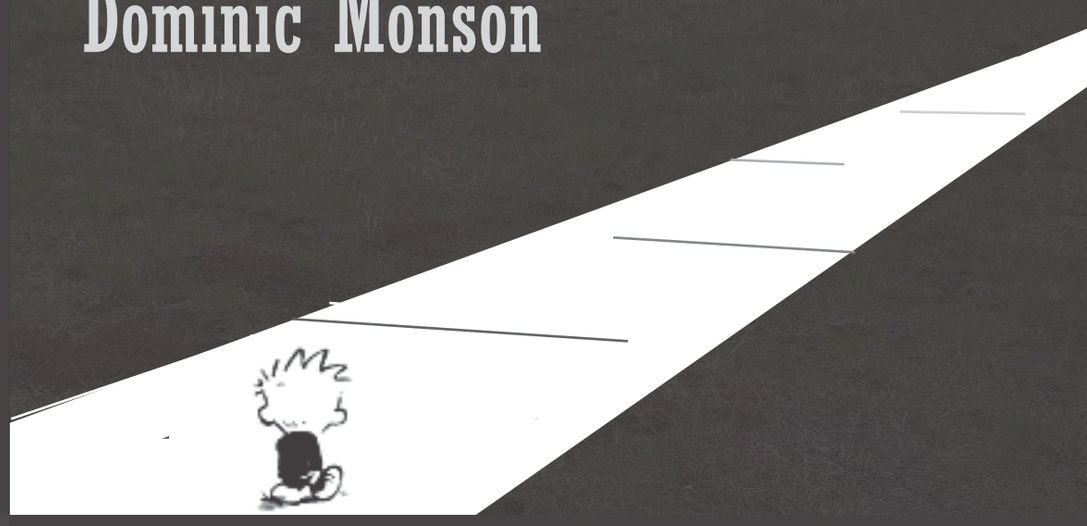
NURTURING
Sustenance

Dominic Monson



signature page

NURTURING SUSTENANCE

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By

Dominic A. Monson

In Partial Fulfillment of the Requirements
for the Degree of Master of Architecture

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PRIMARY THESIS ADVISOR

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THESIS COMMITTEE CHAIR

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My Family

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Abstract

The focus of this thesis is to explore the question “How can the design of a middle school enable the education of adolescents in sustainability and adaptation, and enable the growth of a city?” As described, the build typology is a middle school. The site for the project is located in Sidney, Montana. The Theoretical Premise here is that, “The learning environment needs to nurture a positive perception of growth and sustenance to students.” The justification for this project is that, “When American youth are exposed at an earlier age to sustainable concepts at work, they will hopefully advance forward in a more responsive and concerned manner.”

Key Words:

Middle School
Growth
Sustainability
Perception

Fig. 5a. “BNSF Railway”, Sidney, MT

Fig. 6a. "Yerba Buena Gardens", San Francisco, CA

Problem **Statement**

Fig. 6b. "Highway 16", Sidney, MT

How can the design of a middle school enable the education of adolescents in sustainability and adaptation, and enable the growth of a city?

Statement

of

Intent

Typology
Claim
Premises
Theoretical Premise
Justification

Project **Typology**
Middle School

Fig. 9a. "Central School Stairwell", Sidney, MT

Claim

A school building is a vehicle to teach sustainability and adaptation while influencing community growth.

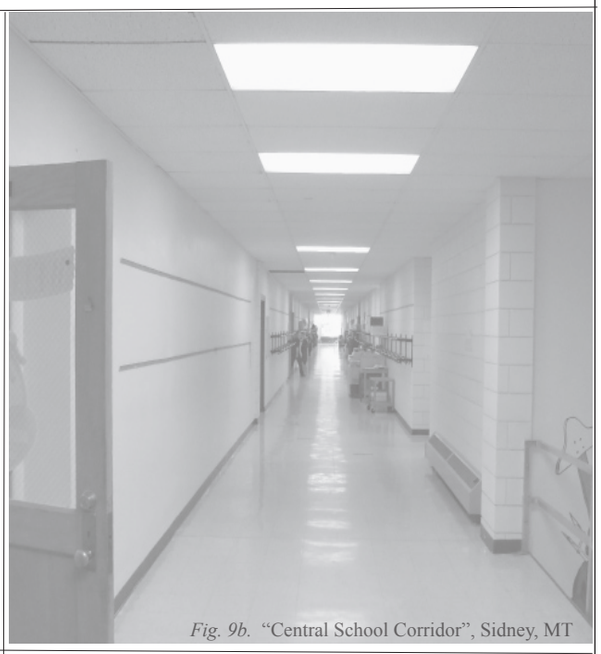


Fig. 9b. "Central School Corridor", Sidney, MT

Premises

Young, impressionable students are influenced by their surroundings.

A school is a tremendously influential environment for the future direction of youth.

Because of its importance to society, the learning environment demands special consideration and sensitivity.

Fig. 10a. "Desk Storage", Sidney, MT

Theoretical **Premise**

The learning environment needs to nurture a positive perception of growth and sustenance to students.

Justification

When American youth are exposed at an earlier age to sustainable concepts, they will hopefully advance forward in a more responsive and concerned manner.

The Proposal

Client
Elements
Emphasis
Site
Research
Methodology
Schedule

NARRATIVE

A few questions: when does an "improvement" become the point of failure? When do the parameters that initially defined and guided the project themselves become little more than floodgates that release the long-term negative effects associated thereafter? When do all of the bad, haste decisions finally catch up, and what then?

I don't mean to sound too pessimistic, but the truth is that my project is being applied to a region with a troubled past that is the result of making continuously bad decisions. And, as I look at the new Bakken oil boom that's transforming my hometown of Williston, ND and the surrounding communities, as I think about how weary that town was as I grew up there after a particularly hard oil bust in the 1980's, and as I watch the well-founded caution of these shaken communities slowly cave to pressure from newcoming residents for immediate changes, I can't help but think about the old saying:

"Those who don't learn from history are doomed to repeat it..."

"Sustenance is best taught by example."

Sidney, Montana is currently such a town at such a crossroads for making decisions that will reach into the future. As is common during times of drastic increase in oil production, the community's schools are among the most stressed. Of the area schools, the middle school is suffering the worst strain from the new enrollment figures trying to make use of an outdated structure that, at present, has many code violations.

The fact is that, due to their importance to the future, schools are something that demand to be done right the first time around. Such a facility must meet the needs of the present while simultaneously acknowledging those of the future. The students that transit the grades of the facility need to be able to see and understand their role for that future, and how inseparable they are from it. Sustenance is best taught by example. The school environment needs to be sustainable to teach sustenance, must expand and shrink with the fluctuation of enrollment, and must be seen as itself an impact - positive OR negative - on the immediate community.

This is what we're doing, right now.

Fig. 14a. "Lockers", Sidney, MT

Our **Client**

In general, the client for this project is the Sidney Public School District. This includes the current students and staff of Sidney Middle School, as well as the projected numbers for that facility over the next few years. For the 2012-2013 school year, there is an expected enrollment increase of 15%.

The new facility has to respond to the influx/ withdraw of boom enrollment while relieving the current strain on the system.

It also has to be dedicated to the safety and health of the students and faculty.

Now and the **Future?**

Sidney Middle School
(2012-2013 School Year)
263 Students
18 Staff Members
Parking for 25-30
Grades 6-8

New Facility
300-600 Students
18-30 Staff Members
Parking for 50+
Grades 6-8

Fig. 14b. "Asbestos Sign", Sidney, MT

Building Spaces

Classrooms
- 20-25 Total

Gymnasium
- Locker Rooms
- Weight Room
- Retractable Seating

Cafeteria (separate from gym)
- Kitchen
- Food Storage

Library

Restrooms
- Primary Set on each Floor

Administration Offices
- Main Office
- Records Room
- Principal Office
- Other Staff Offices

Staff Prep. Room
- Staff Lounge

Music Room
- Band
- Choir

Mechanical Rooms
- Main Utility Room
- Satellite Rooms

Circulation
- Corridors (Tornado Shelter)
- Stairwells
- Elevator(s)
- Exits
- ADA Ramps

Fig. 15a. "NDSU Library", Fargo, ND

Outdoor Areas

Center Courtyard
- Study Spaces
- Bike Storage
- Entry Walk

Parking Lot

Athletic Fields (to the North)

Green Roof

Fig. 15b. "Plaza", San Francisco, CA

PROJECT EMPHASIS

FOCUS

A sustainable environment that nurtures a positive student perception about sustenance through example

1. **Use of nontraditional ECS methods for the building**

EXAMPLE: Geothermal heat pump/sink system to heat and cool the building

2. **Use of alternate building materials**

EXAMPLE: Fly ash from nearby Lewis & Clark Power Plant mixed with structural concrete

Fig. 16a. "Coal Creek Station", Bismarck, ND

FOCUS

A built environment capacity that can fluctuate subject to the oil field economy

1. **Building elements that can be added or subtracted, subject to enrollment needs**

EXAMPLE: Structurally-sound classrooms that can be easily assembled or disassembled for additional spaces

Fig. 16b. "Field", Jamestown, ND

FOCUS

An exploration of the possible effects that this new facility will have on Sidney, Montana at its chosen site

1. **Which direction(s) is the city growing?**

EXAMPLE: Exploring GIS maps of the area to evaluate population trends.

2. **Can this new school adapt to both drastic growth and decline?**

EXAMPLE: Combination of both permanent and non-permanent building elements.

Fig. 17a. "Water Tower", Sidney, MT

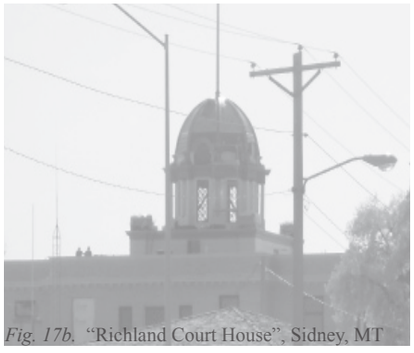


Fig. 17b. "Richland Court House", Sidney, MT

Sidney, Montana

Montana's Sunrise City

Fig. 17c. "Sidney Main Street", Sidney, MT

POPULATION: 5,191 **LOCATION:** Richland County, Montana, USA

ELEVATION: 1,949 Feet **ZIP CODE:** 59270 **REGION:** Upper Midwest

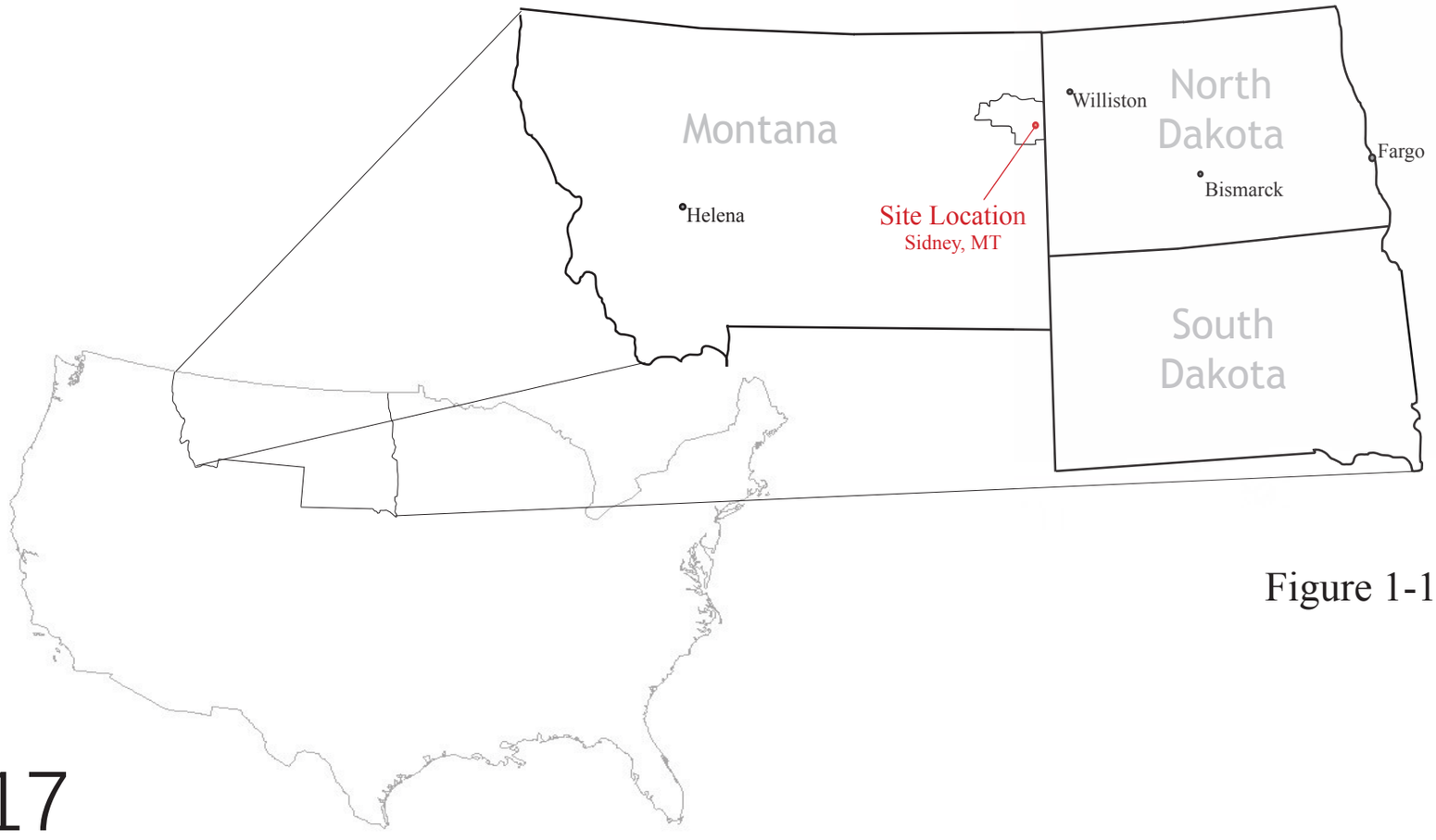


Figure 1-1

SITE INFORMATION

The project's site is located to the northwest of the town's center on unannexed land, part of which is currently owned by the school district. It is surrounded by a subdivision from the last oil boom, the shape of which responds partly to the contours of a water project to the east.

As the city's growth is projected to the north and east in the coming years, this site is the intended location for the district's future school project(s). The land (currently in the process of acquistion) has some of the more pronounced topography of the area, being that it is located on terrain that has been shaped by the Yellowstone River, which forms a confluence with the Missouri River toward the northeast of town outside of Williston, across the state border

The fact that this project is based on a real life challenge for the area, and that it utilizes the intended site defined by the school district, makes it all the more appropriate.

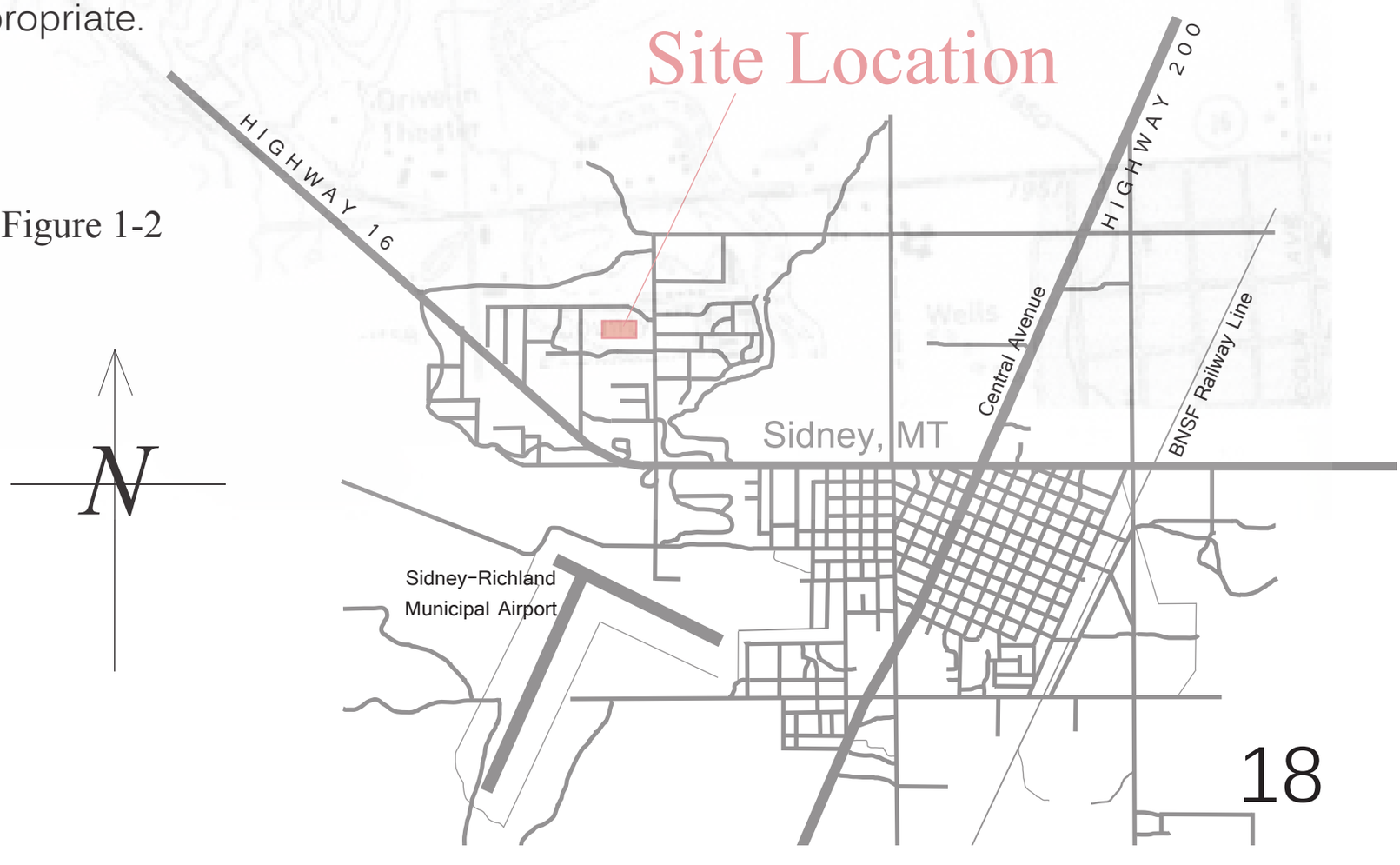


Figure 1-2

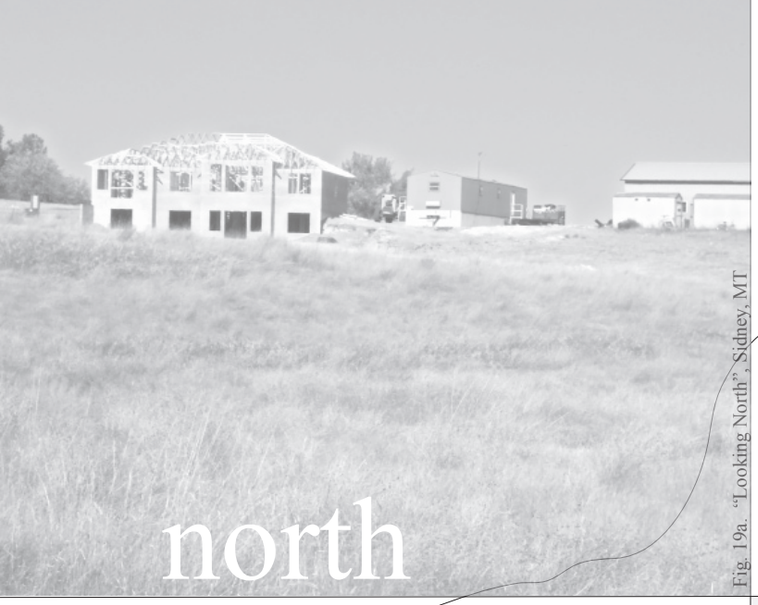


Fig. 19a. "Looking North", Sidney, MT

This thesis project is using the intended site for Sidney School District's future school projects. The land has some significant topography, requiring some grading and leveling for the new facility. However, the intention is that the building and its grounds will conform to the overall slope, with different sections of the school at higher/lower elevations. The hope is to do only what is necessary in terms of site modification and disruption.

Fig. 19b. "Looking West", Sidney, MT

SITE VIEWS

Fig. 19c. "Looking East", Sidney, MT

Fig. 19d. "Looking South", Sidney, MT

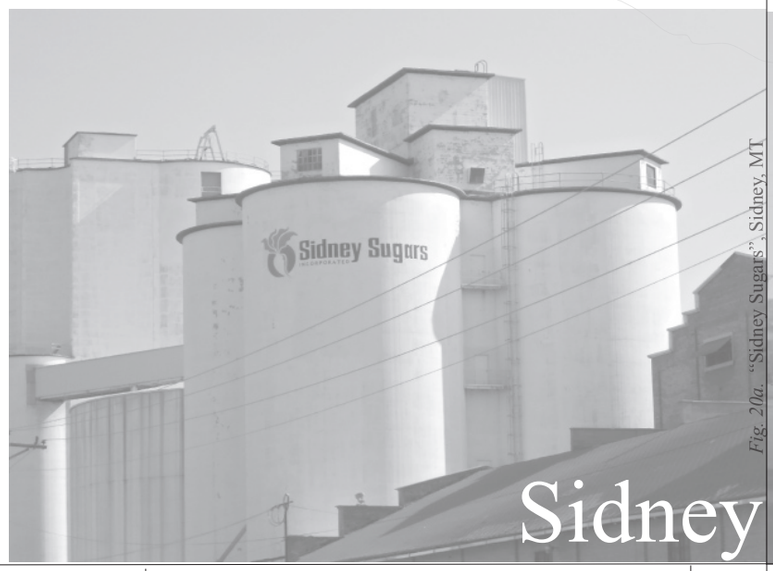


Fig. 20a. "Sidney Sugars", Sidney, MT

Fig. 20b. "Sidney Beet Mill", Sidney, MT

Sidney Sugars Beet Mill

Fig. 20e. "Site Overview", Sidney, MT

& LANDMARKS

Richland County
Court House

Fig. 20c. "Richland County Courthouse", Sidney, MT

Lewis & Clark Power Station

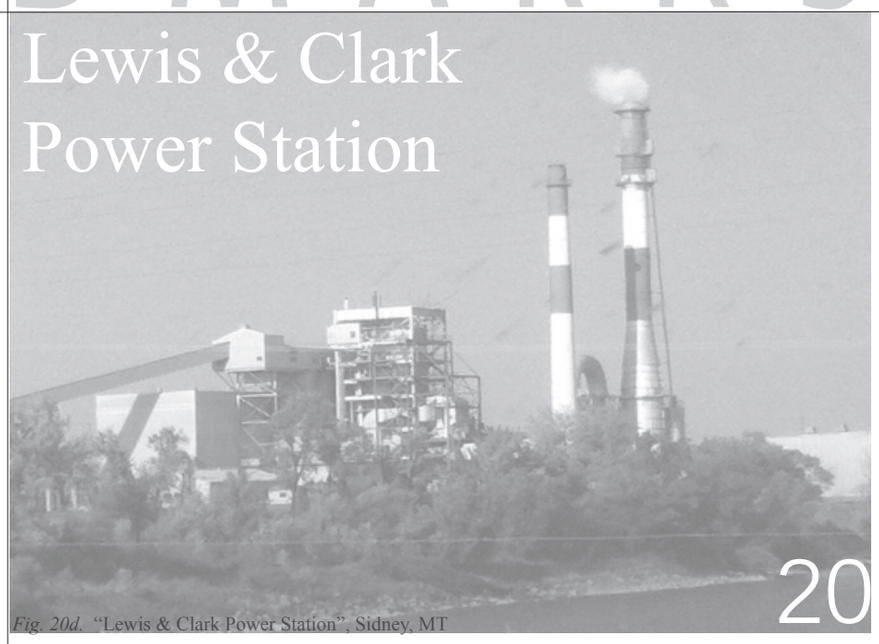


Fig. 20d. "Lewis & Clark Power Station", Sidney, MT

Plan for Research

Fig. 21a. "Site Fence", Sidney, MT

Theoretical **Premise**

The learning environment of today and the future needs to nurture a positve student perception of sustenance. As suggested before, this idea forms the backbone of the project's research, and ultimately this thesis project.

Project **Typology**

The building's typology - a middle school - will be examined in depth throughout the research. This will be done in part by an exploration of case studies, some of which will be presently employing similar concepts.

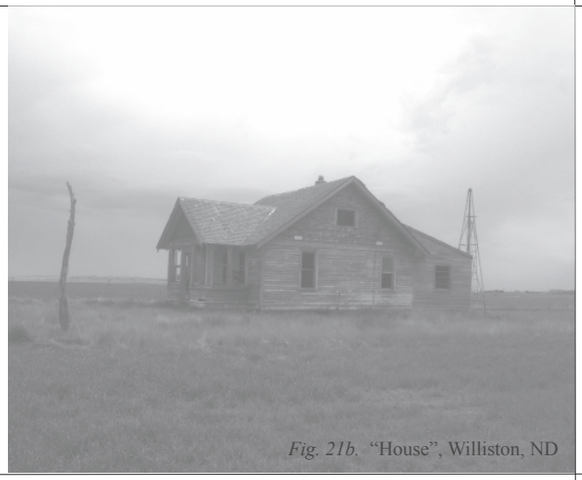


Fig. 21b. "House", Williston, ND

Historical Context

Extensive overview will be done pertaining the site's unique historical conditions. The culture of the area, its location within the country, and local sites of interest will all be among the things considered to develop and foster a meaningful connection to the site and its region.

Site **Analysis**

The site itself will be scrutinized, and its parameters defined. This includes traffic patterns, sound analysis, views, wind and sun influence, and utilities.

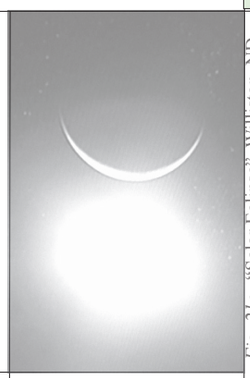


Fig. 21c. "Solar Eclipse", Williston, ND

Programmatic Requirements

The building program will be researched and developed at the same time the typology is explored. The spaces and necessary parts of the facility will be listed and defined.

Strategy:
Concurrent Transformative

"This project will be at its best when it employs various methodologies."

Intended Methodologies:

Mixed-Method
Qualitative/
Quantitative
Graphical Analysis
Digital Analysis

This mixed approach will influence these important elements:

Site Planning
Watershed and Grade Analysis
Form Development
Material Development
Structural Analysis
ECS - Passive Systems
ECS - Active Systems
Final Boards
Model Building
Design Process
Booklet Review

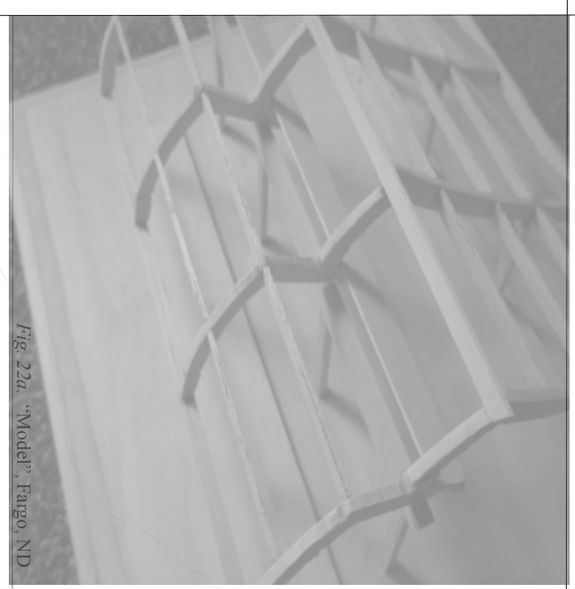


Fig. 22a. "Model", Fargo, ND

DESIGN **PROCESS**

Virtually everything will be documented in some way through out the design process. Images and figures will be scanned and stored digitally, and eventually made available for viewing in the future upon completion of the project.

