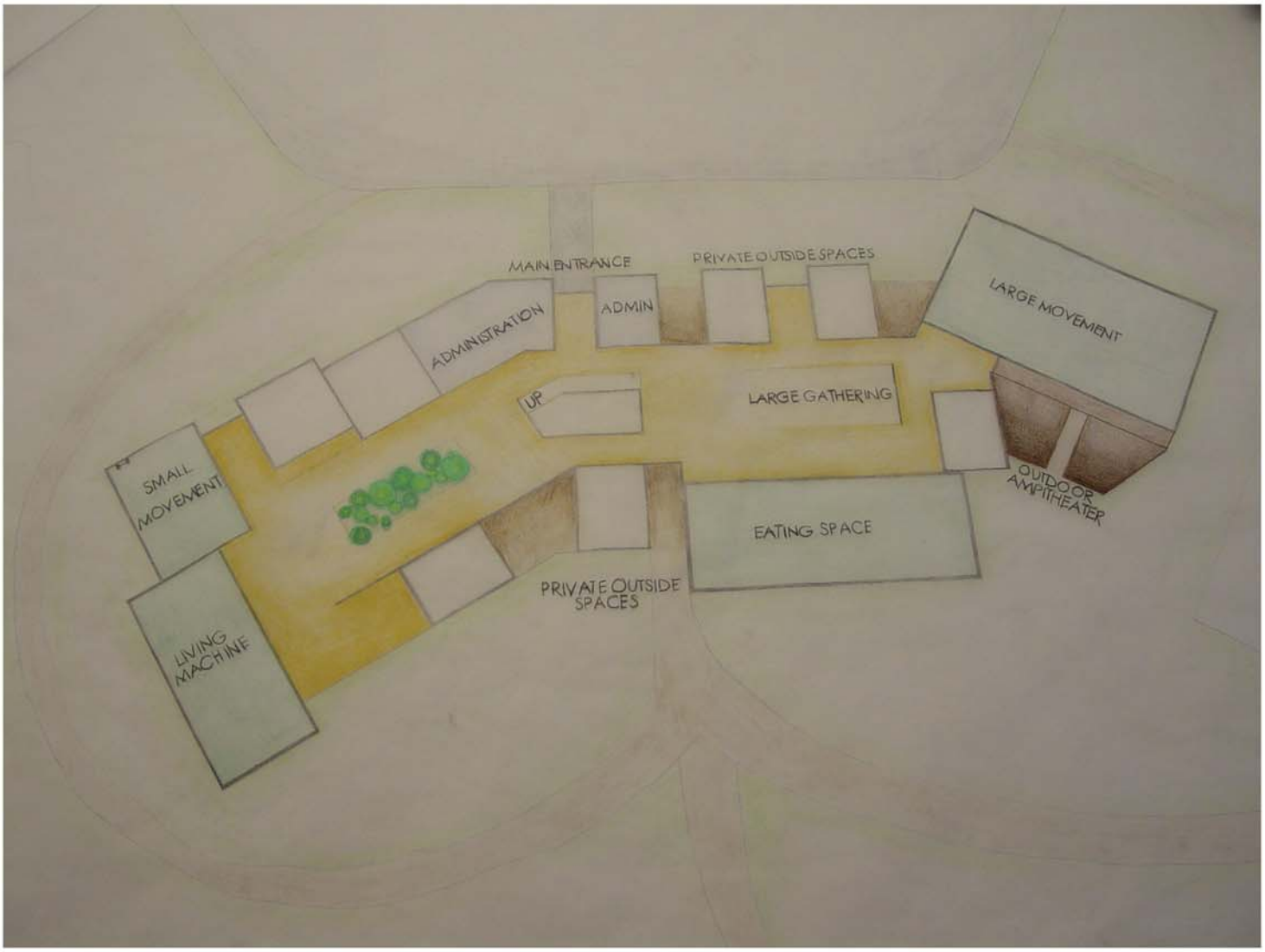


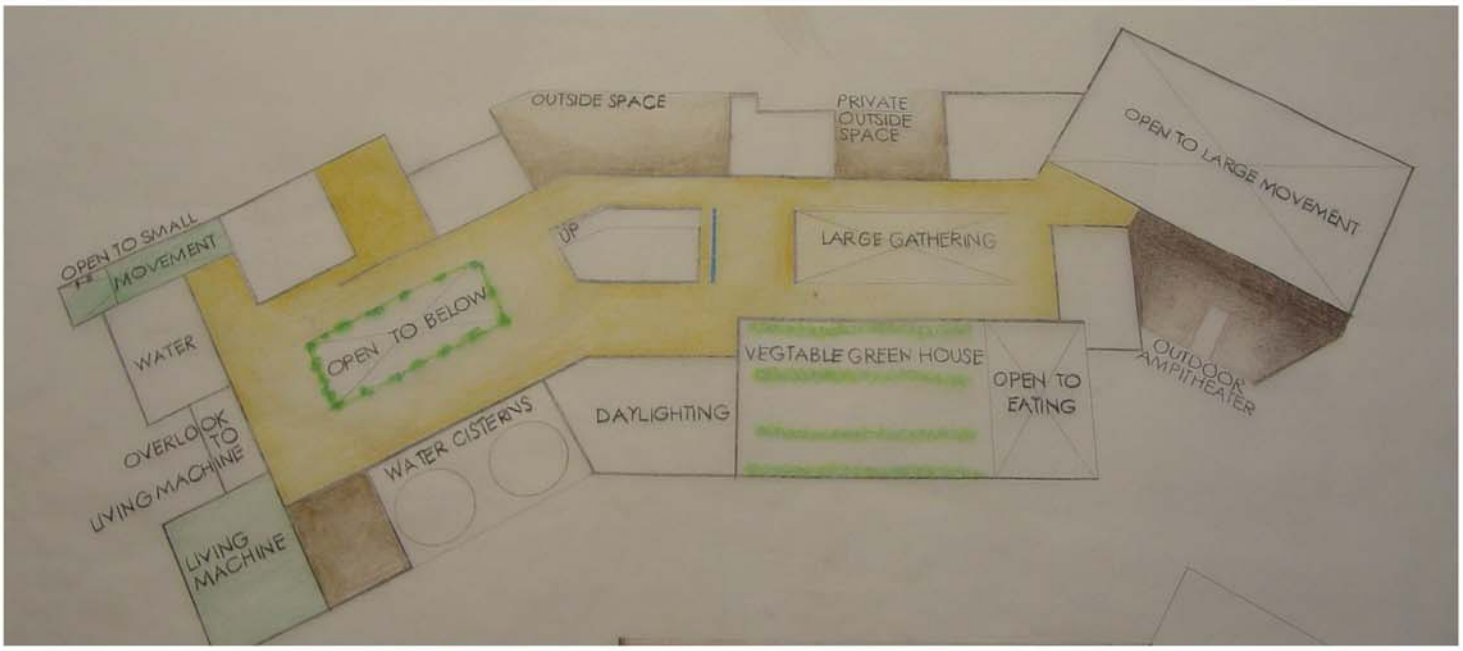


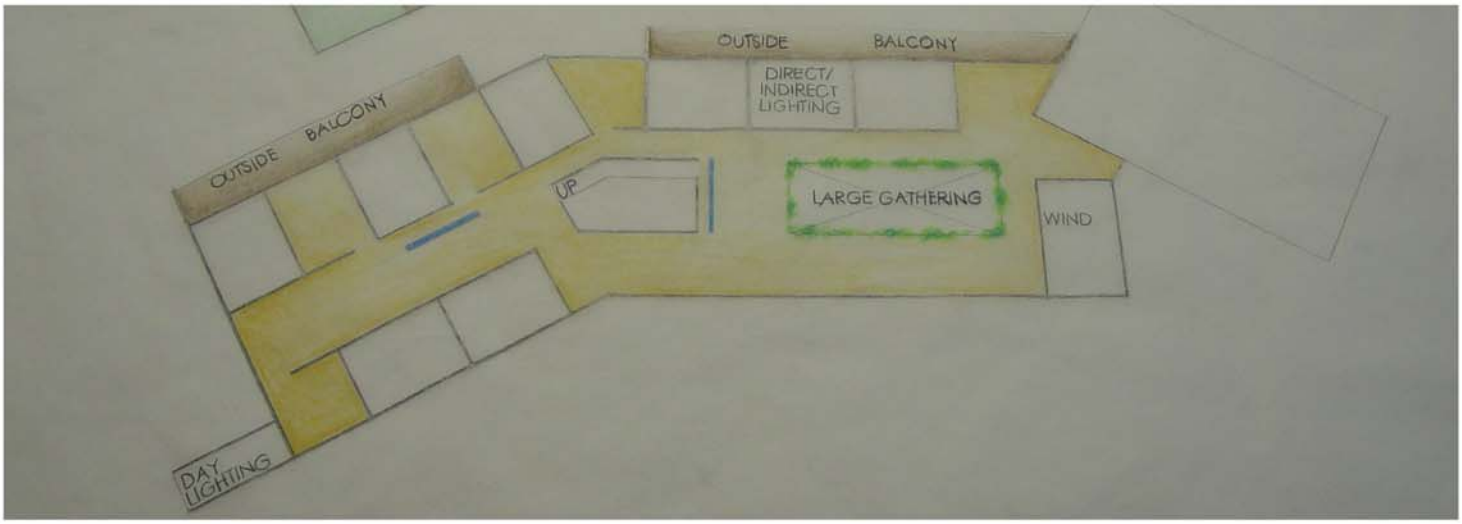




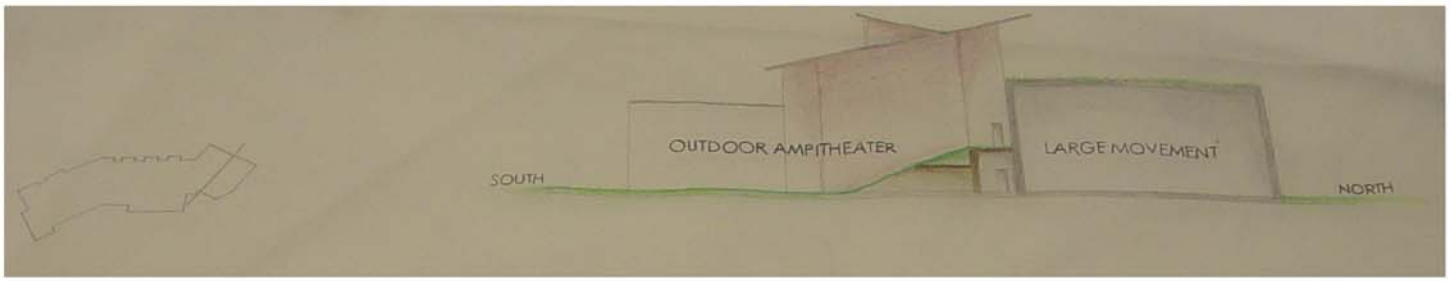
Corresponding with facades, how does the building produce shadows on the landscape.

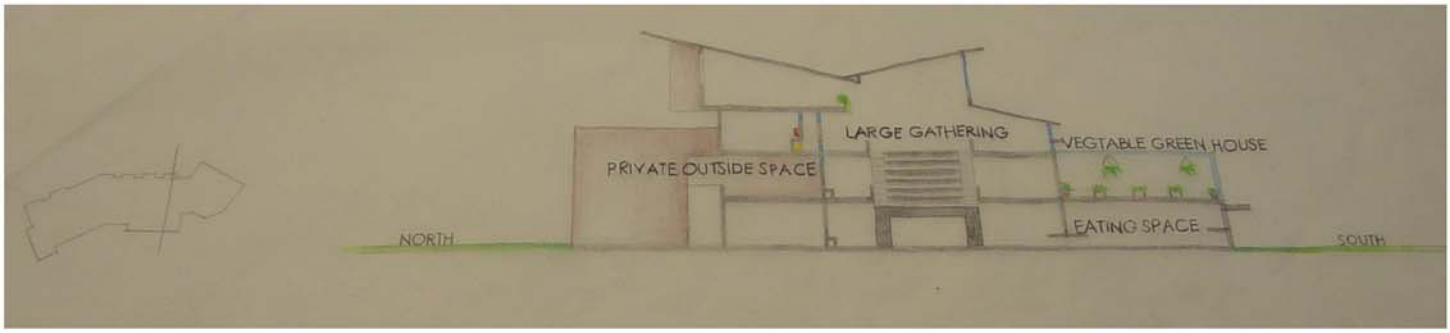

MAIN ENTRANCE
PRIVATE OUTSIDE SPACES
ADMINISTRATION
ADMIN
LARGE MOVEMENT
UP
LARGE GATHERING
