The Biocentric Landscape Architect: Designing the Public Landscape, Benefiting the Natural World

Linda L. Ashby

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Landscape Architecture

Terry L. Clements, Chair
David L. Trauger, Ph.D.
Caren L. Yglesias, Ph.D.
Leehu Loon

May 11, 2005
Alexandria, Virginia

Keywords: Sustainable design, Eco-revelatory design, Ecological design, Design ethic, Environmental ethics and landscape design, Human-nature relationship

CONTENTS

List of Images

For all photographs and images contained in the ETD either permission for use has been obtained or they have been evaluated according to the four 'fair use factors' for copyrighted materials and deemed to be fair. Images not otherwise acknowledged are by Linda Ashby.

APPENDIX TWO

This work is dedicated to my mother, Joyce.

And to Myer, a great companion and guide.

The Biocentric Landscape Architect: Designing the Public Landscape, Benefiting the Natural World

Linda Ashby

Abstract

Owing to the author's interest in and concern for earth's processes, healthy ecosystems, and environmental decline and devastation, this thesis examines the human – nature relationship, as it relates to landscape architecture through spiritual, mathematical, geometrical, historical, economical, ecological, philosophical and ethical perspectives. Sustainable design and eco-revelatory design methods are also explored in order to aid in the development of a personal design ethic that defines and produces ecologically responsible works of landscape architecture. The goal is to establish a personal framework for design that results in built landscapes which are ecologically more benign, holistically more functional, and culturally more significant than standard practices.

Research methodologies include literature review, case study analysis, project site analysis, and personal interviews. Findings suggest that despite a longstanding and growing call for a more harmonious relationship between nature and anthropogenic changes on the land, the green movement remains a loosely defined alternative undercurrent. The field of landscape architecture is uniquely poised to be a leader in the sustainable revolution; this is especially true when its practitioners, researchers and theorists are dedicated to ideals and activities that bring about true ecological value. For the individual designer, the experience of developing and committing to a personal design ethic can be empowering, and can produce work that has more mettle, veracity and purpose than the designer has previously known.

Whatever befalls the earth befalls the sons of earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself.
– Chief Seathl (Seattle) of the Suwamish Tribe

Vision without action is a daydream; action without vision is a nightmare.
– Japanese Proverb

Acknowledgments

Many thanks to everyone who so freely gave their time and energy to this thesis. I hope you will recognize your contributions on the following pages, and know that your support has meant so much to me. I am especially thankful to:

My committee, for leadership and patience as I explored questions that perplexed me and sought answers that had eluded me.

Terry, thanks for your commitment and creativity in overcoming the miles, and for teaching me so much about landscape architecture. Many times your counsel has pointed me in the right direction and provided tremendous inspiration.

David, thank you for the long discussions about ecology, for answering my many questions with sincerity, and for sometimes challenging my understanding of environmental justness. Your door was always open for me, your generosity was always a comfort.

Caren, you kept me going. Your dedication to this thesis, and the enthusiasm, motivation and friendship you have given me kept me afloat during the difficulties and helped me acknowledge the successes. Thank you for the continued support and mentoring.

Leehu, thanks for keeping things manageable. Your talents for making complex concepts understandable, helping me see the big picture when I felt lost, and being approachable with your wit and good nature were sources of energy that kept this fun.

All of those at the Washington-Alexandria Architecture Center and Blacksburg Campus who shared their time, expertise, opinions, reservations, and humor, and encouraged me to dig deeper, make stronger, and keep pursuing these endeavors. Many special thanks to Kristi Geronilla, Annalisa Miller, Paul Killmer, Meredith Upchurch, Dean Bork and Shelly Mrstik.

Friends and family, for understanding the sacrifices and giving support, time, love and much needed levity along the way.

Most of all, I thank my husband and champion, Grant Moosha, for his profuse and unyielding faith and confidence in me, and belief in this work. Without your endurance, patience and pure love, this, and many other pursuits, would never have been.