Schedule Spring 2013

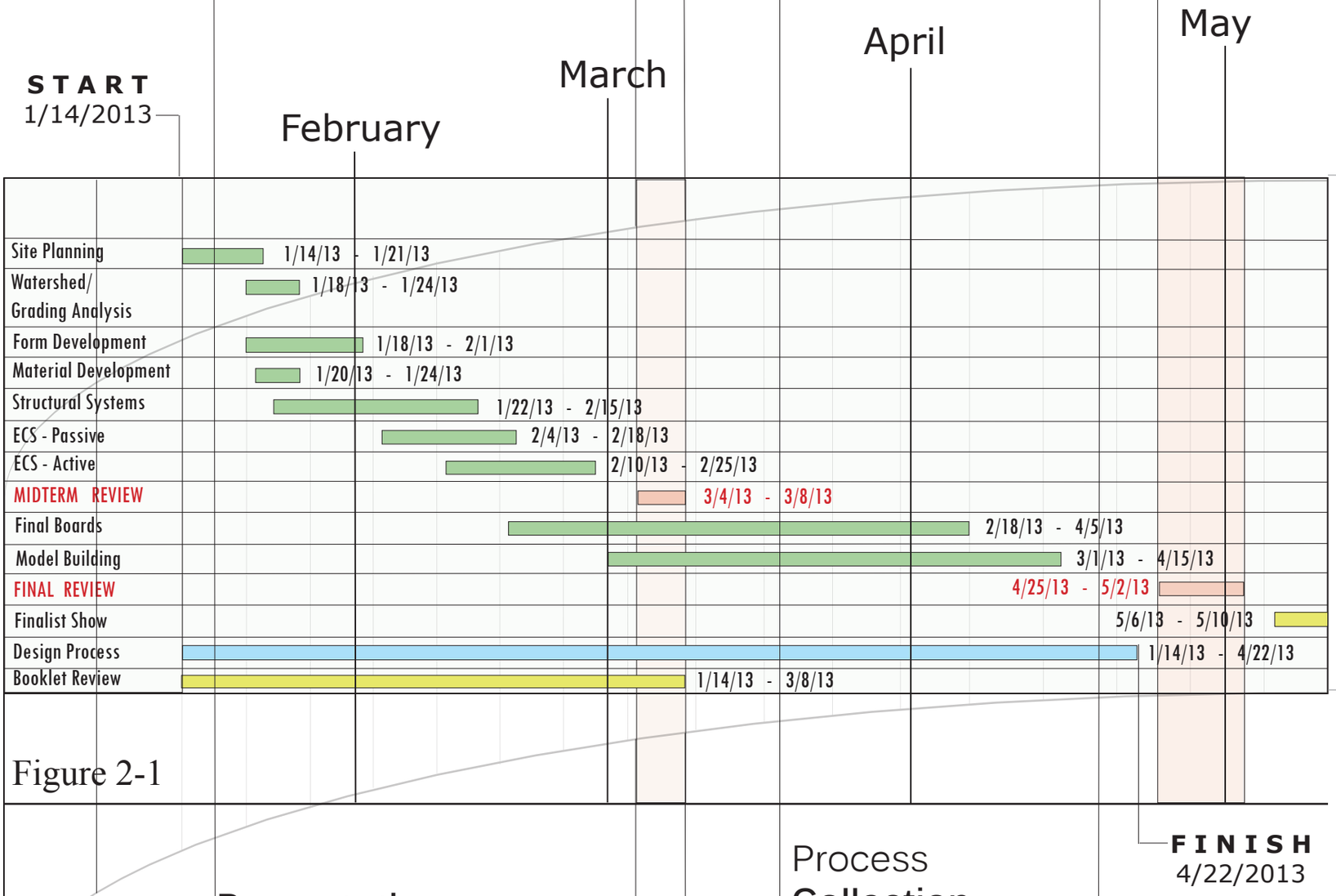


Figure 2-1

Presentation

The final presentation boards will include important elements - such as non-focal images - to illustrate the project's lengthy design process.

Process **Collection**

Images will be collected and scanned at the beginning of each month to ensure none are lost.

STUDIO EXPERIENCE

Fall 2009
Heather Fischer
Tea House
MRC Boat House

Spring 2010
Joan Vordenbruggen
Montessori School
Cripple Creek Dwelling

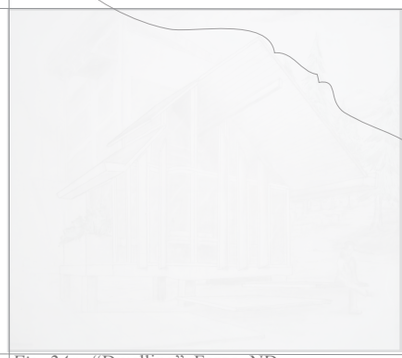


Fig. 24a. "Dwelling", Fargo, ND

Fall 2010
Cindy Urness
FM Food Co-op
NDSU Downtown
Wellness Center

Spring 2011
Ron Ramsay
Shaker Barn
Baltic State Consulate

Fig. 24b. "High Rise", Fargo, ND

Fall 2011
Bakr Aly Ahmed
High Rise

Spring 2012
Ron Ramsay
Red Tail Brewery
St. Varvara Russian
Orthodox Church

Fall 2012
Ron Ramsay
St. Ahab Chapel
Reformed Judaism
Synagogue

Fig. 24c. "St. Ahab Chapel", Fargo, ND

The Program

Literature Research
Report
Summary
Case Studies
Historical Context
Thesis Goals
Site Analysis
Programmatic Requirements

Literature Research

Introduction

Looking at today's context, the world finds itself facing ever more complex problems that warrant equally complex solutions. This thesis was partially inspired by the harsh realization that newer generations don't necessarily share an inclination to solve - or even confront - such world challenges. Likewise (and to be fair), previous generations are somewhat inclined to hand over problems to younger generations with a blunt, but encouraging, "Here, now you have to solve this mess." It seems that both newer and older generations are actively imparting the burden to one another, even when the reality is that both are inseparably intertwined, and both need to be part of the solution.

In many ways, preceding generations are setting the stage and direction for younger generations by foremost providing examples and models for the future. Hopefully, the innovation won't stop there, but rather will be ever improved upon and reset for subsequent generations.

Everything starts with education, and how a person is raised by their parents, schools, and their community will influence the direction that they take in life. This project's core idea and theoretical premise is that: **The learning environment needs to nurture a positive perception of growth and sustenance to students.** There are both good and bad examples provided to younger generations by preceding generations. But even more than that, the premise itself is nothing short of an imperative. The school environment needs to be done correctly the first time around with an acknowledgement that its planning decisions will be critical to many generations of students.

"The learning environment needs to nurture a positive perception of growth and sustenance to students."

Working in conjunction with the theoretical premise is the overall project justification and goal: **When American youth are exposed at an earlier age to sustainable concepts, they will hopefully advance forward in a more responsive and concerned manner.**

Focus

The focus for research here remains the school environment - specifically, the middle school typology. Now granted, this particular thesis involved stumbling across a real life problem, and the final solution is being geared for optimum solvability to that problem. It so happens that the typology chosen was never actually "chosen" - it was the school of a district that was seeing the greatest strain, and therefore it called for either a substantial renovation or an altogether new project on a different site. Also, the typology may seem too specific, which is true to a degree. Simply put, every school environment for every age genre has a lastly impact on its students, which can be positive or negative.

However, while the thesis typology and its corresponding age group appear to be only coincidental, the fact is that the middle school age group has an inherent value with regard to nurturing adaptation and sustenance. Indeed, students of that age genre (grades 6-8, ages 11-13) are transitioning into adolescence, and their minds and belief structures are two of many things being actively engaged. Arguably, this is the particular age group where a student may encounter the full shock of society for the first time in their life, and how they react is all too critical.

Research

Just as the title of this thesis suggests, preceding generations serve to nurture younger generations. It's always needed to be that way. This is something that's done in every way and form, first (and most importantly) by parents, and then later by teachers and members of the greater community. A person's set of values and belief structure develop over a long period of time. In essence, and aside from a certain period of rebellion, youth look upon the example set forth by authoritative figures - role models - in their life with the intention of emulating it.

SUSTENANCE

How does this work with sustainability? Let's consider two possible school scenarios: A and B. School "A" is located in an area of extensive industrial development where environmental concerns, though perhaps not unimportant, are not perceived as something of special emphasis in education. Inversely, school "B" is located in an area of environmental sensitivity, and its facilities not only utilize/showcase sustainable strategies, but also the student body is included in facility upkeep and presented with sustenance education. Both facilities have a lasting effect on the students, and for two primary reasons: the teaching staff (who may view their position as that of a role model to students), and the elements that compose the built environment itself.

This belief is reflected and reinforced by such studies and reports that present modeling as a way to fill the void that exists today in how younger generations perceive sustenance. One such article states, "We focus on both human role models and on institutional models, whereby the setup of a system or facility reflects the values of its creators" (Higgs and McMillan, 2006, pg. 40).

Of the two models presented, the first one (School "A") is a poorer model for sustenance - though may not necessarily be a failure as an educational environment. But in terms of effectively presenting sustainability to younger generations at a needed time in history, that school falls short, and perhaps even works in a contradictory manner.

This mirrors back to the importance of designing such a school environment sensitively from the start, all the while knowing that student values will be growing and developing as the facility walls age over time.

Though the vast majority of schools in the United States today may bear semblance to School "A", fortunately there is an abundance of good examples to be found here in the U.S. and abroad. Some will be presented as case studies. The importance of these examples is that they reflect back to that innate and necessary function of older generations nurturing newer ones. What these examples portray is a passively built environment where the students are engaged by their surroundings, peers, and the nurturance of their teachers. The students are expected to be involved and work in an environment that responds to its environmental conditions, as opposed to merely tolerating them. These school environments are in different locations with varied school demographics, enrollment figures, budgets, and tuition rates. All, however, are actively pursuing measures to model sustenance to students.

One facility, Arthur Morgan School near Celo, NC, has a smaller student body (25 students total), most of whom are from middle or working class Quaker families of the area (Higgs and McMillan, 2006, pg. 42). At Arthur Morgan, both the students and faculty fill the role of caretakers, and there is no maintenance department. The students are required to fulfill a half hours' worth of chores each day. They manage the school grounds, recycling, animal husbandry, food preparation, gardening, and other necessary functions in addition to course work. In the process, the students are exposed to sustainable practices and learn how to responsibly manage their environment. To guide these students along are role models in the form of their teachers, who work alongside them. They serve to exemplify older generations nurturing newer ones, and all the while acknowledging the importance of doing so.

Within a school environment, the ability of role model teachers to have a tight and open relationship with their students also serves to advance sustainable practices. One teacher at Common Ground School (which works within Berkeley High School in Berkeley, CA) said the following:

> "When I get the kids comfortable, they open up, and you're able to address so much more, as opposed to a group of kids who don't trust you - they'd close up, or ignore you, they wouldn't see you as a role model." (Higgs and McMillan, 2006, pg. 44)

While talking closely and directly with their students, the teaching staff have the opportunity to gauge how their students view sustainable practices, and whether that perception is more positive or more negative. Here is another key facet to successfully teaching sustenance: positive perception. The word "positive" is a very intentional word in the theoretical premise for this thesis. Students need to be excited about their future, both personally and for overall society. They need to be involved in it and, again, the teaching staff have the ability to structure involvement.

These advanced examples of learning environments are evolving the definition of the word "classroom," and this is a crucial step in teaching sustenance to youth. It has been suggested that the classroom serves as an **institution** whereby individuals meet to accomplish common purposes (Coates, 1974, p. 19). The author went on to say the following about how the classroom institution will guage its effectiveness:

> "To evaluate and explore classrooms we must keep in mind that they are both simple physical environments and purposeful, goal-oriented constructions. They may thus be evaluated both according to their basic physical nature and according to their success in attaining their specified goals" (Coates, p. 15)

So, what is taught in the learning environment? Is the school (middle school) a setting with the sole responsibility of administering subject course work? Or, as is becoming more and more evident in today's society, is the school the necessary and most effective tool in teaching sustenance to an otherwise indifferent generation?

ADAPTABILITY

Working in conjunction with sustenance, the other area of research for this thesis is adaptation - in this case, creating a facility that responds effectively to drastic enrollment fluctuation brought on by sudden and extensive economic development. This, too, is something that needs to be postively instilled in the minds of youth. Like sustenance, effective adaptation is something best taught by modeling. Students need to be able to associate adaptation to sustenance. Indeed, the two terms work hand in hand.

While certainly not every economic situation will have the same conditions, most (if not all) will at least provide an opportunity for innovative solutions and correct response to those conditions. The question is, how can a large institution adapt to sudden and drastic changes in an area with a particularly volatile economy?

For the school, an institution greatly affected by economic fluctuations, there is need to pay special attention to the area economy during the planning phase for a school project. Is there an inherent stability that will support the increased development? Or, is there a troubling precedent that warns of negative effects brought on by haste decision making? These are two incredibly important questions that need to be considered by everyone involved, as well as the greater community (the one that will determine the need for such a project.) The scale may be of a very dynamic nature, with drastic differences in peak and recession.

Part of the research for this thesis required consideration of overall “building intelligence,” or “smart buildings.” This is something directly connected to an adaptability provision within a greater design, and it is set in motion during the planning phase for a design project. This research came from a surprising source that forced the reader to really think about intelligence in design, and how it cannot and should not be limited. The research started with an investigation of a building’s skin—all of its external systems working together, and how they help to ensure internal stability.

Today, virtually every building typology proclaims its own version of a smart building model, and too often their success is measured only by visual elements that deter any deeper analysis. To the public, a “green” building demonstrates a “green” client, but does it really? “As the term is most often applied to commercial buildings, it also seems to imply a building’s adaptability and responsiveness to satisfying an organization’s business objectives over time” (Wigginton and Harris, 2002, p. 21.) The objective in question will always involve an organization’s connection to the public, and the image that is attached. Sadly, the result is often skin-deep design—and skin-deep architecture.

Too often today the term “smart building” is misapplied, or is at least too specific (Wigginton, p. 20.) Its scope is often limited to buildings with extensive systems that respond to interior/exterior conditions. While these things remain important and have proven their effectiveness, it needs to be understood that building intelligence is, by its own nature, holistic. It involves all aspects of the greater design: the layout, the systems, the programmatic requirements, the opportunities, the immediately evident distressing symptoms, and etc. The point here is that a smart building comes about by smart design. A project shouldn’t be attempted half-heartedly with the intention of modifying and correcting it later on.

In the process of discerning the building form, material composition for the skin will inevitably be considered (though perhaps not finalized.) What can serve as an effective model here is, simply enough, human skin. This is something that absolutely everyone is familiar with and has at least rudimentary understanding of its basic function. The essential and necessary function of a human's skin is not dissimilar to that of a building - to help maintain internal equilibrium.

So, a new challenge emerged: how can the design of a building project's skin emulate the characteristics of a human's skin? (Wigginton, p. 24) A related (and admittedly more abstract) question is: how can a building demonstrate an understanding of its user, and not be limited to only user understanding? What these questions reinforce is that the planning process is so intricately crucial to how a project stands the test of time—well, poorly, or somewhere in between. The planning process needs to understand and provide for adaptability in the project. This, now, is a cornerstone component for this particular thesis.

Finally, while designing an adaptable structure, there is the important issue of occupancy. Most buildings are occupied only half (or less) of the time. For the school typology, after considering summer months, the occupancy time is even further reduced. However, with that understanding, the focus here for this thesis is not so much occupancy time as it is occupancy scale. Being placed in an area of intense economic development, the enrollment figures for the school district in consideration are projected to grow almost exponentially, the result of entire families moving to the area and needing schooling for their children. While being within a rather volatile economy, and using history as a prediction model, can such a facility adapt to maintain its equilibrium if conditions suddenly change - if the boom goes bust? Can, and will, that building skin work to nurture that adaptation?

The answer is, absolutely.

Literature Research

Statement

Perhaps never before has effective modeling for education been so important to the future, and that statement is voiced with a complete acknowledgement of how education has always been a cornerstone in society. Looking at today, there are many problems facing the world, and they are problems that demand complex and highly integrated solutions. Contrary to popular belief, the burden for necessary change cannot fall to a single generation. Rather, both older and newer generations need to work together to solve today's problems, and both sides can bring something to the table. The old can and need to teach the new - this isn't a new idea, but rather one that has continued throughout the course of history. Modeling IS teaching, and we as humans learn largely by example. For this thesis, two topics of particular interest and focus are sustenance and adaptability education, both of which are most effectively taught through modeling. They both are necessary for the design solution, and need to instill a positive (as opposed to neutral or negative) perception about the future.

Research

Our research began with an examination of our earlier theoretical premise: **The learning environment needs to nurture a positive perception of growth and sustenance to students.** First off, why is the learning environment so important? What is this "positive perception" that we are talking about? How are **adaptability** and **sustenance** related to one another? How can this project's typology - the middle school - model both sustainable strategies and responsive adaptation to sudden change?

For sustenance, there was an exploration of what it meant to be sustainable,and how the context may determine certain aspects of perception. Does such a thing even matter to that context? Are elements at work that hinders success? Is it (can it be) positive? Much of the research was conducted by examining case studies that demonstrated effective teaching strategies for sustainable living. Such passive learning environments may be construed as “pushing the envelope” to define what a learning environment is, while viewing the classroom paradigm as itself an institution where a common goal(s) is worked on and eventually accomplished. The faculty acknowledge their necessary service to students as role models, and in a manner similar to their students’ parents.

There is further concern about the defined context with regard to adaptability. For volatile local economies - where drastic changes occur - there is necessity for adaptability in a school environment that responds to enrollment fluctuation. Here is where design intelligence needs to be considered holistic in approach and scale during the crucial planning process. A building’s skin, emulated to human skin, can nurture adaptation.

Findings

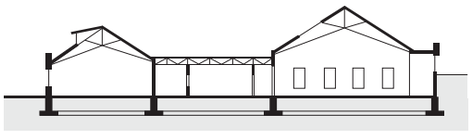
As stated earlier, sustenance and adaptability are best taught through modeling. The learning environment serves as a tool to advance both practices positively to students through modeling, teacher/student interaction, and sustenance education. Likewise, the skin of a building can be used as a tool to advance adaptability. Simply providing the opportunity (in this case, the environment) will go a long way.

Case Study 1

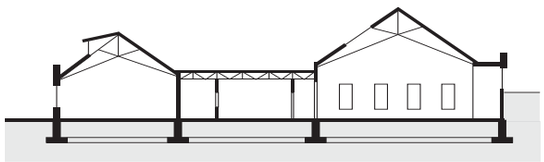
Hood River Middle School

Hood River, Oregon

Elevation



Plan to Section



Structural

Hierarchy

Statement

Located in the Oregon town of Hood River on the Columbia River, this middle school contains grades 6-8, with nearly 440 students. The general middle school itself is on the National Register of Historic Places.

For this case study analysis, the specific focus was the newer science and music building, located on the northeast corner of the site. This 7,200 sq. ft. expansion of the greater school was designed by Opsis Architects and completed in 2010 at a cost of $2.3 million. The building can be recognized by its signature pitched roof that is faced with photovoltaic panels. Its structure utilizes reclaimed wood for the larger spanning scissor trusses, and radiant flooring helps supplement the building's heating needs. The grounds of the building have a large garden and greenhouse system that is reinforced and maintained by student activity. This food production system serves the greater cafeteria of the middle school. Collected rainwater is partially used for irrigation needs in the garden and greenhouse (AIA Top Ten, 2010).

Besides the larger music and science room elements, the building program consists of offices, restrooms, a greenhouse/garden, circulation corridors, and a stone-seated amphitheater pit that negotiates the junction of the building layout and elevates with the site's topography.

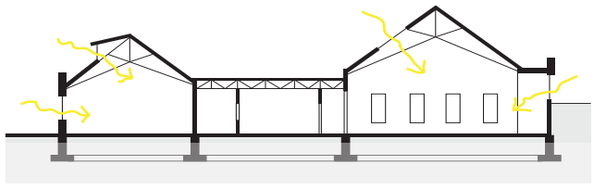
Case Study Images: Figure 3-1

Research & Analysis

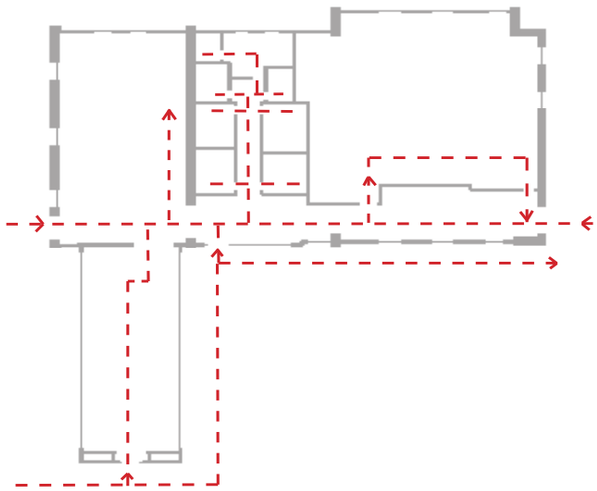
Like the succeeding case studies, Hood River Middle School's music and science building is located in a smaller community (very similar to the focus community for this thesis) in a state with a population that is deeply conscious and committed to sustainable living. This commitment includes proper sustenance education for youth. Gardening is a key aspect that is being introduced early on to students. The roof collects solar gain to the south, with extensive daylighting from the north side of the site. Hood River's music and science building maintains its connection to the historic middle school scheme with traditional wall design and spaces that contribute to food production and collection of the student body, but it's orientation and layout are meant to mirror the community's commitment to sustenance education.

Conclusion

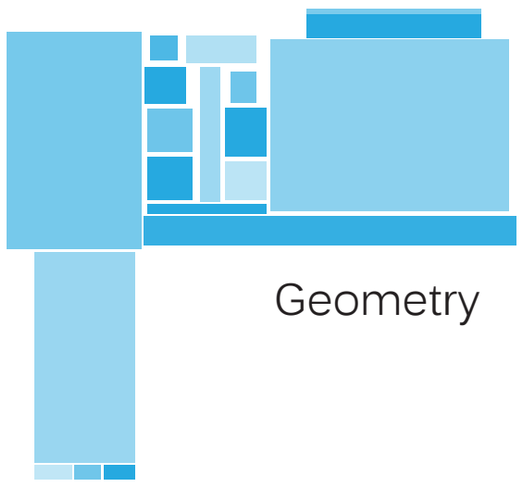
As part of the larger middle school scheme, the music and science building is a responsive addition design that actively engages students by participation, and demonstrates a very mindful utilization of the partitioned site land. As aligns with this project's theoretical premise, the design is meant to model sustainable strategies to students at an earlier age, and allow those same students to identify their own role.



Natural Light



Circulation



Geometry

Massing

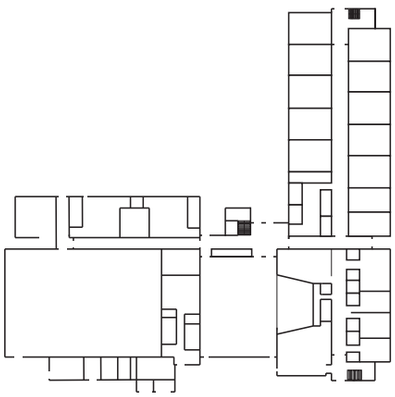
Case Study Images: Figure 3-2

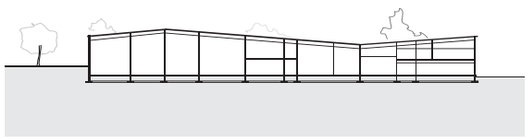
Case Study 2

The Dalles Middle School

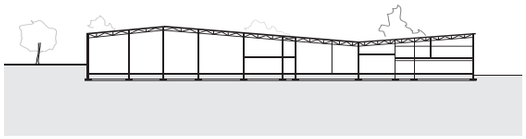
The Dalles, Oregon

Elevation





Plan to Section



Structural

Hierarchy

Statement

The Dalles Middle School, located in The Dalles, OR, was the largest middle school by scale examined as a case study for this thesis. It was designed by architect Heinz Rudolf of BOORA Architecture in Portland, OR. The newer 2002 building replaced the earlier 1955 school that had been built to accommodate a sudden influx of students during that year brought on by the construction of the nearby The Dalles Dam (Oregon Office of Energy, 2002). Today, the building has a LEED Gold certification.

The building is 96,000 sq. feet between two floors and sits on a 13-acre site. The school is primarily steel and concrete by construction, with a gently pitched roof that collects rainwater. The concrete walls are stained to reflect the basaltic natural colors of the area. A very noticeable feature along the lengths of the building are the light shelves that divide the glazing of the building, designed to enhance daylighting for more internal spaces (Oregon Office of Energy, 2002).

Programmatically, the building in L-shaped and divided into two wings connected by a large commons area. Two dominant corridors intersect at the annex of the building and provide the primary channel for circulation. The southern wing, closest to the hill slope, consists of the gymnasium, some classrooms, kitchen, storage, and maintenance shops for the athletic fields directly to the north. The northern wing of the building contains the majority of the classrooms, offices, the auditorium, labs, etc.

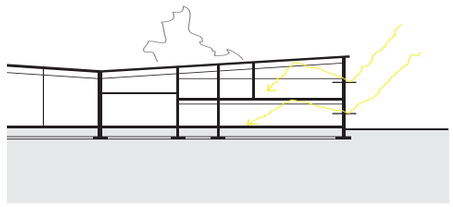
Case Study Images: Figure 4-1

Research & Analysis

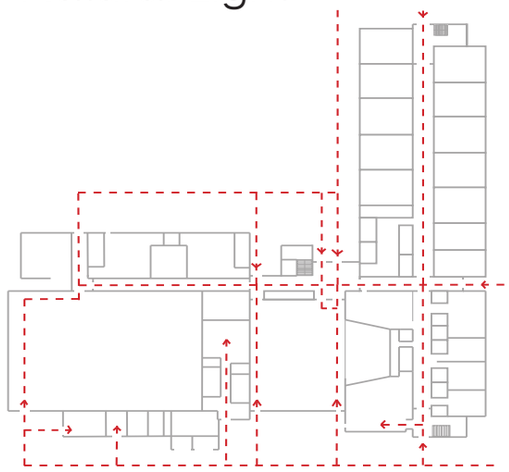
The site was the location of the original middle school (reused for its desirability) and was a challenging piece of land to work with, particularly due to the fact that it was at the bottom of a slope that was prone to landslides. After the site was stabilized in the 1980's by means of a project unrelated to the current school, the same water that caused the landslides is recovered and used geothermally by heat pump/sink to both heat and cool the building (Oregon Office of Energy, 2002). Like the other cases, The Dalles is a school that has taken special initiative to respond to its environment. Oregon remains a leader among the states in terms of sustainable design being exemplified in public institutions. Students of The Dalles are able to see sustainable strategies at work in their facility. However, unlike students in the other two case studies, they are not as actively involved with sustenance practices (essentially, the building does the work for them.) The practices of natural daylighting and natural ventilation are of special importance to Oregon and other Pacific Northwest states.

Conclusion

This particular school has several unique parallels to this thesis - very similar size to the new school needs, and the case's history had the motivation of a near-by project that resulted in a large influx of students, prompting a haste and poorly-planned solution sixty years earlier. In this case, the school district elected to reuse the challenging site and devised it to work to their benefit. Not abandoning the site, in a new way, reflects responsible adaptation.