SMALL MOVEMENT
OUTDOOR AMPITHEATER
EATING SPACE
PRIVATE OUTSIDE SPACES
LIVING MACHINE

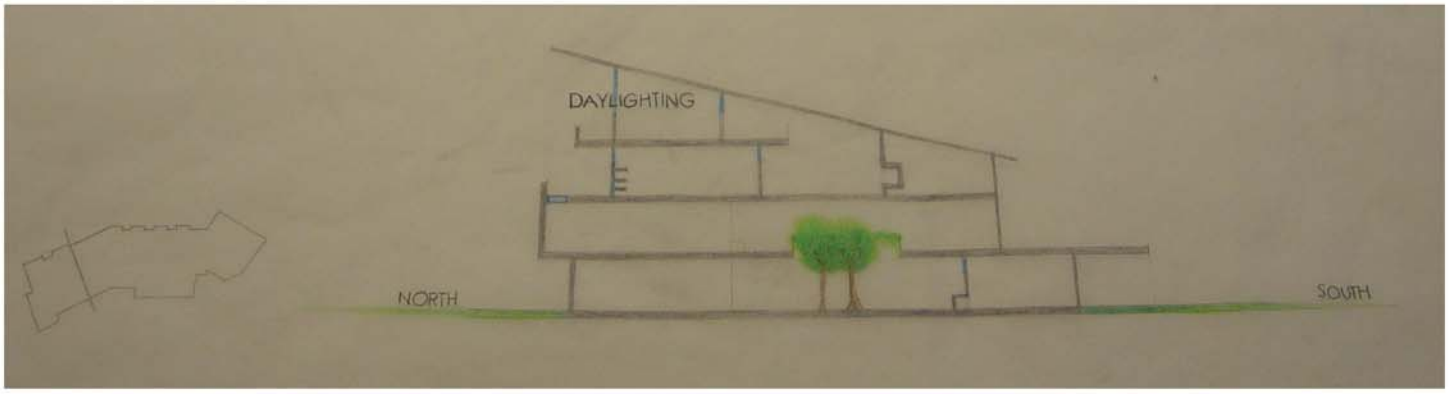

OUTSIDE SPACE
PRIVATE OUTSIDE SPACE
OPEN TO LARGE MOVEMENT
OPEN TO SMALL MOVEMENT
UP
LARGE GATHERING
WATER
OPEN TO BELOW
VEGTABLE GREEN HOUSE
OPEN TO EATING
OUTDOOR AMPITHEATER
OVERLOOK TO LIVING MACHINE
DAYLIGHTING
WATER CISTERNS
LIVING MACHINE

