



2015 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES  
ARTS, HUMANITIES, SOCIAL SCIENCES & EDUCATION  
JANUARY 03 - 06, 2015  
ALA MOANA HOTEL, HONOLULU, HAWAII

# INTEGRAL THEORY AS A FRAMEWORK FOR SUSTAINABLE EDUCATION AND PROFESSIONAL PRACTICE



ROBERTS, SAGLINDA HALLETT  
PHILADELPHIA UNIVERSITY  
MASTERS OF SUSTAINABLE DESIGN

Ms. Saglinda Hallett Roberts  
Masters of Sustainable Design  
Philadelphia University.

## **Integral Theory as a Framework for Sustainable Education and Professional Practice**

### **Synopsis:**

The validity, applicability, and feasibility of applying Integral Theory as illustrated in DeKay's "Integral Sustainable Design" will be explored. A brief outline of the research and guiding principles used to transfer the abstract ideologies of DeKay's "Integral Sustainable Design" into a physical design will be illustrated with 5 separate designs.

## Abstract

Sustainable design needs to be far more than a list of strategies applied mechanically to every design situation. If the architectural and design community is to be truly sustainable a whole new method of architectural practice needs to be pursued. This paper profiles the use of Integral Theory as applied by Mark DeKay in his book "Integral Sustainable Design" as a basis for a Master's in Sustainable Design thesis. The validity, applicability, and feasibility of applying integral theory to a sustainable design project will be explored. A brief outline of the research and guiding principles used to transfer the abstract ideologies of DeKay's "Integral Sustainable Design" into a physical design will be explained. To further explore the validity of the process, four designs were created, each focusing exclusively on each of DeKay's four quadrants: Experience or Beauty, Behavioral or Function, Cultural Connections, and Systems or Ecological Perspective. To complete the process, a fifth design was then created which considered the requirements of all four quadrants simultaneously. The resulting designs show aesthetic, functional, cultural, and ecological improvements in design, along with the ability to produce approximately twice as much energy as required by the building.

The author is a highly experienced professional trained and practiced in the traditional method of design. She will discuss the changes to her design approach, personal design directives, and finally the resulting changes to her professional practice as a result of completing this design exercise. When reviewing these personal shifts, along with the resulting designs, it will become evident that this process has value for both professional practice and academic teaching strategy. Expanding the goals and design directives of the design profession enables the creation of more holistic sustainable designs, which in turn will resonate deeper with clients and the general public, be more energy efficient, support cultural connections, and become an integral part of the eco-system, therefore becoming truly sustainable and restorative. The goal of Integral Sustainable Design as outlined in this paper is not to eliminate the past tenets of architecture, nor the beauty and poetics of space, but rather to broaden architecture's scope to include efficient use and preservation of the earth's resources.

## Reflections on Integral Theory as a framework for Thesis and Sustainable Education

As stewards of the built environment the architectural, design and engineering professions need to take seriously their contribution and understand the gravity of their influence. Fred Gage states in his forward to John Paul Eberhard's book *Brain Landscapes: The co-existence of Neuroscience and Architecture* that; "I contend that architectural design can change our brains and behavior. The structures in the environment...affect our brains and our brains affect our behavior." (2009, p. XIV) The environments being designed today are shaping how people live and function in the future. Dylan Trigg, an Irish Research Council post-doctoral research fellow in Philosophy at University College of Dublin and author of , *The Memory of Place; A Phenomenology of the Uncanny* argues, "As bodily subjects, we necessarily have a relationship with the places that surround us... Over time, those places define and structure our sense of self...Place is at the heart not only of who we are, but also of the culture in which we find ourselves." (2012, p. 1). Speaking more on the importance and place of architecture is Dr. Ashraf Salama, the Founding Head of the Department of Architecture and Urban Planning at Qatar University who writes, "...the built environment [is] a two-way mirror...it conveys and transmits non-verbal messages that reflect inner life, activities, and social conceptions of those who live and use the environment." (2007, p. 87). John Ruskin, an architect from the mid to late 1800's, believed that, "a good building must do two things, firstly it must shelter us, secondly it must speak to us." (<http://www.ozetecture.org/2012/peter-stutchbury/>). Structures do more and serve other purposes than to simply protect from the elements or to be efficient in the resources consumed. Ruskin also stated, "...let us think that we build forever... let us think, as we lay stone on stone, that a time is to come when those stones will be held sacred because our hands have touched them..." (<http://www.energyliteracy.com/?p=204>). Quality, permanence, and a sense of continuity imparted from the past to the future is a prominent and widely accepted principle within the architectural profession. This corresponds to what Salama (2007) argued with phrases like a "two-way mirror....transmits non-verbal messages...[to] reflect inner life...and social concepts" (p. 87).

To advance the professional exploration of sustainable design it must consider that, "Although we fundamentally shape our surroundings, ultimately place exists independently of human life, in turn shaping us" (Trigg, 2012, p. 2) The built environment touches the human experience, changing individuals and society. As a result, it is pertinent to examine in the beginning discussion of sustainable design Creating a pattern for sustainable design that is holistic should be among the highest priorities for the stewardship of the built environment. If Integral Design Theory is applied to sustainable design then restorative, holistic sustainable design solutions will result, changing people's view of architecture and the sustainability movement, and creating a different design process.

Restorative, integral sustainable design recognizes that all these varying aspects of human existence exist and that these are basic premises of architecture and are indeed valid and important. Restorative, integral sustainable design is not looking to do away with the past tenets of architecture, nor the beauty and poetics of space, but rather it attempts to broaden its scope to include efficient use and preservation of the earth's resources and promote the understanding, "...that the rights of one species are linked to the rights of others and none should suffer remote tyranny." (McDonough, 1993, p. 8)

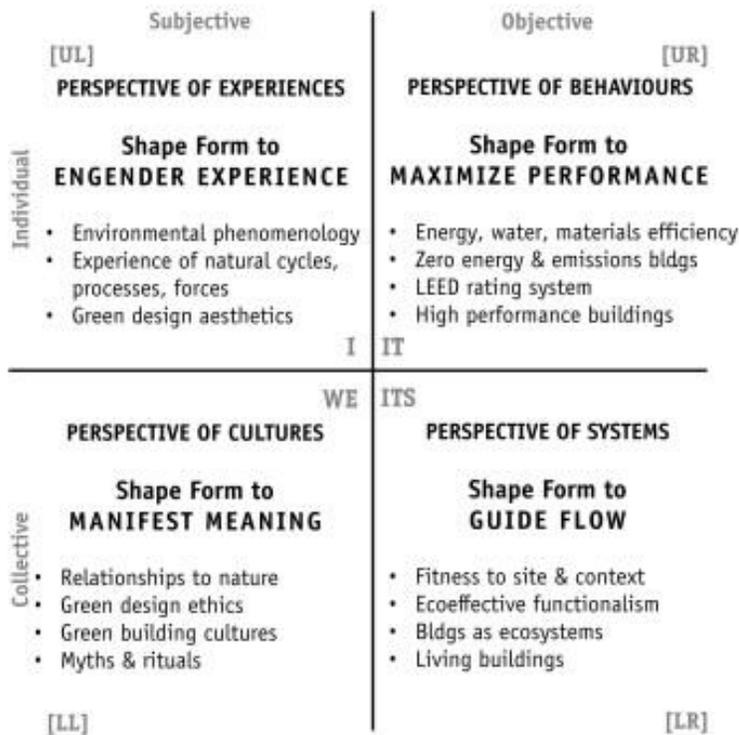
### Introduction to Integral Theory

Integral Theory was proposed and popularized by Ken Wilber, a philosopher, mystic, trans-personal psychologist and prolific author. In his first book, "The Spectrum of Consciousness," Wilber (1977), looked at history, psychology, and Eastern Mysticism seeking to combine the knowledge from these disparate fields into one worldview or philosophy. Wilber (1977) theorized that all human perception could be broadly classified into four areas; Experience or Beauty, Behavioral or Function, Cultural Connections, and Inter-related Systems or Ecological.

Mark DeKay, Associate Professor and the Director of Graduate Studies at the University of Tennessee's College of Architecture and Design, is the first to attempt to apply Wilber's theory to architecture in his book "Integral Sustainable Design". He is a registered, practicing architect specializing in ecological design theory and practice. Through professional practice, DeKay (2011) observed that design tended to be viewed from inherently different perspectives because people are guided by their own priorities. As he gained more experience working collaboratively, he also observed that the inclusion of differing views, or priorities into the design process resulted in stronger, more restorative, holistic solutions; becoming truly sustainable.

DeKay (2011) adapted Wilber's (1977) four quadrants to correspond to sustainable design, using Vitruvius's (c.25 B.C.) "Firmness Commodity and Delight" as a starting point. His goal was to create, "An integral approach to design ... that unites the beautiful, the art of design, and the good, the ethics of design with the true, the science of design." (DeKay, 2011, p. XXXI). The grid is broken into four quadrants each representing the four "primary dimensions" or perspectives of design/understanding. The grid is an easy way to organize and understand all the differing aspects of sustainability, and it helps to move the profession beyond the focus only on renewable energy sources.

**Illustration 1: Integral Sustainable Design Grid, DeKay (2012)**



Source: DeKay, 2011, p.18

### Brief Overview of DeKay's Four Quadrants

#### Upper Left Quadrant - Experience

“How shall we shape form to engender experiences of Nature and process?” (DeKay, 2011, p. 19)

This quadrant is concerned with designing for the individual, subjective, experience of space, beauty, and nature. Though not specifically mentioned, concepts such as aesthetics, experience, personal perception, place, Phenomenology, psychological reaction, and subconscious behavior would all fall into this category. The understanding of health, behavioral and perceptual changes associated with architectural design or volumetric configuration, creating connection with nature, light, form, color meaning, benefits attributed to full spectrum lighting, environmental psychology, and designing the building to compliment the surrounding topography would also be included in this quadrant.

#### Upper Right Quadrant -

“The upper right quadrant is concerned with measurable performance, asking the question “How shall we shape form to maximize (eco) performance?”

(DeKay, 2011, p. 19)

This quadrant is concerned with measurable, quantifiable aspects or engineering based technologies or calculations that influence the building's performance. All the factual aspects of site, climate, topography and renewable energy available of a specific site. DeKay's main focus is “...building with Nature into an ecological context at multiple scales (element, building, site, and on up to the global atmosphere).” (217)

Included though not specifically stated would be functions smaller or below the level of the building envelope such as occupant use or functions. Additional areas which should be addressed in this quadrant are embodied energy, Biomimicry, cradle-to-cradle principles, space planning, occupant function/efficiency and site or urban planning.

#### Lower Right Quadrant - Systems

“The lower right quadrant is concerned with systems or “guide flow” performance. It asks the question “How shall we shape form to guide ecological flows?”

(DeKay, 2011, p. 19)

This quadrant is concerned with forming an interconnected system between topography, ecosystem, urban landscape, building, occupants, and natural forces of the earth. The architecture is seen as part of the systems of site, ecology and culture. DeKay's ultimate goal for this quadrant is to “... not merely to minimize out impact on Nature or to create artefacts that act like a natural cycle...but to create dynamic, flexible networked human ecosystems where Nature and society are, at the holarchic level of life integrated as one web...” (232-233) He also relies heavily on Alexander's (1977) view of “... connect[ing] a pattern of space to a pattern of social or natural events...” (DeKay, 236)

#### Lower Left Quadrant - Cultural Connection

“How shall we shape form to manifest meanings of ecological systems and our relationships to them?”

(DeKay, 2011, p. 19)

DeKay's primary concern in this quadrant is “...how any design places us into relationship with nature in ways that embody meaning.” (DeKay, 2011, pg 82) Issues that are typically considered with the use of the term culture, such as historic or vernacular architecture, ethnic origins, shared human rituals, or social practices should also be included. Historic preservation, adaptive reuse, past land uses, should also be included along with social equity. These things are all part of what is termed “Place” and are important aspects of connecting and bonding with a specific location.

## Integral Theory's Applicability to Sustainable Design and Architecture

Integral Theory's other broad goal is to re-join and recreate relationships that acknowledge the natural interconnectedness of all things, both seen and unseen, and "...is concerned with facilitating human existence with quality, equity and beauty along side of [energy] efficiency." Peter Buchanan (2012) pointed out that "Pre-Modern" humans, referring to the time before monotheism or Greek Philosophy, had an innate, organic connection to nature, and considered themselves part of it. Their architecture clearly exhibits this very a distinct connection, reliance and interconnection with the earth which made the structure an integral part of the landscape.

Integral Sustainable Design (ISD) is also concerned with inclusion and alignment of otherwise competing goals, allowing an architecture "...informed by the processes, patterns and connections relating to its purpose, rather than some preconceived idea of beauty that dictates function by its form." It seeks to expand the view and focus of the design professional enabling the creation of more holistic, restorative, and truly sustainable designs, which resonate deeper with its occupants, are more energy efficient, support cultural connections, becoming an integral part of the eco-system. DeKay reasons, "If we indeed desire to create an integral architecture we need an integral path to get there." (DeKay, 2011, p. 243)

Though lacking in some areas, DeKay's grid represents an efficient organizational system with which to classify all the aspects which should be considered in Sustainable Design. In his essay, *The Big Rethink: Toward a More Complete Architecture*, Buchanan described the goal of Integral Sustainable Design as; "...vastly inclusive yet disciplined...combining richness with rigor, breadth with depth...giving equal value to the subjective and objective while also grounded in empirical evidence...providing a conceptual framework that stimulates new insights by highlighting neglected areas of investigation" (2012, p.3/25) The AIA endorses DeKay's book as a "...powerful conceptual framework." (2014, Architect's Knowledge website)

### Design Exercise

The site selected for the thesis project was a parcel of land currently for sale in the Roxborough, District of Philadelphia. The general agrarian character of the neighborhood had been preserved since the Mid-1800s when the land was first developed. I participated in a design charrette facilitated by Re:Vision Architecture, and initiated by the residents and surrounding conservancy organizations to develop strategies for maintaining the pristine unaltered topography of the 10 acres parcel currently for sale. (See Illustration 2) The information regarding preferred development patterns, neighborhood aesthetics, setbacks and vegetation coverage was incorporated to the design directives and was used for the Cultural Quadrant.

## Illustration 2: Surrounding meadows, Port Royal Avenue



Source: Photo by author, used courtesy of Re:Vision Architecture

The same client profile was used for all 5 houses: a professional woman, with college age children who visit sporadically, a home studio and entertaining space.

### Experiential Quadrant Design

“How shall we shape form to engender experiences of Nature and process?”  
(DeKay, 2011, p.19)

### Process and Research Focus

Study and research showed this quadrant is really about the relationship and interaction between the occupant and the structure, going far deeper than pure aesthetics to all levels of perception including the conscious, unconscious and psychological responses to volumetric configuration, light, and space. The keywords used to summarize and understand the directives for this quadrant would be: experience, perception, phenomenology, cognition, beauty, delight, visual, subjective, and transcendence.

The Guiding Principles or questions that directed the design of the Experience Quadrant house would be as follows in Table 1.