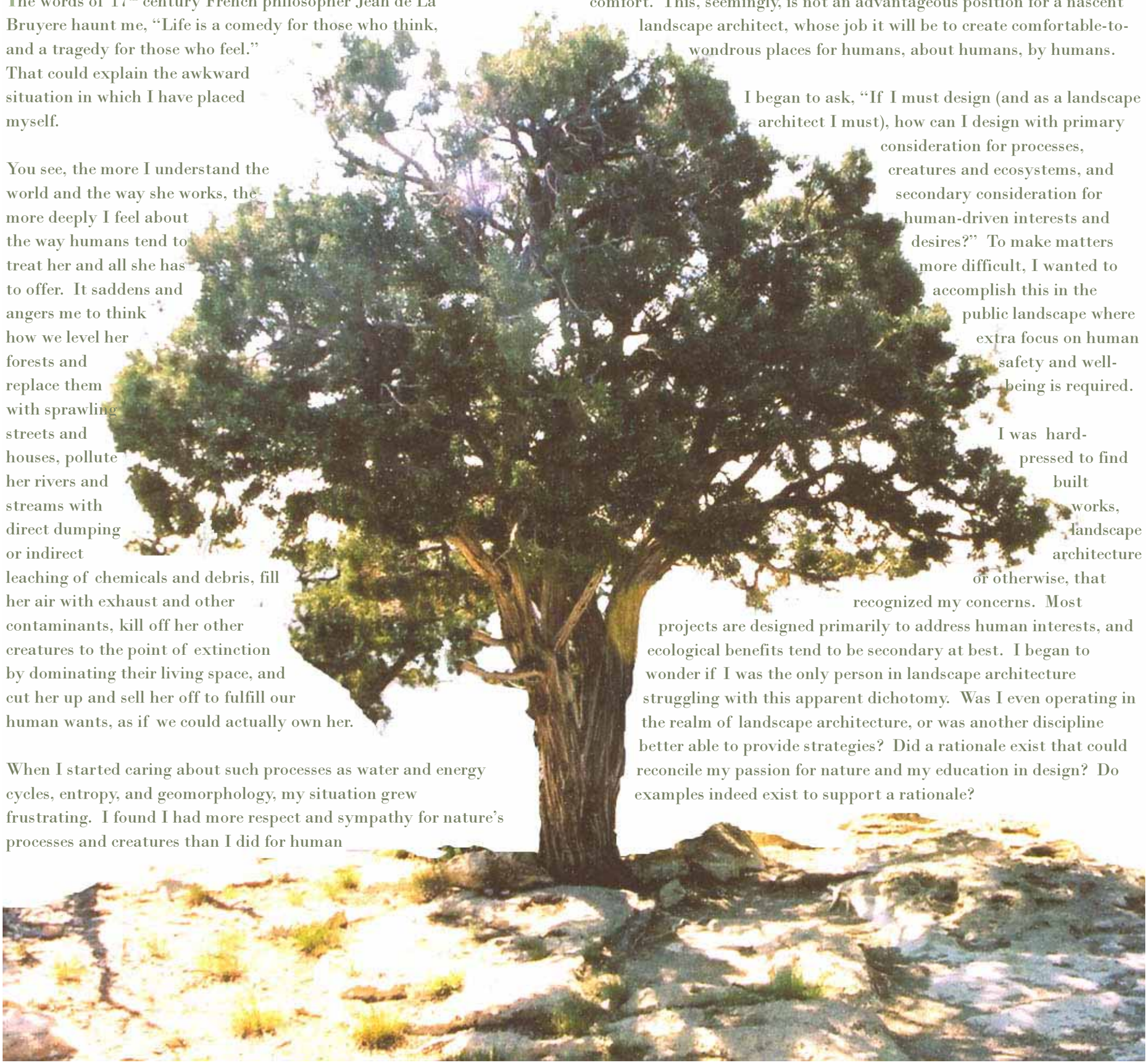
The words of 17th century French philosopher Jean de La Bruyere haunt me, "Life is a comedy for those who think, and a tragedy for those who feel." That could explain the awkward situation in which I have placed myself.

You see, the more I understand the world and the way she works, the more deeply I feel about the way humans tend to treat her and all she has to offer. It saddens and angers me to think how we level her forests and replace them with sprawling streets and houses, pollute her rivers and streams with direct dumping or indirect leaching of chemicals and debris, fill her air with exhaust and other contaminants, kill off her other creatures to the point of extinction by dominating their living space, and cut her up and sell her off to fulfill our human wants, as if we could actually own her.