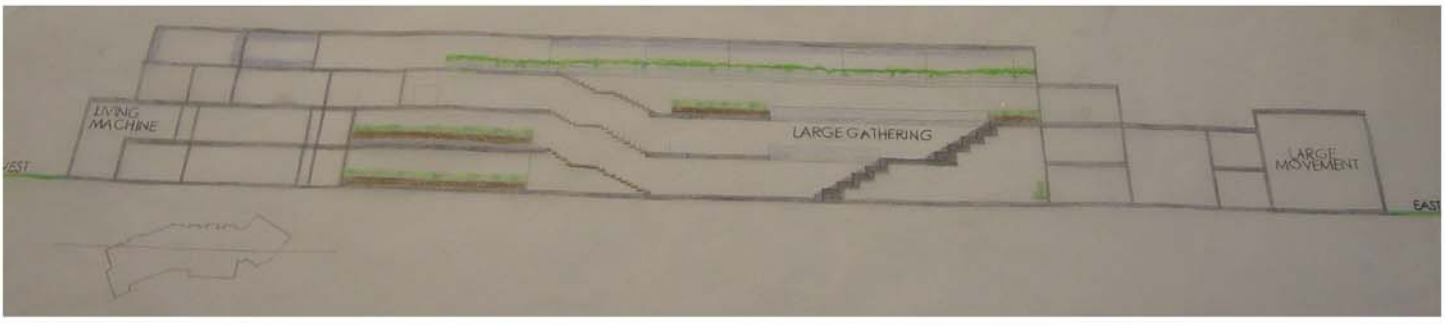

OUTSIDE BALCONY
DIRECT/
INDIRECT
LIGHTING
OUTSIDE BALCONY
UP
LARGE GATHERING
WIND
DAY
LIGHTING

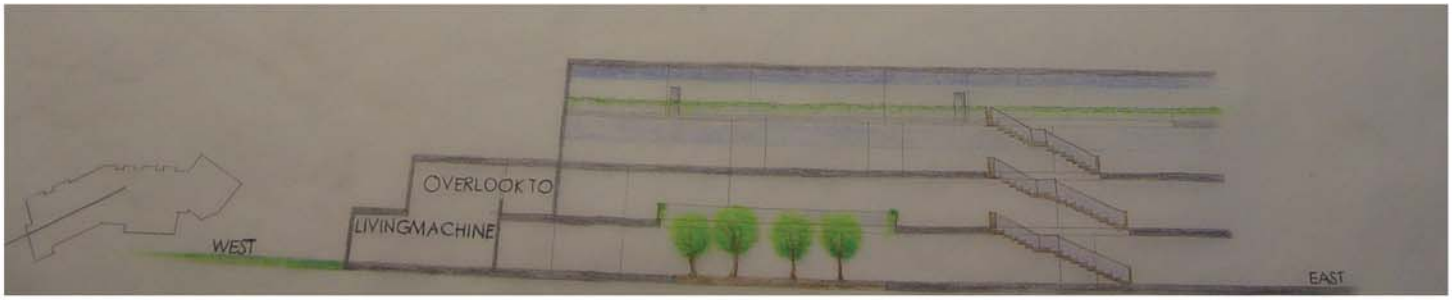

DAY
LIGHTING
BELOW
OUTSIDE
SPACE
OUTSIDE SPACE
UP
OPEN TO BELOW

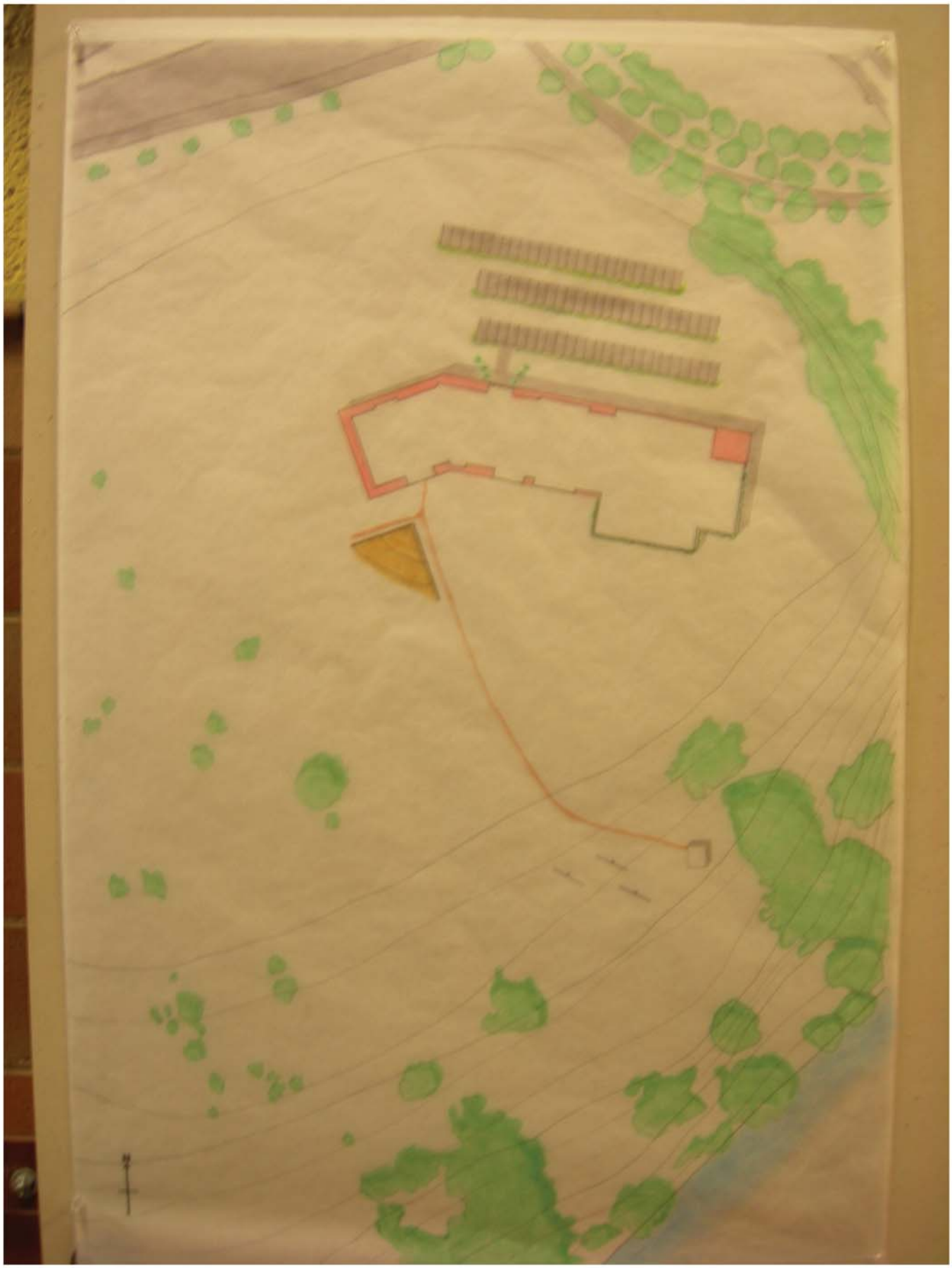

OUTDOOR AMPITHEATER
LARGE MOVEMENT
SOUTH
NORTH

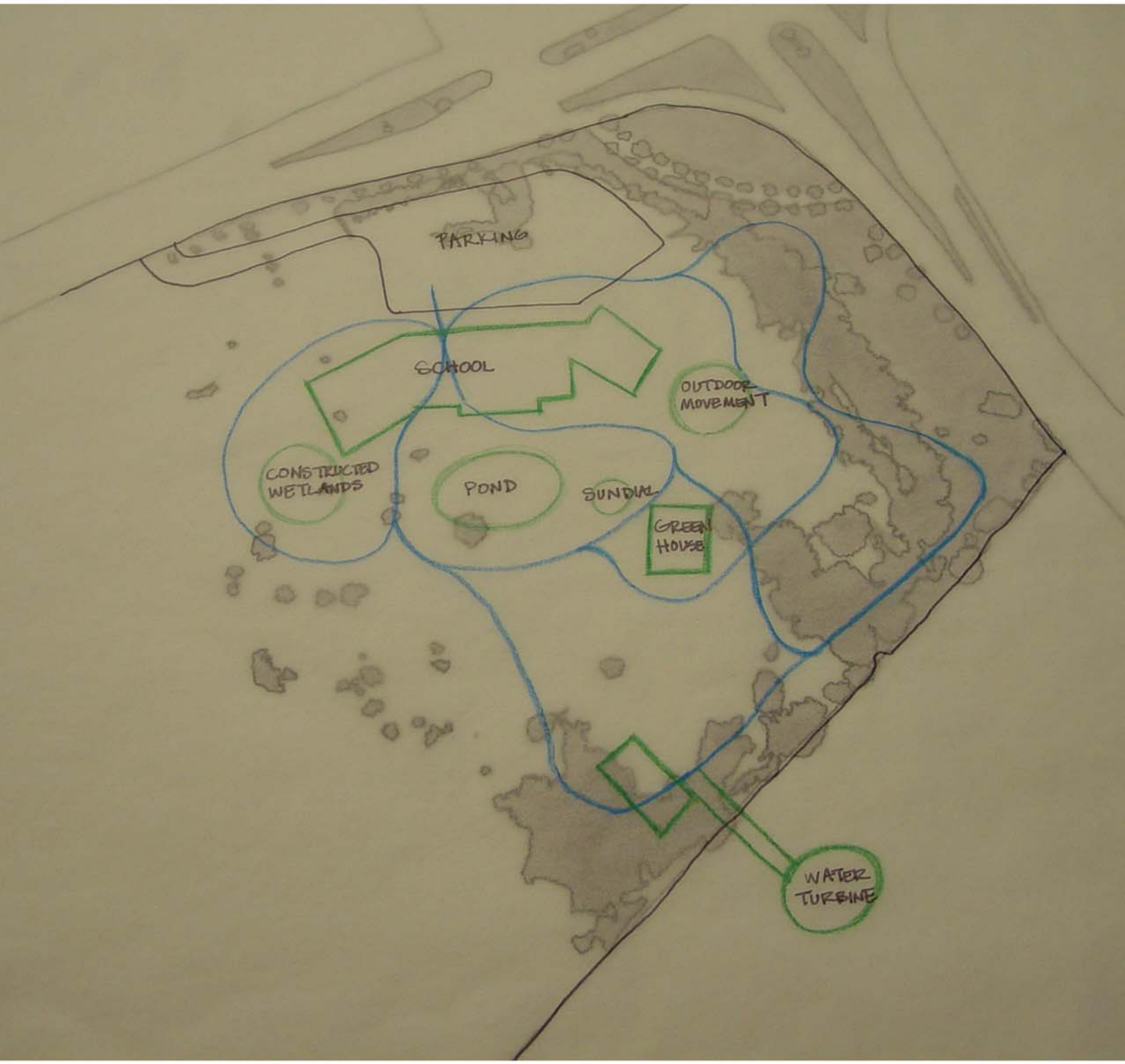

LARGE GATHERING