**Table 1: List of Guiding Principles for the Experiential Quadrant House**

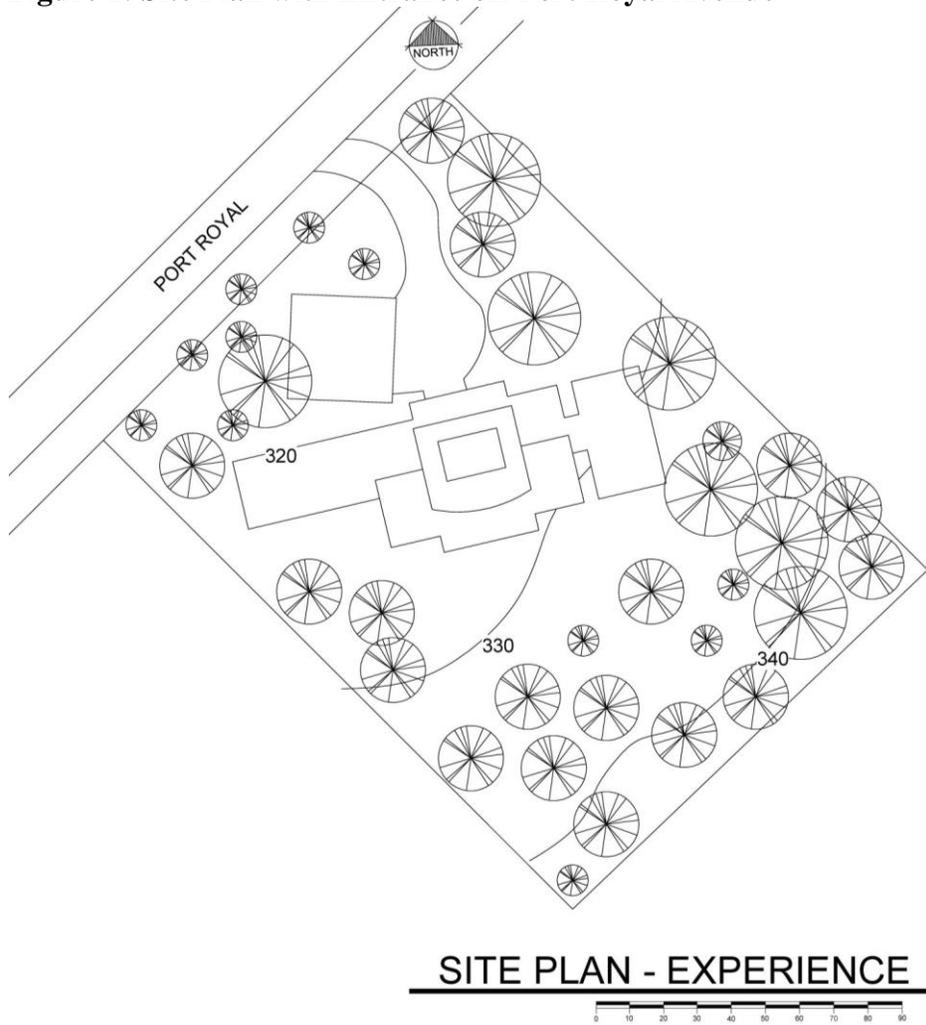
Guiding Principles
Openness, light, views, connection to outdoors
Beauty and experience only
Light, spatial relationships and volumetric form to reflect clarity of purpose and function
Transparent yet protective structural form based on function and flow
Volumetric configuration defining functions and flow
Sense of retreat and privacy
Interrelated rhythm between the structure and design elements of plan providing supporting anticipate activity of occupants

### Plans

The Experience scheme site plan below in Figure 1 shows the house and garage on the site. The driveway enters off Port Royal Avenue. The position of the garage provides a sheltered courtyard for the front entrance as well as privacy from the main street. All areas have visual access to the rear of the house with outdoor living areas. The trees on the rear and west portion of the lot remain for privacy as well as aesthetics.

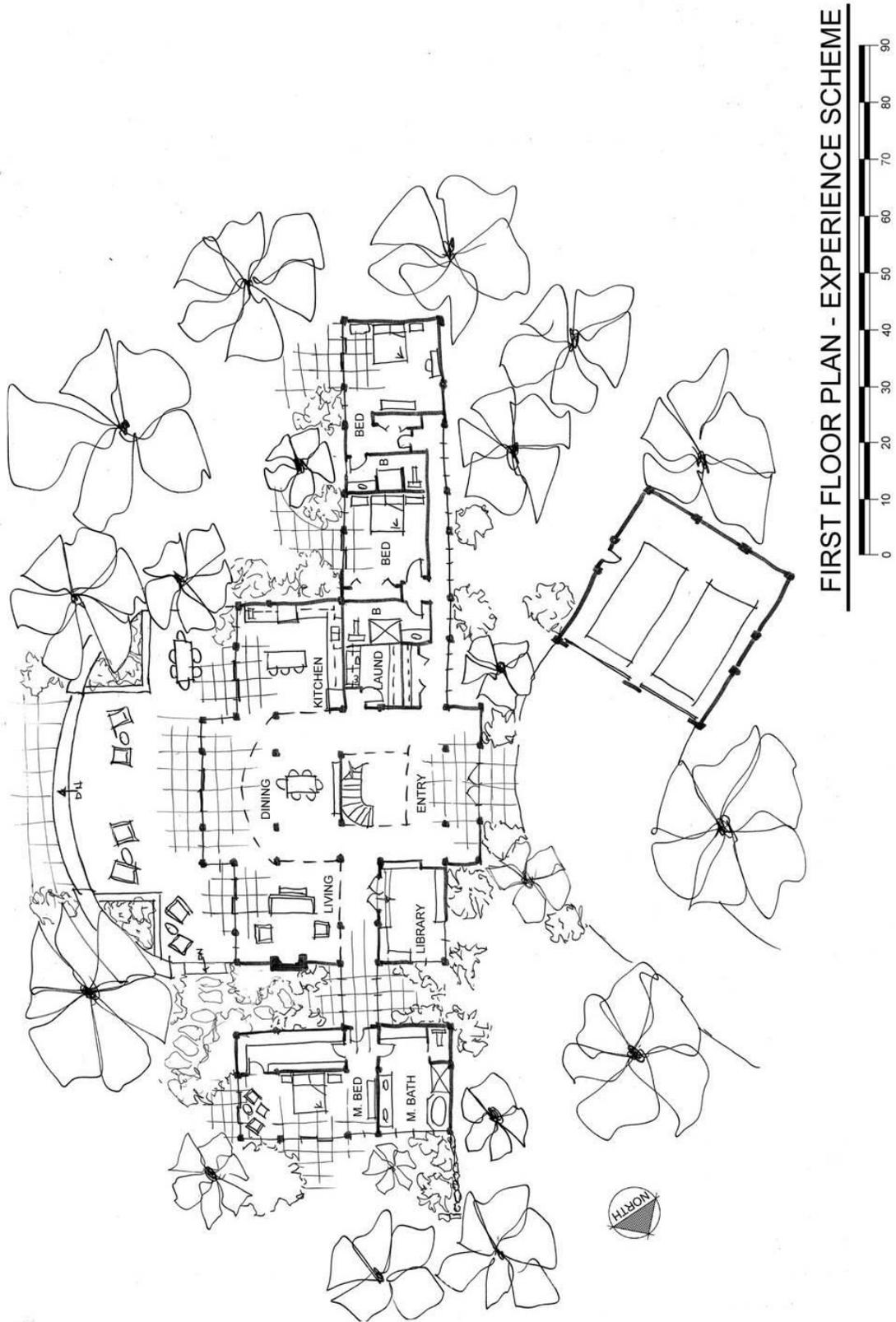
The first floor plan, shown on the next page in Figure 2, is designed based on a structural grid with an A/B rhythm on a 3' module, with exposed timber frame construction, stone floors and exposed metal connector plates.

**Figure 1: Site Plan with Entrance off Port Royal Avenue**



The ceiling and floor finish extend outside the building envelope into the overhangs and outdoor living area floors to give a sense of continuity between the outdoors and inside. All interior rooms have access to outdoor living areas in the rear of the house. Large, high windows were placed in the rear of house to extend and expand the view of the private areas of the property. Decisions were based strictly on beauty and perception, forgoing cost considerations.

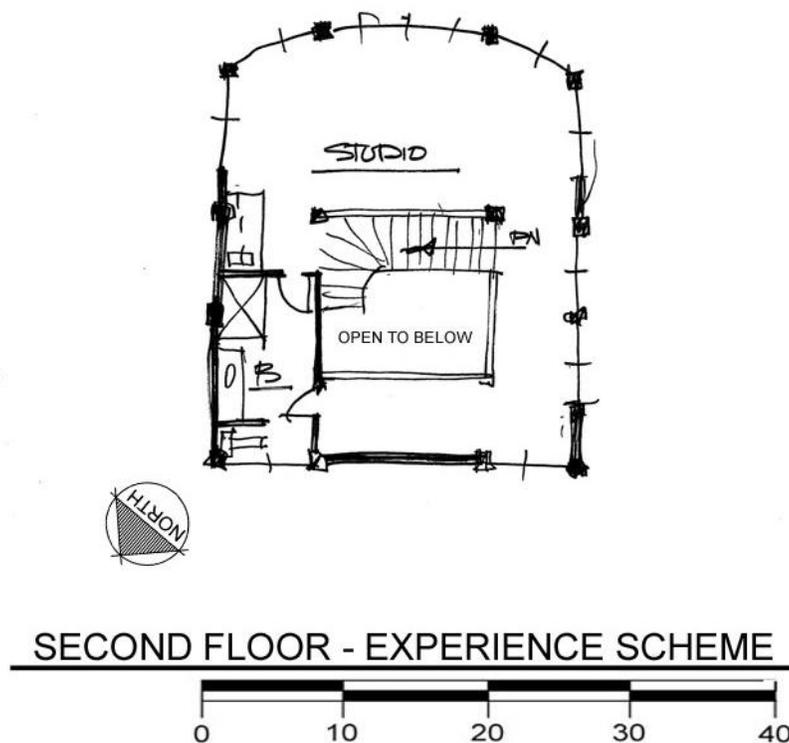
Figure 2: First Floor Plan, Experience Scheme



Ceiling heights were determined by the actual or desired activity level. Areas where the occupants would be more active were given higher 12' ceilings. Areas with less activity were given lower ceiling heights of 10', because the natural subconscious reaction to compressed volumetric space is to become settled. The guest bedrooms are separated for privacy of both the guests and owner, also making it easier to heat or cool when unoccupied. The library provides privacy within the public spaces of the house. The Entry ceiling is open to the Studio above, allowing light and air movement into the core of the house.

The corridor locations and configurations are used to organize the privacy level of the residence. These glass corridors provide a sense of transition between public and private, creating a more intense visual interaction with the outdoors. The Studio, shown below in Figure 3, has its own full bath and small kitchenette. The curved wall overlooks the private area at the rear of the house as well as provides consistent natural light and air flow. This area could also be used as a guest apartment.

**Figure 3: Second Floor Studio, Experience Scheme**

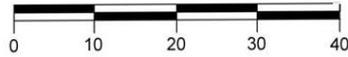


The section through the main living area of the house, in Figure 4 shows the relationship of floor levels to the function of the spaces. There is also light available from the open curved staircase to the Studio.

**Figure 4: Section through Entry and Dining looking toward Living, Experience Scheme**

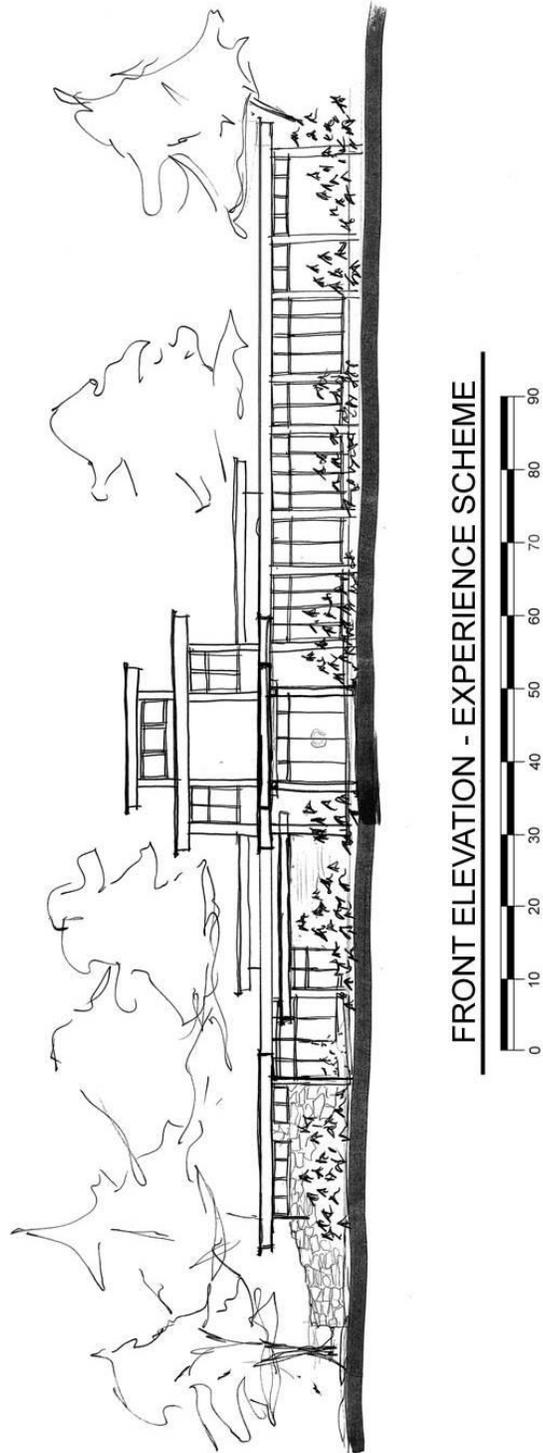


**SECTION - EXPERIENCE SCHEME**



The Front Elevation, is shown in Figure 5. The position of the garage creates a sheltered courtyard entrance, as well as more visual privacy for the glass corridor to the guest rooms. The elevation is light and open, yet maintains privacy for the occupants without extensive use of window treatments. The main areas of glass on the street side of the house are public circulation corridors

**Figure 5: Front or North Elevation, Experience Scheme**



## Professional Insights from Exclusively Designing for Experience

*Designing to only consider beauty was harder than it seemed because in actual professional practice there are always the factors of budget, practicality and function to consider. This highlighted the fact that how the space functions is also part of experience and perception. The cupola was originally added for light and volumetric expansion, yet also promoted natural ventilation...a passive system. This revealed that function and performance are part of perception and experience and maybe a flat two dimensional grid was maybe an inaccurate way to be looking at this whole picture. Though I loved the purity and clarity of the exposed structure, the direct relationship to purpose, and the unbroken 3' A/B rhythm to the structural grid, in the end realized that space sizes and configurations are better determined by using the flow and function of the project.*

As important, and subjective, as beauty and perception are, designing to only consider these illuminated several aspects of the design process that require closer attention. Table 2 shows a list of the main lessons I learned from the design process.