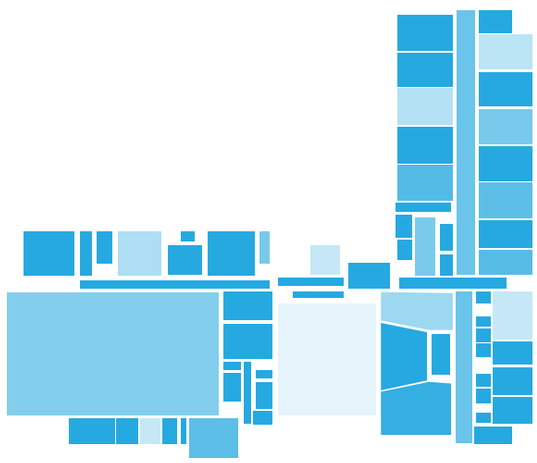


Natural Light



Circulation

Massing



Geometry

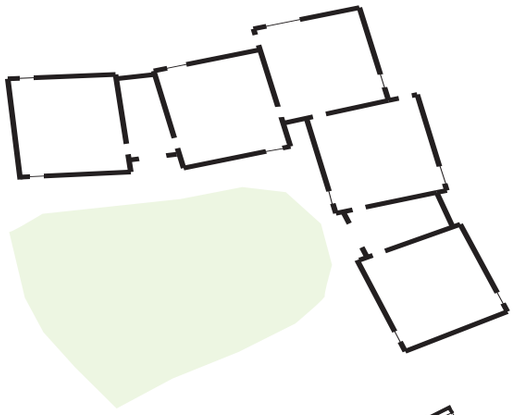
Case Study Images: Figure 4-2

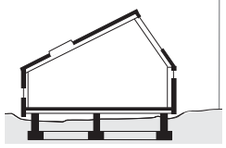
Case Study 3

Dartington Primary School

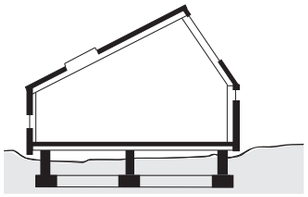
Dartington, Devon, United Kingdom

Elevation





Plan to
Section



Structural

Hierarchy

Statement

Of the three case studies, Dartington Primary School in England is perhaps the most unusual, certainly the most unorthodox by design standards. At a glance, it bears very little resemblance to a typical primary school. However, at heart this project was intended to make significant bounds in demonstrating to students proper sustenance practices and responsible material composition. It exemplifies modular construction for a large scale school project.

Designed by White Design Associates, the project was completed in 2009. The school facility is spread out over several acres, with four primary clusters of connected classrooms and related elements, all of pod construction. The project is orientated to the south. A larger non-pod building on site serves as the cafeteria and kitchen, with some offices. Between-spaces throughout the school grounds contain assembly areas, playgrounds, gardens, tree-covered seating, and circulatory sidewalks (Sustainability in Practice, 2009).

Each pod has a distinctively pitched roof with photovoltaic panels on the south face, and a clerestory on the north for natural daylighting purposes. By construction, each pod is its own structural unit and facilitates an inherent ease of assembly. The dominant material is wood - timber panel construction with extensive insulation and wood panel cladding for the exterior skin of each individual pod (Sustainability in Practice, 2009).

Case Study Images: Figure 5-1

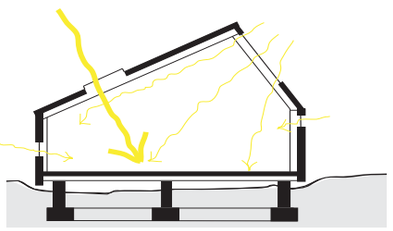
Research & Analysis

In England, there is growing concern about responsible land development and the utilization of passive strategies in all economic sections. Schools are serving to help guide the way. How newer generations perceive sustainability is also being examined, and its importance considered. Teaching by modeling is becoming increasingly prevalent in the public realm, and student involvement in school function is also being modified.

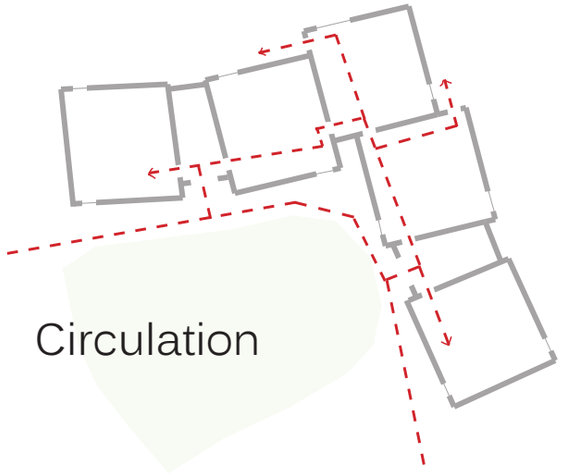
Like the other case studies examined, the built school environment here is designed as a reflection of these values (new as they may be), and the school building itself serves as a significant part of the model. The hope is to educate students at an earlier time in their lives about the importance of proper sustainable practices so that the students consider them as the norm and become active participants by choice more than anything else. In that way, they see their role as being part of the solution.

Conclusion

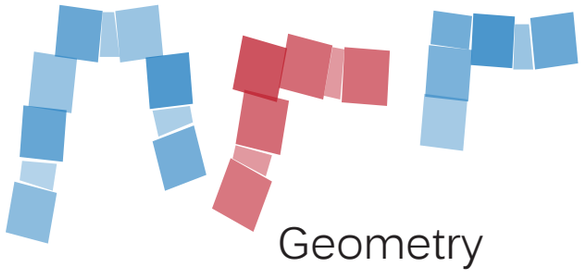
The pod composition of the facility serves for a special adaptability for enrollment fluctuation (though not at as drastic or significant of a scale as this thesis project's setting.) For this reason in particular, this case was chosen to demonstrate the need for adaptation to be itself a sustainable practice.



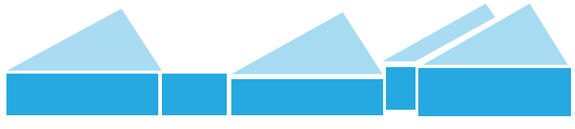
Natural Light



Circulation



Geometry



Massing

Case Study Images: Figure 5-2

Introduction

Every one of the preceding case studies that were examined provided their own contribution to this thesis, as well as ideas for how to proceed. All of them also reinforced the initial ideas set forth by the theoretical premise of this thesis. Two of the cases (Hood River and The Dalles Middle Schools) were located in Oregon, a place where significant attention is being directed to how public environments - not the least of which are schools - respond to their natural surrounding conditions, the materials used for their construction, and practices used for sustainability. The two schools evaluated in Oregon are active examples of environments that, working with the teaching faculty, serve to model sustenance to the student body. On the other side of the world in England, the Dartington Primary School provides a unique understanding of structural adaptability that remains permanent as long as is deemed necessary. This, too, reinforces the theoretical premise.

For these cases, the methodology for accomplishing sustenance modeling ranges from providing students with a passively-built environment were their inclusion in upkeep and functioning is essential, to simply providing a school environment that showcases sustainable strategies and sets itself apart from the normal connotation of what a middle school is within the greater community.

Analysis

Each of the case studies underwent a visual analysis of both form and function. Plans and sections of the buildings/spaces allowed for examination of appearance, internal and external circulation, hierarchy, structural configuration, and the manner with which the facility utilized natural daylight. Additionally, study was done regarding the basic building form by means of generalized massing and simple geometry.

Conclusions

The case studies all reinforced the initial ideas of the theoretical premise for this thesis project, and all provided a unique contribution to the overall meaning of that premise. Methods of teaching sustenance to students were similar for two studies (Hood River and Dartington.) This fact is a reflection of the shifting attitudes of local and national governments with regard to what sustainability means to students, and how such practices are taught. The sites were all unique, and The Dalles situation was particularly admirable as it elected to use a difficult site to maintain community connection. The Dalles also represents a project that was influenced by drastic enrollment increase, which is similar to this thesis. The other situations basically involved adding to an existing institution. Dartington Primary had, at least by concept, the most unusual layout for a school facility, and that very anomaly is what sets that school apart in terms of providing for flexible adaptation for the future. That school provided a very similar approach to classroom addition/subtraction as will this thesis, though with very different environmental and socioeconomic conditions. The core concept, however, remains strong and provides some new emphasis to the theoretical premise.

NARRATIVE

Introduction

This thesis project is being located in an area of what may be considered "graceful seclusion." The distance to the largest city in the state (Billings) is 270 miles. There is an interesting dynamic in Montana that exists between the flatter, rich agricultural lands of the eastern side of the state, and the rugged, mountainous western side. Metaphorically, the length of Montana east to west can be thought of as a huge crescendo. Likewise the nature of the area, thanks to the abundance of natural resources, has a similar dynamic - one of peace and solitude for most of the time that is periodically pierced by times of tremendous excitement, unrest, strain, violence, and even chaos.

The town of Sidney, Montana sits on the east side of this crescendo. It is a very rural setting surrounded by rich farmland alongside the Yellowstone River, which confluences with the Missouri a very short distance to the northeast. The town shares a strong relationship with my hometown, Williston, ND, which is forty miles away and also to the northeast. Sidney isn't exactly a satellite town of Williston - I've always thought of the town having its own unique independence and identity. The road between the two is very beautiful and all too brief, with the Missouri giving way to the Yellowstone, the very hilly nature of western North Dakota leveling down to river valley, and the natural beauty of the place interrupted only by the shaping of agricultural fields beside smaller towns and, now especially, the reach of the latest Bakken oil boom. It's an area with a paradox nature, seeing both sides of the spectrum: tranquility as well as volatility. It's still beautiful, though, with treelines breaking the fields, small towns along the way, the occasional house visible at or near the road, and the lightly brown and gray basin walls building up the immediate horizon, always reminding you where you are.

Truthfully, a person doesn't need to be born here to appreciate it.

Early History

The site context, as explained previously, has a mixed complexion of naturally embedded peace and tranquility, as well as utter turbulence and volatility, such as that felt in present day as a direct result of the boom in energy production. The normal character of the region is that of a rural, agricultural-based and family-centered community. These natural aspects are essential (and gracious) ingredients needed in generating the nurturing atmosphere described in this thesis' theoretical premise.

The area was graced by the Lewis and Clark Expedition in 1804, and is in close proximity to Fort Union and Fort Buford, two historic posts located near and at the confluence of the Missouri and Yellowstone Rivers. Although the town doesn't straddle the Yellowstone River, the waterway has a dominating presence in both the town and the general area. The river sediment has endowed the area with a strong agricultural economy. Sugar beets are the primary crop here, and Sidney is home to a large sugar beet processing plant built in 1925, which remains the largest employer for area residents.

A small town of just over five thousand, Sidney, MT was founded in 1911 and celebrated its centennial in 2011. The town was named after the son of early settlers by a former justice of the peace. The post office was established in 1888, receiving a new building 1987. The local population is—and always has been—proud of their community. The far-east location of the town, very near to the Montana/North Dakota border, lends the town the nickname as Montana's "Sunrise City," one of the first in the state to be graced by the sun each morning.

THE OIL BOOMS

1970's Oil Boom

For Sidney, the late 1970's and early 1980's saw a drastic boom and bust in energy production. Remnants of this past boom, both physical and psychological, are evident in the area today. The 1970's energy boom (shortly after the energy crisis of 1973) was responsible for developing many of the newer sections of town, which includes the subdivision that surrounds the determined site for this thesis project. The boom changed the face of the town as the population grew and local businesses thrived. Much of the transient work force that composed area rig crews lived in man camp conditions in the surrounding area, with available housing in the town quickly disappearing. The schools saw a large increase in enrollment, prompting newer building projects and additions to existing facilities.

The Sidney Medical Center also required expansion, as there was a drastic rise in medical emergencies. Such need for greater medical resources was evident due to many factors which included a rise in crime levels, more car and truck traffic in town and for the servicing of rig locations, and also the dangerous nature of working on an oil rig (at the time, safety conditions were significantly more lax and overlooked, especially in areas of booming production.) Such an increase in oil field-related industrial accidents prompted the town's medical center to enlarge their Emergency Receiving Department. Frank Kratky, AIA, an NDSU adjunct professor in architecture, was working for Fargo-based Foss Architecture at the time, and worked as project architect on the 10,000 square foot expansion of the medical center from 1981 to 1985. He recalls Sidney being (even during that oil boom) a "peaceful, western, small town." Professor Kratky also recalls how, while evaluating the scope of the project during its beginning phases, the hospital administrator at the time described his stressed facility as feeling "like a battleground or MASH unit setting," with "[injured] people being placed in the hallways" (F. Kratky, personal communication, Dec. 5, 2012). The medical center was a facility that felt the full impact of the boom, as is likely in the present due to the rising population.

Bakken Oil Boom (2008-present)

The current oil boom has been in the making for forty years now, with newer technologies allowing for a greater recovery of oil reserves. The formation is named the Bakken, after an area farmer. It is part of the Three Forks Group, which contains additional (and perhaps even greater) reserves of oil. The crude that is extracted, though difficult to drill for due to the nature of the Bakken shale, is considered generously rich in refinement. This has already been declared to be the single greatest discovery of oil in forty years, with as much as 24-25 billion barrels recoverable. The year 2008 can be considered a marker, as that year production began its newest increase in the Williston Basin, located in the heart of the Bakken Formation. Since then, each year has seen increased drilling and economic development (Geology.com, 2008).

Like other communities that benefit and suffer as a direct result of the effects of oil booms, Sidney residents perceive the current Bakken boom as a mixed blessing. Whether the pros outweigh the cons varies by person and experience. However, like in the nearby community of Williston, most area residents remain cognizant of how damaging such a boom can be to their community if appropriate planning actions are not implemented in a timely sequence. While the local economy (in this case, Sidney's) has been strong and robust during an otherwise deep nationwide recession, the town's essential faculties are being stressed just as they had been in the previous oil boom. Water, sewage, waste management, crime rate, and housing are all being impacted. Businesses, though booming, are having a difficult time attracting workers, as they often can't compete with the wages of oil companies. This problem is not reserved only for the private sector, however. City government, services, and education are all feeling this strain.

Just like local businesses, area schools are growing. This fluctuation of enrollment requires a different (and even more careful) approach to planning so as to not overbuild or underbuild.

Historical Context

Sidney has its own history and experience with oil booms. For a larger case study into the detrimental effects of an oil boom, Sidney only needs to look at Williston, ND. That town is currently experiencing the same growing pains as Sidney, only on a larger scale and with more diverse situations.

During the 1970's oil boom, Williston's population exploded in a manner similar to that of the present boom. All elements of the town felt the strain, and expansion was inevitable to provide housing for the new population. Also like the present boom, the 1970's oil boom was considered permanent, and many planning decisions were made based on that assumption. Case in point: the Pheasant Run Subdivision located to the northwest across the west bypass in town. This large housing development consists of a combination of townhouses, apartment buildings, and a trailer park. As one of the primary projects to house the new population, its scale was consistently expanded and overbuilt. In the early 1980's, with the bust of that oil boom, virtually the entire subdivision was left standing unoccupied as the city's population dwindled back down to 12,000. The failed project left the city of Williston in debt for more than a decade afterward. Today, the subdivision is now fully occupied and under further expansion. However, its earlier history serves as a cautionary tale for the city council, who have paid more attention and consideration to future development requests. As of 2012, with the immense population increase in Williston demanding new city expansion projects, that caution is actively being sidelined.

In Sidney today, there are several new housing developments underway, mostly expanding the town to the north. As these large tracts of land are being developed for housing, appropriate and responsible planning action is called for. For the new middle school, presently being proposed for a site in the original northwest subdivision on unannexed land, city growth may be further expanded as housing develops directly adjacent to the school district's desired site.

The Future

So what will the future be like for the Bakken region in five years? In ten? In twenty? Sadly, most of what is being built there is done so with the mentality of, "I want it to cost as little as possible, and be built by tonight." That mentality often sacrifices sufficient design as there isn't adequate time for proper and meaningful planning. The structures are often not very adaptable, and are not long lasting.

Williston is presently ground zero for the energy production boom, with hundreds of national companies locating (or at least attempting to) within the area. Most incoming companies and transient workers have no connection to the area, and no desire to forge one. My thesis isn't being directed to change that and, frankly, I personally don't consider that fact to be a problem or have a viable solution. For example, if a person is from Louisiana working a rig in North Dakota as a job, and their entire family remains down south, and they have no connection to the area whatsoever, chances are they'll return to Louisiana. However, there are cases where entire families relocate and intend to stay. More families mean more children, which require facilities built or expanded to educate them.

Today, the community of Sidney is at a crossroads. Despite the increase in oil production and population, the town still retains its small town feel and emphasis on agriculture. The boom has brought both good and bad elements to the area. Roads and streets are seeing far more traffic than they were originally designed for. Housing is scarce, and renters in both of the described towns are seeing ever rising rates. Crime has also risen - national attention was focused on the town of Sidney briefly in the spring of 2012 with the abduction and murder of Sherry Arnold, a local teacher at Sidney High School.

The situation isn't hopeless and eventually will stabilize. Solutions are demanded right now, but need appropriate consideration for the future. For the most part, area residents in both Sidney and Williston know better than to consider a boom "permanent," or even "long-lasting."

Academic

I am developing this thesis to fulfill the education requirements for a Masters of Architecture degree, as set forth by the NDSU architecture program and the NAAB. The thesis project is something that I, as a student, have been anticipating for the past four years. Over that time, there were instances where I assumed I understood the scope of such a project, and other times where I had to push off thoughts of it to focus on the present, as it all seemed too overwhelming. I want my thesis project to have a solid solution in its final design, but perhaps even more important to me now is the lengthy process necessary in getting there. For me, it took my entire time in architecture school to fully appreciate the importance of process to any project, and I want the documentation and contribution of such process to be an extensive and visible element in my thesis work. I do see the thesis project as the culminating and comprehensive project that it has been defined to be, and I want to use this project to show everything that I've learned throughout my time in architecture school. I also intend to develop a thesis project that emulates my view of what architecture is, and what it means to people. To me, this discipline is one that does its best work without people necessarily even noticing it. My project involves a school, which I see as an incredibly formative environment in virtually every person's life. The goal here is to give this typology the holistic attention that it deserves and demands.

Professional

After graduation in May, I intend to start my IDP internship and study to take the licensing exams. My goal is to eventually become a licensed architect and discern a specialty. I would like to start working, and I presently have no desire to further my education (though that may change someday.) The thesis project that I leave in the Institutional Repository is something that I want to be able to look back at proudly, knowing that I didn't take it lightly and that I did the absolute best to my ability. Perhaps it may even help get me a job. Regardless, I intend for my thesis to be meaningful and carefully developed with the perception that each design decision can have an impact, whether immediately or in the future. I believe such perception is valuable and necessary in the workplace.

Personal

My personal goals for this thesis are simply to demonstrate the necessity of architecture, where its subtle and inherent contributions may be its most valuable. People always have had a connection to the built environment that surrounds them, and therein lies the importance of architecture - not as the showy, stylistic and high-society past time that it often is misrepresented to be, but rather as the very human practice that started with devising a shelter from the elements. To me, subtle architecture is the best architecture, where the things that you don't see somehow make all the difference in the world. Meaning, integrity, function, flexibility, adaptability, and sustenance for the future are what I want this thesis to show.

Narrative

Fig. 53a. "Separated Trees", Fargo, ND

* The separated trees that mark the east-side start of the site.

As has been previously mentioned, the site for this thesis project is located to the NW in Sidney, MT, on unannexed land surrounded by an existing residential development. Street and utility connections terminate at certain points around the site, though they can be made easily accessible to further development on the site.

When I visited the site for the first time toward the end of September 2012, the Sidney Superintendent of Schools, Daniel Farr, took me to the site and explained how the school district wanted to expand eastward on the piece of land within the site that it currently owns. My first impression of the site was that the land seemed to be wasted - it was surrounded by single family homes that almost radiated outward from the site's center point. The terrain of the site transitions from somewhat flat and level on the east side to a sloping increase on the west end. There is an elevation change of approximated 60 feet from one end of the site to the other. The vegetation of the site consists mainly of field grass with a perimeter of both coniferous and deciduous trees. I used two such trees that were separated from the perimeter to mark the east-side start of the site.

Fig. 54a. "Site Center", Sidney, MT

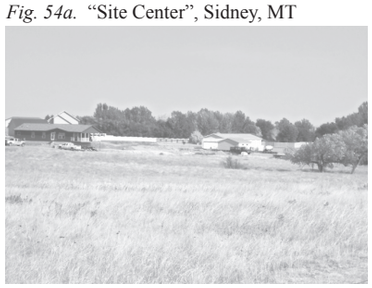


Fig. 54b. "Graded Pad", Sidney, MT

Fig. 54c. "NE Corner", Sidney, MT

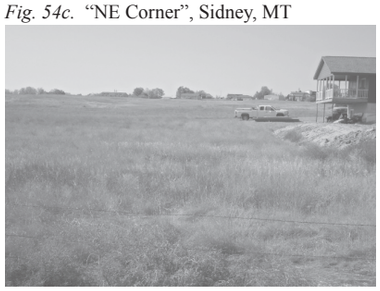
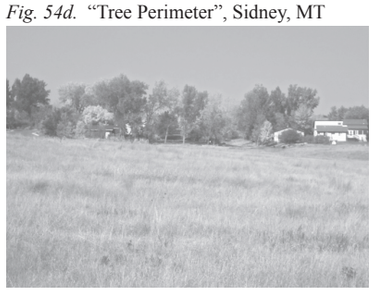


Fig. 54d. "Tree Perimeter", Sidney, MT



The ground of the site showed signs of erosion brought on during periods of heavy precipitation, and the ground contained tread tracks from ATV transit. Wind plays on the site in a manner that conforms to the sloping topography, where the wind practically "holds on" to the land as it transits the site, most often from the northwest or west.

The surrounding subdivision is experiencing a change in population, just like the rest of Sidney. New homes and shop buildings are currently under construction, particularly to the north and east. Directly adjacent to the site on the east, there was a new shop being built, which added an extension to an existing city street (named Sage Lily Drive) that will, eventually, cross the unannexed void and connect to the opposite side at another street extension called Mission Canyon Drive. This would provide direct access to the site from the south (which goes along well with the future building's intended orientation.)

At present, besides the new surrounding construction, the site's south side is undergoing new grading and leveling, most likely for the purpose of the previously mentioned street.

For sure, the site has tremendous potential. Placement of a large school on the site needs to be done in such a way to enhance the experience and utilization of the land while contributing to its stability.

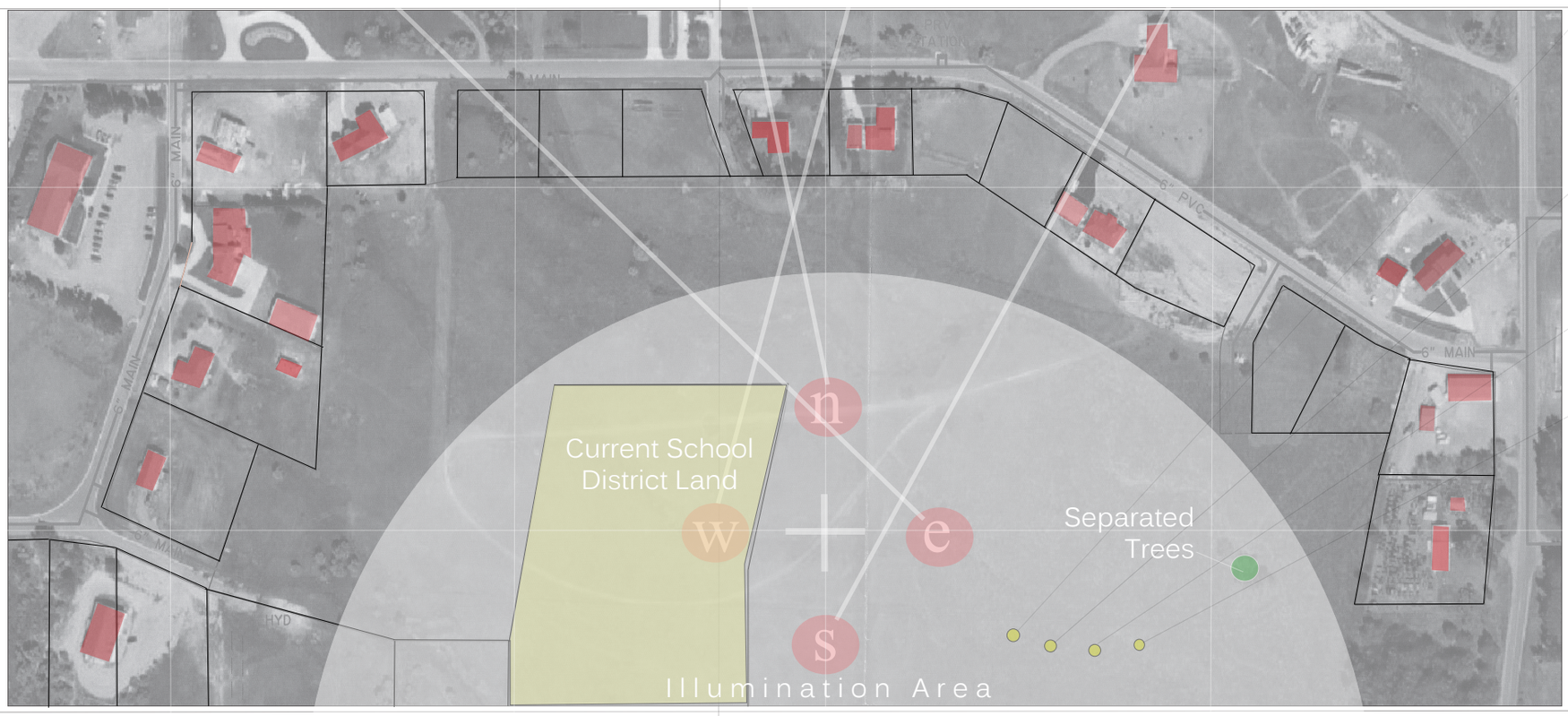
Site Analysis

Fig. 55a. "East", Sidney, MT

Fig. 55b. "North", Sidney, MT

Fig. 55c. "West", Sidney, MT

Fig. 55d. "South", Sidney, MT



Photogrid: Figure 6-1

Photogrid

North
South
East
West

Built Features

The site is located in the middle of a residential subdivision, with single-family homes bordering on all sides. There are several existing extensions for street connections to serve as access to the center of the site.

Fig. 56a. "Sun East", Sidney, MT

Fig. 56b. "Sun South", Sidney, MT

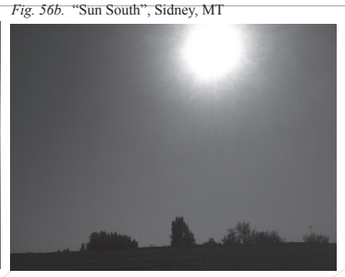


Fig. 56c. "Sun High", Sidney, MT

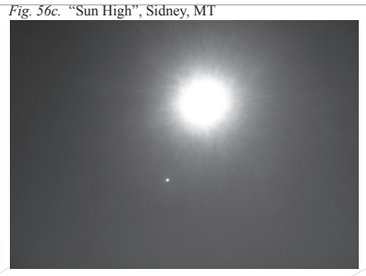


Fig. 56d. "Sun West", Sidney, MT

Light Quality

Vegetation

The site is basically a grassy slope composed mostly of Buckwheat and wheat grass. There are few trees on the site itself, though they form somewhat of a perimeter along the edge of the site on neighboring properties. Trees include: Rocky Mountain Juniper, Peachleaved Willow, Cottonwood, American Elm and Plum, and Green Ash.

Wind

The dominant wind direction is from the NW, and flows over the site uninterrupted until meeting the perimeter trees (and residences.) The wind seems to curve with the contours of the land.

Fig. 56e. "Distress", Sidney, MT

Distress

There is some distress evident throughout the site, particularly in the form of dead deciduous trees collected into brush piles. Much of this was likely cleared during the new grading.

Soils

Fig. 57a. "Soil", Sidney, MT

Lihen Loamy Sand 4 - 15 % Slope
Depth: 80+ inches
Well Drained

Tinsley Soil 15 - 65 % Slopes
Depth: 80+ inches
Excessively Drained

Topographic Survey

Site Section: Figure 7-1

Human Characteristics

Apart from the surrounding housing development, the site currently has some new grading underway on the south end.

Site **Character**

Some erosion is evident at the SE corner and along parts of the perimeter, likely brought on by heavier precipitation.

Drainage

Water drains down slope over the site toward the Lower Yellowstone water project on the east boundary of the subdivision. Eventually, this water drains into the Yellowstone River.