VEGTABLE GREEN HOUSE
PRIVATE OUTSIDE SPACE
EATING SPACE
NORTH
SOUTH


DAYLIGHTING
NORTH
SOUTH


LIVING MACHINE
LARGE GATHERING
LARGE MOVEMENT
EAST

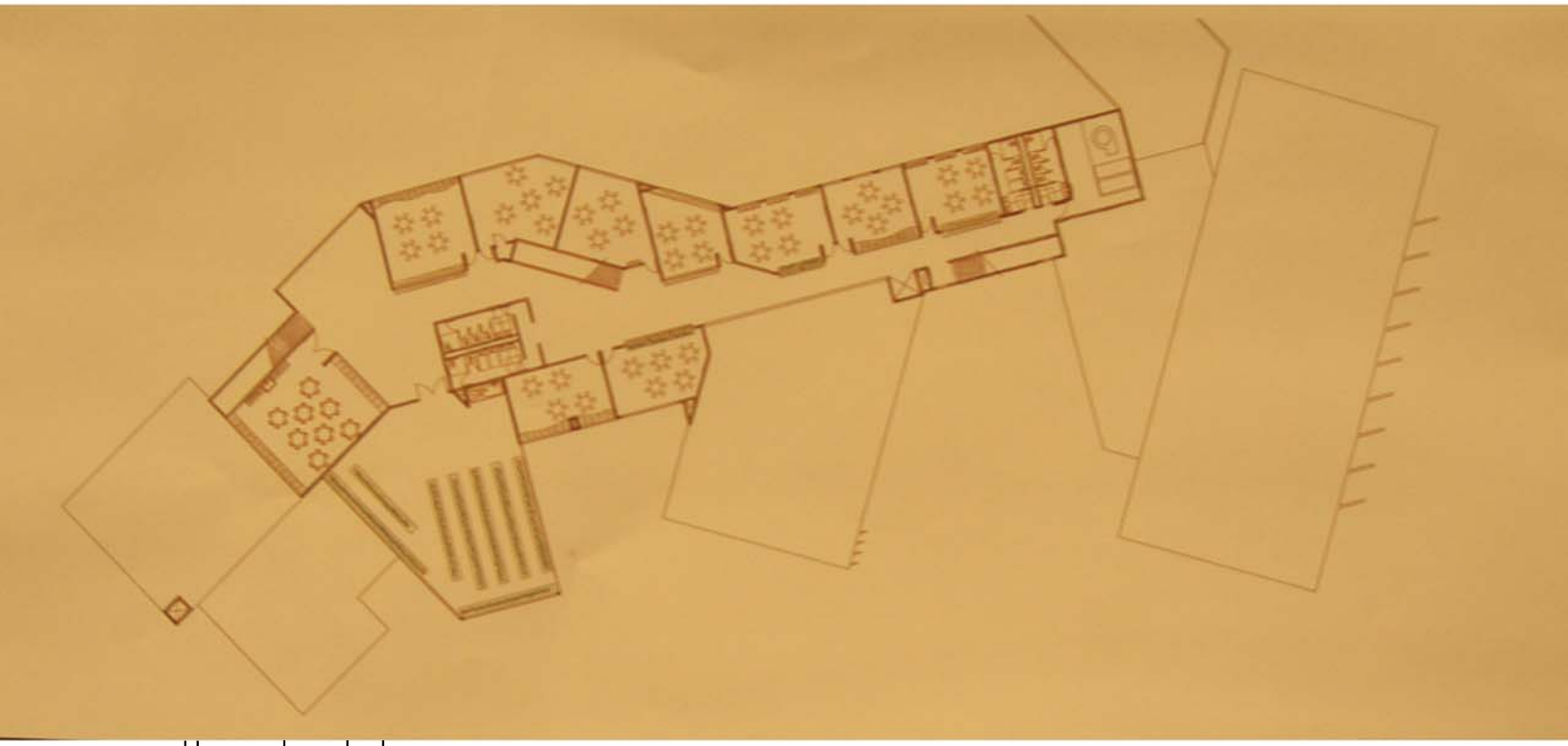

OVERLOOK TO
LIVINGMACHINE
WEST
EAST



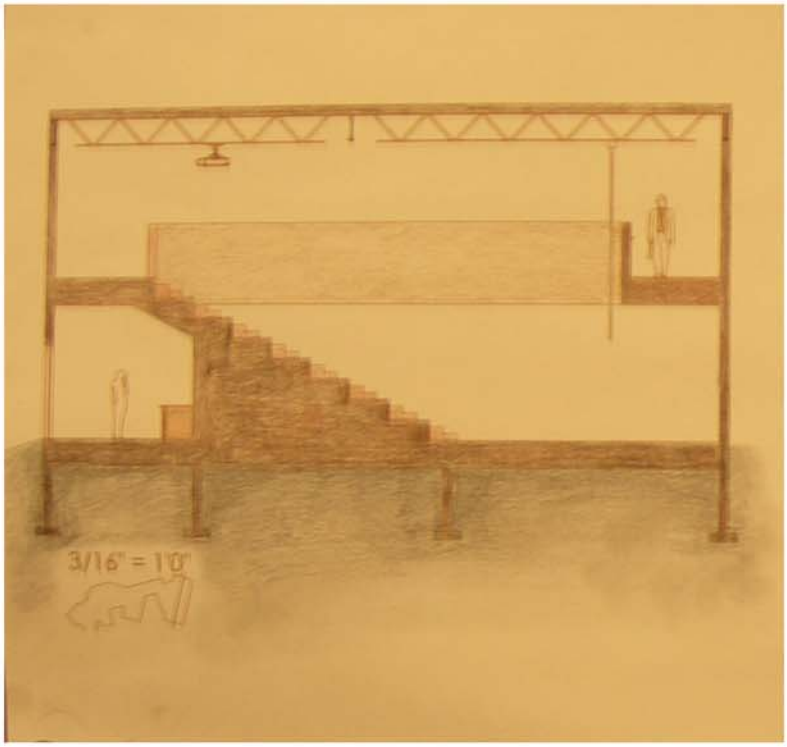

PARKING
SCHOOL
OUTDOOR MOVEMENT
CONSTRUCTED WETLANDS
POND
SUNDIAL
GREEN HOUSE
WATER TURBINE

Lower level plan

Entry level plan