**Table 2: List of Lessons Learned from the Experiential Quadrant House**

Lessons Learned
Aesthetics can become dominating
Don't let the building design you, you design the building
Beauty and connection are extremely important
Material Matters – it changes the whole feel
Design elements can be both beautiful and functional
Beauty is deeper than ornamental configuration
Perception is deeper and greater than visual, aesthetic appeal
Form and elemental structure should be shaped by function and flow, not a structural grid
Committing to aesthetic form can cause resistance to change
How much does the occupant sense or understand without the same insight into design decisions as the designer?
Do we ever know ahead of time if we are creating buildings of lasting significance that will be revered?

## Concerns with Exclusively Designing for Experience

One of the design goals was to have privacy and a sense of retreat, and this house achieves that but at the expense of shunning the surrounding neighborhood with its placement, configuration and aesthetic choices. The historical character, architecture and undisturbed topography of the site were not addressed in this design. One would have to assume great resistance from the surrounding property owners if this house were to be built. All the glass was beautiful from an experience point, but the heating and cooling costs would be extremely high.

## Cultural Quadrant Design

“How shall we shape form to manifest meanings of ecological systems and our relationships to them?”

(DeKay, 2011, p. 19)

### Process and Research Focus

Study and research revealed that this quadrant was mainly about the structure's relationship with societies' view looking towards the structure. DeKay extends this to our connection to nature or Biophilia. Keywords directing my focus were: historic and vernacular architecture, materiality, and social equity. Because of the strong historic nature of the surrounding structures, the preservationist attitudes of the residents, and the results of the design charrette I participated in, the direction for this house was very.

The Guiding Principles that guide the design of the Cultural Connections Quadrant house are shown in Table 3.

**Table 3: List of Guiding Principles for the Cultural Connections Quadrant House**

Guiding Principles
Exterior conformity to historic character of neighborhood
Use proportions, materiality and massing expressed in charrette results
Interior to adapt for current lifestyles
Tie social equity into Cultural Connection in the most complex way
Design so nature is a sensed cyclical force, creating rituals that foster connection.

The directives resulting from the design charrette with the community established the following Guiding Principles for any new development in the neighborhood (Table 4). These directives were also used when designing for this quadrant

**Table 4: Design Directives Resulting from Design Charrette**

Charrette Design Directives
Match existing massing and proportions of existing houses
Maintain existing 20'-30' set backs
Maintain existing Materiality of stone, stucco and wood
No garages facing Port Royal Avenue
Maintain naturalistic feel of Port Royal Avenue
Limit amount of developed space on lot to approx 40% or less

## Plans

The site plan in Figure 6 shows the house and garage on the site. The driveway enters off Port Royal Avenue. The position of the garage provides a sheltered courtyard for the front entrance as well as privacy from the main street. All areas have visual access to the rear of the house with outdoor living areas. The trees on the rear and west portion of the lot remain for privacy as well as aesthetics.

**Figure 6: Site plan with entrance off of Port Royal Avenue**

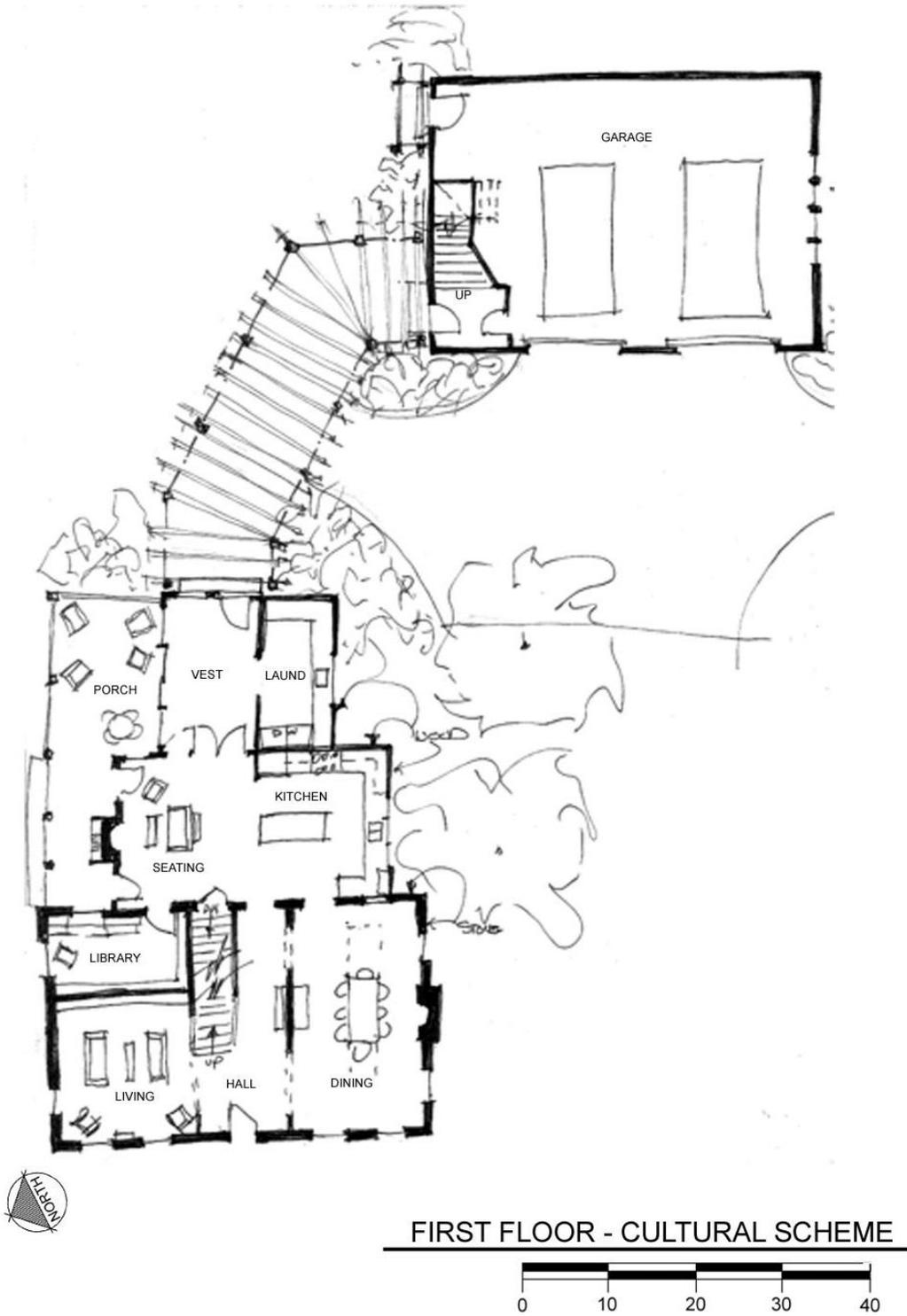


The majority of original structures were first constructed of stone or stucco, with a steep single gable roof parallel to the road, two stories and a full height attic, with approximately 12' floor to floor height. The front of the house had symmetrical large windows, two each side of front door, the side windows are smaller with asymmetrical placement and the fireplace was on the gable end. The main or original structure appeared to be laid out with the typical center hall floor plan; the subsequent additions were configured in a telescoping pattern extending at the rear of the original structure. These additions were typically of wood with reversed gable roofs. Where garages were present, they were separate buildings not facing the road.

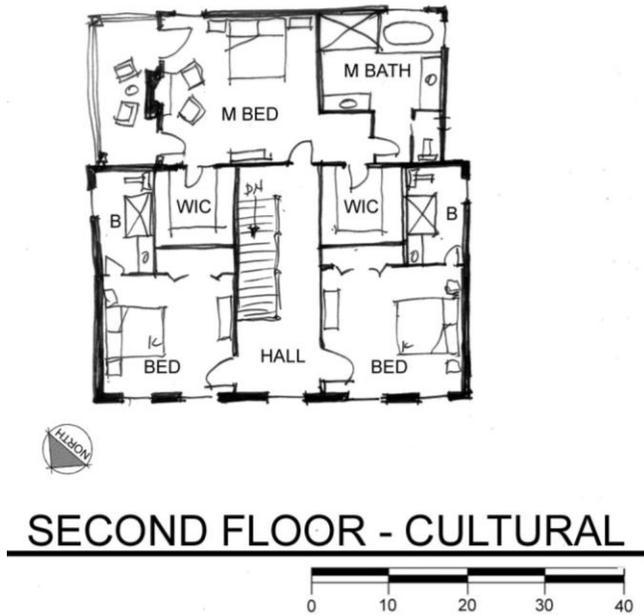
The first floor plan, shown on the next page in Figure 7, is designed based the above criteria attempting to replicate a typical historic home which was developed over time. The interior of the first floor uses the typical center hall plan as a basis for creating a more open living pattern with a larger open kitchen including sitting area, outdoor living area and library. The second floor was designed to accommodate couples or small families with each guest room being equal and similar to the Master Bed room. The Master Suite has an outdoor sitting area as shown in Figure 8.

The Studio as shown in Figure 9, was separated from the main house and uses the space over the garage which is behind and perpendicular to the main house. The walkway between the two buildings is covered with a pergola and has a heated walkway for winter ice.

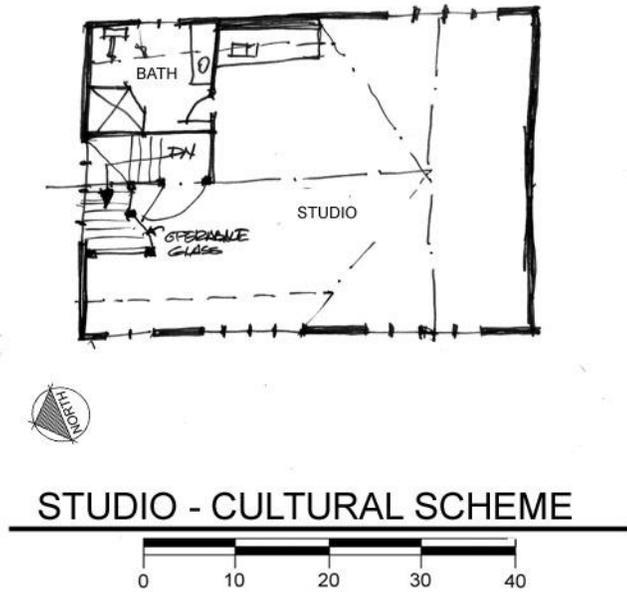
Figure 7: First Floor Plan Cultural Connections Quadrant



**Figure 8: Second Floor Plan, Cultural Connections Quadrant**



**Figure 9: Studio Plan, Cultural Connection Quadrant**



The front elevation which faces north shown below in Figure 10 gives the same appearance from Port Royal as the existing residences with the purpose of connecting with the history that is so much a part of the culture of this area. The side elevation shown in Figure 11 shows the exterior living spaces and the pergola connecting the garage and studio with the main house.

**Figure 10: Front Elevation, Cultural Connection Quadrant**



**Figure 11: East Elevation, Cultural Connections Quadrant**



## Personal Insights from Designing Exclusively for Cultural Connections

*Cultural connections are commonly considered, however, there was still much that was learned in focusing solely on this quadrant. The idea of specifically creating a connection with nature beyond the visual and designing for a sense of the diurnal and seasonal ritual defines the passage of time, acknowledges nature as a real presence in daily life, and may be the first steps toward preservation by creating an appreciation and connection.*

*I found it very hard, after the previous design, a large, open contemporary house, to think of the same functions, relationships, and openness in a smaller envelope which had to conform in its massing and fenestration placement to those around it. There was an initial hesitation and resistance to changing the original design showing an element of commitment and ownership that exists naturally when design decisions are made.*

The main lessons learned during and from the design are summarized with the intention of informing the final synthesized design in Table 5.

**Table 5: List of Lessons Learned from the Cultural Connection Quadrant House**

Lessons Learned
Many historic cultural elements also mitigate negative climate forces
Shared spaces are more energy efficient
Smaller square footage for spaces can be used without feeling confined
Offset massing creates natural interior divisions while maintaining openness
Nestled interconnected spaces can be more pleasant to live with than large open spaces
Historical norms can be achieved without sacrificing program or aesthetics
Connection with culture does not always require replication
Designing for natural cyclical force and creating rituals is possible and adds deeper level of connection with design
Social equity issues can be applied to individual buildings and interiors
Reflecting current lifestyles while acknowledging the past can work

## Concerns with Exclusively Designing for Cultural Connections

The main outdoor areas and majority of the glass were based on achieving the most privacy and interior plan and were therefore on the East and Northeast of the property. This part of the site would be shaded from the afternoon and early evening sun during the warmer months, but would miss the natural summer breezes for cooling and effect energy efficiency in colder months. There are little if any opportunities for solar gain or passive heating in the winter months. The dining room as a separate room sized to accommodate the required number of people could be seen as wasted space because of its limited use.

### Performance Quadrant Design

“The upper right quadrant is concerned with measurable performance, asking the question “How shall we shape form to maximize (eco) performance?”

(DeKay, 2011, p. 19)

### Process and Research

This quadrant is mainly concerned with the building's relationship and connection to performance and energy sources and usage, but should also be concerned with how the physical spaces work and function for the occupants. This quadrant would deal with anything factual, provable, and measurable.

The focused research dealt mainly with the general climate data for the region but also a study of the micro-climate created by the specific land massing and vegetation of the site. An in depth study of typical characteristics of passive systems and their relation to architectural configuration was made to increase building efficiency. The building form and facade was intended to play an active role in increasing building performance.

The Guiding Principles or questions that guide the design of the Performance Quadrant house would be as follows in Table 6.