Fig. 58a. "Grading-1", Sidney, MT

Fig. 58b. "Grading-2", Sidney, MT

Base **Map**

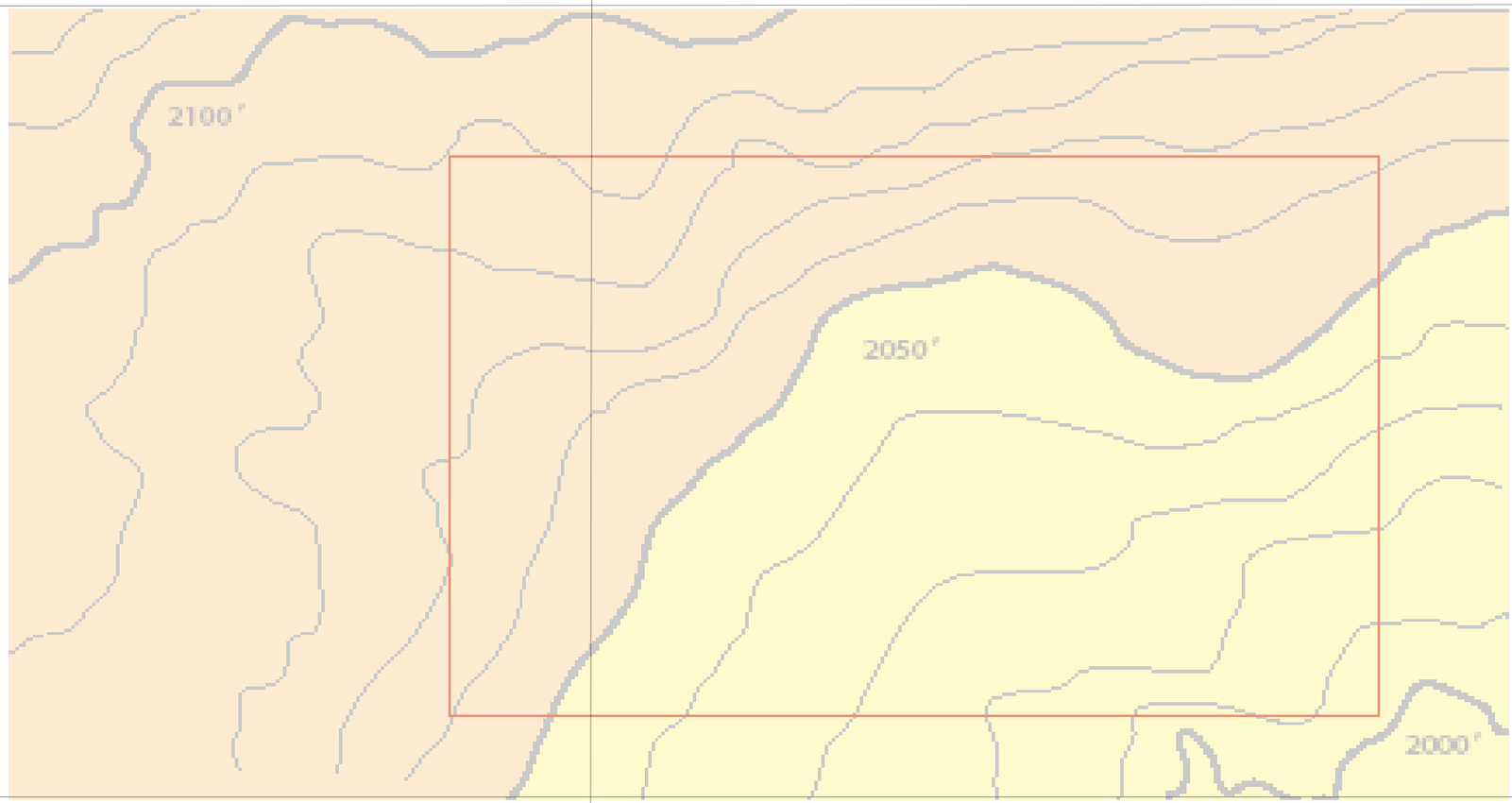
Base Map: Figure 8-1

Utilities
Pedestrian Traffic
Vehicular Traffic
ATV Trails
Wind Direction
Boundaries

Project **Climate** Data

Slope Analysis
Topography
Shading
Temperature
Humidity
Precipitation
Cloudiness
Wind Rose
Sun Path

Slope Analysis



Slope Analysis: Figure 9-1

	Loamy Sand	4 - 15 % Slope
	Tinsley Soil	15 - 65 % Slope

Topography

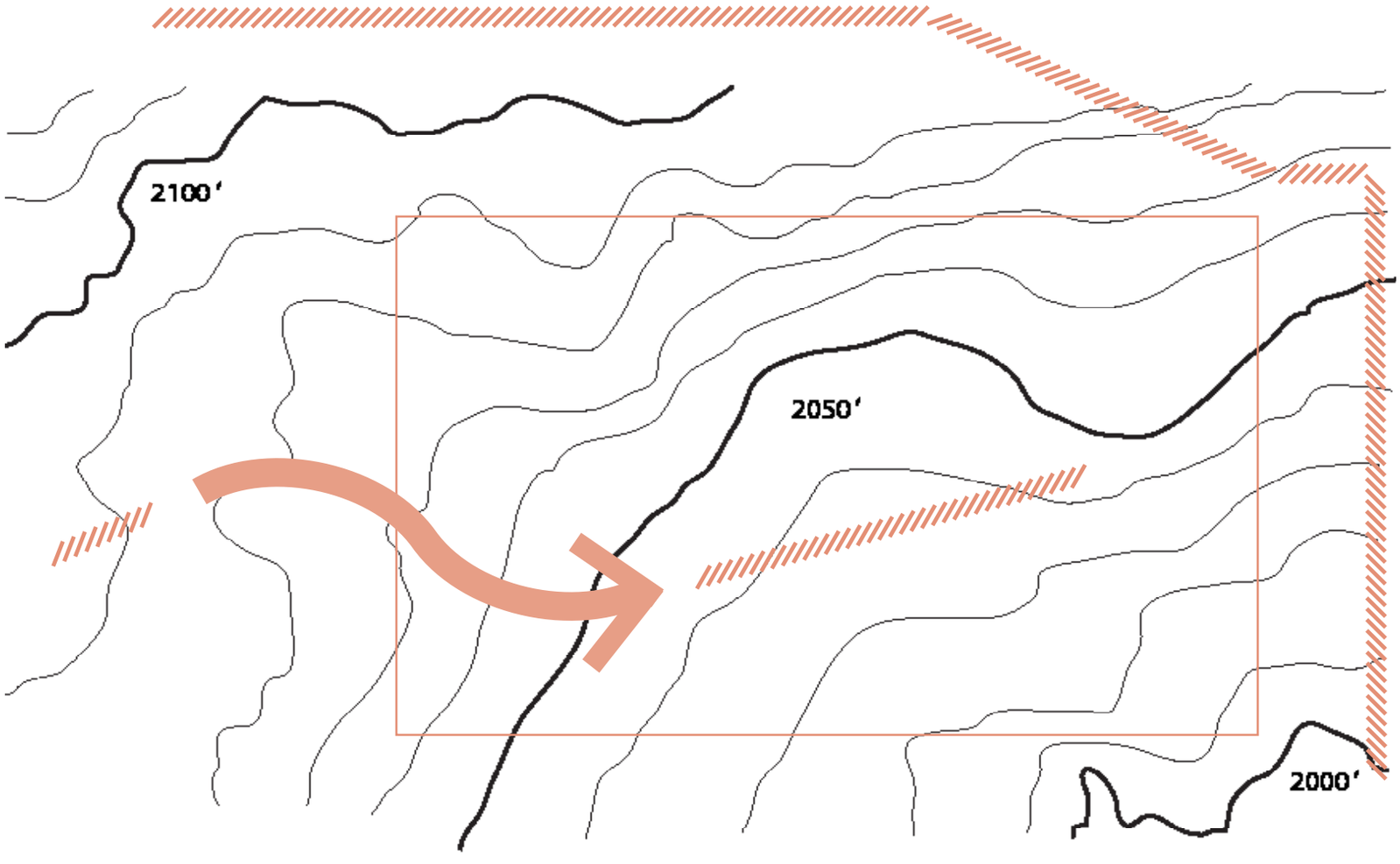
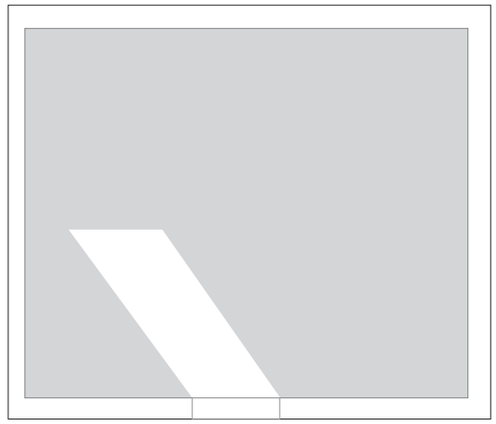


Figure 10-1

Noise

Air Movement

Shading



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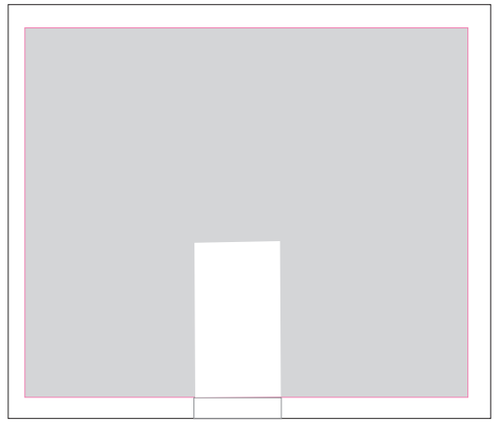

Figure 11-1

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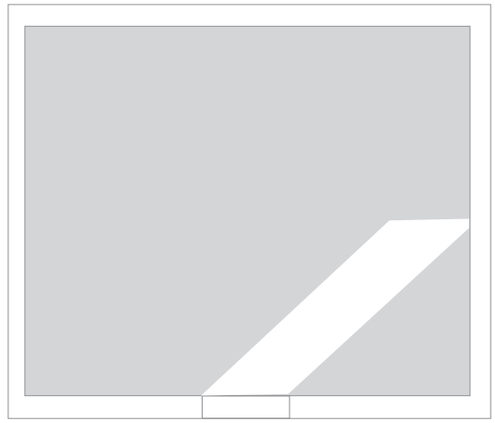

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Temperature

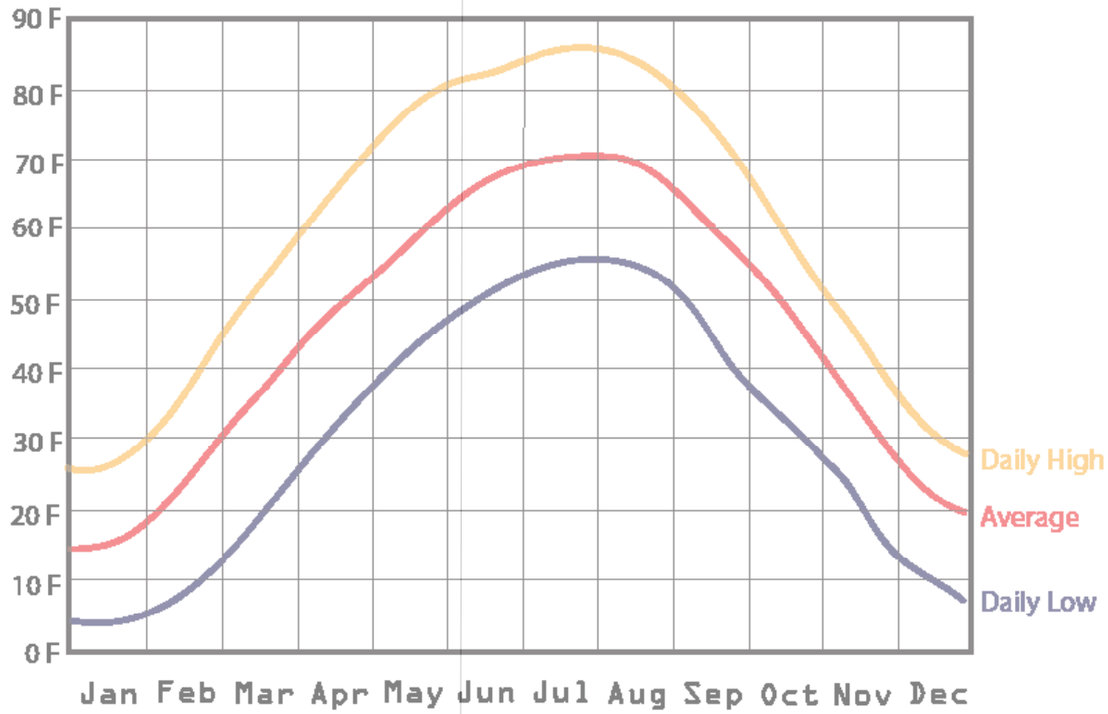
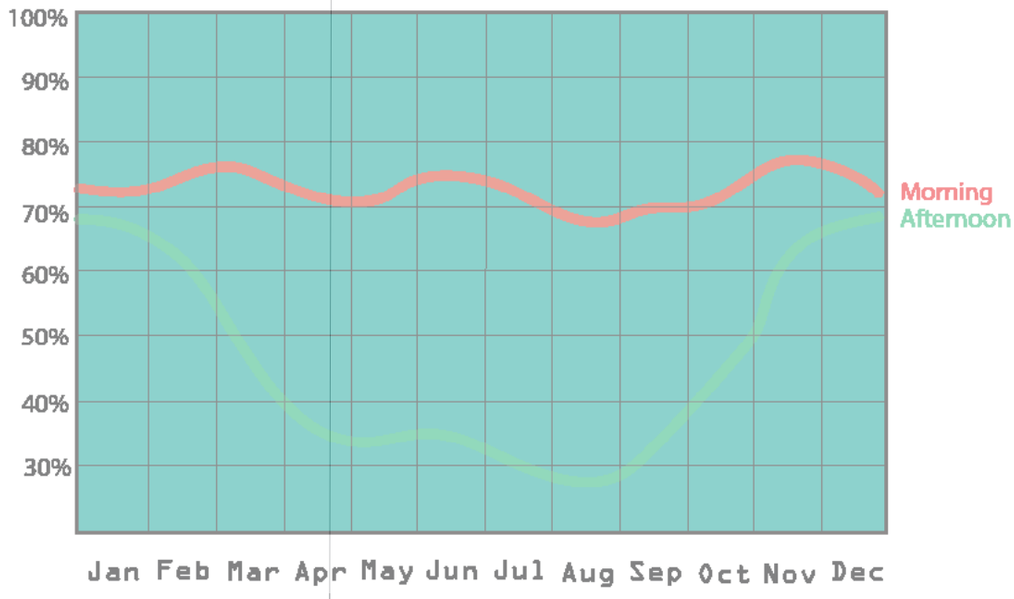
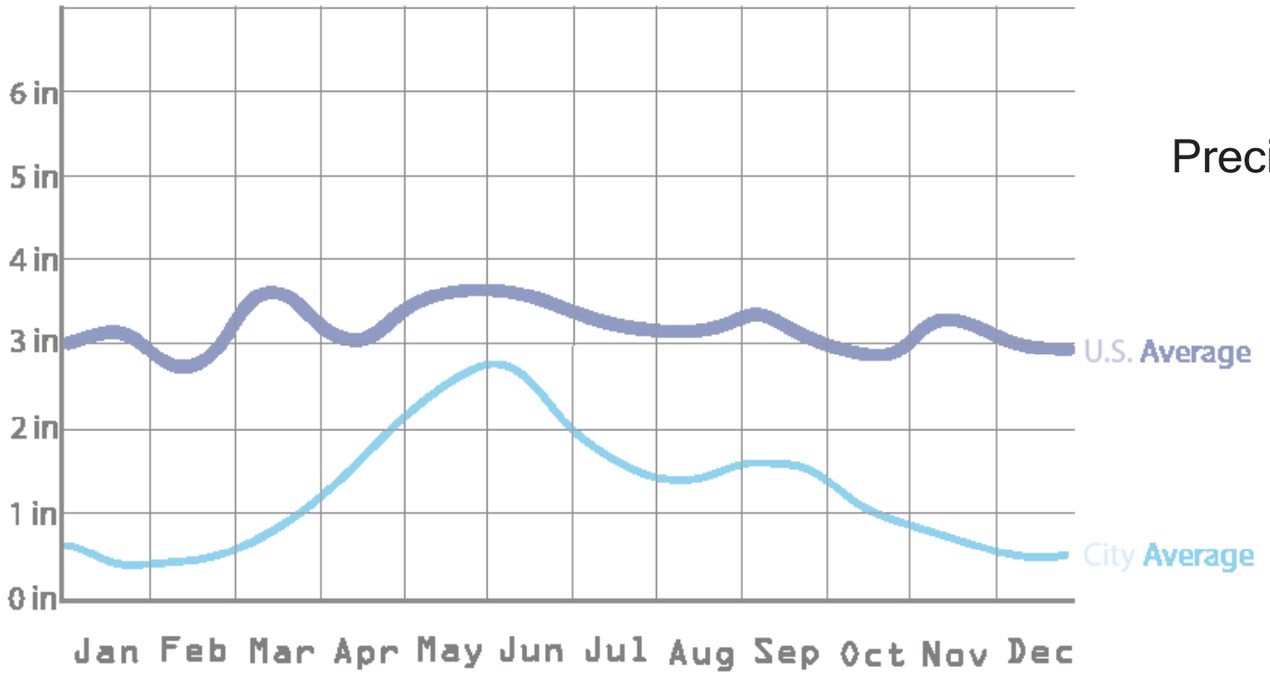


Figure 12-1

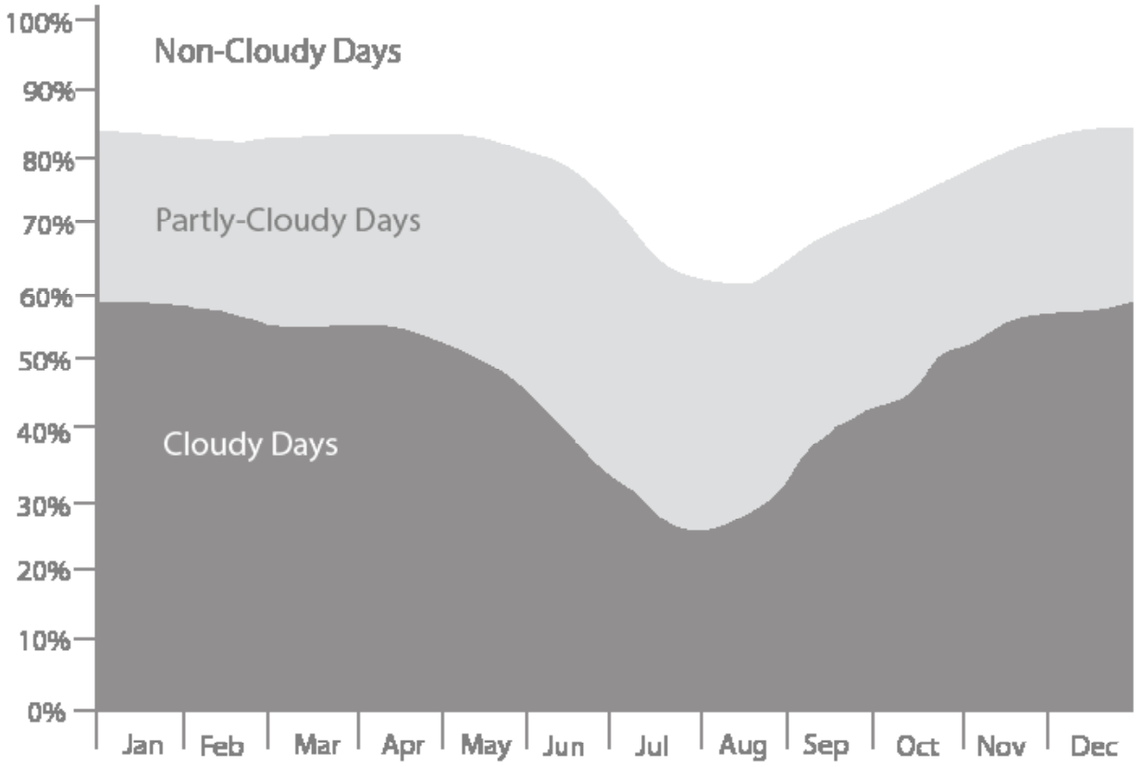
Humidity



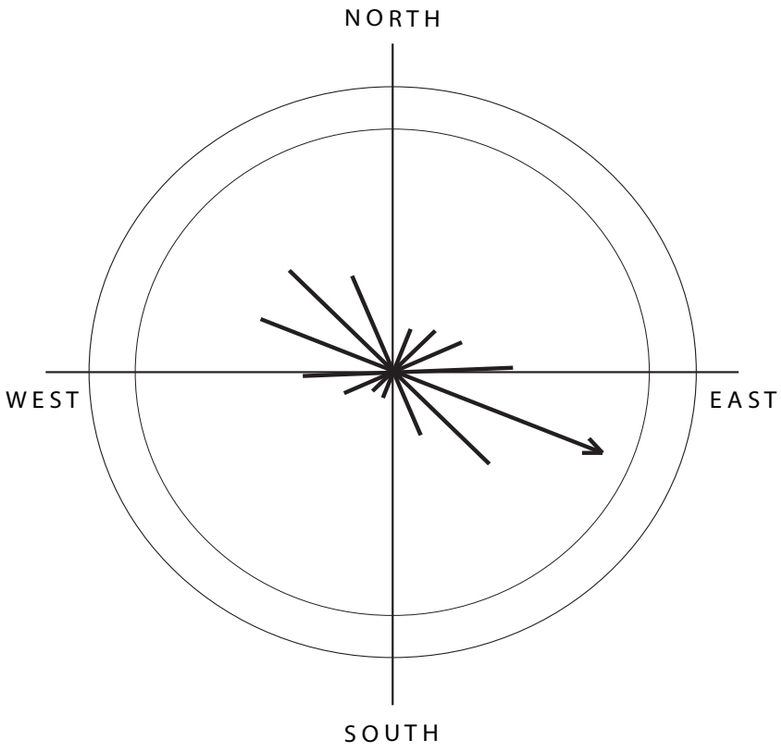


Precipitation

Figure 13-1

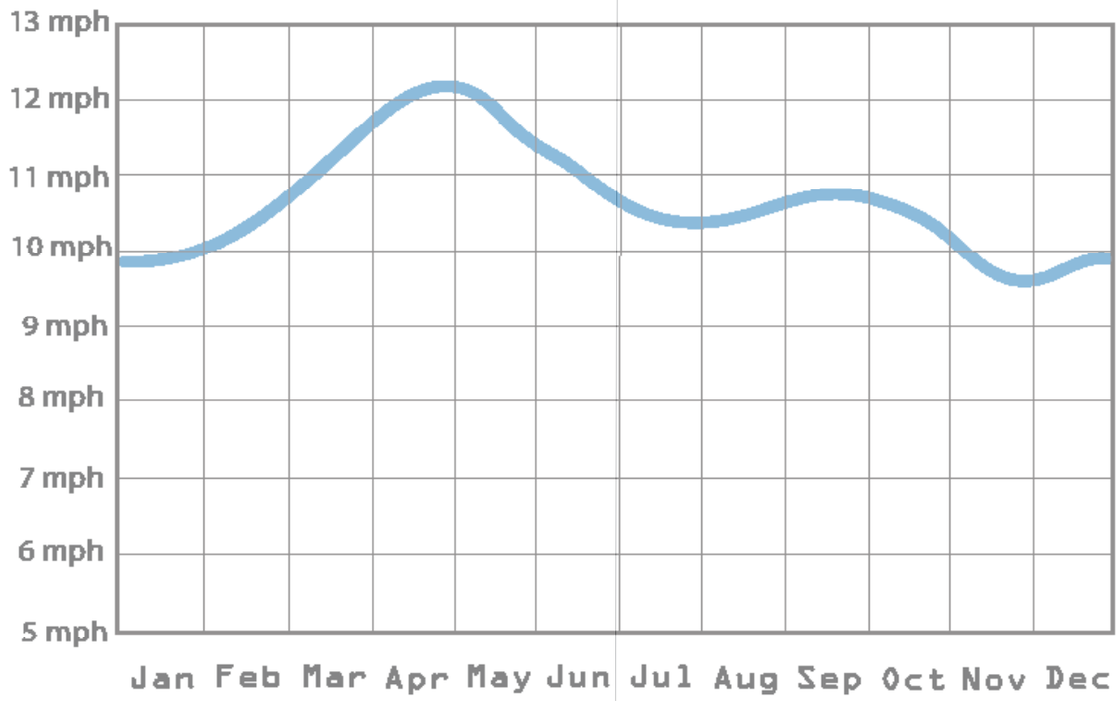


Cloudiness



Wind Rose & Speed

Figure 14-1



Sun Path

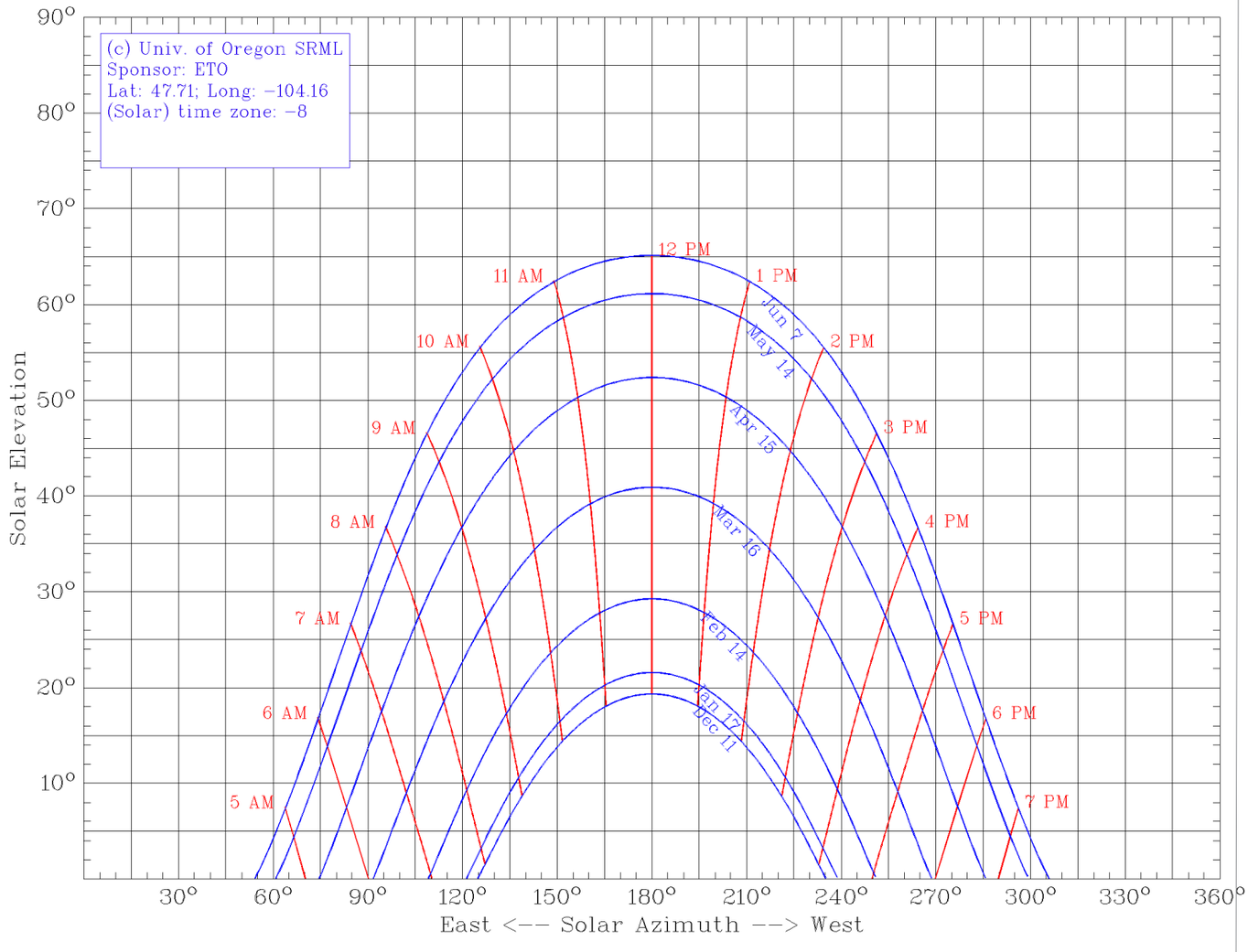


Figure 15-1

Space Allocation

The facility spaces are considered to be a combination of permanent and non-permanent (adaptable) building elements, depending on their unique functions.