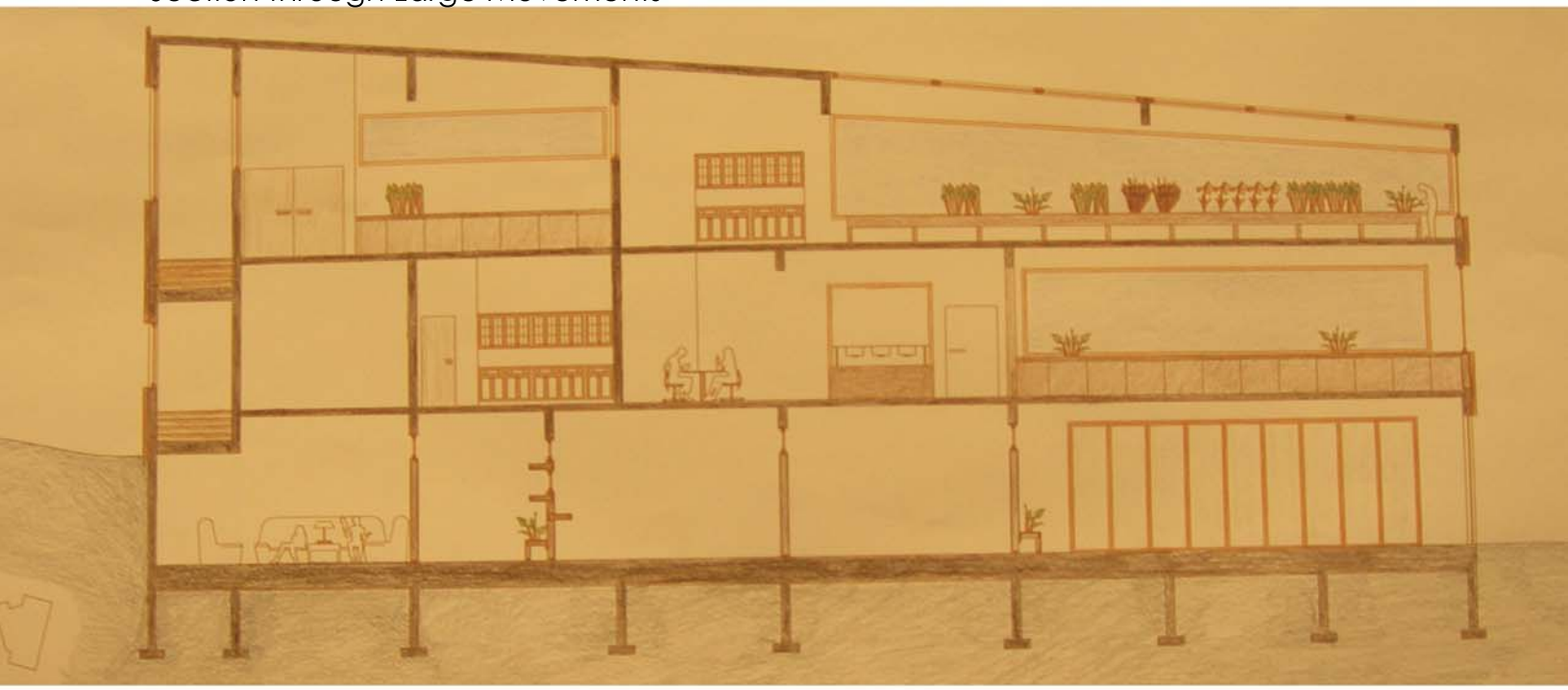
Upper level plan



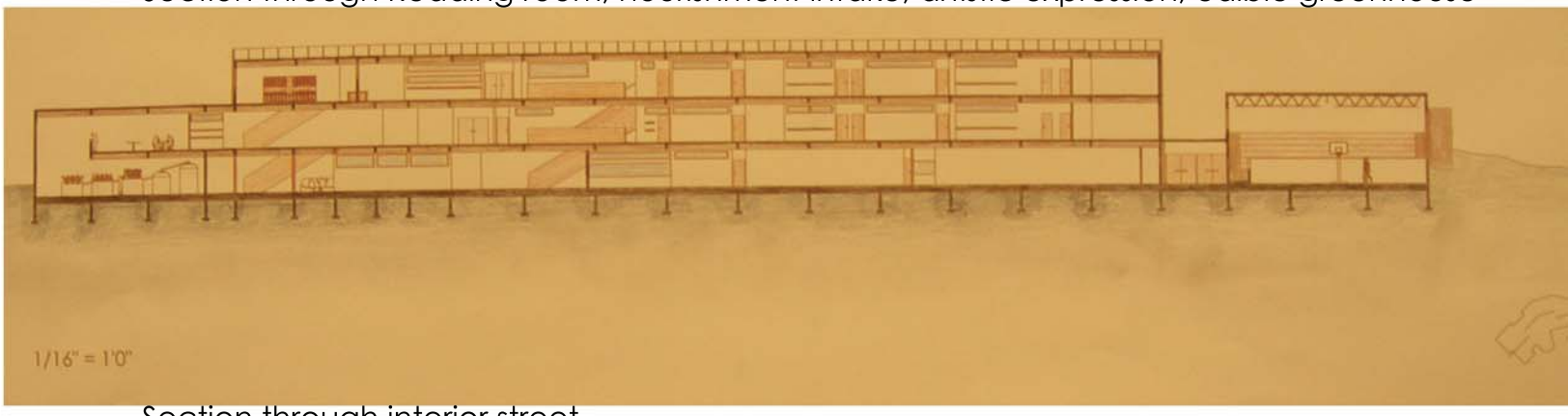
Section through Large Gathering Space

Section through Living machine, Water, Geology

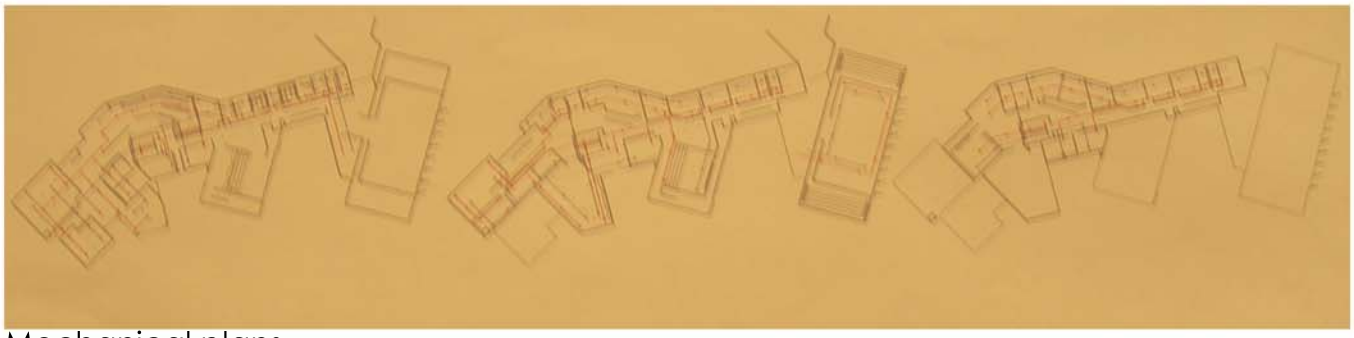
Section through Large Movements



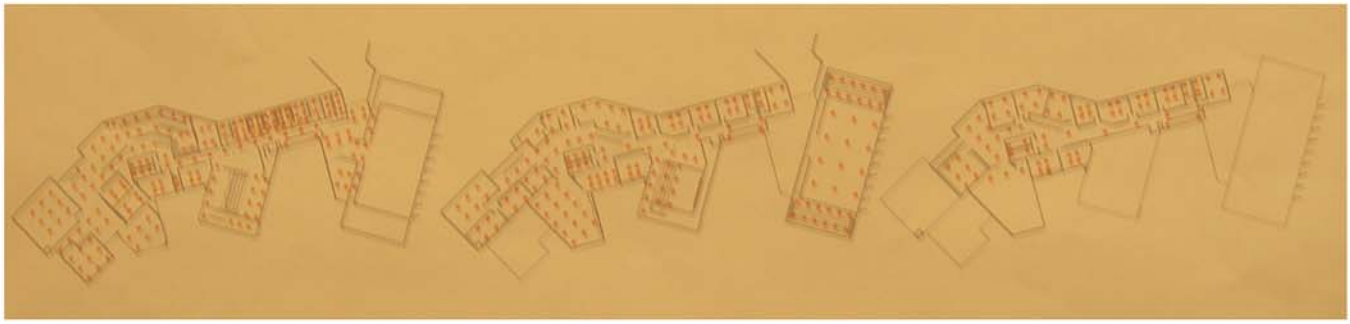
Section through Reading room, nourishment intake, artistic expression, edible greenhouse