**Table 6: List of Guiding Principles for the Performance Quadrant House**

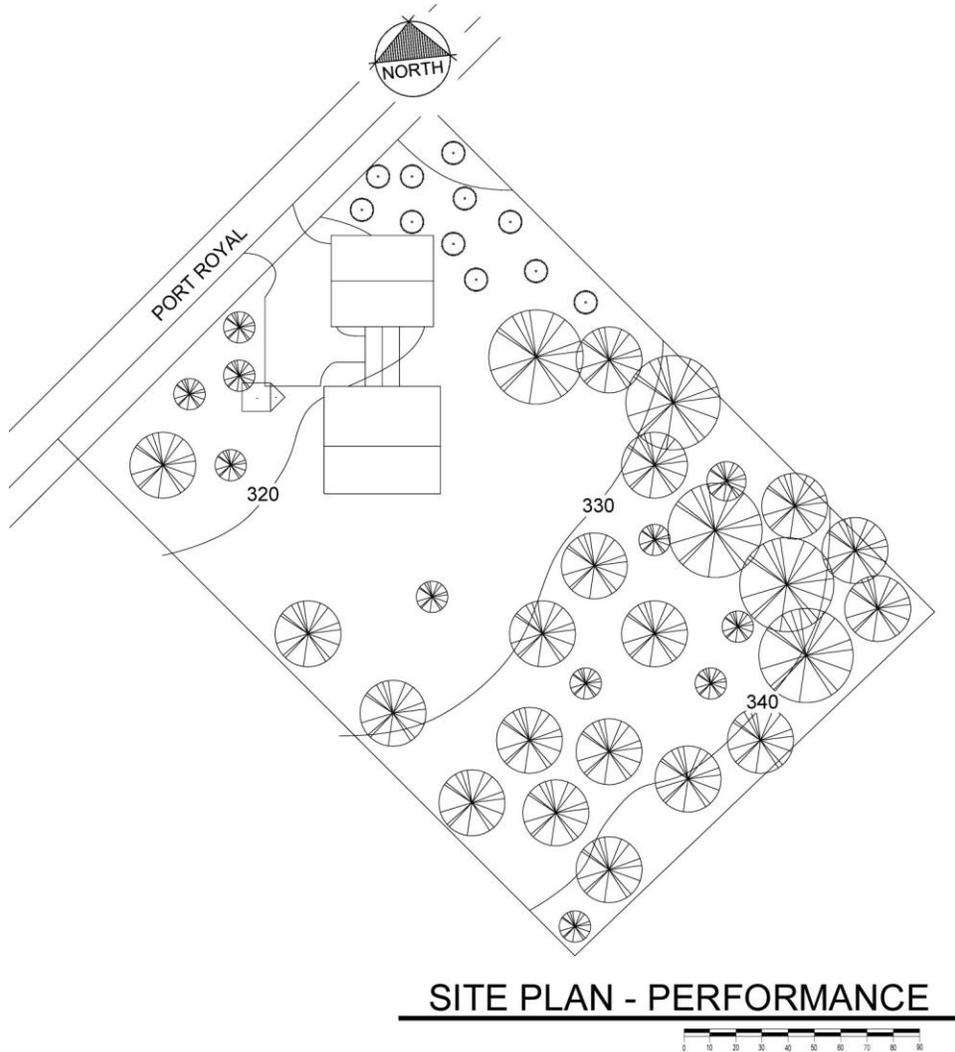
Guiding Principles
Net Zero Energy
Performance only, No aesthetics
Climate data driven
Minimum space requirements for most compact plan
Maximize passive systems - solar, shading, airflow, daylighting
Site first, passive strategies second, then mechanical systems
Expose systems when possible to create connection
“...admitting a desired resource is more important than blocking an undesirable force” DeKay (2001 p.22)
Facilitate occupant functional processes

### Plans

The site plan below in Figure 12 shows the house and detached garage on the site. To be most efficient the driveway is directly off Port Royal Avenue, and is typical black top material with the garage at the edge of the minimum setback. The house faces due south. The trees were removed on the southern and west side of the site to maximize solar collection. The garage blocks the northern winter winds. Because efficiency and performance were the only considerations, the site was excavated to allow for a full height foundation with the southern portion partially exposed for daylighting to the bedrooms on the ground floor.

The old growth trees were removed and new evergreens were planted to create a wind block on the Northern and Northeast sides of the site. Rain water is harvested for use in flushing. Storm water is handled on site, and a wet land was constructed for septic.

**Figure 12: Site plan with entrance off of Port Royal Avenue**



To create the most efficient building as possible the house was positioned facing due south for the greatest solar collection. All glass and windows were shaded to allow no direct sun during the warmer months. The stacked plan arranged all the public rooms on the south to take advantage of the best daylighting as well as the heat gain available in the

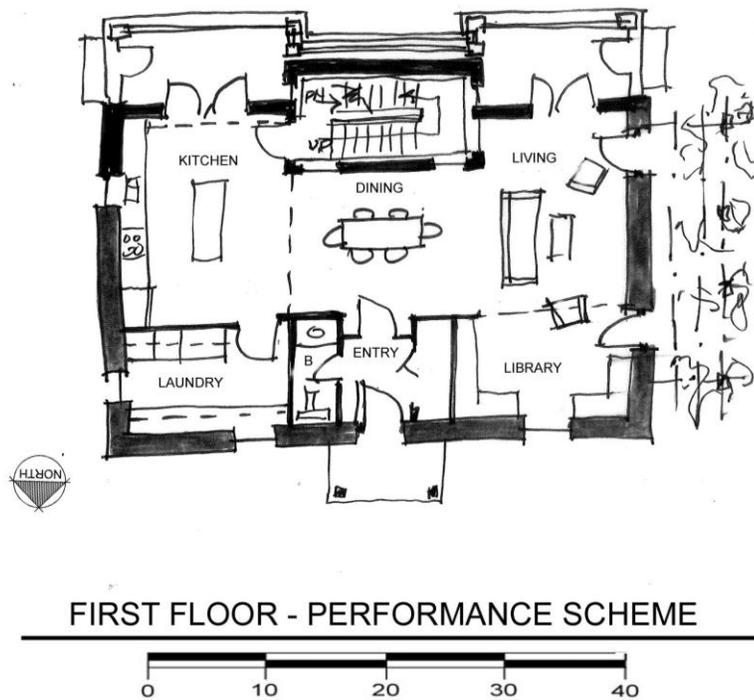
winter months. The ground floor bedrooms which are partially underground require no additional heat when not in use. It was the intention to make the performative systems visible to the occupants whenever possible.

The first floor plan shown below in Figure 13, is designed to have all the main living areas positioned with southern exposure. The area is 16' deep and can be naturally lit though out the day. Areas not requiring as much light or with lower occupancy rates are located on the north side as a buffer in winter. All floors are polished concrete with radiant floor heating supplied with geothermal heat pumps.

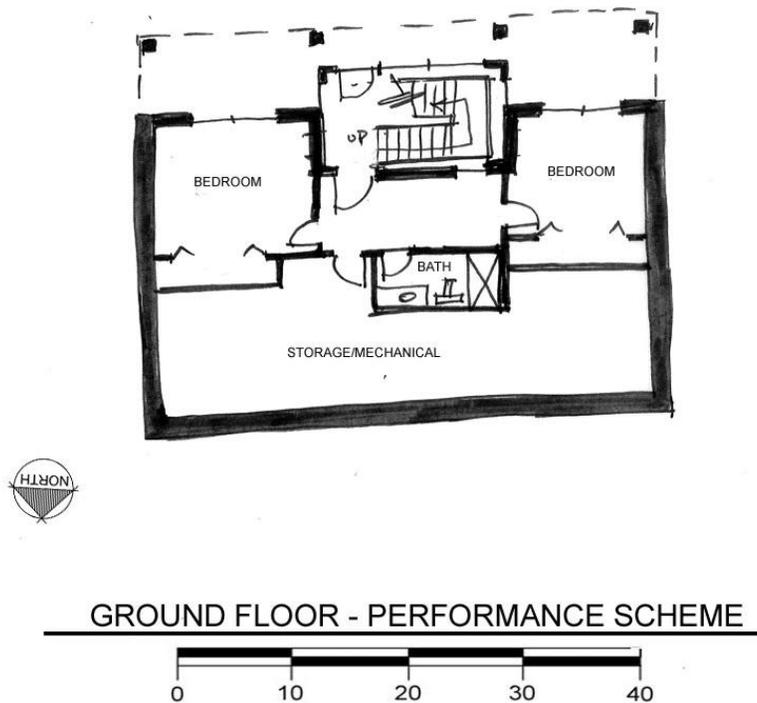
The stairway is unconditioned and acts as a heat sink in winter and a solar chimney for ventilation in the summer months. Clerestory windows take advantage of the air stratification for natural ventilation during the summer months. The glass louvers and stair configuration allow for the introduction of conditioned fresh air in the winter months, and also provide expanded living space during cooler months.

The ground floor accommodates two guest bedrooms. The site was excavated to allow windows in the front wall. Being partially below grade the guest rooms and bathroom would require no extra heating when not in use. See Figure 14.

**Figure 13: First Floor Plan, Performance Scheme**



**Figure 14: Ground Floor Plan, Performance Scheme**



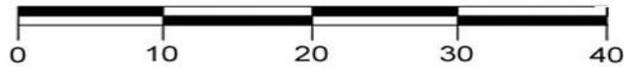
The second floor plan (Figure 15) shows the Studio being open to the main living areas of the house. The Master Bedroom and Bath have interior glass high in the walls adjacent the main living area allows better natural ventilation during the summer months. The building section shown below in Figure 16 gives a more detailed look at the passive systems used in designing this house.

High windows in main living area can be vented in warmer months through clerestory windows. Stair acts as additional means of natural air flow. Glass louvers provide additional insulation value in winter as well as providing for the introduction of conditioned fresh air. In summer the louvers can be fully open increasing air movement. The roof uses Structural Insulated Panel construction with R-Value of 60. Walls except for south Trombe wall are Structural Insulated Panel construction with R-Value of 40. The south facing portion is angled at 18 degrees, perpendicular to the summer sun angle, for optimum solar collection. Shading devices at each floor level keep direct sunlight out during warmer months while allowing full sun exposure during cooler weather. The North elevation below in Figure 17, the detached garage is placed to shelter the entrance as well as buffer the winter winds.

**Figure 15: Second Floor Plan, Performance Scheme**

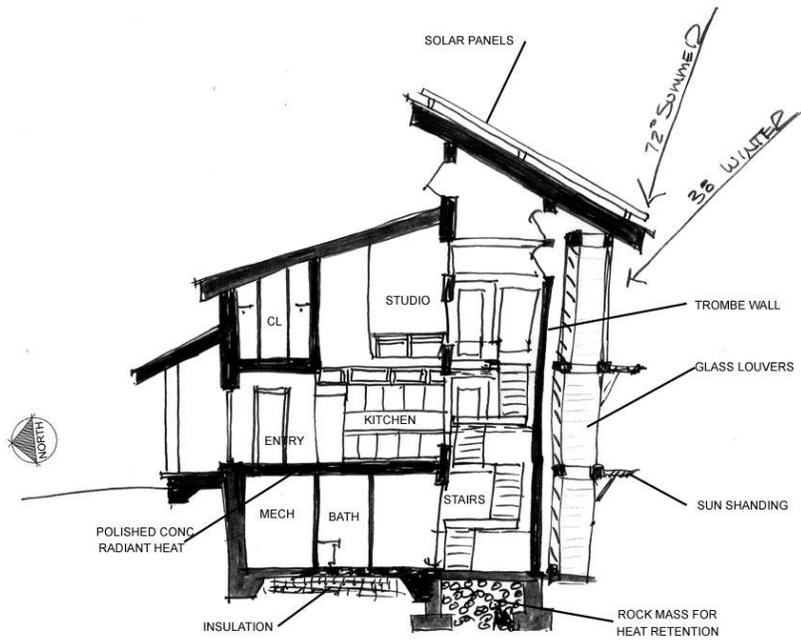


**SECOND FLOOR PLAN - PERFORMANCE SCHEME**

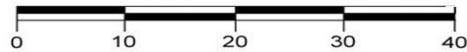


All elevations are designed to meet the maximum allowable square footage of glass. The wall on the south exposure is designed as a masonry Trombe wall to capture heat from solar exposure. Furthermore, this Trombe wall is fully shaded in the summer. See Figure 18. The roof area over the south portion of the house is angled at 18 degrees perpendicular to the summer sun angle for optimum solar collection, accommodating 54 Sunpower E20/327 solar panels. Maximum Array output is 20,753 kWh per year.

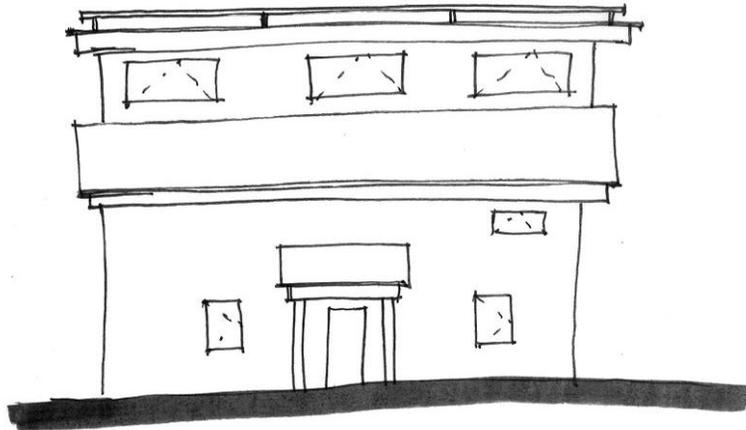
**Figure 16: Section, Performance Scheme**



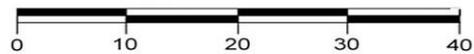
**SECTION - PERFORMANCE SCHEME**



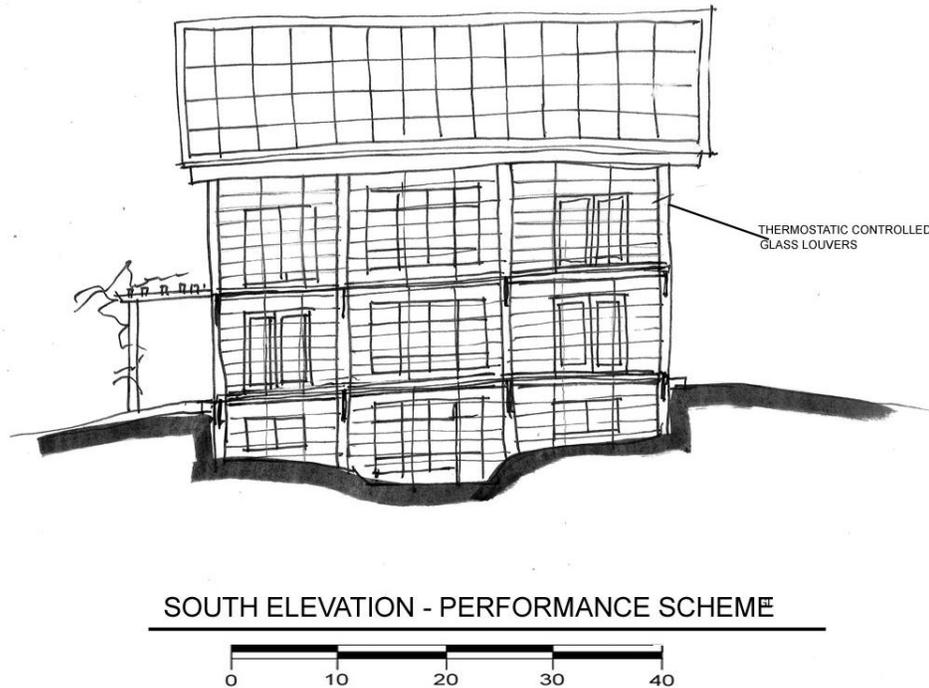
**Figure 17: North Elevation, Performance Scheme**



**NORTH ELEVATION - PERFORMANCE SCHEME**



**Figure 18: South Elevation, Performance Scheme**



### Personal Insights from Exclusively Designing for Performance

*This was both the easiest and hardest house for me to design. Easy because I was very familiar with many of the passive and active systems to employ and knew the minimum space requirements and strategies to reduce energy usage. Hard to design because I was able to see how strong and unconscious my desire for aesthetic and perceptual beauty is. This also was a clear illustration of how formative and prevalent one's own personal perspective is when designing or approaching anything.*

*The reduced number and size of the window openings to increase energy performance brought to my attention the importance of perception's role in designing integral holistic spaces. Feeling good about one's carbon footprint can not override the unconscious physical or psychological reactions the body has to the material world and architectural configuration.*

*My visceral reaction to living in this house was claustrophobic, this design elicits no desire to return to it, or spend more time there than necessary. This goes against the very fundamental, philosophical concept of home as a retreat and place to be nurtured and refreshed. Designing exclusively for energy efficiency and performance cemented my belief that additional areas need to be addressed to advance sustainable design and clearly illuminated the fact that all the quadrants are inter-related and extremely important to include when designing.*

The main lessons learned during and from the design were categorized with the intention of informing the final design, see Table 7.