- Denotes adaptable building elements
- Denotes permanent building elements

Sq. Feet	Space
21,000	**Classrooms**
1,050 ea.	20 Total (Grades 6-8)
9,350	**Gymnasium**
900 ea.	Locker Rooms (2 total)
1,200	Weight Room
-	Retractable Seating
2,304	Balcony Running Track
2,800	**Cafeteria** (separate from gym)
800	Kitchen
210	Food Storage
2,800	Green Roof (over Cafeteria)
1,230	**Library**
900	Computer Lab
2,200	**Restrooms**
733 ea.	Three Primary Sets
2585	**Administration Offices**
530	Main Office (with Records Room)
165	Counselor
180	Principal Office
165	Assistant Principal
165	Special Education
60	Isolation Room
320	Meeting Room

Programmatic Requirements

Sq. Feet	Space
1,000	Staff Lounge/Work Room
2,600	Music Rooms
1,500	Band
1,100	Choir
7,740	Mechanical/Custodial
7,500	Main Utility Room
120 ea.	Satellite Rooms (2 total)
20,476	Circulation
	Corridors (Tornado Shelter)
	Stairwells
	Elevator(s)
	Exits
	ADA Ramps
6,200	Auditorium
4,200	Vocational Ag.
800	Science Lab
89,741	**Total**

Additional Spaces:

- Parking Lot
- Athletic Fields (to the North)
- Center Courtyard
- Study Spaces
- Bike Storage
- Entry Walk

Interactive **Matrix**

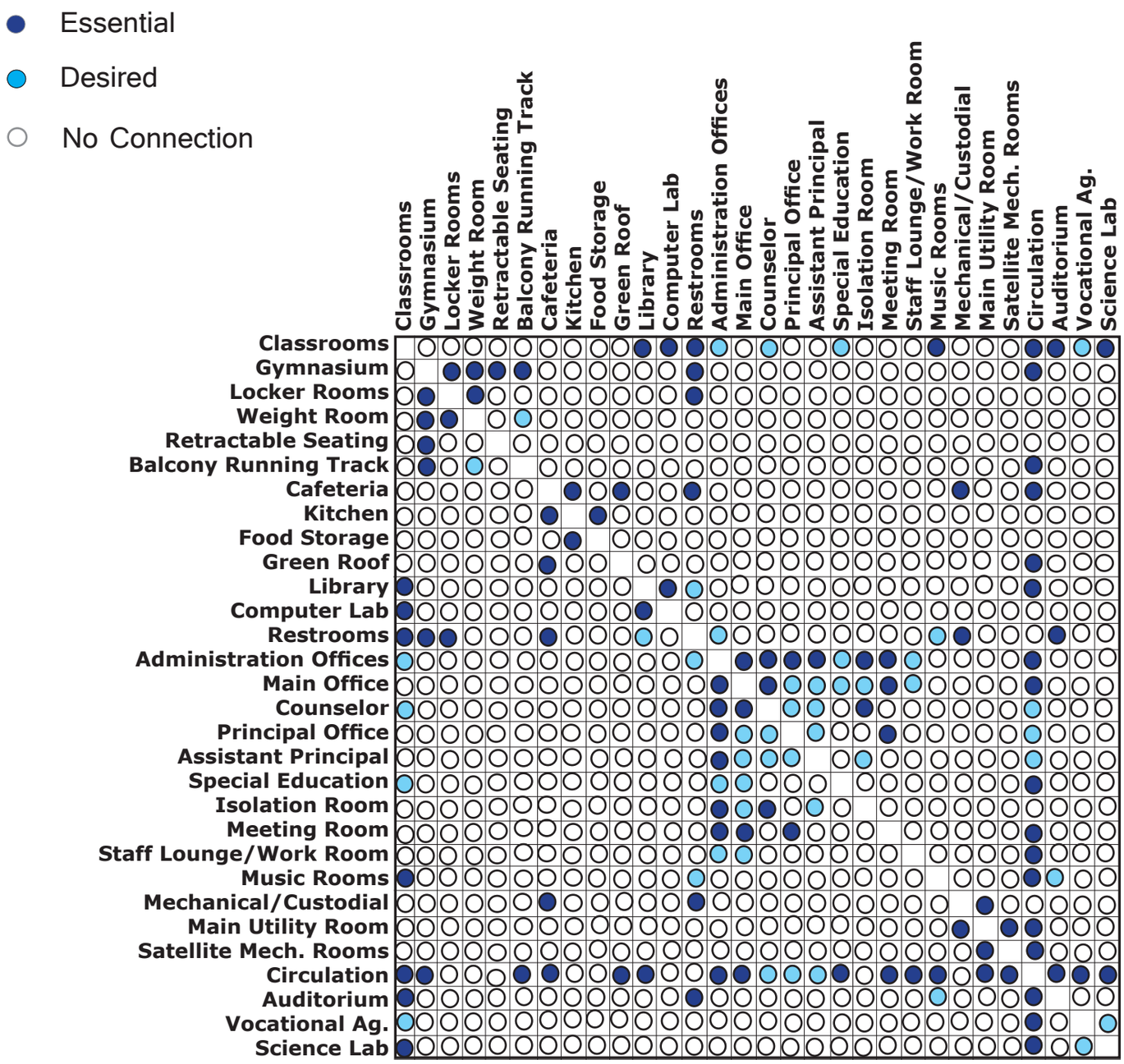


Figure 16-1

Public
Private
Work

Formal Connection
Informal Connection
Casual Connection

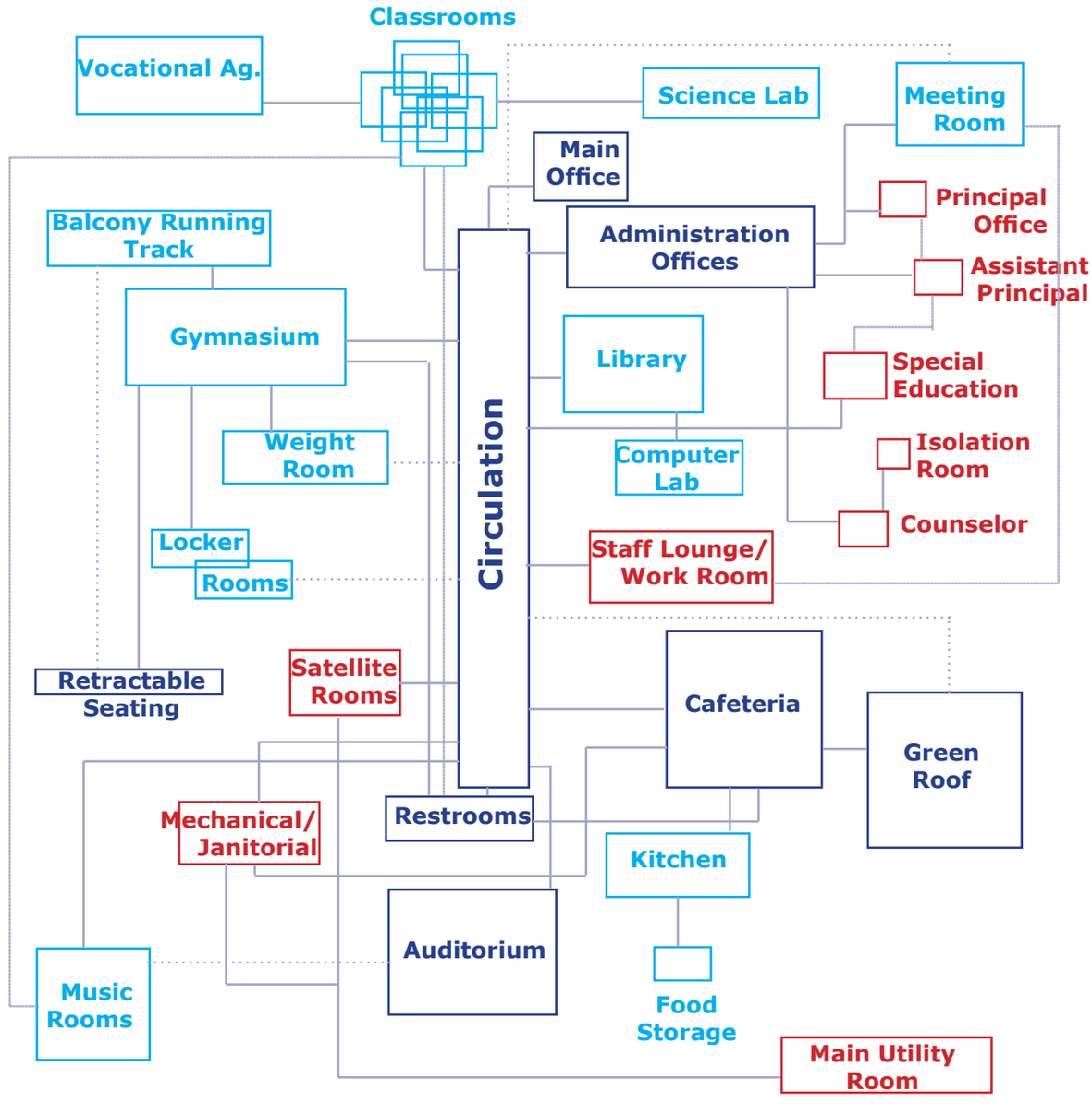


Figure 17-1

Nurturing Sustenance

Sidney Middle School
Sidney, MT

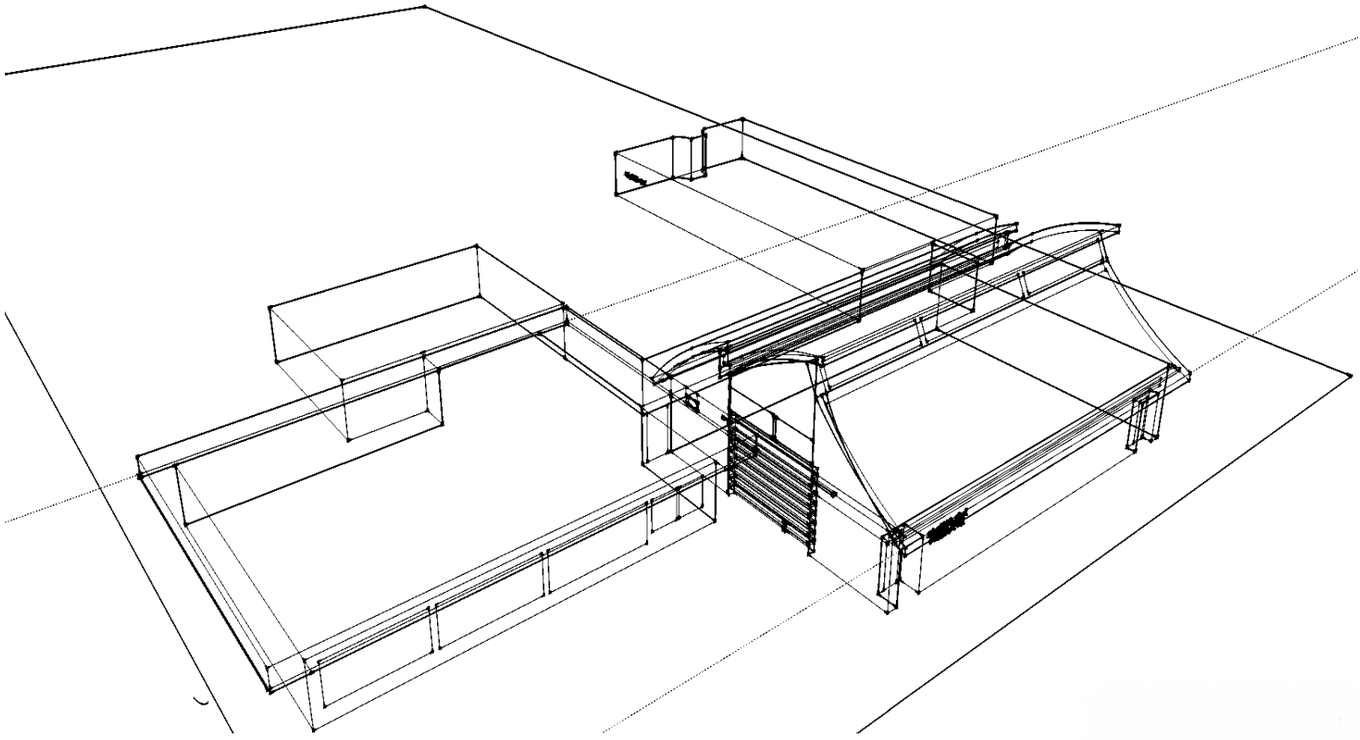
Dominic Monson

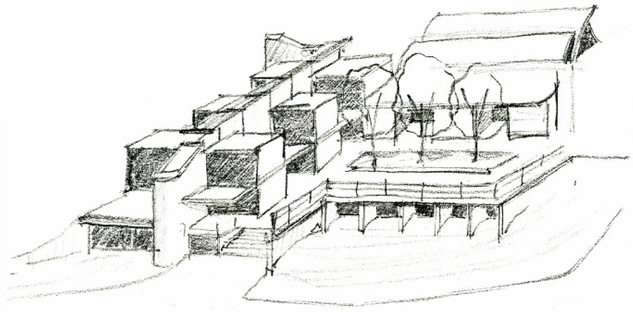
Design **Process**

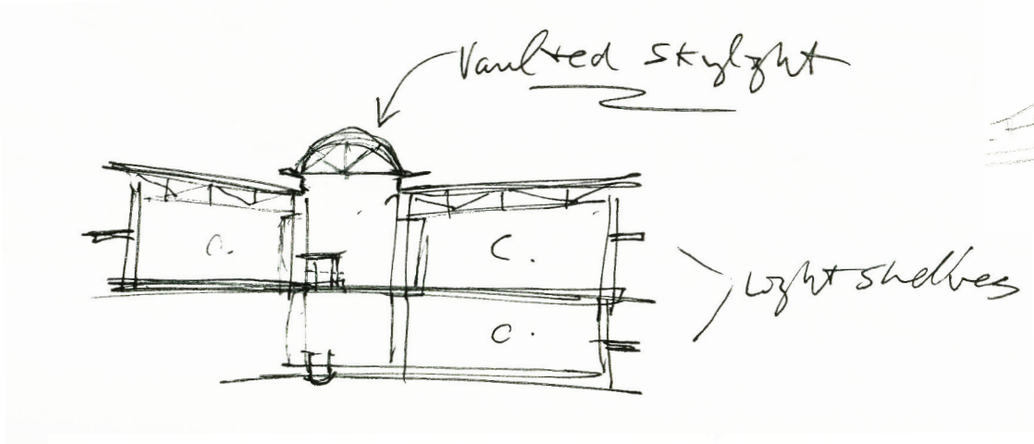
Like most thesis designs, this particular project had a very lengthy design process, with many different ideas being tested, evaluated, integrated, and subtracted. The following pages show key moments in the design process beginning with the preliminary form study of the spaces and ending with structural specifics.

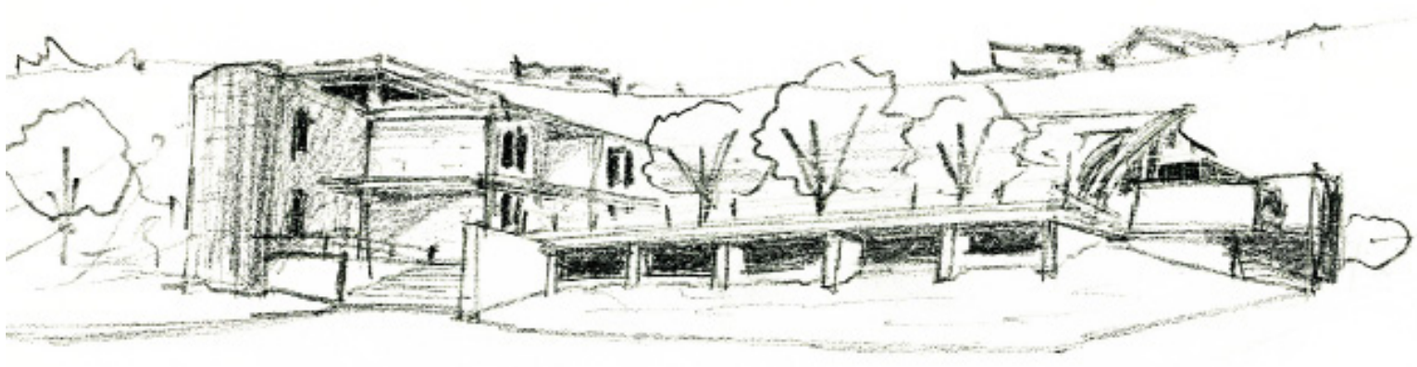
One of the most important aspects of the design - which required continuous revision - was the building's layout. The floorplans and their scale were subject to change right up to the end of the process, when all circulation elements and programmatic spaces finally came together.

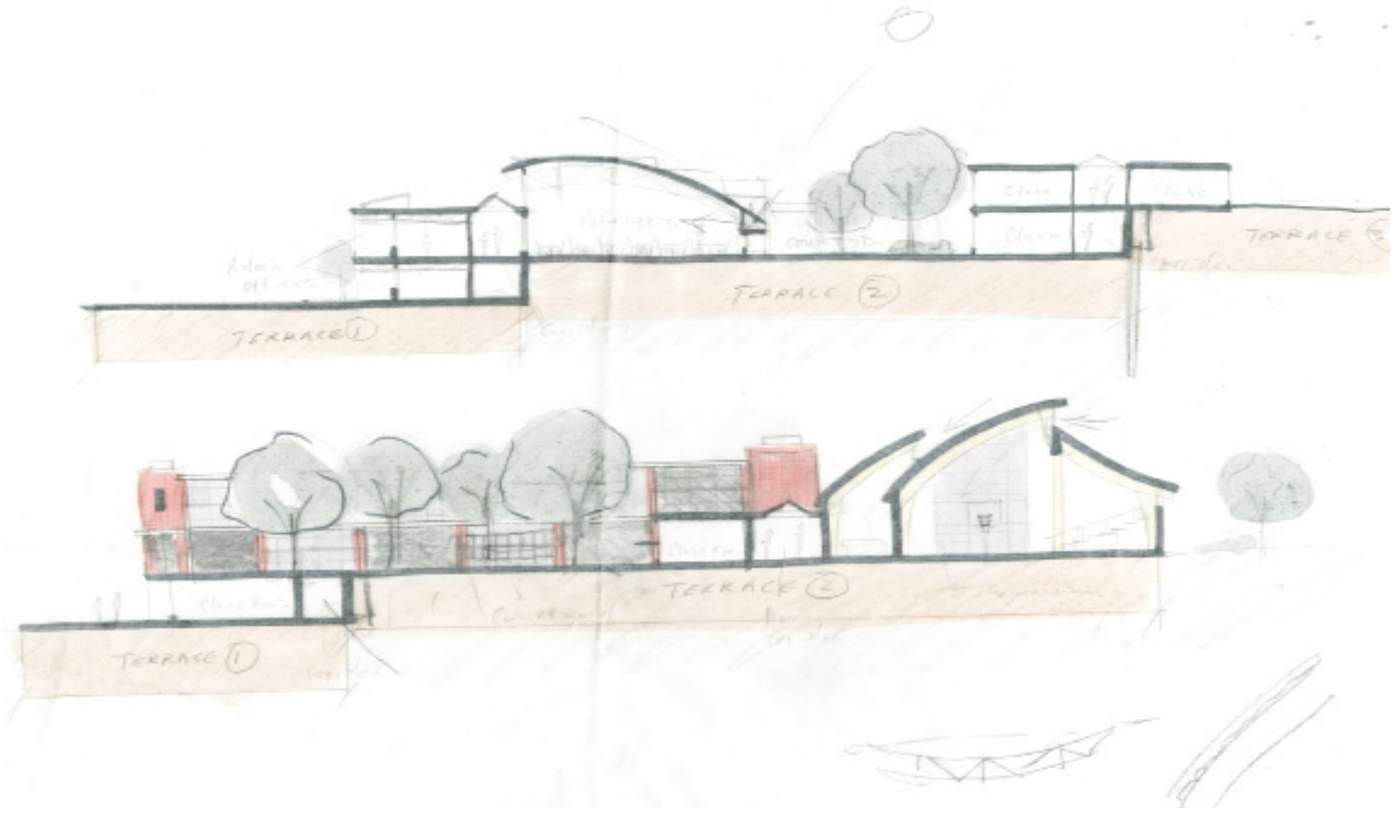
Form Study





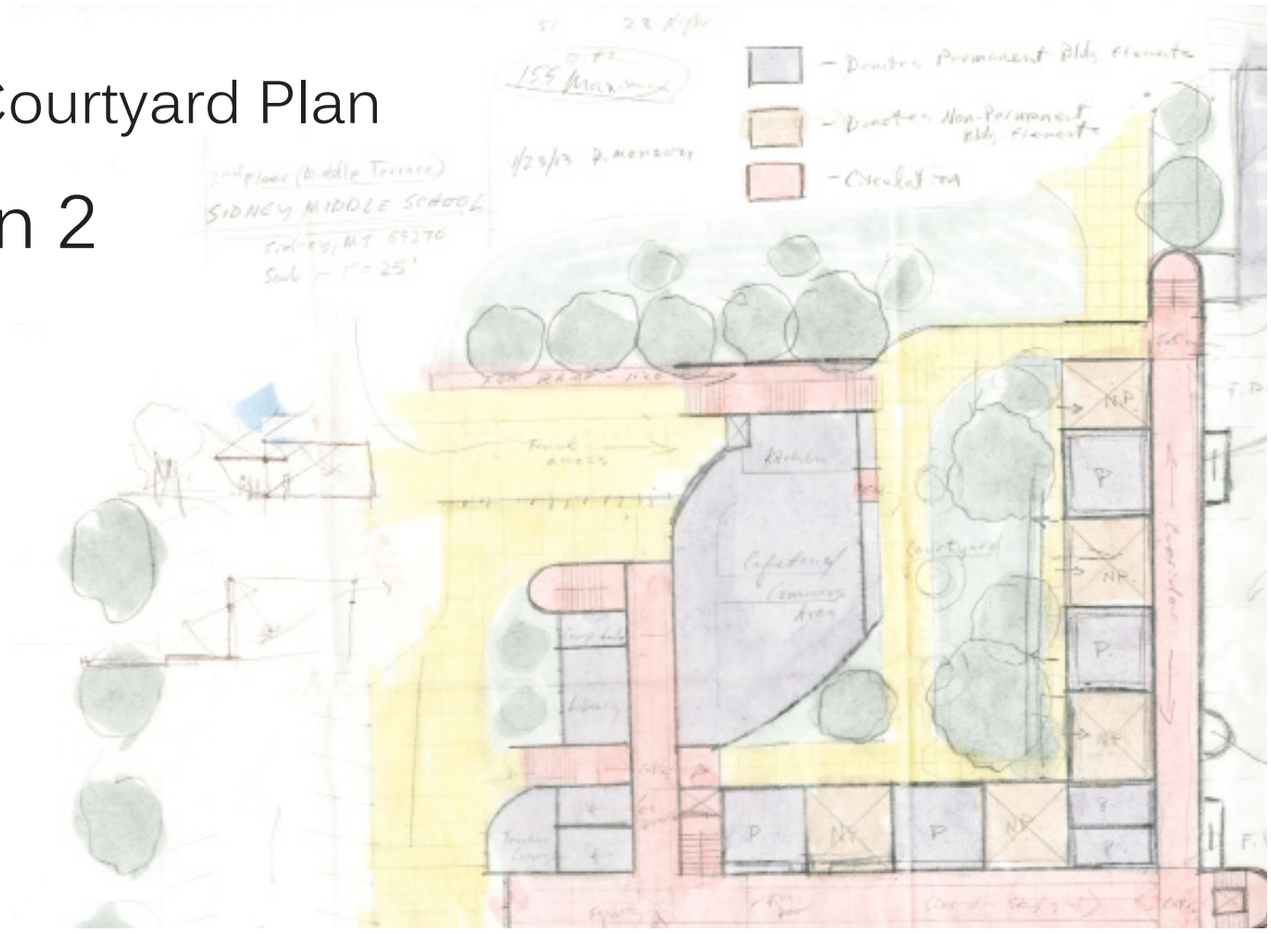




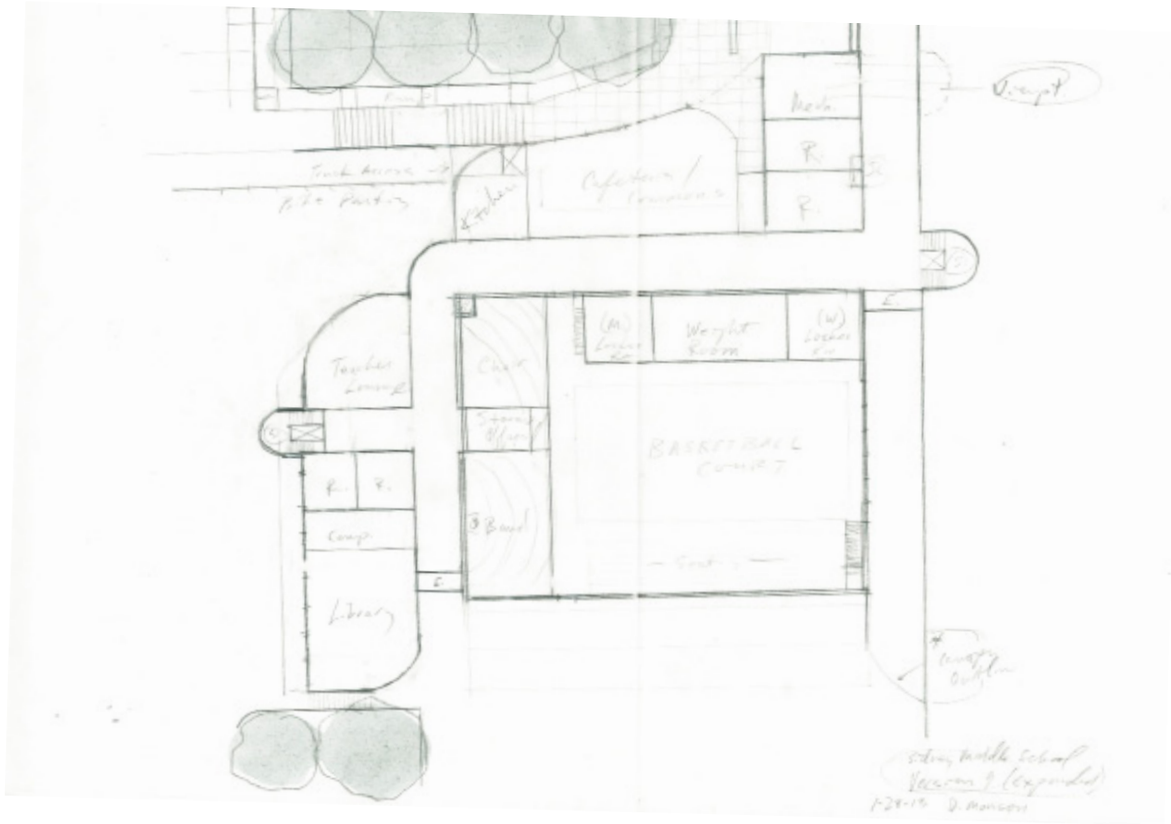


Earlier Courtyard Plan

Version 2



Version 9



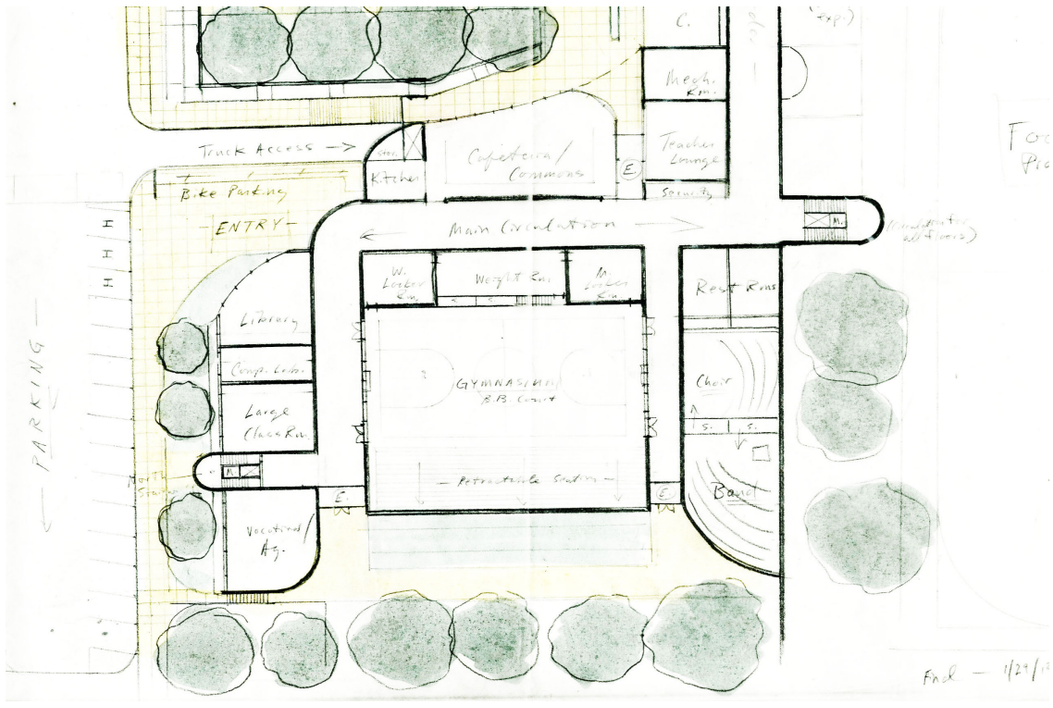
(Football Field)