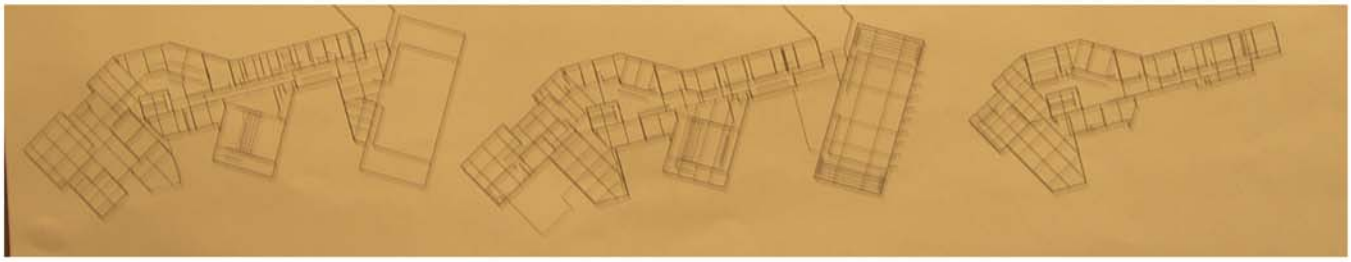
Section through interior street



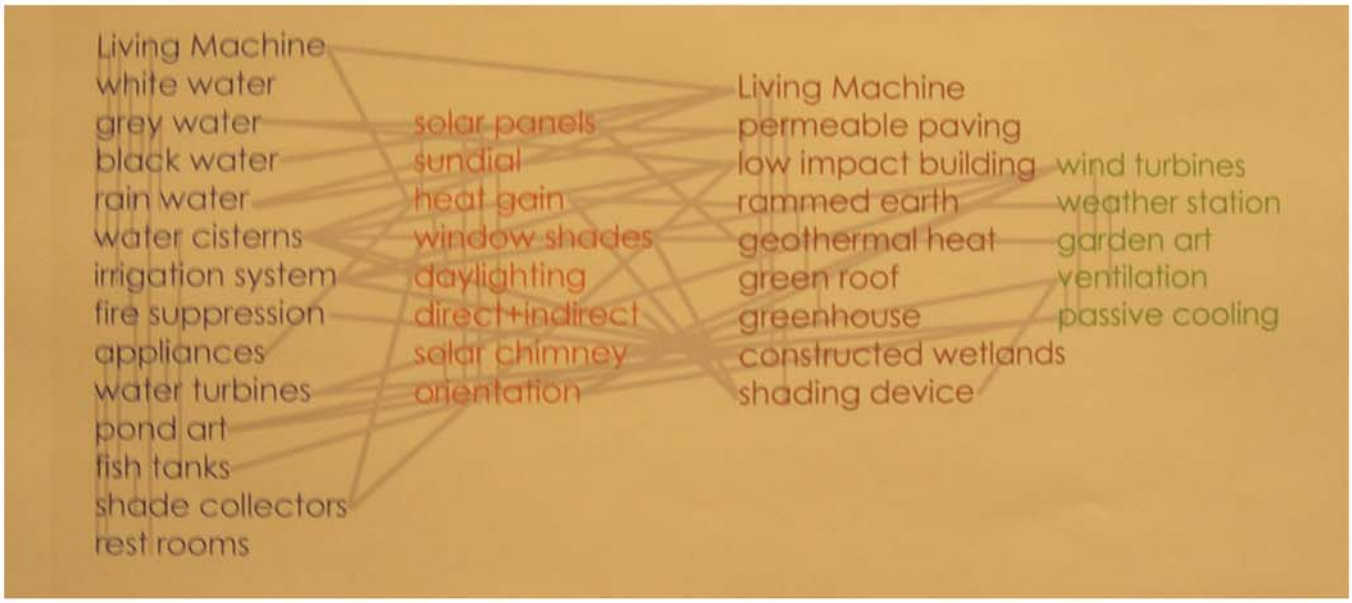
Mechanical plans



Lighting plans



Structural plans

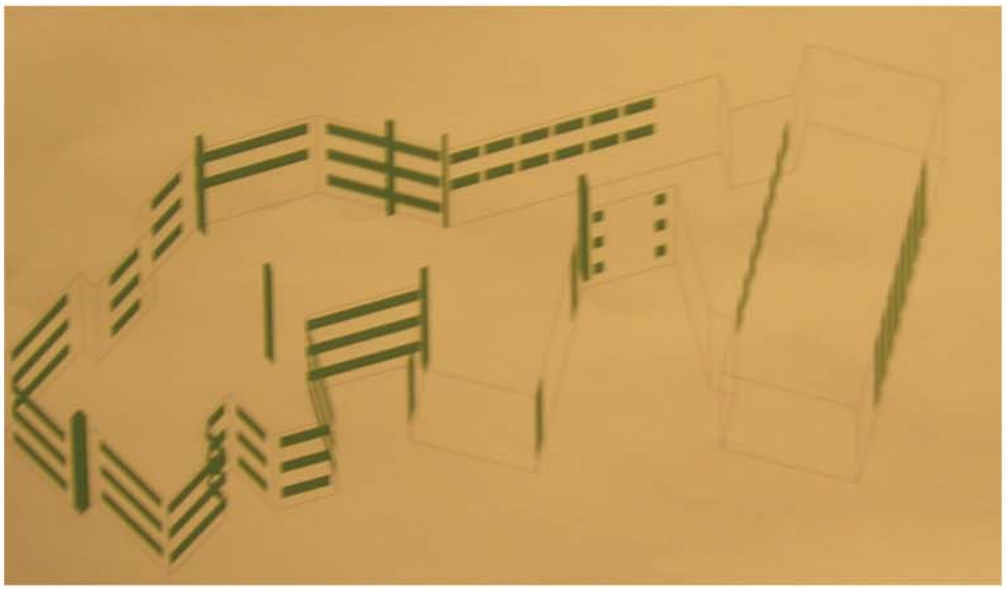


EARTH

There is only one earth- be careful how you use it.

The lessons taught will be consumption, horticulture lessons, and care and maintenance. The vessel for this will be the constructed wetlands, vegetation on the site and throughout the building, the geology space and the greenhouse.

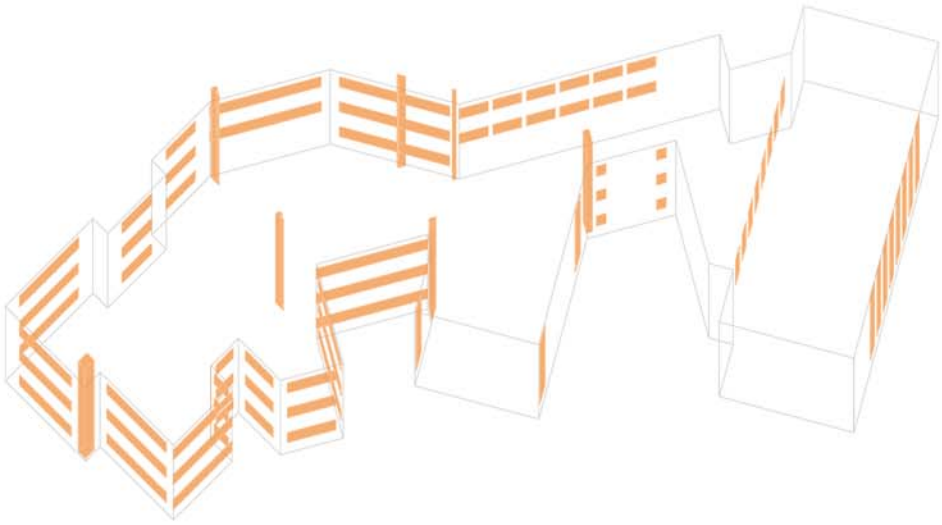
Living Machine
permeable paving
low impact building
rammed earth
geothermal heat
green roof
greenhouse
constructed wetlands
shading device