Table 7: List of Lessons Learned from the Performance Quadrant House

Lessons Learned
Glass louvers for double skinned or "winter garden" approach
Net Zero easier to achieve than originally thought
Air movement with enclosed stair - glass adds visual appeal
Moving spaces with less occupancy and light requirements to North
Explore reduced square footage requirements
Explore passive strategies
Understanding Micro-climate is very important
Meeting requirements of the other quadrants is more important than originally thought

#### Concerns with Exclusively Designing for Performance

The issues of privacy, acoustics, and separation of spaces are a large and valid concerns. The Studio is open to the rest of the living area and as a result occupants may need to cross through it to reach the Master Suite. This circulation path could be an issue in some circumstances. Aging in place or any type of physical impairment would be hard to accommodate with this plan because of the stairs between the public and private areas. The rudimentary form and aesthetics of the house is very much in opposition to the surrounding buildings and it is imagined that there would be great resistance from the surrounding community. However, it is encouraging that Net Zero is achievable through time honored classic passive strategies only.

#### Systems Quadrant Design

“How shall we shape form to guide ecological flows?”

(DeKay, 2011, p.19)

#### Process and Research Focus

This quadrant seeks to discover the deeper patterns and the reciprocal interconnected of all things. It is concerned with evaluating all the possible systems and connections between building, site, ecosystem, and the larger surrounding community. The objective is to create a building that co-exists with the natural world and that will be a restorative force for ecosystems. Keywords used to direct my design focus were interconnected, Deeper patterns, reciprocal relationships, flows, living systems, and restorative.

For the Systems Quadrant house I considered all the climate information that I gathered during my research for the Performance Quadrant. In addition I studied the ariel maps provided by the National Land Trust during the design charrette to plot as accurately as I

could the existing trees with approximate heights. I also analyzed the topography for water and air movement on the site. Root compaction zones were plotted as well as projected summer solstice shade lines. The additional challenge was to only remove two trees on the whole site.

The Guiding Principles or questions that guide the design of the Systems Quadrant house would be as follows in Table 8.

**Table 8: List of Guiding Principles for the Systems Quadrant House**

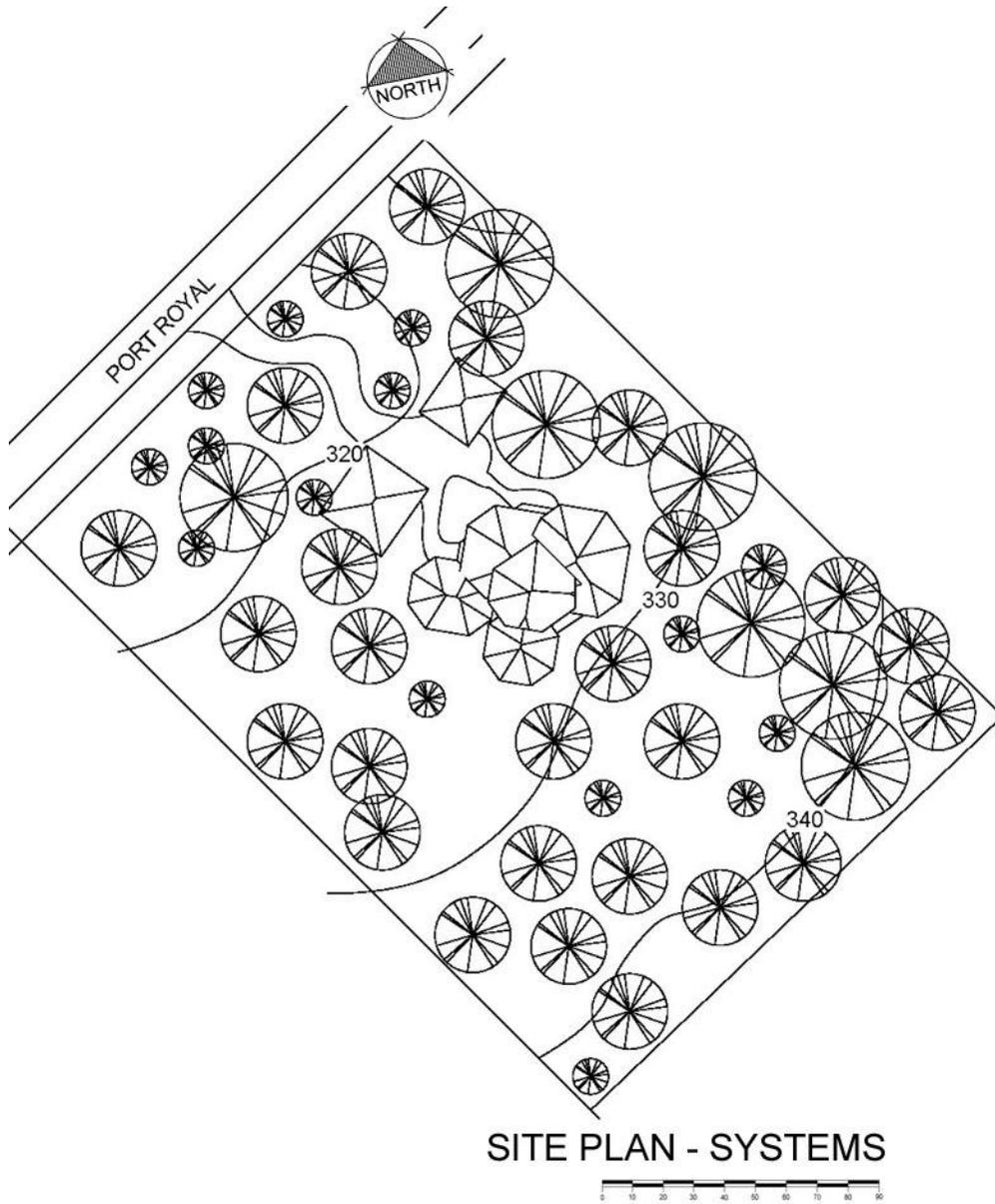
Guiding Principles
Building as an interconnected system with site
Be restorative
Guided by landscape, minimizing impact
Guided by flow and purpose of house and site
Look to nature for forms of development- Naturalistic forms
Celebrate and focus attention to natural cycles, functions, seasons
Passive systems only
Human and architectural intervention being restorative
Architecture as a system, within the system of site or ecology, facilitating the system of human function

### Plans

The site plan below in Figure 19 shows the house and garage on the site. The driveway enters off Port Royal Avenue following the natural opening in the trees to keep tree removal to a minimum. The garage is divided into two separate buildings to better fit on the available open land. The house is placed in the natural clearing and shaped to fit the configuration. The road is permeable recycled paving material. Rain water is collected for flushing and site storm water is diverted to rain gardens, septic is handled with constructed wet lands. Only two trees were taken down as a result of this scheme.

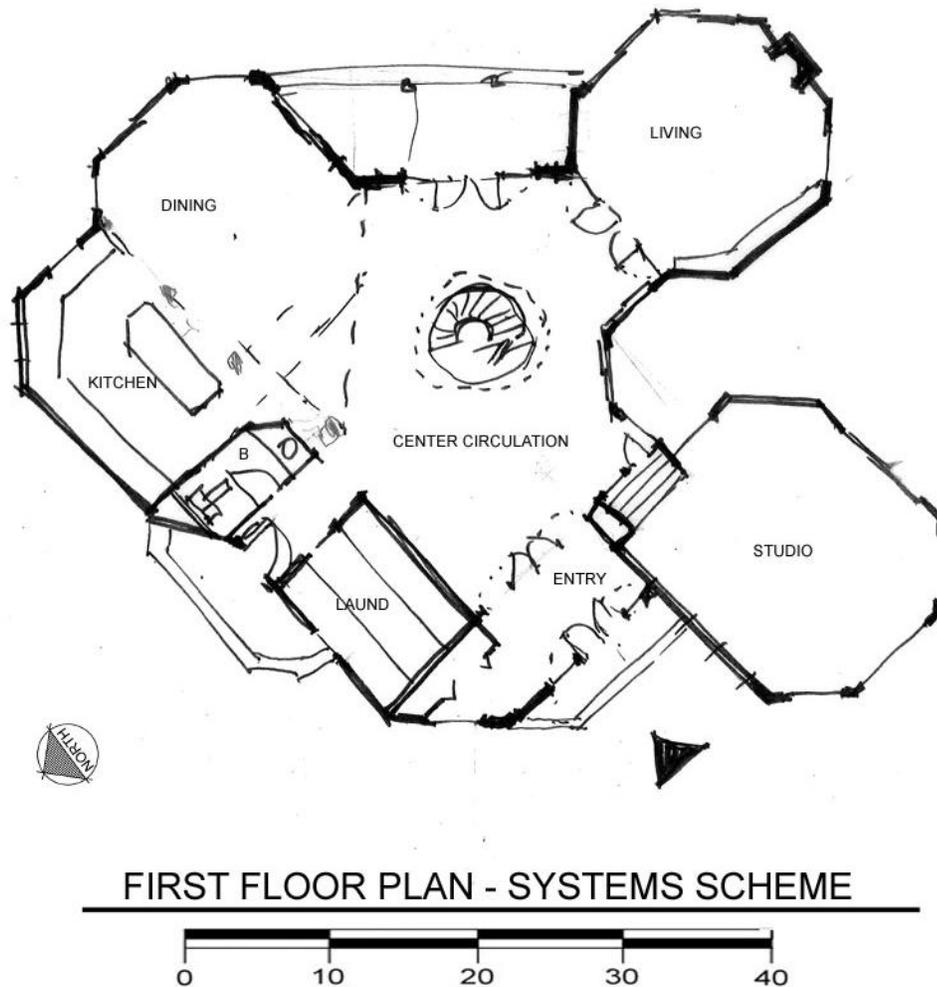
For this quadrant the site was studied in detail before any design began. Native indigenous plant research was done to understand what invasive species should be removed. The root compaction zones were plotted as well as the line of shade likely to be thrown by the 40' high trees. Seasonal winds were taken from research performed during the Performance Quadrant design and plotted along with projected air movement due to the topography and vegetation patterns. The water movement across the site was also studied for the storm water management and water gardens. See Figure 20 below.

**Figure 19: Site plan for Systems Quadrant Design**



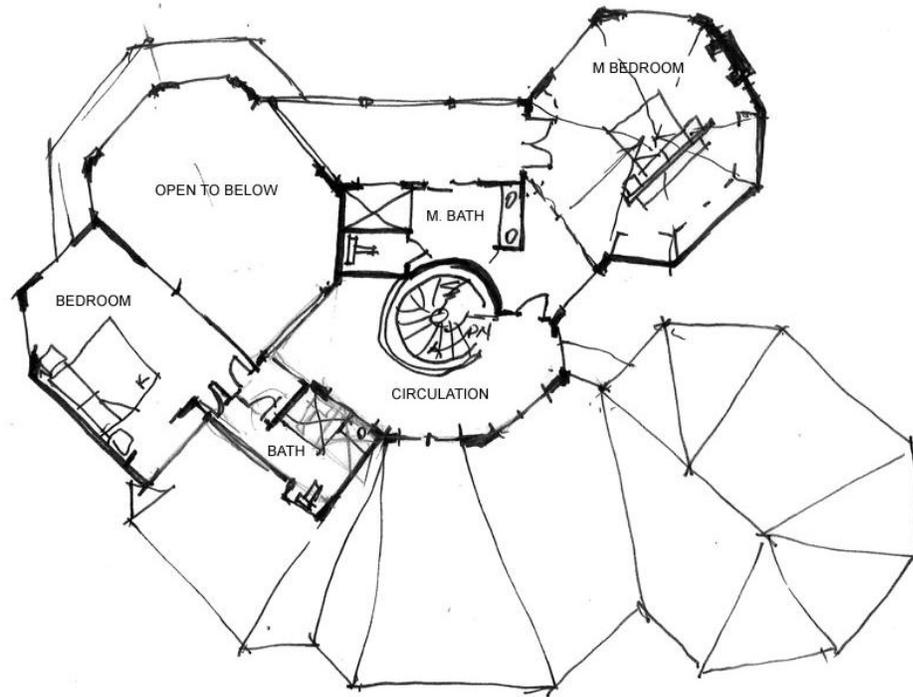


**Figure 21: First Floor Plan System Quadrant Design**

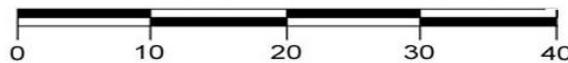


Shown below in Figure 22 is the Second Floor Plan for the Systems Quadrant design. The second floor houses the Master Suite, Guest Room and Bath. The circulation space below the cupola is used for library shelving. The dining area is open to below for interest and to accommodate the natural ventilation system. The additional Guest Room and Bath are above the large garage.

**Figure 22: Second Floor Plan Systems Quadrant Design**



**SECOND FLOOR - SYSTEMS SCHEME**



The section through the center circulation is shown below in Figure 23. The higher facades where most of the glass is to the south are placed within the shade line of the existing trees. The house has 3' overhangs as well to prevent the heat gain from the direct sun during the warm months. The lower plate height and long sloping roof line help to deflect the winter winds from the north as well as helping the house blend into the surrounding trees.