Terrace 3 - Upper Level

Terrace 2 - Middle Level

Terrace 1 - Lower Level

(Parking Lot)



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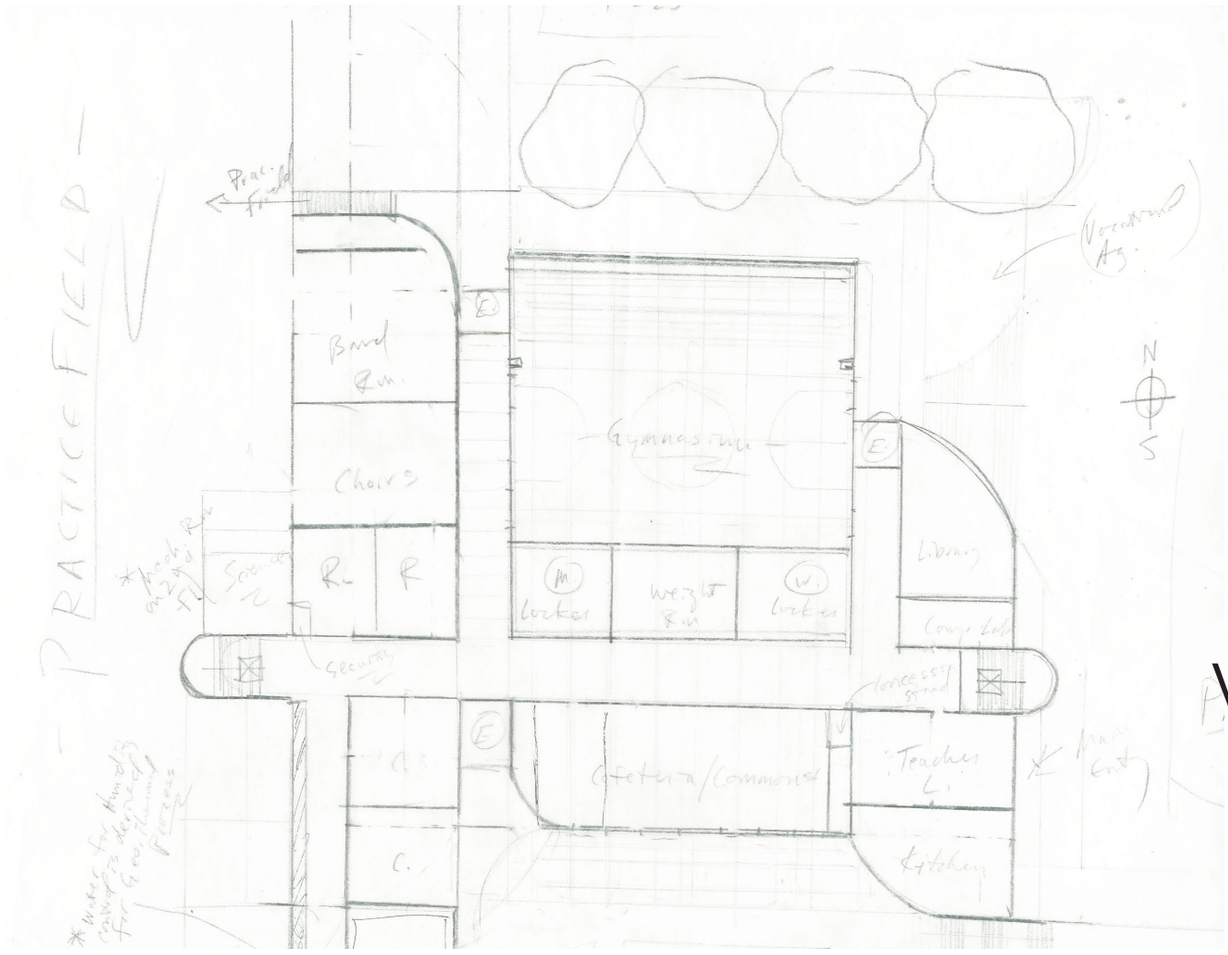
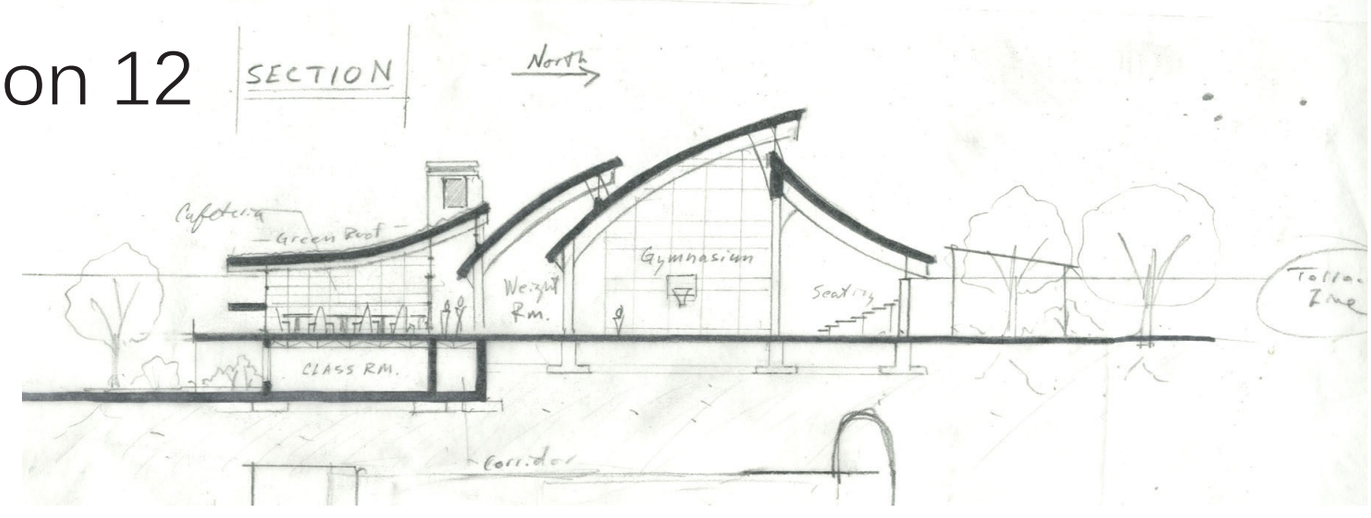
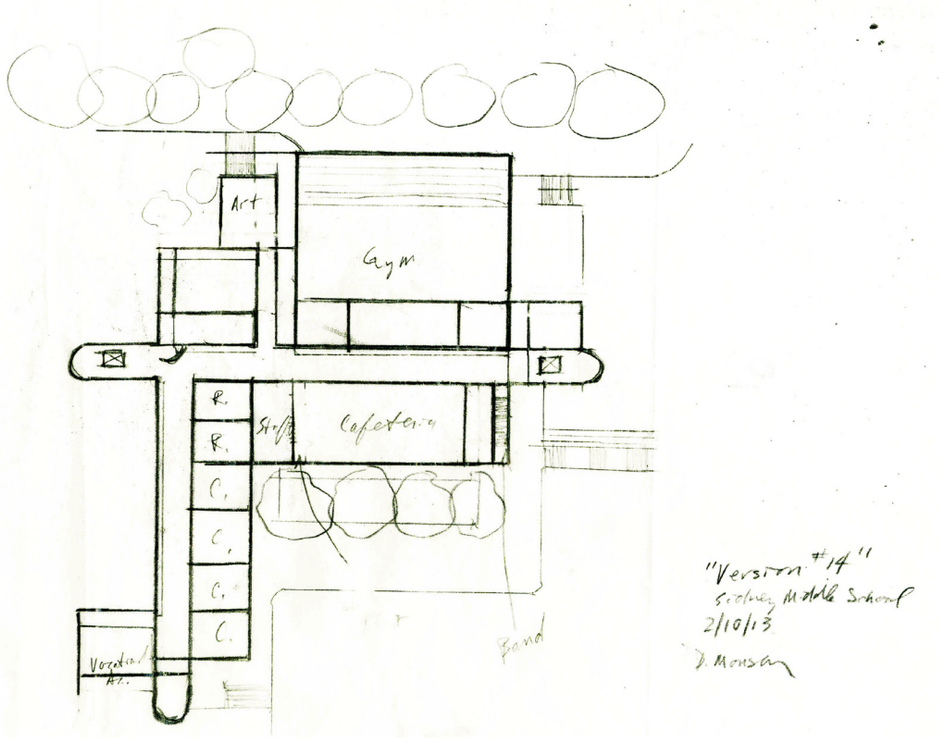
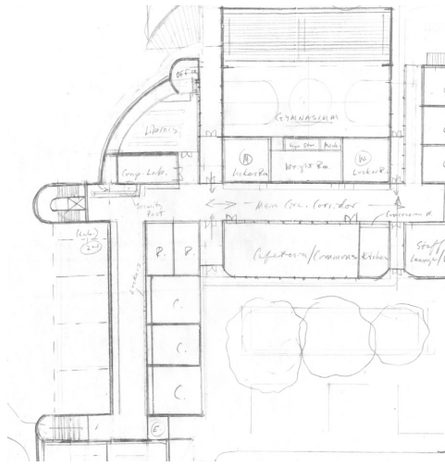


Version 12

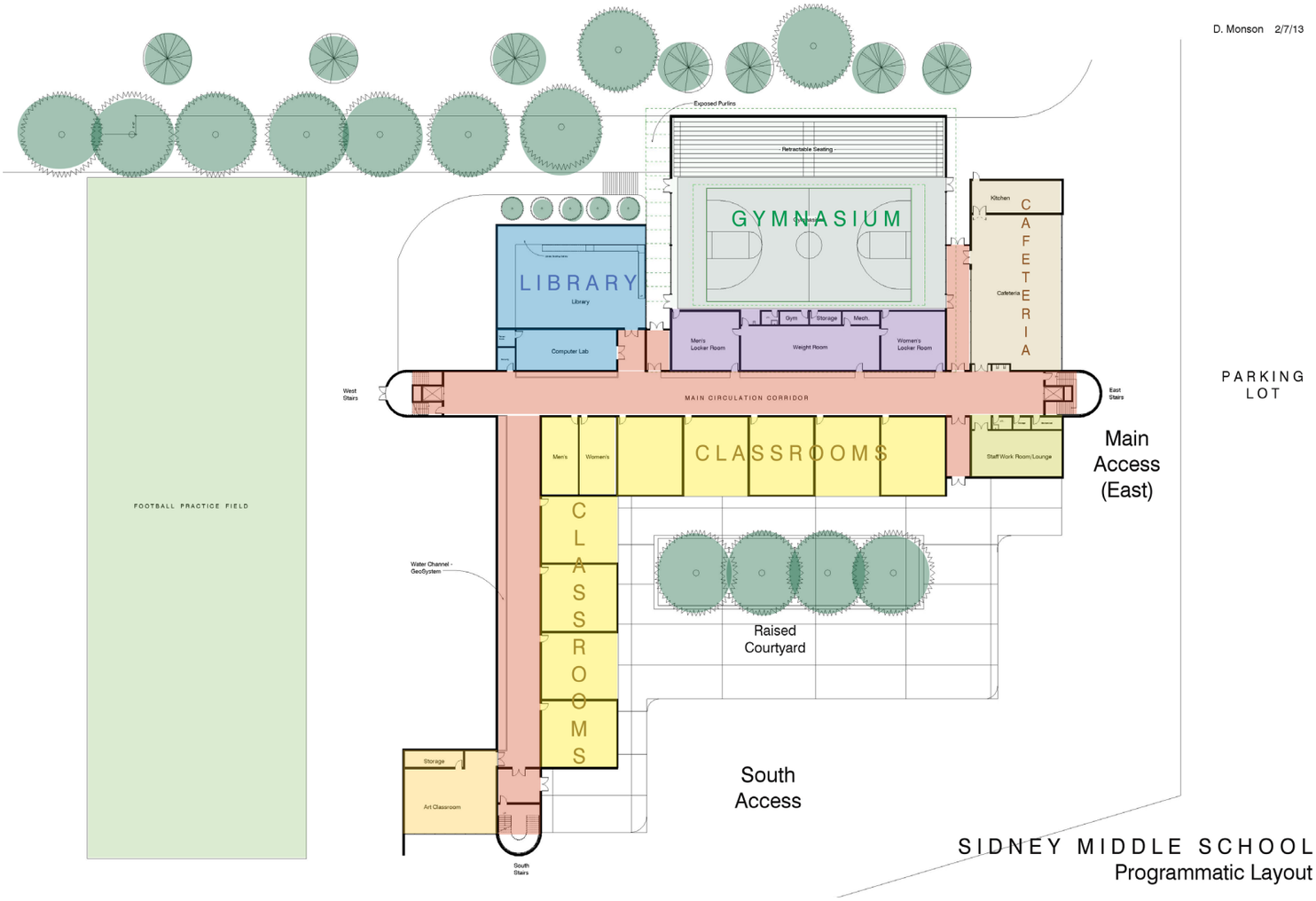
Version 12



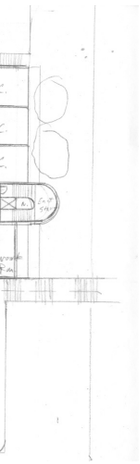


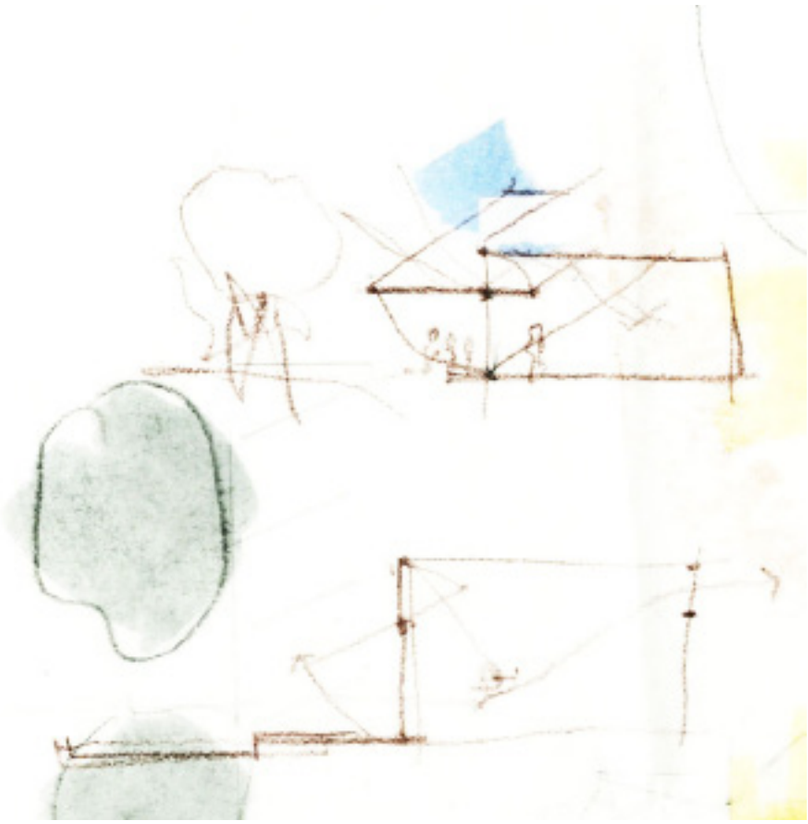


Version 14

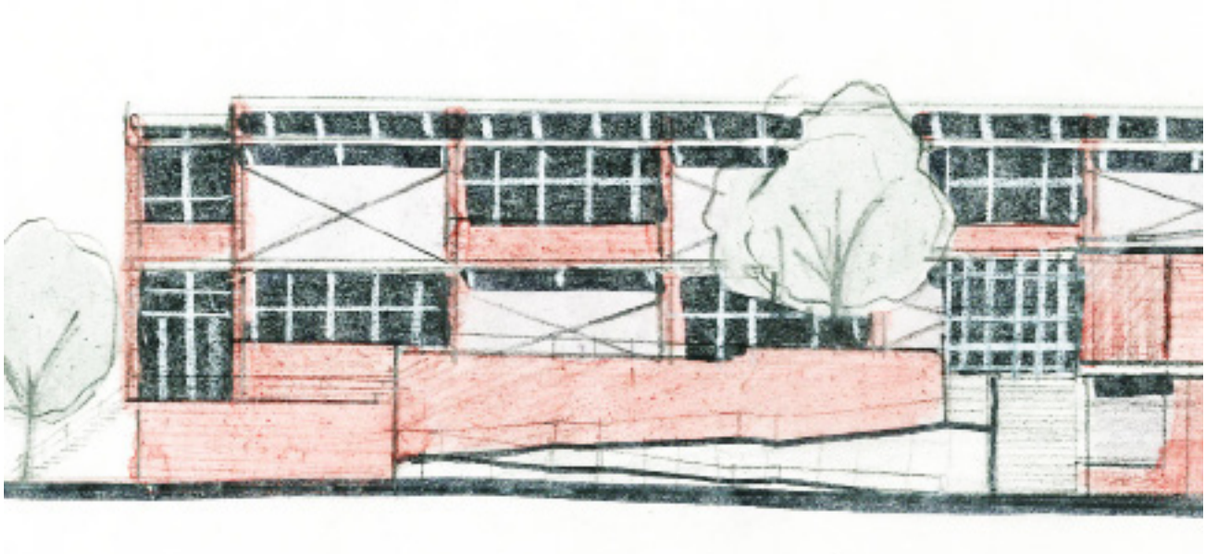


SIDNEY MIDDLE SCHOOL
Programmatic Layout

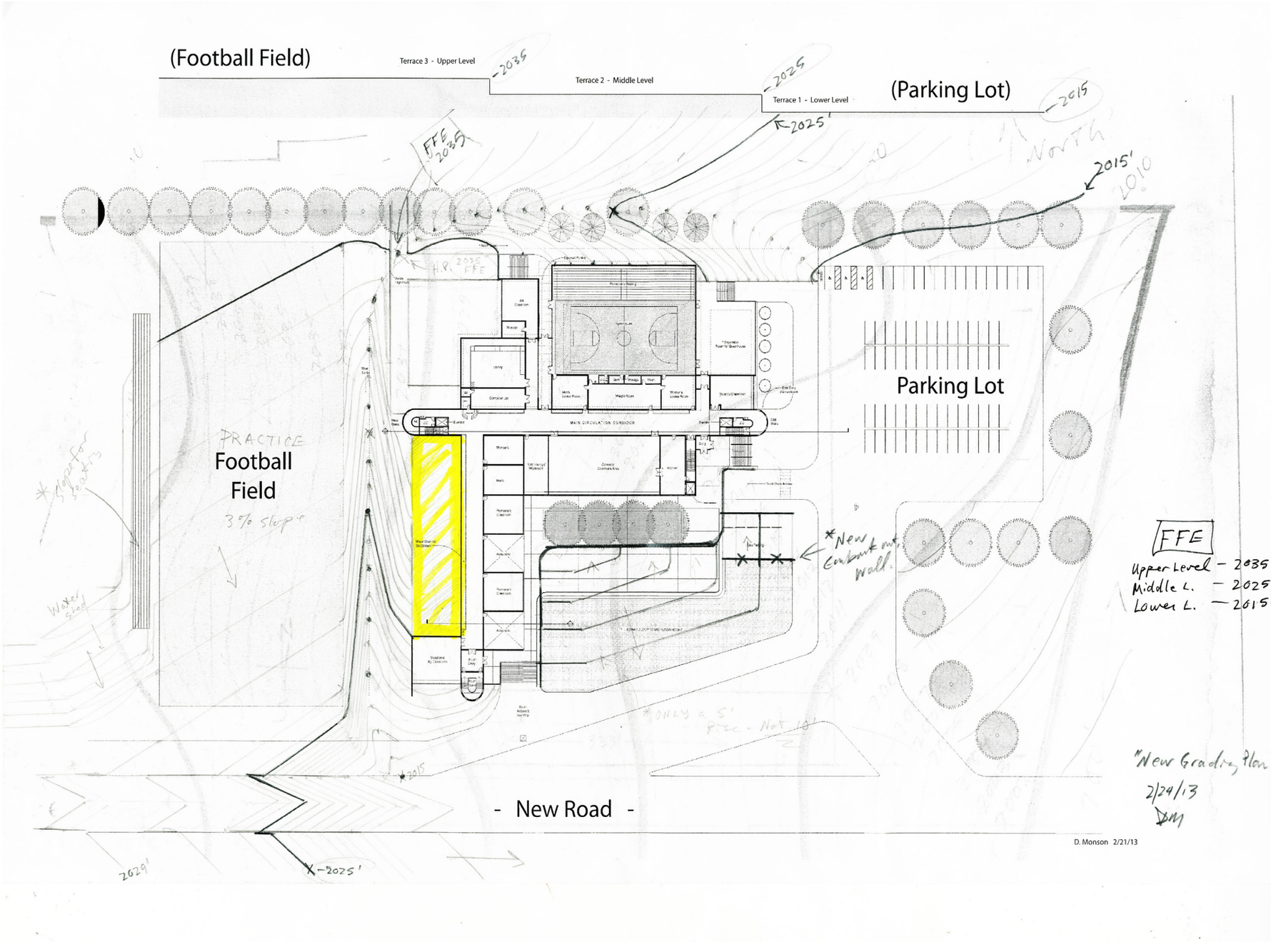




Adaptable Class Spaces

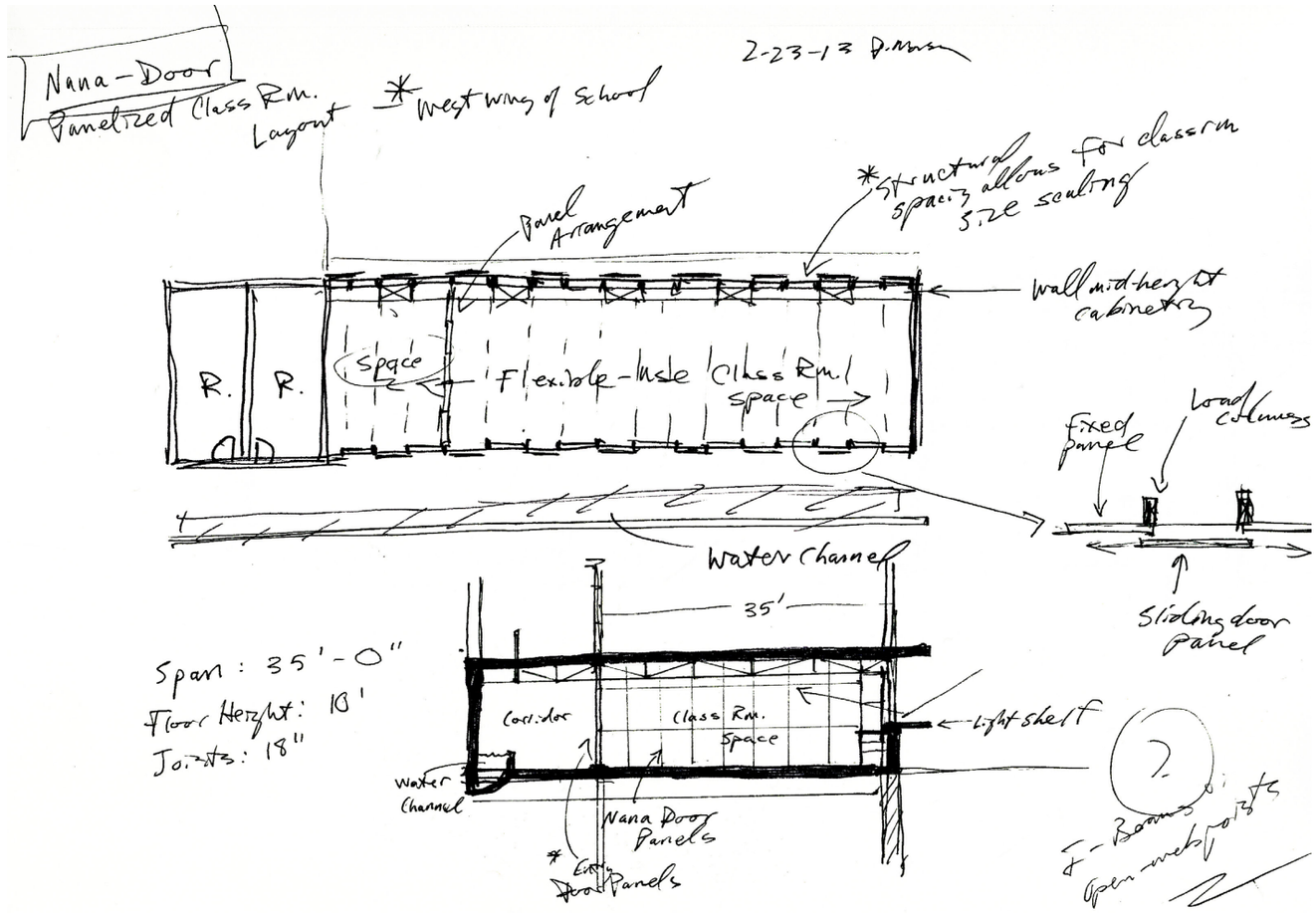


New Grading Plan



Adaptable Classrm. Wing

Panelized Partitions as Full Enclosure

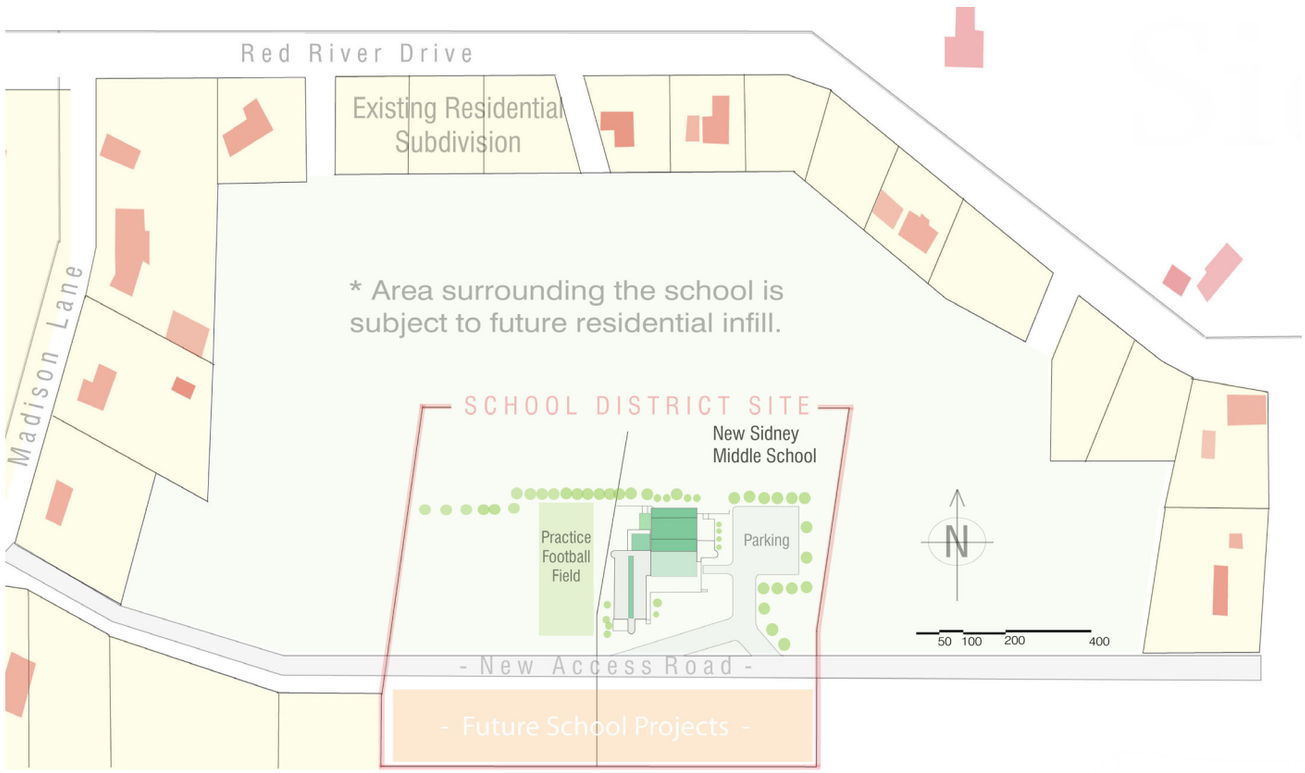


Project
Solution

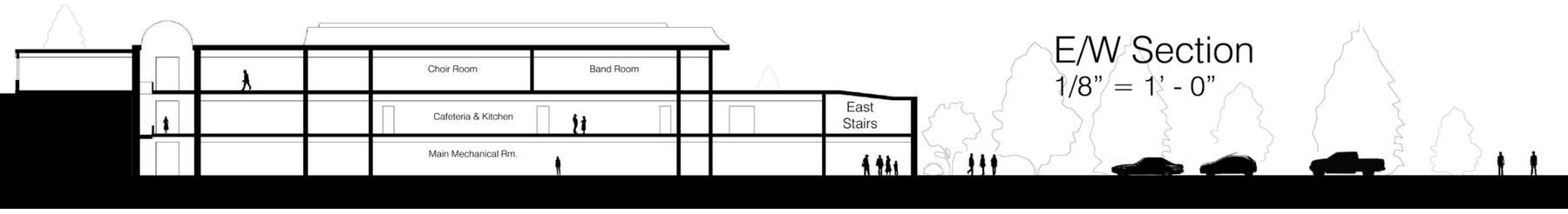
While formative for personal and educational growth, the school environment is also formative for responsible habits. For this middle school, such habits are embedded as subtle, simple things that are meant to help curb a student's perception of their immediate environment (for example, a student/teacher finds it easier to open an operable window to cool a room instead of activating an active system, or take the numerous broad stairways at the ends of the building to traverse the floors instead of taking the single elevator.) The building layout consists of three floors that are divided on three distinct terraces to help it adjust to the site's westward climb in elevation.