WIND

The winds blow from the southwestthroughout the year. Natural ventilation will be used as the primary source of cooling in the building. This is used through solar chimneys and operable windows. There is also a small farm of wind harvesting turbines.

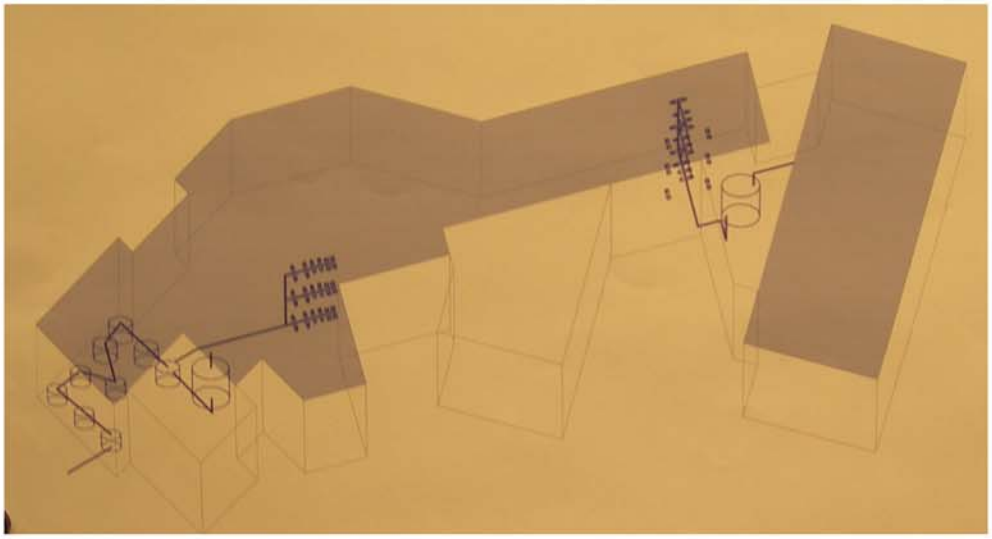
wind turbines
weather station
garden art
ventilation
passive cooling



SUN

Daylighting is the primary source of illumination. This lesson can be taught through daylighting, direct/indirect sunlight rooms and by the placement of the windows on the walls.

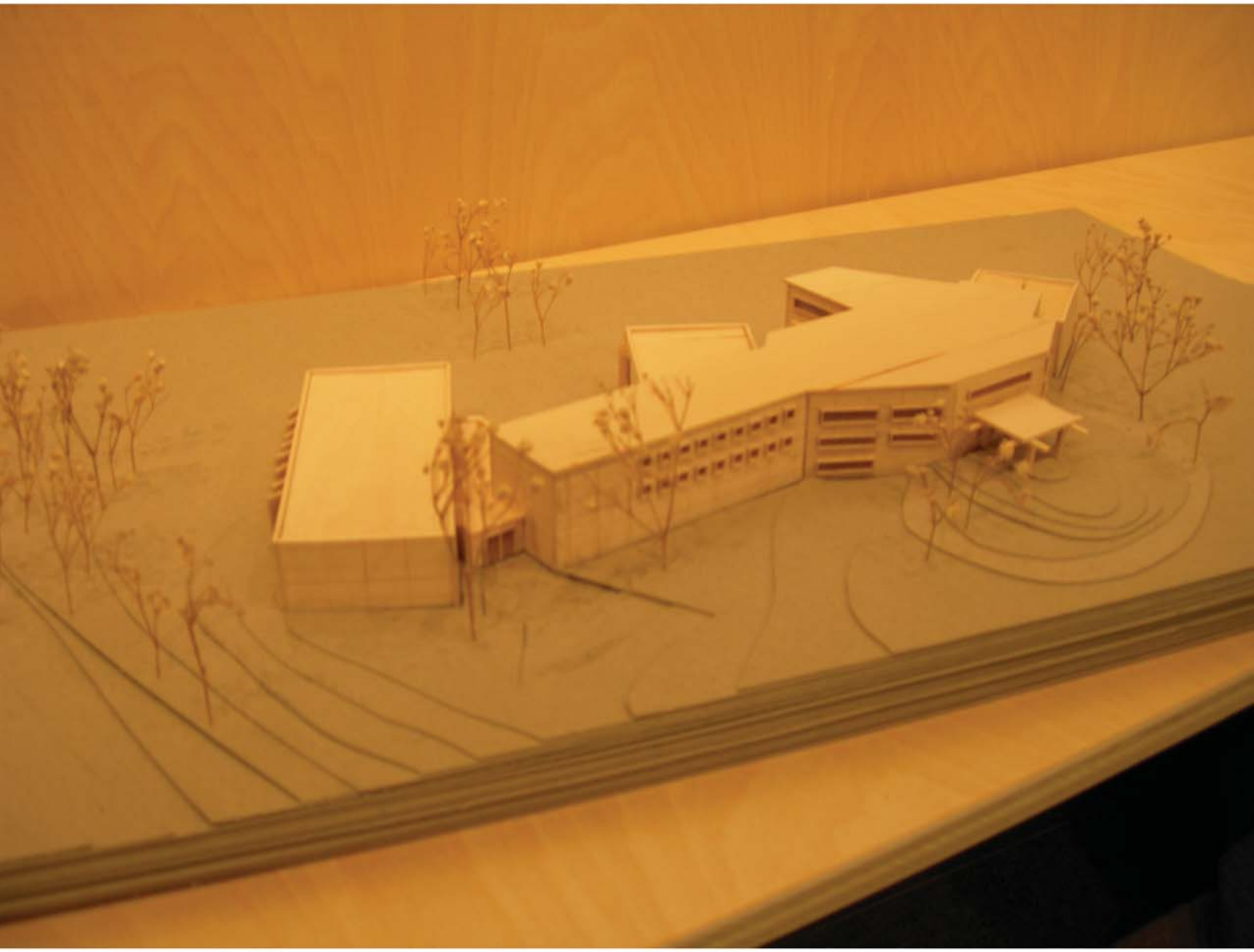
solar panels
sundial
heat gain
window shades
daylighting
direct+indirect
solar chimney
orientation