**Figure 23: Section at Center Circulation Area, Systems Quadrant Design**

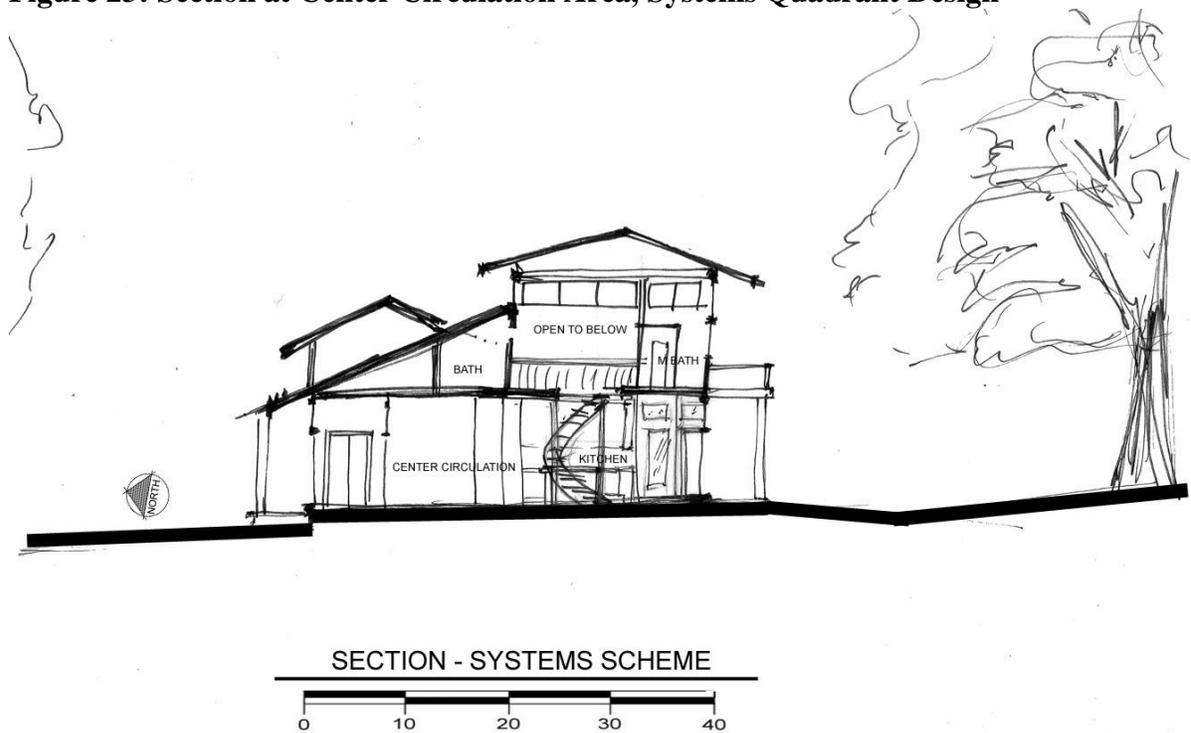


Figure 24 shows the North Elevation. This is the view upon entering the property. The dropped floor in the Studio allows a gradual ascending form to the house as well as signaling function change with in and helping to deflect with northern winter winds. There are very few windows on the northern side to prevent heat loss. Light and air movement are facilitated with the large cupola.

**Figure 24: North Elevation, Systems Quadrant Design**



### Personal Insights from Designing Exclusively for Systems

*The central lesson learned by designing strictly to the Systems Quadrant is a deeper understanding of how everything in the ecosystem is connected including human existence. I initially felt designing for this quadrant would be very restrictive, but found that as you studied the various levels of systems and their inter-relation, the building's place within that system became clearer. The study also revealed how the building and man's intervention could restore things which the natural systems alone could not. I finally understood Wilber's concept of "holons" and realized that buildings need to work as a system on many levels; as a smaller component of the site, and as larger system for its occupants to function within.*

*Doing an intensive site study, along with the micro climate and the myriad of other site specifics and their (inter)connections creates a firm basis of design. By concentrating on all the various systems created a sense of freedom and expectancy. The more I thought about what interconnections were possible, the more I saw. It was very freeing to allow the site and design speak as to what the best possible design would be.*

Other lessons learned during and from the design were categorized with the intention of informing the final design, see Table 9.

**Table 9: List of Lessons Learned from the Systems Quadrant House**

Lessons Learned
Everything is a system and it goes deeper than what first appears
Examining the site in comprehensive way enables a better informed design and configuration
Houses don't have to be square
Research indigenous species - presence isn't accurate indicator of indigenous species
Passive systems can be in conflict with active ones
Very freeing to allow the site to speak
Let the site speak louder
Be an "observer and recorder," Listen
The building should be an extension of the site
Low site impact requires new look at traditional building patterns
Animal traffic, feeding and habitat patterns need consideration
Architecture is system, within the system of site and ecology, facilitating the system of human function
Architecture and the landscape effect all life forms
Human intervention on a landscape can be restorative

#### Concerns with Designing Exclusively for Systems

Visual access to the site from every area is present, but physical access or the ability to expand the interior spaces during the warmer months is missing. More thought could have been given to this area. The outdoor areas that are provided do not correspond directly to the building mass or configuration or existing landscape. The main entrance though recessed and provided with an air lock, is on the North side and could be better protected from the winter winds. In general the concerns result more from lack of design foresight rather than the theoretical approach dictated by the quadrant directives.

#### Composite or Integral Design

“The purpose of architecture is to show how the world touches us.”  
(Merleau-Ponty quoted by Pallasmaa, 2005, p.56)

The "Composite Design" approached the design of using the same design criteria on the same site where all four quadrants are considered equally and simultaneously. This design was to incorporate all the information from the four previous designs; to have the unseen be of equal value with the seen or measurable; to use flow, process and the connections between the occupants and the other systems of the site as guides for form.

The Guiding Principles or questions that guide the design of the Composite Design would be as follows in Table 10.

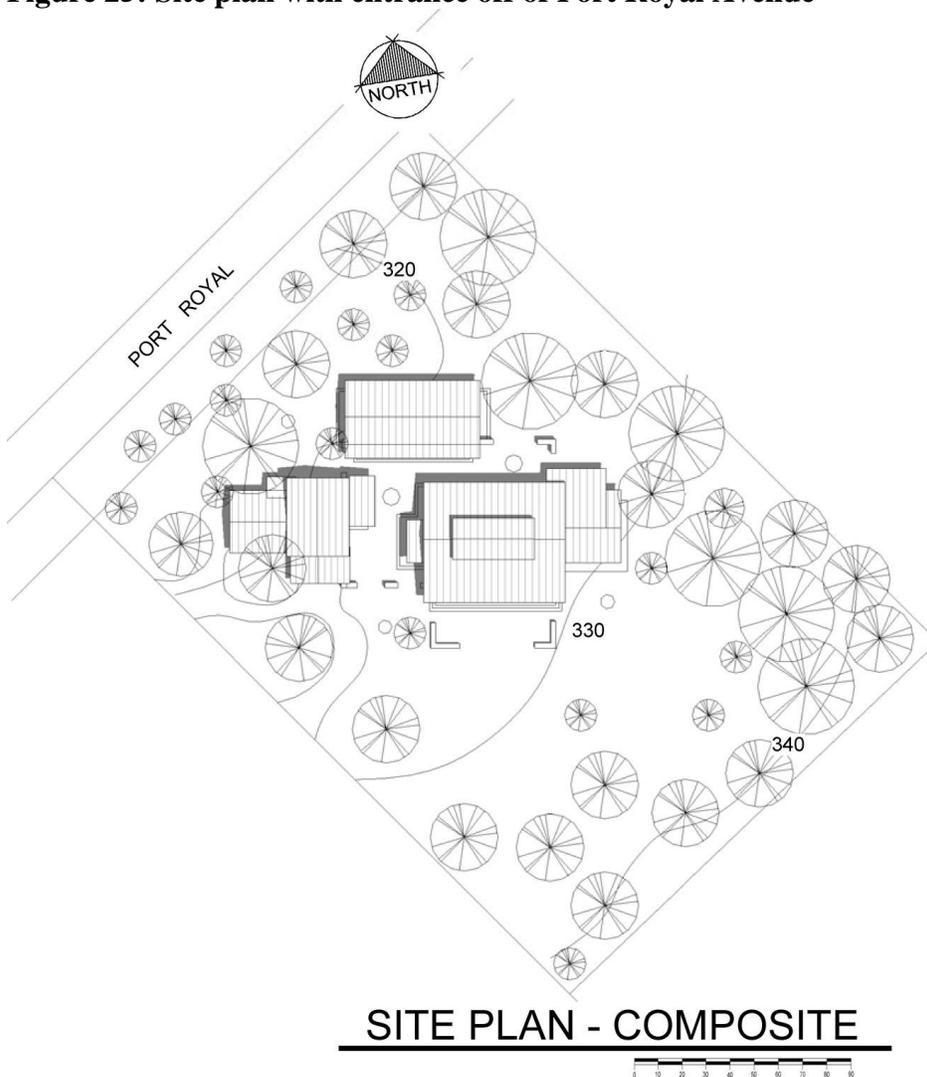
**Table 10: List of Guiding Principles for the Composite Design**

Guiding Principles
Net Zero energy use
Let the site and nature speak & touch occupant
Let History speak & touch occupant
Create seasonal cycles create connection or ritual
Fractals - Interconnected wholes - Organized Complexities
Outside in - Inside extend out
FREE THE MIND
BREAK TRADITIONAL PATTERNS - DISCOVER A NEW WAY TO DESIGN
∴...show how the world touches us."

### Plans

The site plan below in Figure 25 shows the house and garage on the site with the entrance being from the newly created road. The drive is split between the garage entrances. The configuration of the garage is the result of respecting the root compaction zones and the desire to leave as many trees as possible. The circle section of the drive at the main house provides ease of access as well as additional parking for visitors.

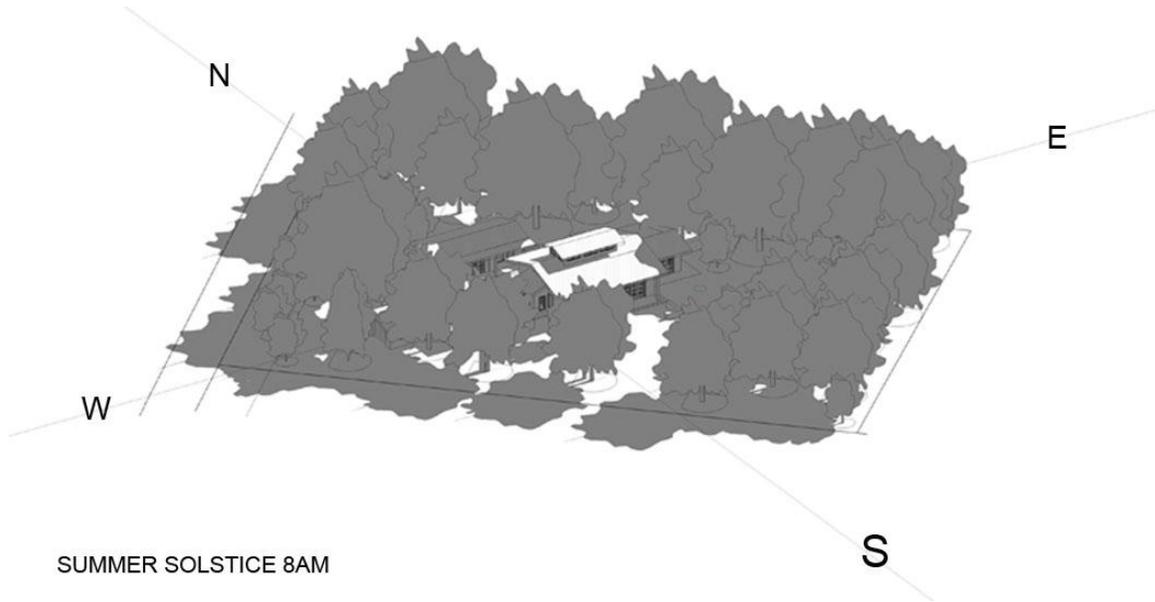
**Figure 25: Site plan with entrance off of Port Royal Avenue**



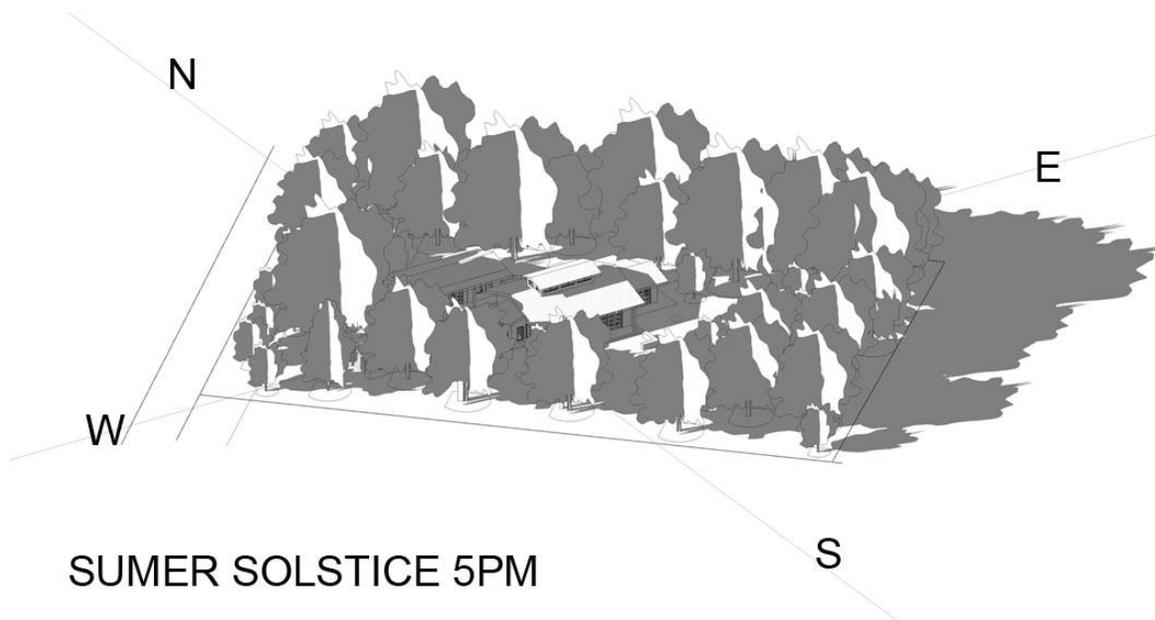
The drive material is made from permeable recycled content. Rain water is collected for flushing as well as being daylighted, and used for the water features and gardens though out the courtyard and site, shown as circles on the site plan. Potable water is from the on site well, and wetlands were constructed to handle the septic.

Figures 26 through 29 show the three dimensional sun studies used to determine the best location for solar collection while leaving as many trees as possible. The Figures show there is full exposure between 8am and 5pm at the Summer Solstice and between 9:30am and 3:30pm at the Winter Solstice. The studies revealed that instead of placing the building in the natural clearing, it was actually more efficient to use the existing clearing as a sun corridor and to have a 16' plate height. These two moves increased the solar exposure while cutting less trees down. The interior spaces are fully shaded during the summer and have full light during with winter months.