Spaces within the building are designed to be adaptable (specifically, enlarged or diminished) to respond to variable classroom scale, as well as the drastic enrollment fluctuation that can be expected for an area subject to boom/bust cycles in energy development, such as Sidney, MT. Sidney Middle School is designed to serve an enrollment range between 300 and 600 students, with 25 to 50 faculty and support staff.

The new Sidney Middle School is designed for the use of localized materials and construction practices. The design is meant to be easily identifiable as a school building, with a familiar material and color palette.

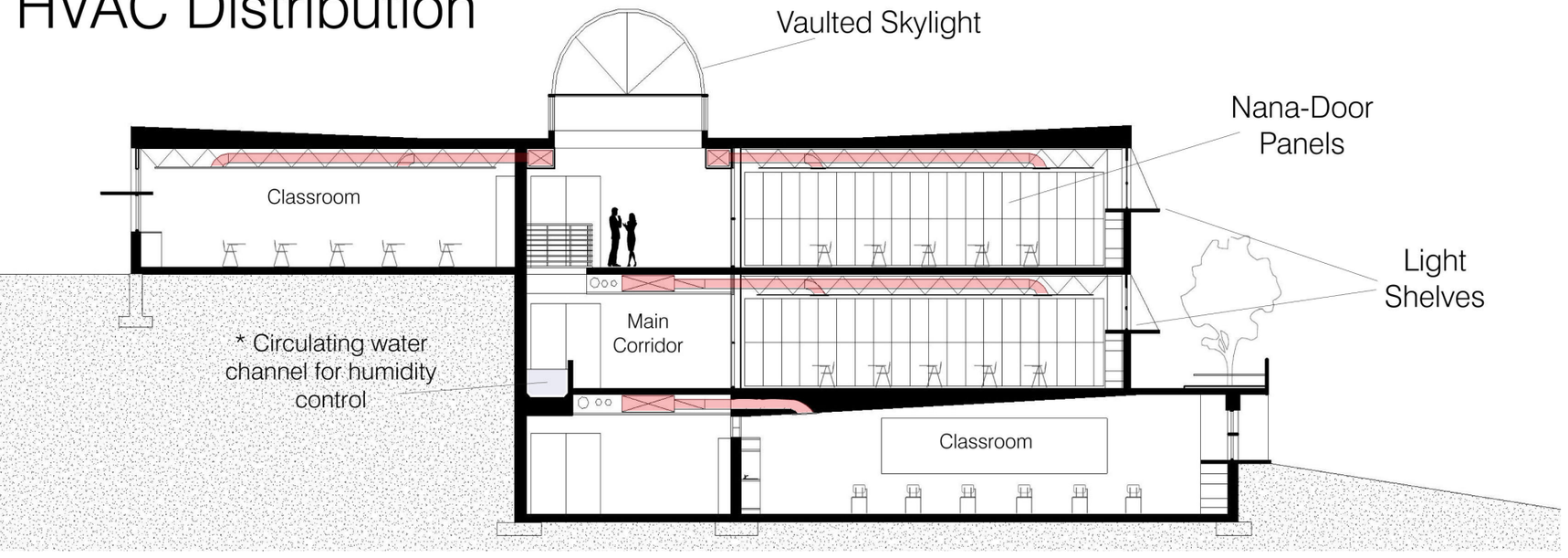


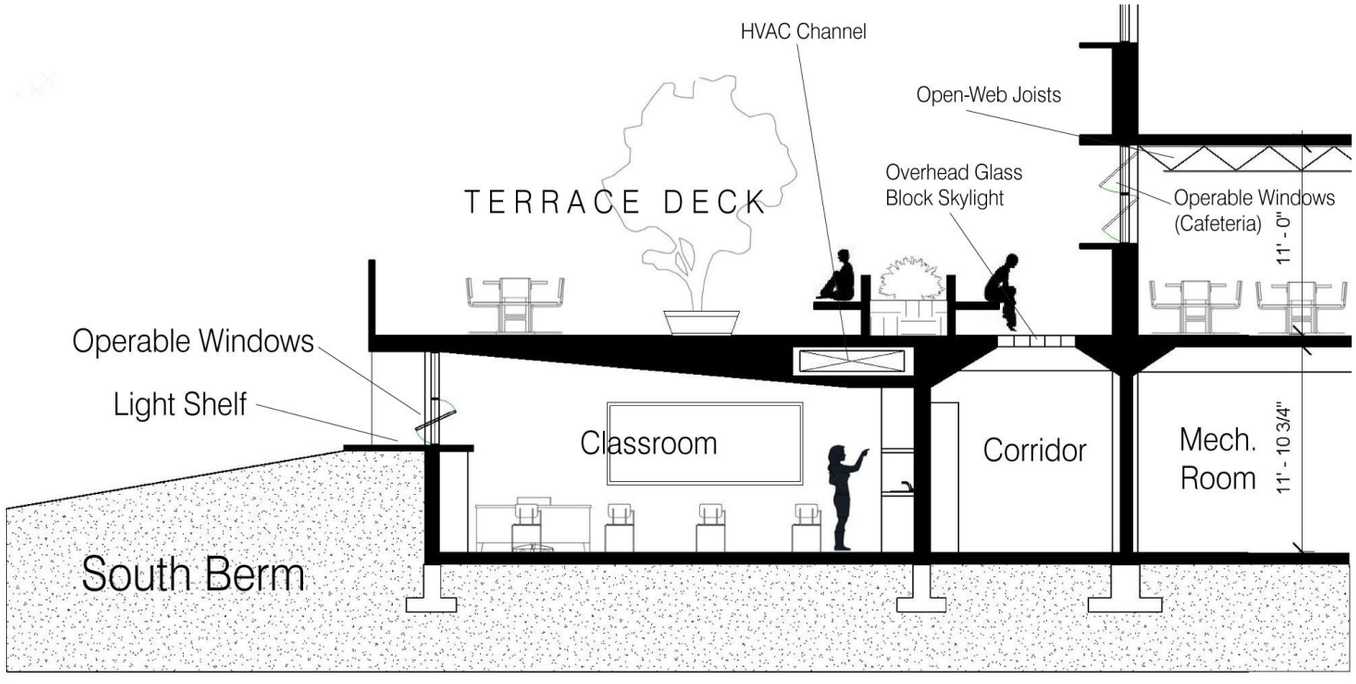
Site Plan



E/W Section
1/8" = 1' - 0"

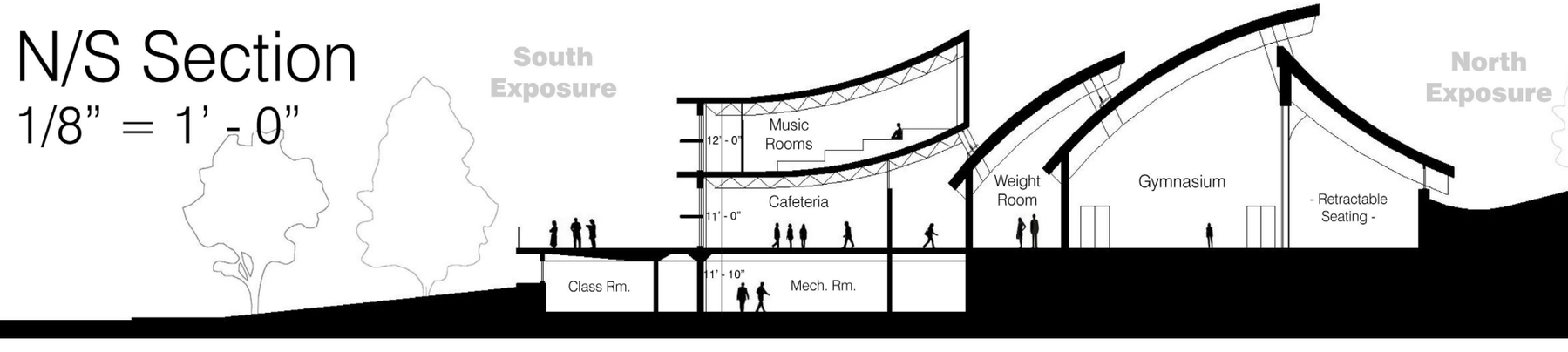
HVAC Distribution

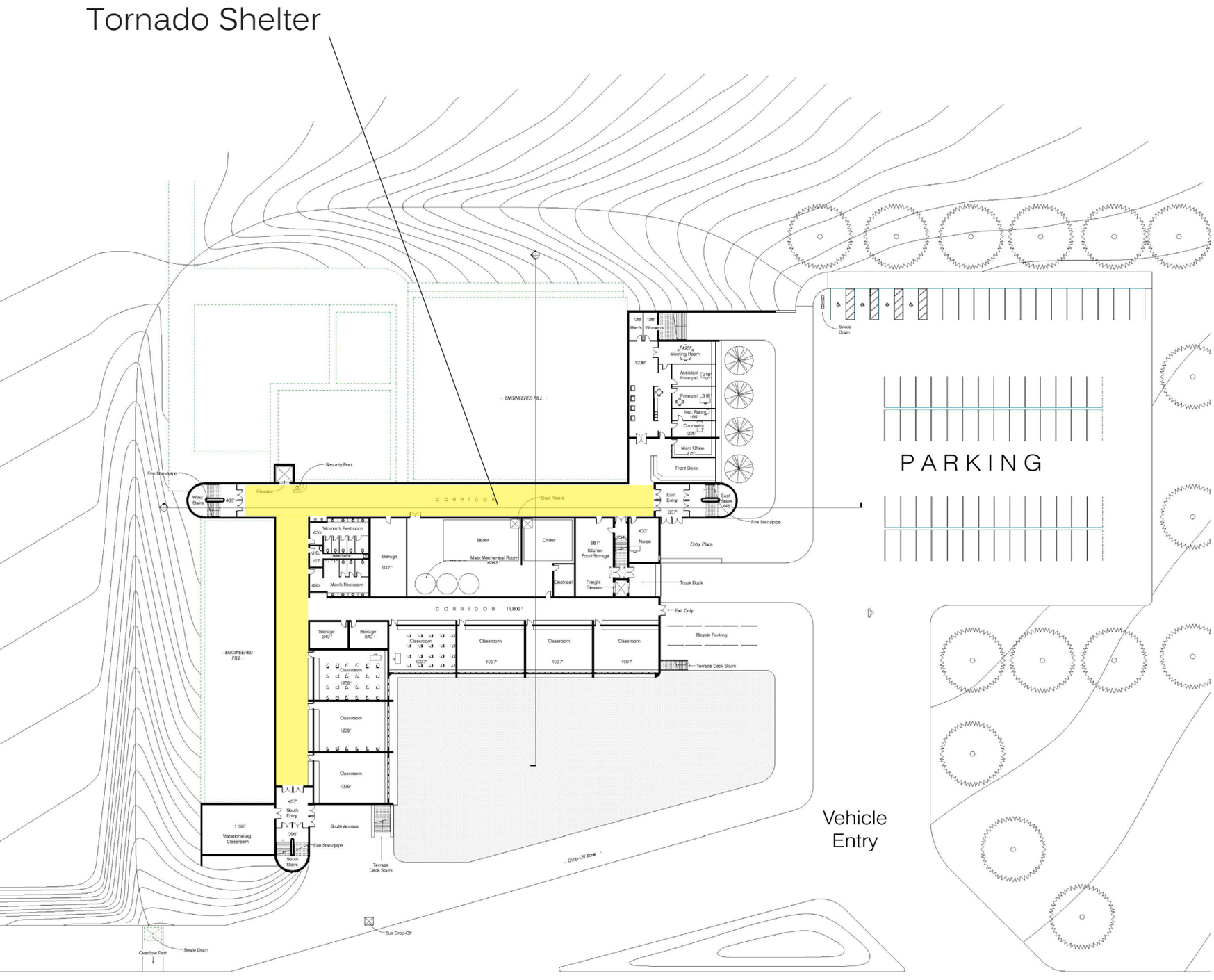




N/S Section

1/8" = 1' - 0"





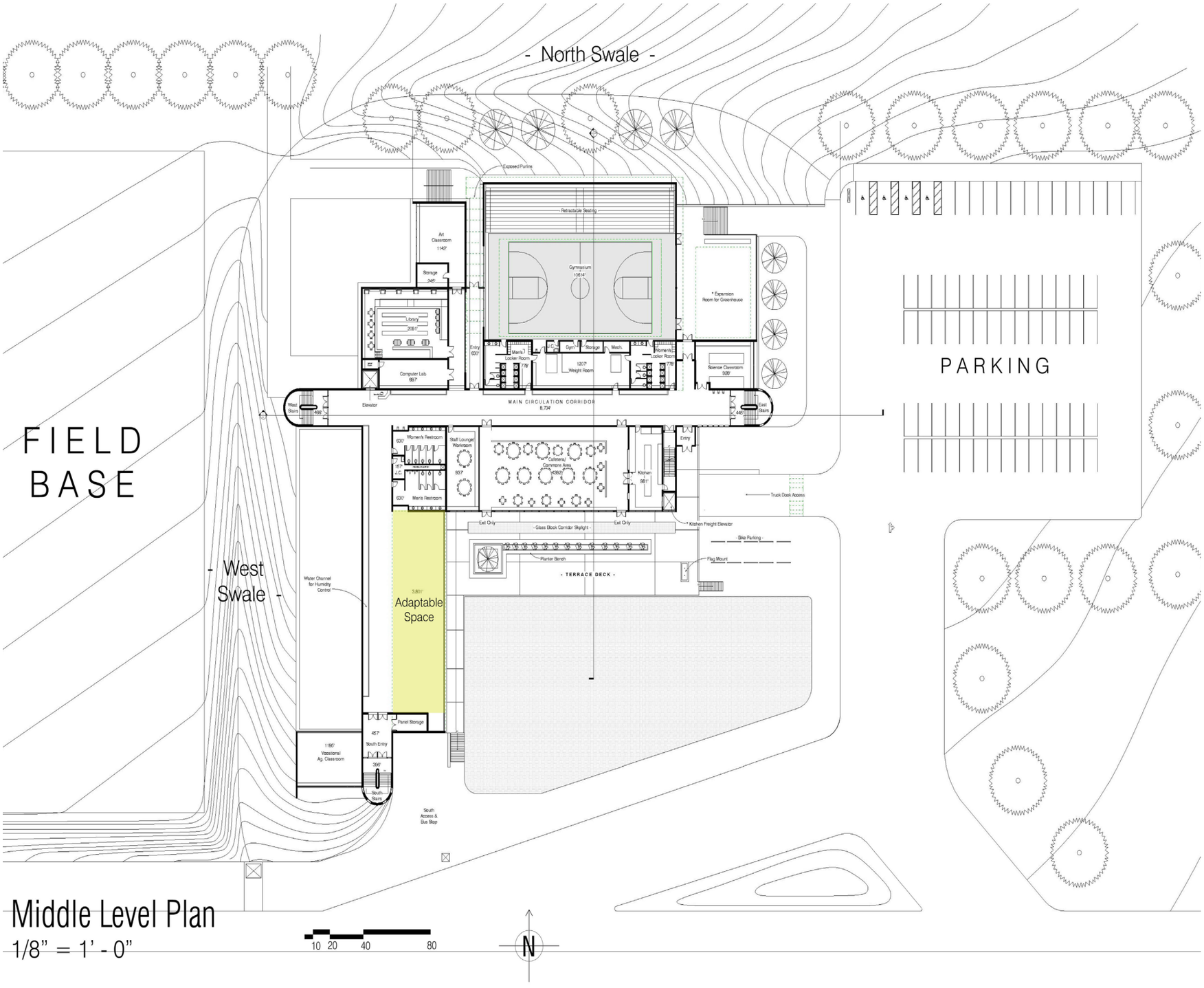
Lower Level Plan

1/8” = 1’ - 0”

10 20 40 80

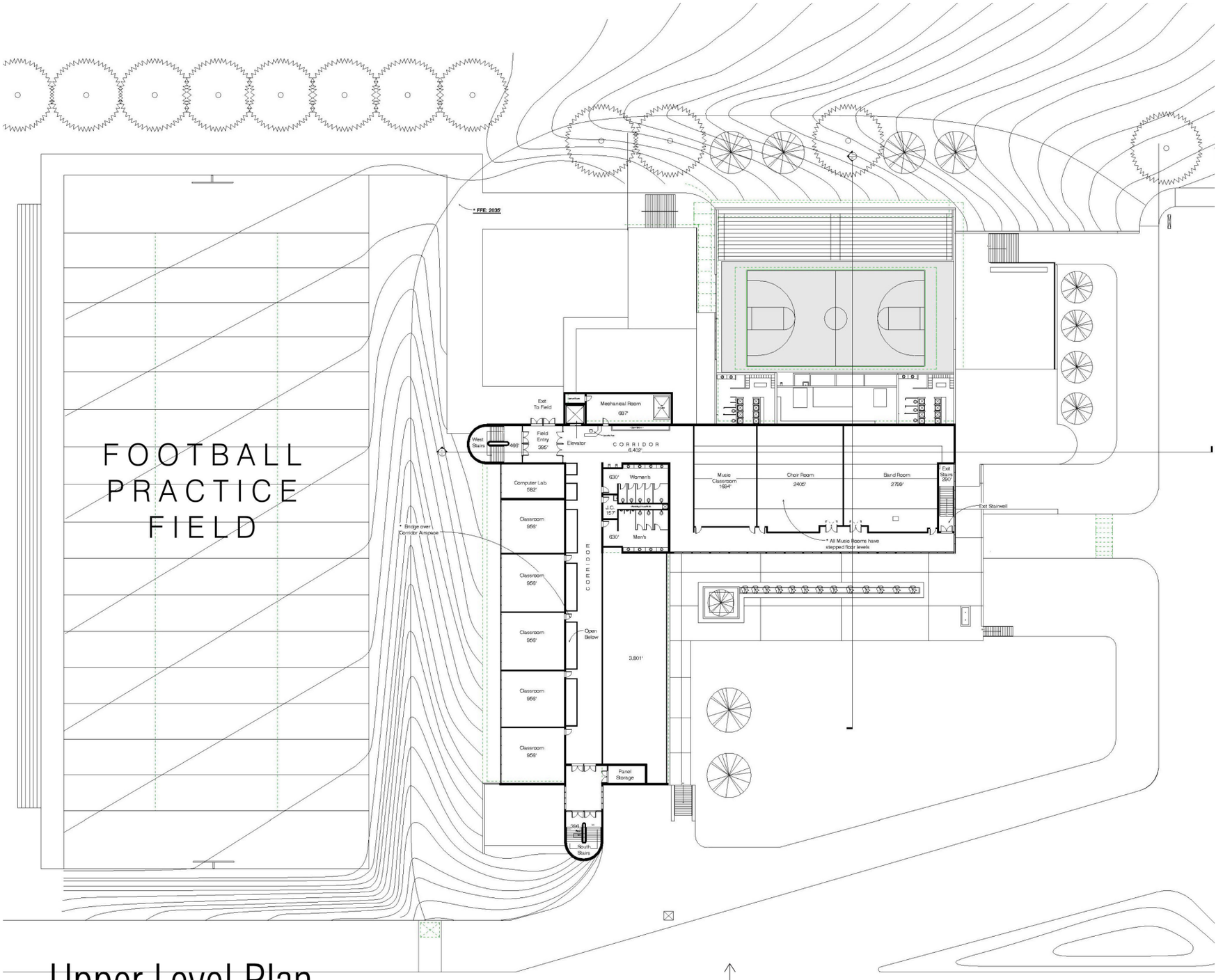
N

Terrace 1



Middle Level Plan

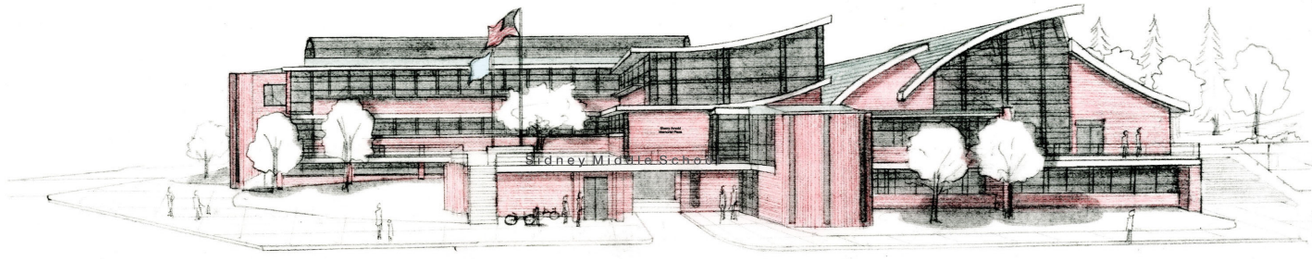
1/8" = 1' - 0"



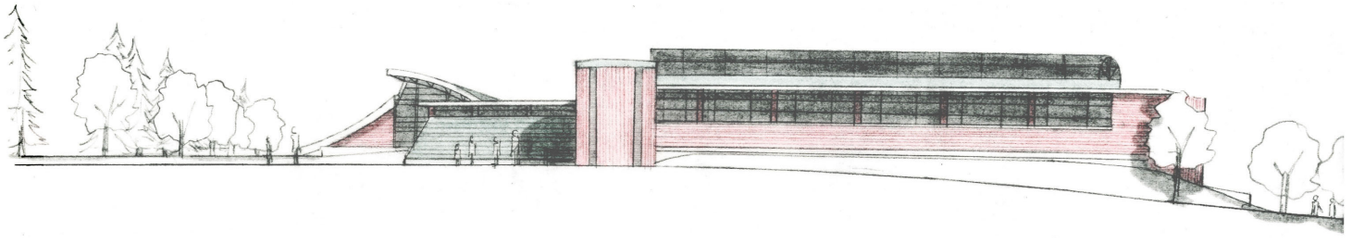
Upper Level Plan

1/8" = 1' - 0"