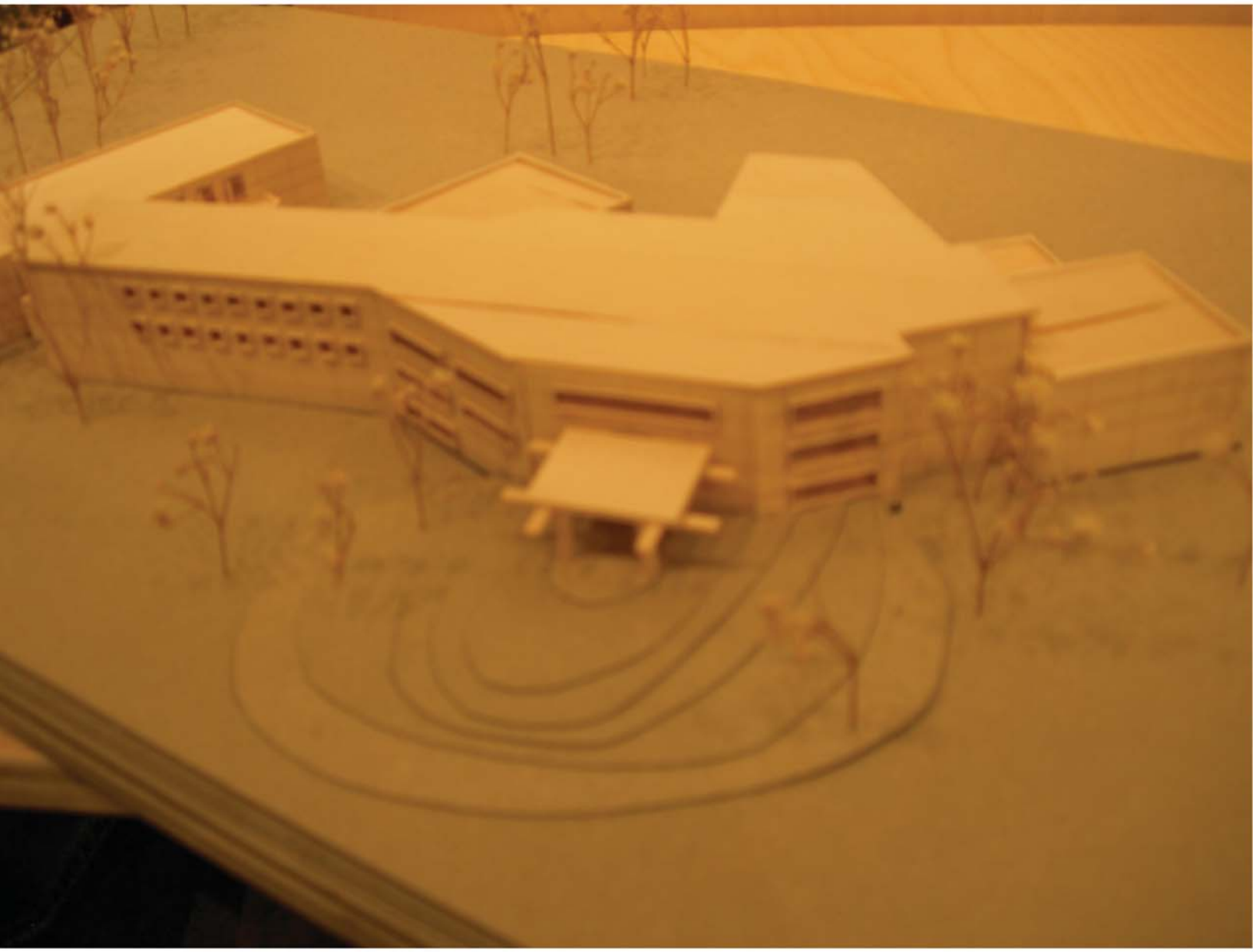


WATER

A living machine will clean the water used throughout the building. It will also cleanse the water collected from the roof and stored in the water cisterns. The primary lesson in water will be responsible use, conscious reuse, active recycling, and purifying water.

Living Machine
white water
grey water
black water
rain water
water cisterns
irrigation system
appliances
water turbines
pond art
fish tanks
shade collectors
rest rooms
fire suppression





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Metropolis is a publication that houses new architecture, culture and design. Each issue highlights different influences and trends of the design world. In his article, Aric Chen goes in-depth with the sustainability details for Sidwell Friends Middle School. There are plans, elevations and photographs that have been incorporated into each page layout.

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Divided into three parts, public domain, marking space leaving space, and inviting form, Hertzberger not only designed but also verbally describes how architecture is able to reach people of all ages and sizes on many different levels. Herman Hertzberger believed that "everyone is automatically in possession of an ever-expanding arsenal of potential instructions with which to choose a path towards a solution."

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Hailed as the "ultimate primer for living sustainably", Greg Horn offers tips to help turn everyday practices and household items into a sustainable lifestyle.

Johnson, LouAnne. Teaching Outside the Box: How to Grab Your Students by Their Brains. 1st ed. San Francisco, CA: Jossey-Bass, 2005.

LouAnne Johnson is a former U.S. Navy journalist, Marine Corps officer, high school teacher, and the author of The New York Times bestseller Dangerous Minds, which was the basis for the major motion picture Dangerous Minds in 1995. From her experiences, she has written several bestsellers about educating ESL students (English as a Second Language), at-risk students, and students with behavior disorders.

Ecology Architecture Education Design

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Roth, Leland M. Understanding Architecture: Its Elements, History and Meaning. 2nd. Eugene, OR: Westview Press, 2007.

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Rhythms of Learning offers a collection of lectures by Rudolf Steiner that explain each section of the Waldorf education. Such sections include an explanation of the foundation of Waldorf education, the teacher and child and the various levels of education that a student and teacher progress through.

Ecology.Architecture.Education.Design