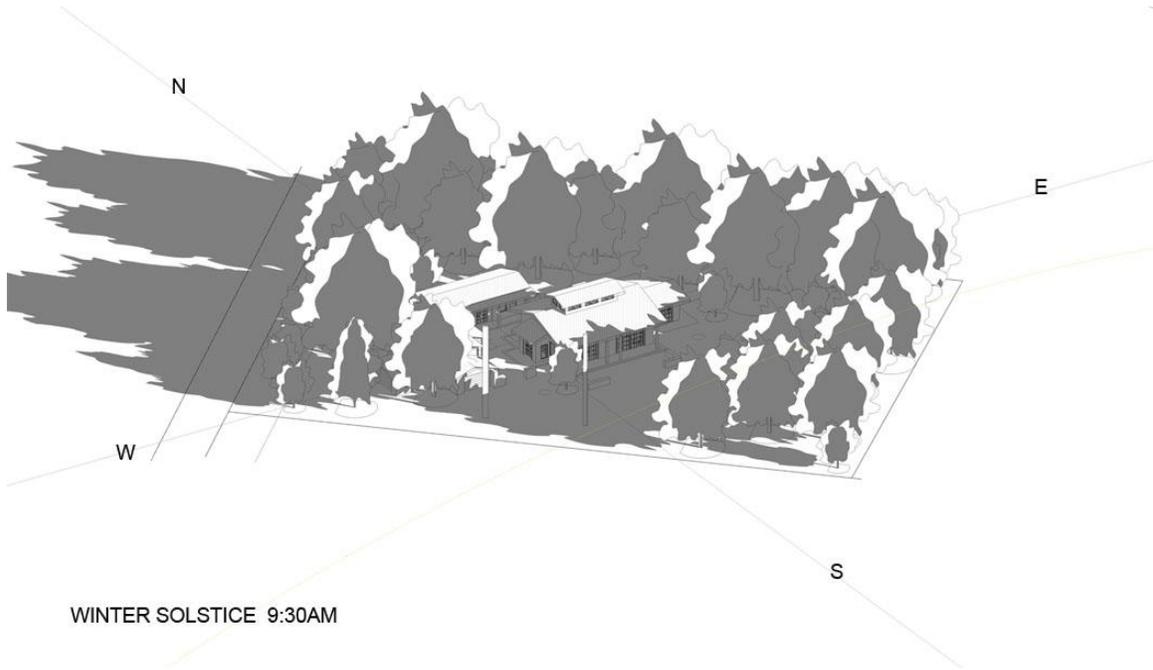
**Figure 26: Solar Exposure 8am, Summer Solstice, Composite Design**



**Figure 27: Solar Exposure 5pm, Summer Solstice, Composite Design**



**Figure 28: Solar Exposure 9:30am, Winter Solstice, Composite Design**



**Figure 29: Solar Exposure 3:30pm, Winter Solstice, Composite Design**

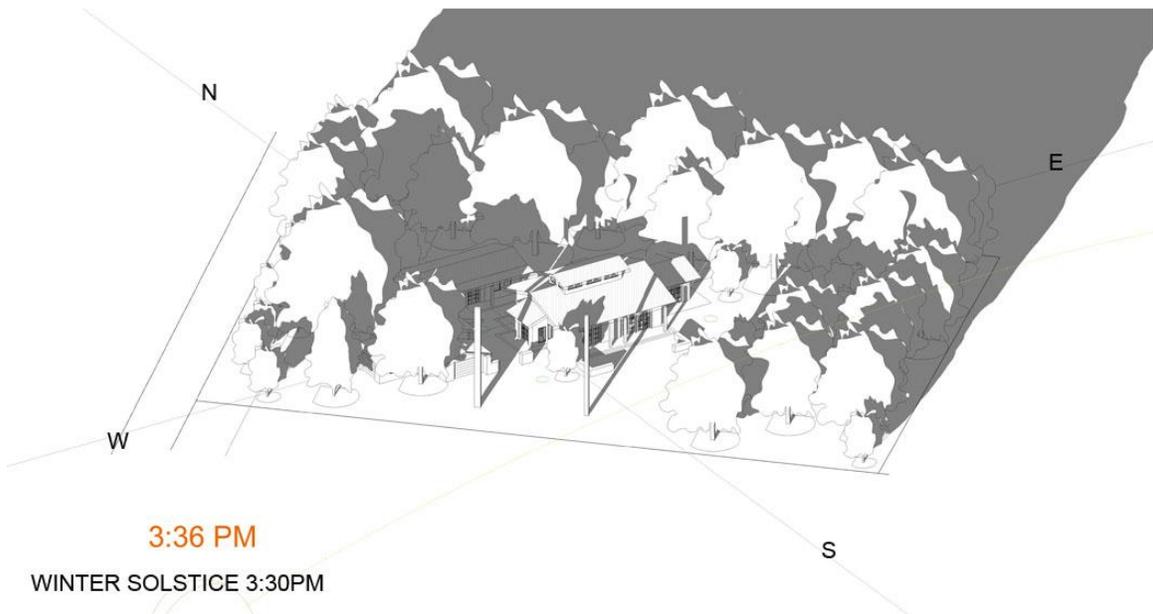




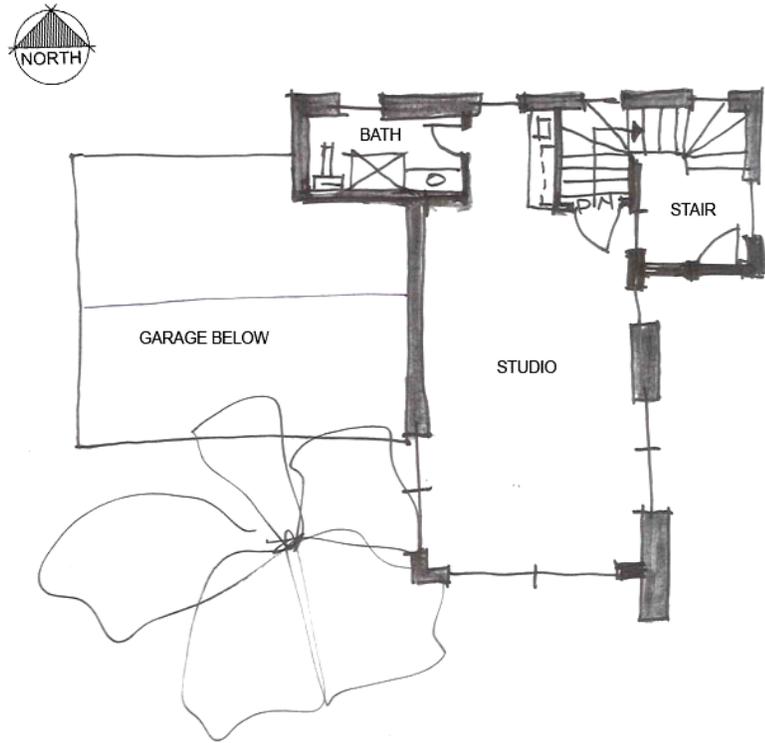
Figure 31 shows the First Floor Plans of all three buildings that make up the complex. Because of the particular client criteria; grown children who visit for short times throughout the year, the guest bedrooms were given a separate building that would be fully conditioned only when occupied. By doing this the conditioned square footage is decreased and each space is given direct contact with the site along with access to fresh air, light, natural breezes and direct sunlight during the cooler months.

The center courtyard acts as the central core circulation space and becomes a transition to the site. Occupants are in constant contact with nature, weather, plants and the seasons since the core circulation space is the exterior courtyard. All the senses are being employed in the connection with the surrounding ecosystem when passing between buildings. This is an outdoor living space during warmer months and reduces the conditioned square footage even further. The walkways connecting the different buildings are heated to address issues with ice and light snow.

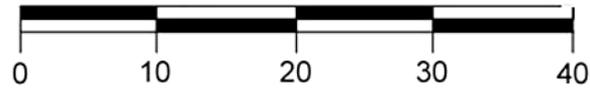
The initial premise of the design was to construct essential spaces around what was left of a stone barn and its outbuildings. The partial height stone walls that loosely enclose the courtyard help to define the original large main barn structure. All the areas that would have full time occupancy are contained in the Main Building, with the Studio above the garage.

The Studio above the garage is shown below (Figure 31). It has a full bath and can also be used as guest quarters or an apartment. The lateral section in the main house is shown below in Figure 32. There are high windows and clerestory windows for daylighting deep into the plan and also to assist with natural ventilation. The windows are remotely controlled.

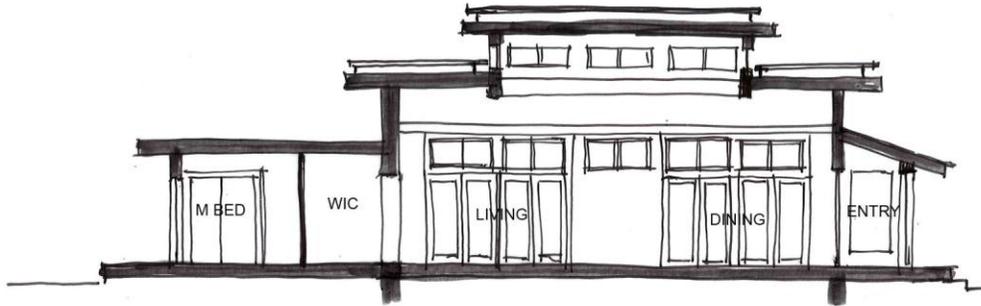
**Figure 31: Second Floor Plan, Garage, Composite Design**



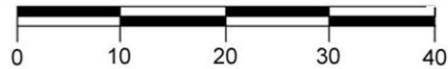
**SECOND FLOOR PLAN - COMPOSITE DESIGN**



**Figure 32: Lateral Section, Main House, Composite Design**

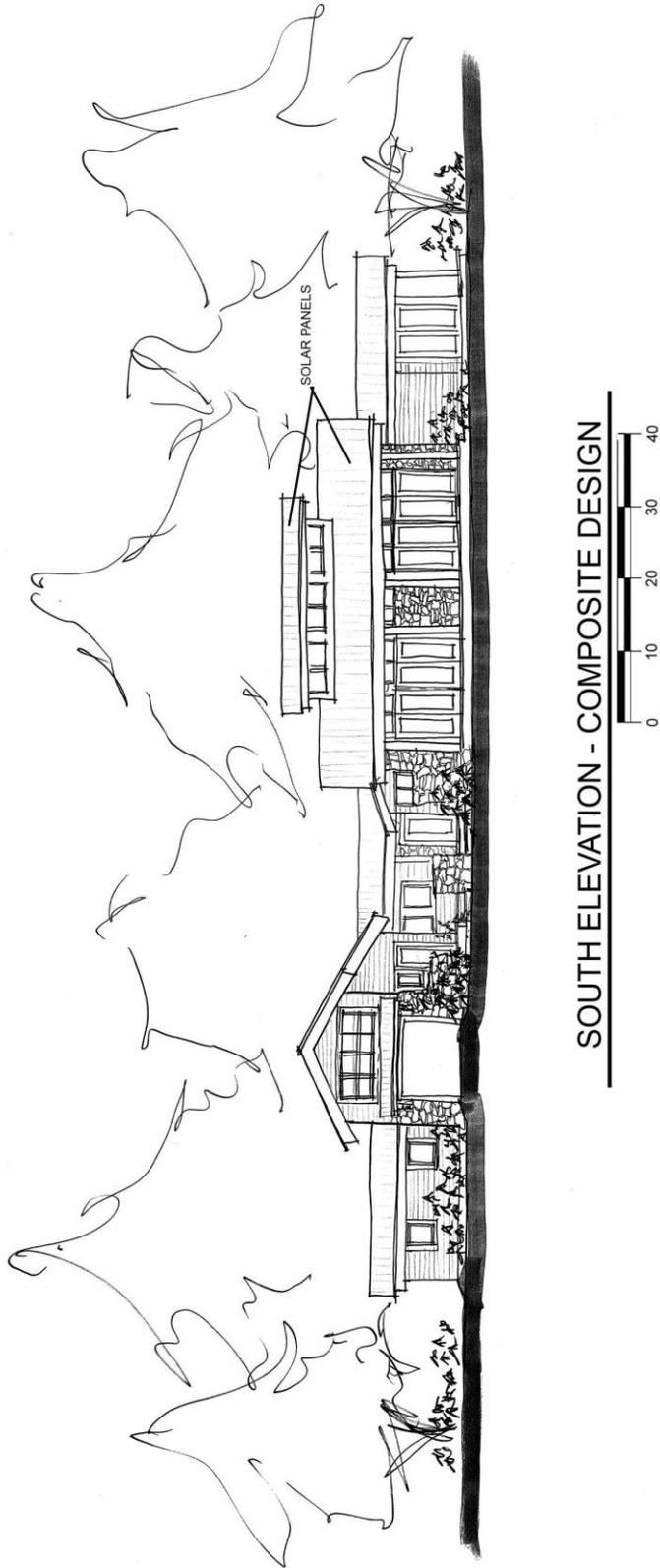


**SECTION MAIN HOUSE - COMPOSITE DESIGN**



Shown below in Figure 33 is the south Elevation. The roof is standing seam metal to reference the agrarian cultural past of the site. Exterior walls are either stone or wood siding with R40 insulation. The solar panels are mounted on the south sides of both the main house and clerestory area.

**Figure 33: Overall South Elevation, Composite Design**



Illustrations 34 and 35 show the energy modeling reports for the main house. Models were based on full time occupancy using geothermal radiant floor heating. All utilities are electric, including cooling and hot water. All lighting is high performance fixtures. There is minimal glass on the north side, while the glass percentages are slightly above the minimum on the south, east and west because of daylighting and view requirements.

**Figure 34: Annual Energy Consumption by Enduse, Main House**

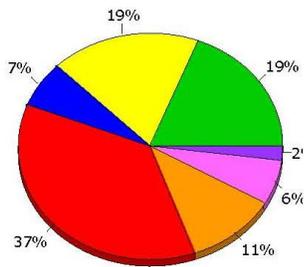
Project/Run: Main building - Thesis - Main Building Thesis

Run Date/Time: 12/10/13 @ 13:32

**Annual Energy Consumption by Enduse**

	Electricity kWh	Natural Gas Btu	Steam Btu	Chilled Water Btu
Space Cool	906	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	5,093	-	-	-
HP Supp.	-	-	-	-
Hot Water	1,533	-	-	-
Vent. Fans	863	-	-	-
Pumps & Aux.	280	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	2,662	-	-	-
Task Lights	-	-	-	-
Area Lights	2,588	-	-	-
<b>Total</b>	<b>13,926</b>	<b>-</b>	<b>-</b>	<b>-</b>

- Area Lighting
- Exterior Usage
- Water Heating
- Refrigeration
- Task Lighting
- Pumps & Aux.
- Ht Pump Supp.
- Heat Rejection
- Misc. Equipment
- Ventilation Fans
- Space Heating
- Space Cooling

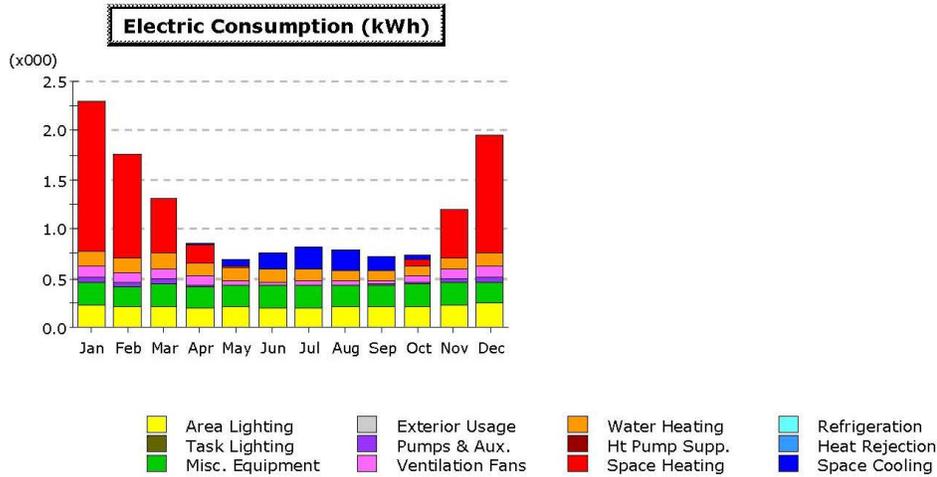


**Electricity**

Source: eQuest

In Illustrations 34 and 35, the annual electrical usage is projected to be 13,930 kWh per year. Only the South facing portions of the main house roof and clerestory roof will be used for solar collection. It can accommodate 64 Sunpower E20/327 solar panels, which are 51.5 inches wide by 34.5 inches high, and have an output of 327w. The total maximum array output is 26,134 kWh per year.