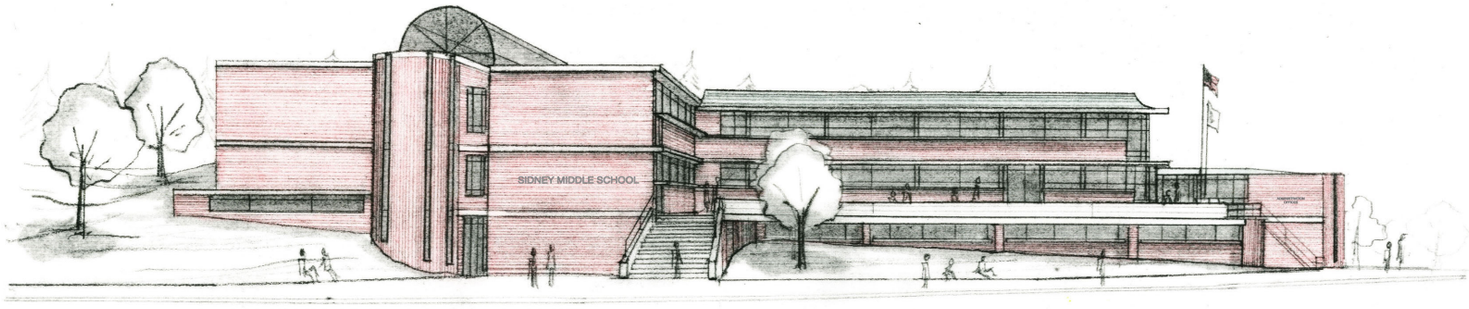
Terrace 3



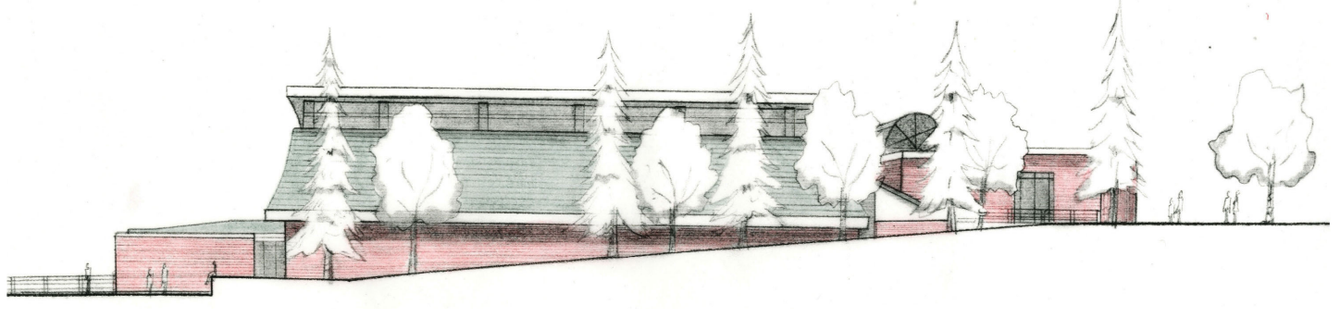
East Elevation



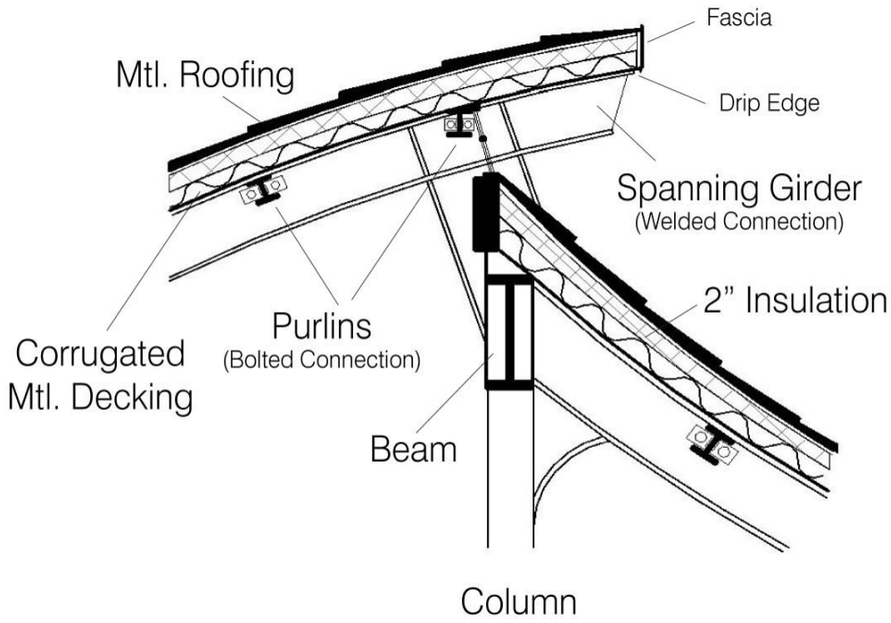
West Elevation



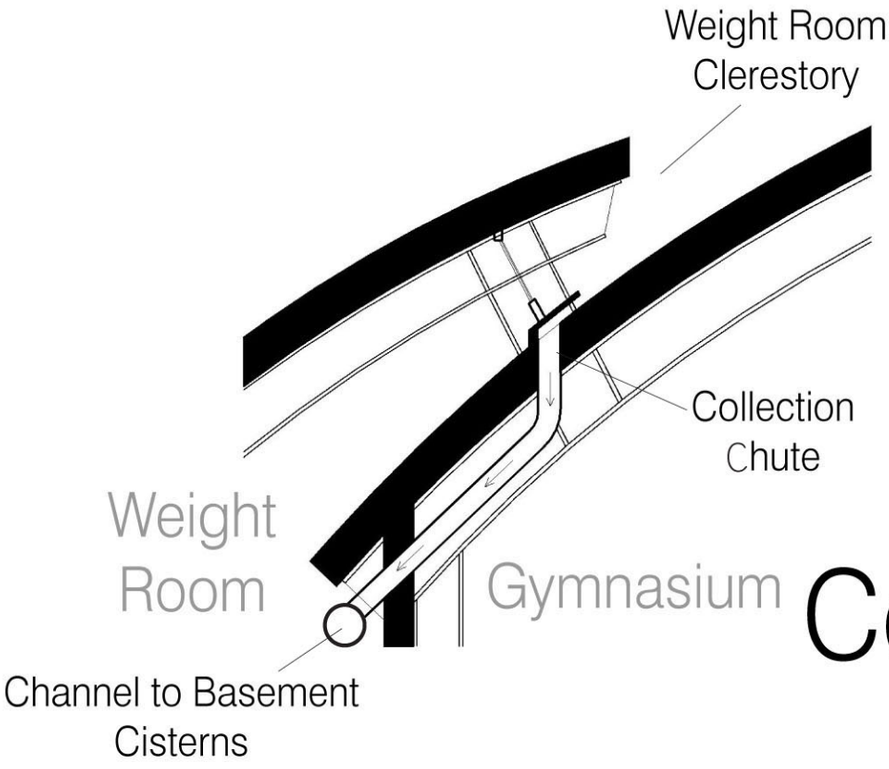
South Elevation



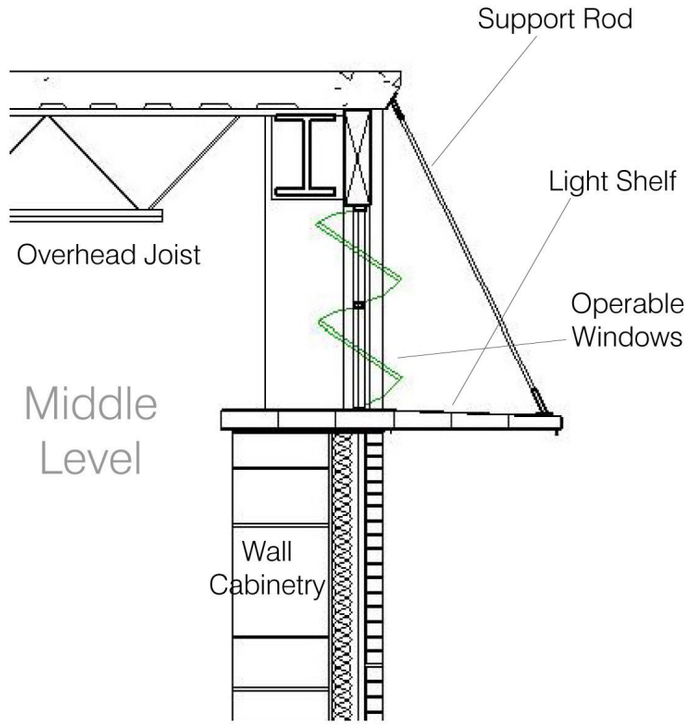
North Elevation

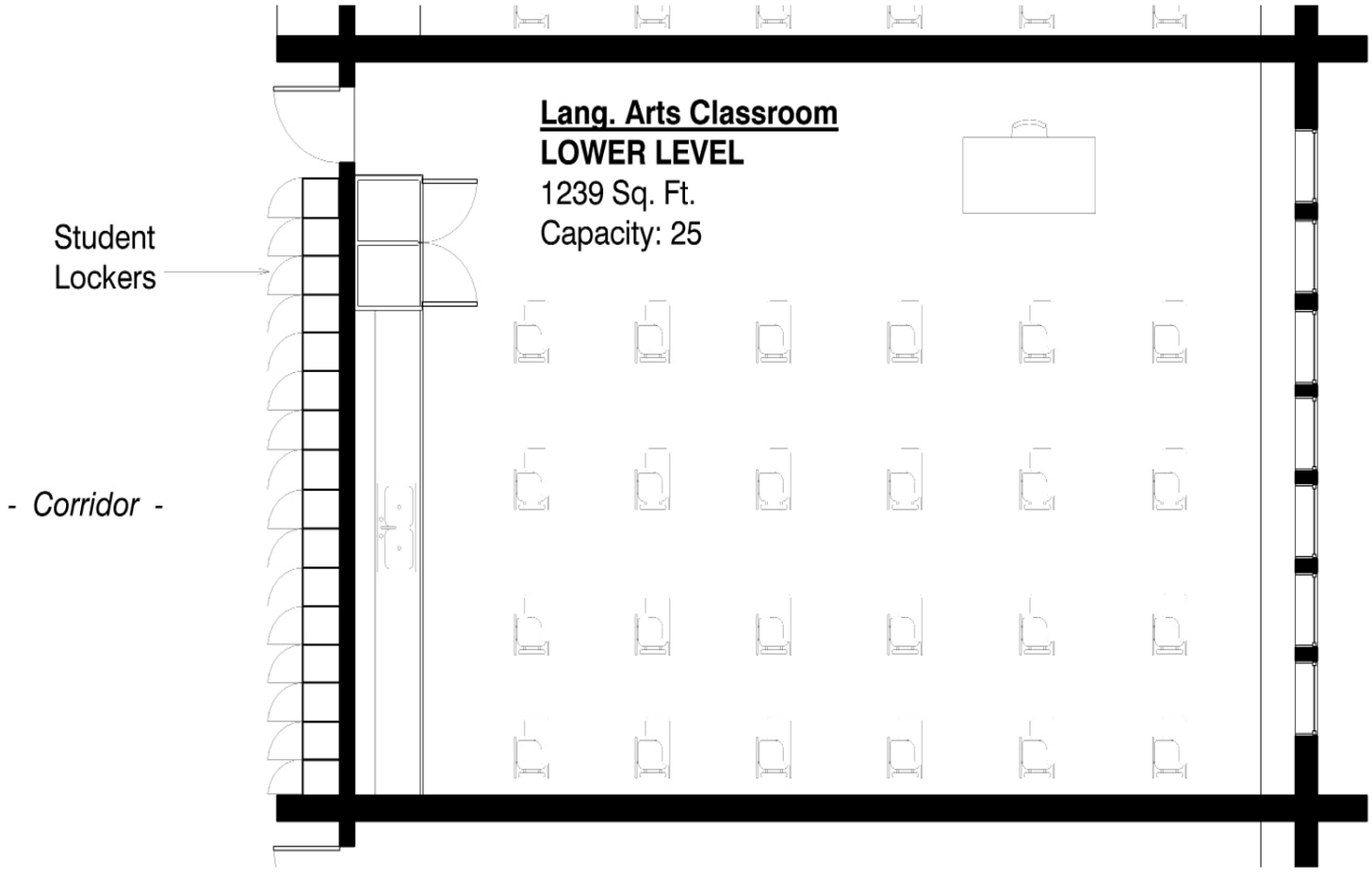


North Clerestory Detail



Water Collection


Support Rod
Light Shelf
Overhead Joist
Operable
Windows
Middle
Level
Wall
Cabinetry


Lang. Arts Classroom
LOWER LEVEL
1239 Sq. Ft.
Capacity: 25
Student
Lockers
- Corridor -

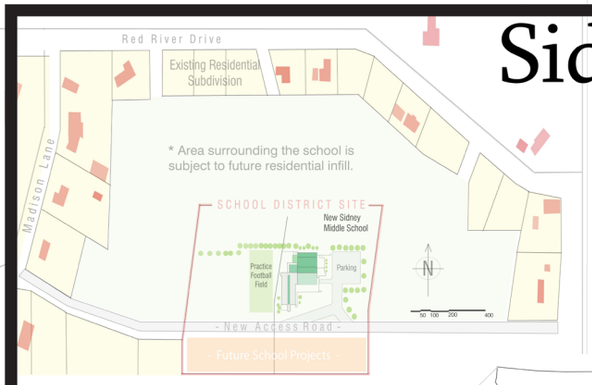
Digital **Presentation**

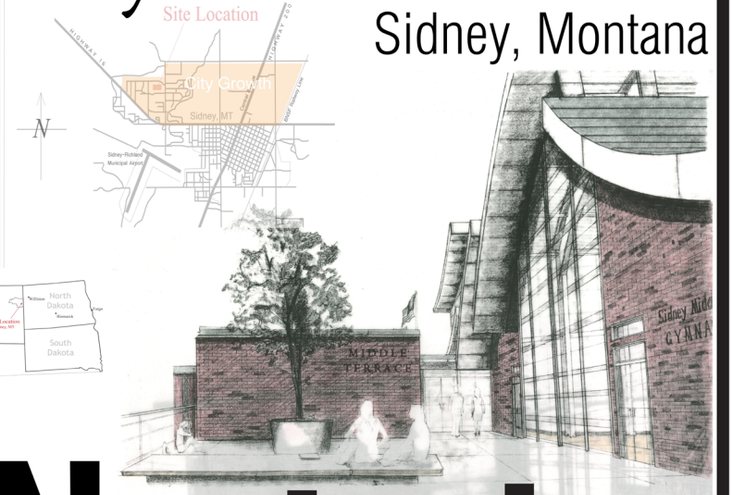
The final presentation of this thesis consisted of 4 20” X 30” boards, scaled down to be at viewpoint for a person of average height. I did not want my physical presentation to be intimidating in approach, and I opted to use soft hand drawings for their comfortable human feel. A digital slideshow was presented on my presentation day (April 25th, 2013) to give the critics an understanding of the lengthy design process.

A small mass model was constructed to show the generalized form and area scale of the project.

Sidney Middle School

Sidney, Montana





PROJECT CONTEXT

Located near the western edge of the Bakken oil formation, the town of Sidney, MT is presently experiencing exponential growth and development from increased oil production. The area's school district is severely stressed and there is need for new school projects, particularly a new middle school to meet an enrollment fluctuation of 300-600 students, divided between grades 6-8. This thesis is based on a real project, and uses the exact site prescribed by the Sidney School District, located at the northwest corner of town.

PROBLEM STATEMENT

"How can the design of a middle school enable the education of adolescents in sustainability and adaptation, and enable the growth of a city?"

THEORETICAL PREMISE

The learning environment needs to nurture a positive perception of growth and sustenance to students.

CONCLUSIONS

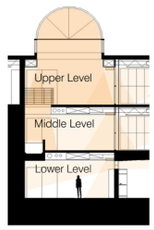
While formative for personal and educational growth, the school environment is also formative for responsible habits. For this middle school, such habits are embedded as subtle, simple things that are meant to help curb a student's perception of their immediate environment (for example, a student/teacher finds it easier to open an operable window to cool a room instead of activating an active system, or take the numerous broad stairways at the ends of the building to traverse the floors instead of taking the single elevator). The building layout consists of three floors that are divided on three distinct terraces to help it adjust to the site's natural westward climb in elevation.

A number of features were implemented to minimize the project's environmental footprint, including extensive daylighting enhanced by light shelf installations, cycled rainwater and snow meltwater collected by roof systems, operable windows, a circulating water feature for humidity comfort, and, perhaps most obviously, a physical building footprint that is maxed-out for an enrollment peak, yet fairly compact and not of a sprawling nature to help lessen intrusion on the site.

Spaces within the building are designed to be adaptable (specifically, enlarged or diminished) to respond to variable classroom scale, as well as the drastic enrollment fluctuation that can be expected for an area subject to boom/bust cycles in energy development, such as Sidney, MT. Sidney Middle School is designed to serve an enrollment range between 300 and 600 students, with 25 to 50 faculty and support staff.

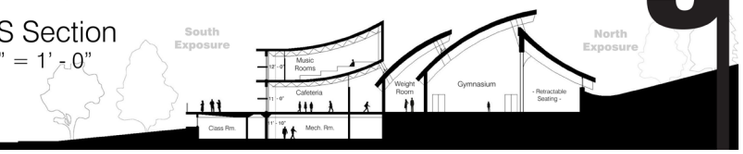
The new Sidney Middle School is designed for the use of localized materials and construction practices. The design is meant to be easily identifiable as a school building, with a familiar material and color palette.

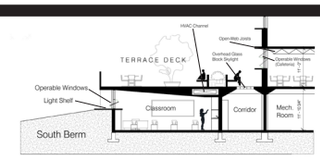
Corridor Illumination



Nurturing

N/S Section
1/8" = 1' - 0"



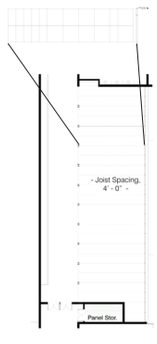


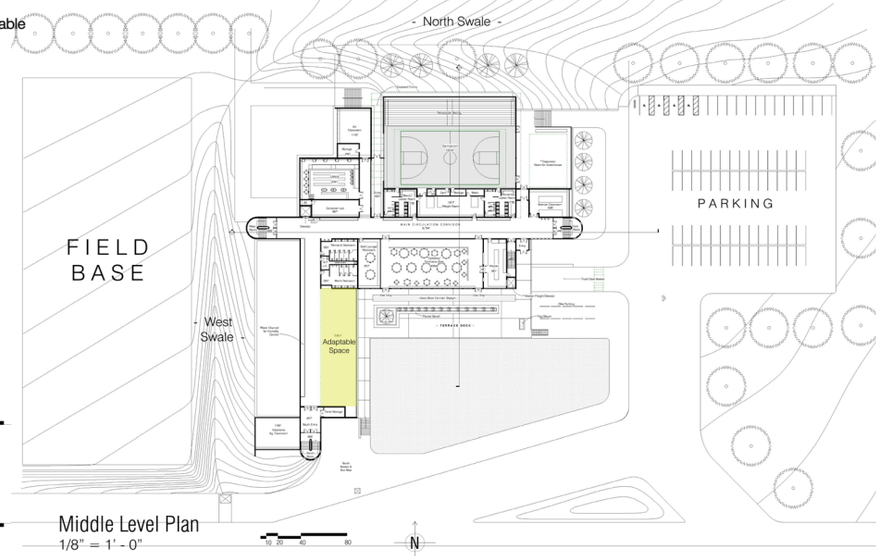
Sustenance

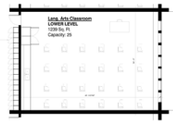
SPATIAL ADAPTABILITY

Though most classrooms in the building are of set dimensions, the fact is that one size doesn't fit all. To help accommodate variable classroom size, the west wing of the building is an area that can be partitioned into separate spaces by "Nana-Doors," dimensioned 2 feet wide, 3 inches deep, with a height of approximately 9 feet. The panelized partitions are sound dampered to isolate unwanted noise, with a neoprene gasket connection to the floor surface. The changes in space configuration are done internally, the space sharing one continuous exterior wall. The partition spacing aligns with that of the overhead structural floor joists.

AREA: 21,228' of Adaptable Classroom Space







Middle Level Plan
1/8" = 1' - 0"

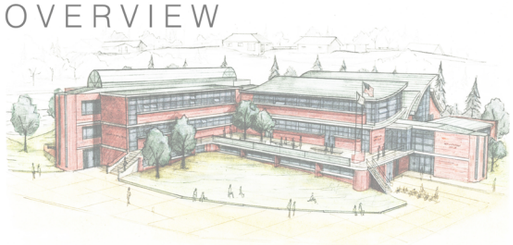
Department of Architecture & Landscape Architecture, NDSU
ARCH 772, Design Thesis, Spring 2013

"Nurturing Sustenance", Middle School
101,698 Square Feet Total

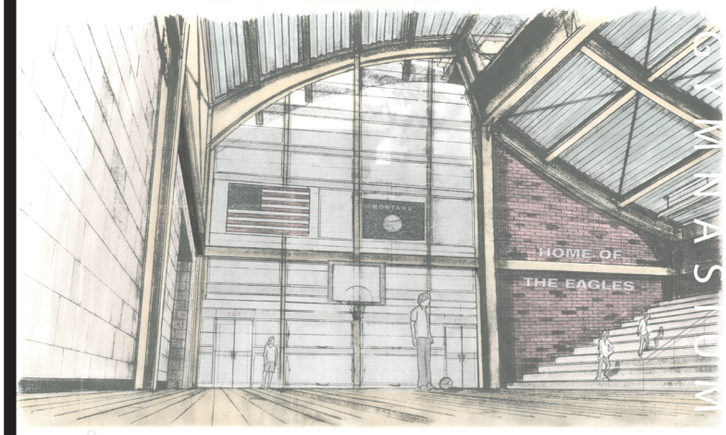
STUDENT: Dominic Monson
THESIS ADVISOR: Ganapathy Mahalingam

Programs Used:
Revit Architecture, SketchUp, Illustrator, Photoshop

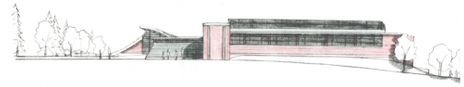
OVERVIEW



CORRIDOR

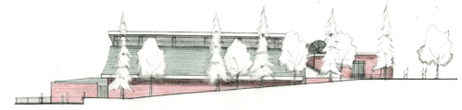


EAST ELEVATION

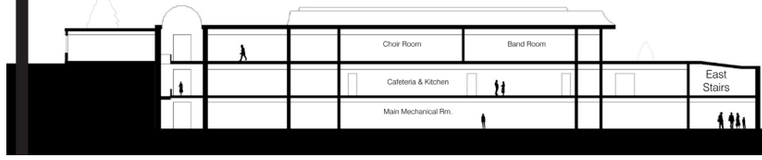


WEST ELEVATION

SOUTH ELEVATION

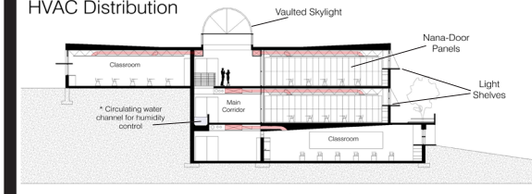


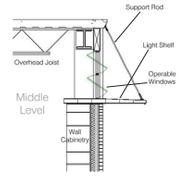
NORTH ELEVATION

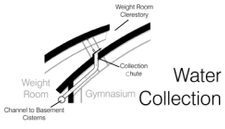


E/W Section
1/8" = 1' - 0"

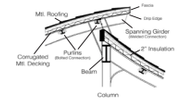
HVAC Distribution





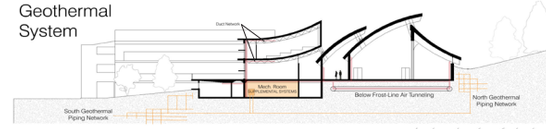


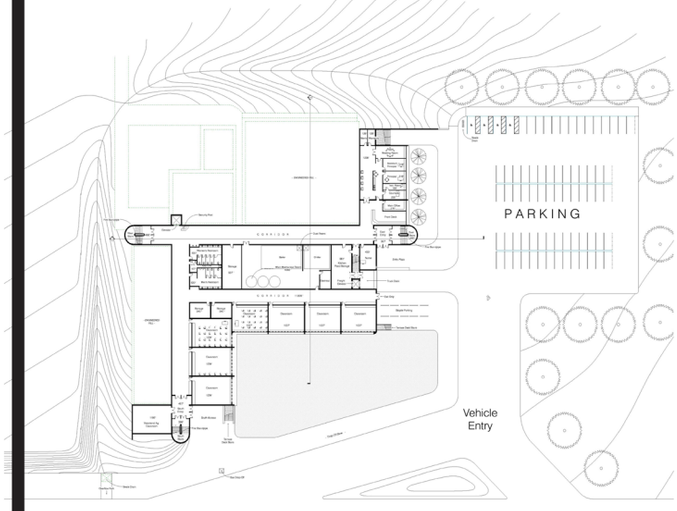
Water Collection



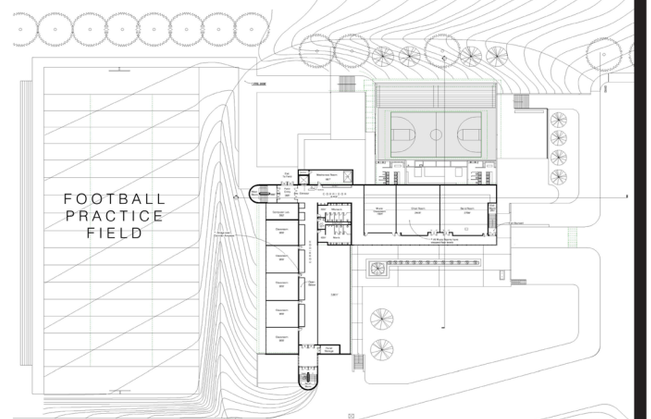
North Clerestory Detail

Geothermal System





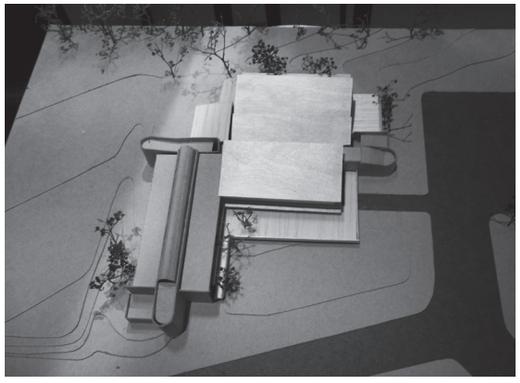
Lower Level Plan
1/8" = 1' - 0"

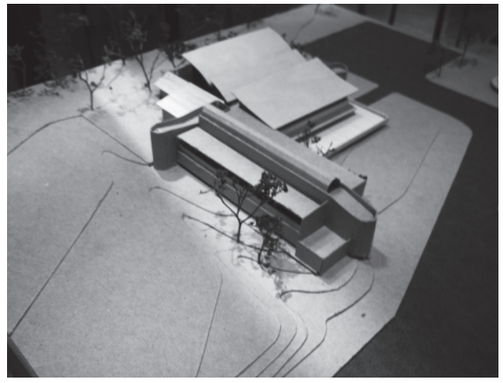


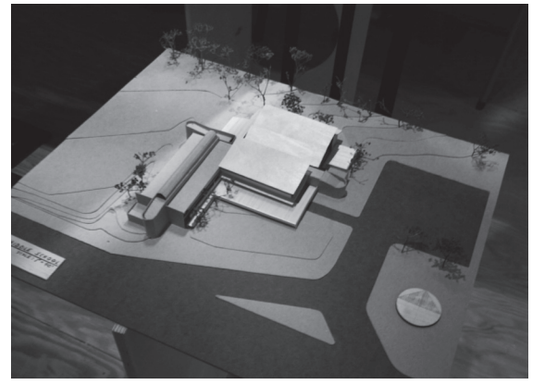
Upper Level Plan
1/8" = 1' - 0"

FINAL DISPLAY

Boards







Model

References

Watterson, B. (1985). *Calvin and Hobbes.* [Comic strip image]. Retrieved from http://www.fanpop.com/spots/calvin-and-hobbes/images/23583441/title/calvin-hobbes-comics-photo&docid=18blhQmal-utMM&imgurl=

Sidney Public School District. (2012). Sidney Public Schools. Retrieved from http://www.sidneyps.com/site/default.aspx?PageID=1

U.S. Department of Education. (2011). Sidney Middle School in Sidney, MT. Retrieved from http://www.public-schools.findthebest.com

U.S. Department of the Interior. (2012). [Midwest Map image]. Retrieved from http://www.blm.gov/mt/st/en/prog/energy/oil_and_gas/apds.htm

Higgs, A. L., McMillan, V. M. (2006). Teaching through modeling: Four schools' experiences in sustainability education. The Journal of Environmental Education, 38, p. 39-53.

Wigginton, M., Harris, J. (2002). *Intelligent skins.* Woburn, MA: Architectural Press.

Coates, G. (1974). *Alternative learning environments*. Stroudsburg, PA: Dowden, Hutchinson & Ross, Inc.

Hartman, H. (2009.) Sustainability in practice: Primary schools. *Architects' Journal, 230*. p. 41-45.

U.S. [Map]. (2012). Retrieved from http://www.geography.about.com

American Institute of Architects. (2010). *AIA Top Ten*. Retrieved from http://www.aiatopten.org/node/77

City-Data.com. (2012). Sidney, Montana: 2012 climate data [Data set]. Retrieved from http://www.city-data.com/city/Sidney-Montana.html

Geology.com. (2012). Bakken Shale. Retrieved from http://geology.com/usgs/bakken-formation-oil.shtml

MT.Gov. (2010). Montana Field Guide. Retrieved from http://fieldguide.mt.gov/displayES_Detail.aspx?ES=3114

Oregon Office of Energy. (2002) *Case study: The dalles middle school*. Retrieved from http://www.oregon.gov/ENERGY/cons/school/docs/thedalles.pdf

MT.Gov. (2010). Montana Topographic Map Finder. Retrieved from http://maps2.nris.mt.gov/scripts/esrimap.dll?name=LocMap&Cmd=Map

University of Oregon Solar Radiation Monitoring Laboratory. (2007). Retrieved from http://solardat.uoregon.edu/SunChartProgram.html (Figure 15-1)

* Aerial site photos provided by D. Farr and ABC Building Concepts, LLC.
* Process sketches, documentation, and modelling by Dominic Monson.

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"I don't believe in quotes..."
- A recent NDSU Graduate