**Figure 35: Monthly Proposed Energy Usage, Main House Composite Design**



**Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	0.00	0.02	0.07	0.17	0.24	0.21	0.15	0.05	0.01	-	0.91
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	1.52	1.07	0.57	0.18	0.00	-	-	-	-	0.07	0.48	1.19	5.09
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.15	0.14	0.16	0.15	0.14	0.12	0.11	0.10	0.10	0.11	0.12	0.14	1.53
Vent. Fans	0.11	0.10	0.10	0.08	0.04	0.04	0.05	0.05	0.04	0.06	0.10	0.11	0.86
Pumps & Aux.	0.05	0.05	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.28
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.23	0.21	0.23	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	2.66
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.24	0.21	0.22	0.20	0.21	0.20	0.20	0.21	0.21	0.22	0.23	0.24	2.59
<b>Total</b>	<b>2.30</b>	<b>1.77</b>	<b>1.32</b>	<b>0.86</b>	<b>0.69</b>	<b>0.76</b>	<b>0.82</b>	<b>0.78</b>	<b>0.72</b>	<b>0.74</b>	<b>1.20</b>	<b>1.96</b>	<b>13.93</b>

Source: eQuest

**Personal Insights from Designing to Consider All Quadrants**

*The composite scheme meets the directives of all four Integral Theory quadrants. It is not prototypical in its approach or design solutions, but it blends the specific site and climate with the specific client requirements and history of the surrounding community. What emerged was a far deeper solution that allowed the site, and history and nature to speak and touch the occupants. The points of connection between the occupants, building, site, nature, climate, and seasonal cycles are multi-faceted, layered and interwoven into the fabric this house. The means of connection are not contrived or based superficial strategies, but an intrinsic part of occupying this house and never would have been possible without going through the above examining all four quadrants. (Table 11)*

**Table 11: List of Lessons Learned from the Composite House**

Lessons Learned
Layers and patterns are what give design depth
Thinking outside the box allows greater range of ideas
Sustainability is not about a set of rules
Openness and insight and willingness to listen to intuition are crucial
Listen to the site, let the design emerge, leave preconceived ideas behind
See and acknowledge systems and interconnectedness
Process and connections should be first to inform design
Net Zero Energy can exist with beauty
Integral Design is greater than the sum of its parts

### Concerns with Designing to Consider for All Quadrants

Some issues that could be of concern with this design is the amount of time it would take to bring the guest quarters up to acceptable heating levels in the winter. The design is atypical for the neighborhood though it uses a deconstructed barn structure as its basis. This design is very client specific, yet it could easily be adapted to alternate life styles which may be perceived as a concern for some.

### Composite Design Summary

The final Composite Design met the directives of all four quadrants of DeKay's (2011) Integral Sustainable Design Grid in the following way.

The directives of the Performance Quadrant have been by the main house producing approximately double the amount of energy it uses in a year according to the energy modeling. The roof, walls and floors are highly insulated. All areas use lower square footage figures, and are zoned separately for greater control of heating and cooling. All buildings are orientated directly south and employ daylighting, passive heating and cooling strategies, with the northern guest house providing a wind break for the courtyard and entrance. Extensive studies were done to determine the best placement and configuration for solar collection, designing for full exposure.

The directives of the Systems quadrant have been met by the individual buildings and their placement to form an interconnected system with each other, the topography of the site, the culture of the neighborhood though the appearance of being built around an existing barn structure, and meeting the Net Zero Energy requirements. There is a reciprocal interconnectedness between humans and nature with the views, access to the exterior from every location and the stepping transition between the inside and outside spaces. Occupants are in constant contact with nature, weather, plants and the seasons with the core circulation space being the exterior courtyard. All the senses are being employed in the connection with the surrounding ecosystem passing between buildings. The buildings themselves are separated by function and occupancy needs, forming a fractal system that is part of the larger system of the site's ecosystem. The manmade structures become part of the natural landscape and are tied to the site's historical context

through their basis of construction being based on barn ruins. All areas are served with passive heating, cooling, and daylighting causing nature to be experienced inside the structures as well. Water is collected, celebrated and included in daily rituals and practical uses.

The directives of the Cultural Quadrant have been met by connecting with the surrounding neighborhood through the design charrette. All the directives set by the charrette for sensitive design were adhered to. These would include but not be limited to setbacks, materiality, smaller proportion buildings, no garages facing Port Royal Avenue, heavily wooded or landscaped lot with small lawn. The structures allude to the past creating their own cultural system for the occupants. Ecological connections and seasonal rituals are fostered with the configuration of the buildings around the courtyard.

The directives of the Experience quadrant have been met by Nature and the Ecosystem of the site being a structural part of the occupants experience. There is beauty not only in the forms and configurations of the buildings and how they fit with each other, but also with how they fit into the site or landscape. The daylighting and natural ventilation add comfort, health benefits, but also the varying colors of light, and scents of vegetation entering the living space. The line between humans and nature is softened with the stepped transitions between the outside and inside allowing the occupant an experience of all diurnal and seasonal cycles.

### Reflection on Professional Changes

As a result of performing this exercise, there was a total shift in the way I perceive and approach design. Once design and the world is seen through the multiple lenses of Integral Theory the one dimensional view of personal preference seems flat and insufficient. Below is a summary of the professional design approach changes that evolved from this extended exercise. (Table 12:)

**Table 12: Changes from using Integral Theory in an extensive design exercise**

Professional Insight and Changes Resulting from Using Integral Theory
Interdependency of all things, and the importance of maintaining these connections
Ask deeper questions for deeper solutions - Look for and honor the unseen
Sustainable Design cannot be a standard set of rules mechanically applied
Solutions need to be unique and specific engaging all areas of perception
Concentrating directives of all quadrants, leave preconceived solutions behind
To Listen and See the full potential of the site and each varying aspect of the culture, climate, performance, ecosystem and beauty.
To be, as Murcutt advocated, "... an observer...a recorder of what became evident...combining intuition and training to translate the emerging design."
Collaborators welcome for enriching and balancing design solutions
Created a freer and more intuitive design process and solution
Showed I wasn't as inclusive or comprehensive as originally thought
Experiencing inner conflicts helps inform understanding of others objections and areas for additional personal change

## Validity of Applying Integral Design to Architectural Practice and Education

Instead of architecture and design focusing on the visual end product, Integral Sustainable Design looks toward the process, connections and interactions to shape and configure the building. This approach leaves room for deeper design solutions to emerge. The intensified research and understanding of each quadrant's directives produced guiding principles of focus enabling a free and new design process to take place. Resulting in the knowledge that Sustainability needs to be far more than a list of strategies mechanically applied to every design situation.

The final composite design would not have been possible without going through the process of designing the four previous houses. In actual professional practice the four designs would not have to be developed to the extent required by my thesis. Much of the initial research regarding the design directives of each quadrant could be transferred to various other projects. The broad climate information is also applicable for other projects within the same geographical region. Over time and with practice, this methodology could be incorporated into standard architectural practice quite naturally. The superior designs which would emerge could increase client satisfaction, offsetting any additional time spent during design. The fact that many successful architects and designers, such as Glen Murcutt and James Culter and even Frank Lloyd Wright to some extent, employ the same or very similar strategies testifies to the validity of approaching design this way.

Robert Fleming in *Integrative Approaches to Sustainable Development at the University Level: Making the Links (World Sustainability Series)* profiles how Integral Theory is used to inform program directives and procedures of the award winning Masters of Sustainable Design program at Philadelphia University. Using it as "... a framework within which a holistic and interconnected curriculum was developed and implemented." (Filho, et al, 2015, p. 267). Integral Theory is also the basis of all the class material creating a "... broader and more holistic vision of sustainability." (Filho, et al, 2015, p. 272). This broader and holistic vision of sustainability establishes core values consistent with regenerative, or authentically sustainable design which will continue to shape students design decisions as they move forward in their professional career.

**"The purpose of architecture is to show how the world touches us"**  
(Merleau-Ponty quoted by Pallasmaa, 2005, p.56)

After all the research and study, this phrase speaks to the essence of Integral Theory as applied to Sustainable Design. Not only is it beautiful, and poetic, but the phrase: "...show how the world *touches* us" is so explicitly accurate. Not only is touch visual, but physical and active and tangible, yet also spiritual and intangible and mystical, all at the same time... and that is what architecture is...and that is what holistic, regenerative, truly sustainable design needs to be, if it is ever going to be the norm. It needs to, as Ruskin says; "...Shelter... [and] speak to us...", (<http://www.ozetecture.org/2012/peter-stutchbury/>), and "...reflect [our] inner life...and social concepts" (Salama, 2007, p. 87).

Remembering that; “Although we fundamentally shape our surroundings, ultimately place exists independently of human life, in turn shaping us” (Trigg, 2012, p. 2). DeKay quotes Kahn on the subject who states, "...designers in particular bridge the realms of spirit and nature linking them and making silence spring forth into the world, that is...making nature that reflects and is constituted of the transcendent." (2011, p. 419)

Expanding the goals and design directives of the design profession enables the creation of more holistic sustainable designs, which in turn will resonate deeper with clients and the general public, be more energy efficient, support cultural connections, and become an integral part of the eco-system, therefore becoming truly sustainable and restorative. The goal of Integral Sustainable Design as outlined in this paper is not to eliminate the past tenets of architecture, nor the beauty and poetics of space, but rather to broaden architecture's scope to include efficient use and preservation of the earth's resources and promote the understanding that, "...the rights of one species are linked to the rights of others and none should suffer remote tyranny." (McDonough, 1993, p.8) The world is changing and the architectural profession needs to change with it or be left behind.

### Resources

- Alexander, C., Ishikawa, S., & Silverstein, M.,. (1977). *A pattern language : Towns, buildings, construction*. New York: Oxford University Press.
- Benyus, J. M. (2002). *Biomimicry : Innovation inspired by nature*. New York: Perennial.
- Brown, G. Z., & DeKay, M. (2001). *Sun, wind & light : Architectural design strategies*. New York: Wiley.
- Buchanan, P. (2012). The big rethink: Integral theory. *The Architectural Review*, , 1/25-25/25.
- Buchanan, P., & Architectural League of New York. (2005). *Ten shades of green : Architecture and the natural world*. New York, NY: Architectural League of New York : Distributed by W.W. Norton.
- Burger, C., (2003). *A richer heritage: Historic preservation in the twenty-first century*, edited by robert E. stipe. Historic Preservation Foundation of North Carolina: Copperline Book Services
- Cherulnik, P. D.,. (1993). *Applications of environment-behavior research : Case studies and analysis*. Cambridge; New York: Cambridge University Press.

- Contosta, David R., Franklin, Carol,, (2010). *Metropolitan paradise : The struggle for nature in the city : Philadelphia's wissahickon valley, 1620-2020*. Philadelphia: Saint Joseph's University Press.
- Cunningham, S. (2005). Restorative development: What is a development model that repairs as vigorously as the current model destroys. *Urban Land*, , 20-23.
- Darke, R. (2002). *The american woodland garden: Capturing the spirit of the deciduous forest* (First ed.). The Haseltine Building, 133 S.W. Second Ave, Suite 450, Portland, Oregon 97204: Timber Press Inc.
- DeKay, M., & Bennett, S. (2011). *Integral sustainable design : Transformative perspectives*. London; Washington, DC: Earthscan.
- Eberhard, J. P. (2009). *Brain landscape : The coexistence of neuroscience and architecture*. Oxford; New York: Oxford University Press.
- Filho, W.L., Brandli, L., et al. (2015). *Integrative Approaches to Sustainable Development at University Level: Making the Links (World Sustainability Series)*. Switzerland. Springer International Publishing
- Fong, Wen, Chang, Amos Ih Tiao., (1957). The existence of intangible content in architectonic form based upon the practicality of laotzu's philosophy. *The Journal of Asian Studies the Journal of Asian Studies*, 16(3), 421.
- Goodbun, J., Till, J., & Iossifova, D. (2012). *Scarcity : Architecture in an age of depleting resources*. London: John Wiley & Sons.
- Hall, E. T. (1959). *The silent language*. Garden City, N.Y.: Doubleday.
- Hayden, D. (1995). *The power of place : Urban landscapes as public history*. Cambridge, Mass.: MIT Press.
- Jacobs, J.,. (1993). *The death and life of great american cities*. New York: Modern Library.
- Jaffe, S. B. (2011). Balancing sustainable renovation, historic preservation, and real estate investment in older suburbs.
- Katz, P., Scully, V., & Bressi, T. W. (1994). *The new urbanism : Toward an architecture of community*. New York: McGraw-Hill.
- Kellert, Stephen R., Heerwagen, Judith,,Mador, Martin,, (2008). *Biophilic design : The theory, science, and practice of bringing buildings to life*. Hoboken, N.J.: Wiley.

- Kellert, S. R., (2005). Building for life designing and understanding the human-nature connection. Retrieved
- Kibert, C. J. (2008). *Sustainable construction : Green building design and delivery*. Hoboken, N.J.: John Wiley & Sons.
- Lewis, J. (2007), The native builder. *New York Times*, <http://www.nytimes.com>
- Mallgrave, H. F. (2006). *Architectural theory*. Malden, MA: Blackwell Pub.
- McDonough, W. (1993). A centennial sermon design, ecology ethics and the making of things. The Cathedral of St John the Devine.
- McDonough, W., & Braungart, M.,. (2002). *Cradle to cradle : Remaking the way we make things*. New York: North Point Press.
- O'Neil Webcast. (2009). Energy literacy.com2. Retrieved January 4, 2014, from <http://www.energyliteracy.com/?p=204>
- Oz.e.tecture. (2013). Official website of architecture foundation australia and the glenn murcutt master class. Retrieved January 3, 2014, from <http://www.ozetecture.org/2012/peter-stutchbury/>
- Pallasmaa, J. (2005). *The eyes of the skin : Architecture and the senses*. Chichester; Hoboken, NJ: Wiley-Academy ; John Wiley & Sons.
- Peter Buchanan. (2012). The big rethink: Integral theory. *The Architectural Review*, , 1/25-25/25.
- Salama, A. M. (2007). Mediterranean visual messages: The conundrum of identity, isms and meaning in contemporary egyptian architecture. *Archnet-IJAR International Journal of Architectural Research*, , 86-104.
- Stipe, R. E. (2003). *A richer heritage: Historic preservation in the twenty first century*. Chapel Hill and London: The University of North Carolina Press.
- Tallamy, D. W.,. (2007). *Bringing nature home : How native plants sustain wildlife in our gardens*. Portland, Or.: Timber Press.
- Trigg, D. (2012). *The memory of place : A phenomenology of the uncanny*. Athens: Ohio University Press.
- Tyng, A.,. (1984). *Beginnings : Louis I. kahn's philosophy of architecture*. New York: Wiley.