When I started caring about such processes as water and energy cycles, entropy, and geomorphology, my situation grew frustrating. I found I had more respect and sympathy for nature's processes and creatures than I did for human comfort. This, seemingly, is not an advantageous position for a nascent landscape architect, whose job it will be to create comfortable-to-wondrous places for humans, about humans, by humans.

I began to ask, "If I must design (and as a landscape architect I must), how can I design with primary consideration for processes, creatures and ecosystems, and secondary consideration for human-driven interests and desires?" To make matters more difficult, I wanted to accomplish this in the public landscape where extra focus on human safety and well-being is required.

I was hard-pressed to find built works, landscape architecture or otherwise, that recognized my concerns. Most projects are designed primarily to address human interests, and ecological benefits tend to be secondary at best. I began to wonder if I was the only person in landscape architecture struggling with this apparent dichotomy. Was I even operating in the realm of landscape architecture, or was another discipline better able to provide strategies? Did a rationale exist that could reconcile my passion for nature and my education in design? Do examples indeed exist to support a rationale?



I needed help in my search for answers, and in defining my design goals. In order to better understand my emergent thoughts, I turned to sources outside landscape architecture – to individuals, cultures and fields of study that have explored, in various ways, humans' connection with nature. I was particularly drawn to those that have used their findings to take a position on the matter and develop applicable models or advice for living. My plan: to become acquainted with their work, to explore if and how I could apply their conclusions to my study of landscape architecture, while determining how it could inform my own design work.

I sought answers as one would examine a crystal – gazing upon it from different points of view, under different conditions of light, turning it over and over in order to appreciate its complexity, brilliance and essence. I considered the human–nature dynamic from a number of viewpoints: spiritual, mathematical, geometrical, historical, economical, philosophical and ethical. I considered different conditions of understanding and motivation with which humans approach the landscape, because clearly there are opposing opinions as to how the earth should, or should not, be cultivated. All the while I hoped these diverse perspectives would combine, or at least influence me in a single direction, toward a way of thinking and designing that honored my concerns for nature, yet upheld design principles within the realm of landscape architecture.

The exploration did, in fact, lead me to a way I can address the land that feels more right to me than most of my pre-thesis design work. It is a way that seeks insight into and understanding of earth's processes. It embraces solutions and techniques that replenish natural resources rather than deplete them. It provides structure and limits for design that respect nature's needs above human wants.

While my thesis work gained insight from a number of perspectives, it is not *about* any one of them. After all, my desire for my own design work is to make less dichotomous the human–nature relationship. As such, this thesis is about establishing a personal design ethic, and adhering to that ethic in a practical design application. What follows is my personal journey toward what I ultimately call *biocentric landscape architecture*.

Part 1, "The Position," is the presentation of my research and the formation of my stated position. Divided into three sections, "Universal Connections," "The Disconnect," and "The Reconnect Envisioned," Part 1 includes information I learned from individuals, cultures and fields of study outside landscape architecture.

Part 2, "In Search of a Reconnective Design," returns the discussion to landscape architecture, as well as other related fields. I present numerous interpretations of "ecological" design, along with examples of built works and commentary on how they do or do not support arguments for my design ethic and the idea of biocentric landscape architecture.

Part 3, "Biocentric Design Studio," is the presentation of my design work. Exhibited is both work that assisted in developing my position, as well as the resultant final design that tested the personal design ethic detailed in Part 1, my so-called biocentric approach. By way of presenting site selection criteria, design goals and objectives, site research and analysis, and concepts and design, challenges to my approach are examined and strategies to overcome them are explored. Part 3 closes with reflection on the goals of this project, and how those goals were or were not met.

Part 4, "Thesis Findings and Design Criteria," concludes the book with overall lessons learned as they relate to landscape architecture and design. By way of examining some of the challenges I faced, approaches I took that did not work, and the resulting relationship between the position and the design, I made suggestions as to ways this approach to landscape architecture might evolve and improve in the future.

In all, I hope to have defined an approach to landscape architecture that goes beyond design for design's sake, one that is truly ecologically functional, culturally appealing, and socially responsible. If so, then I feel I will have found my niche in the field, a realm in which I can practice landscape architecture in good conscience. If this work provides even a modicum of inspiration to others, then that is all the better.

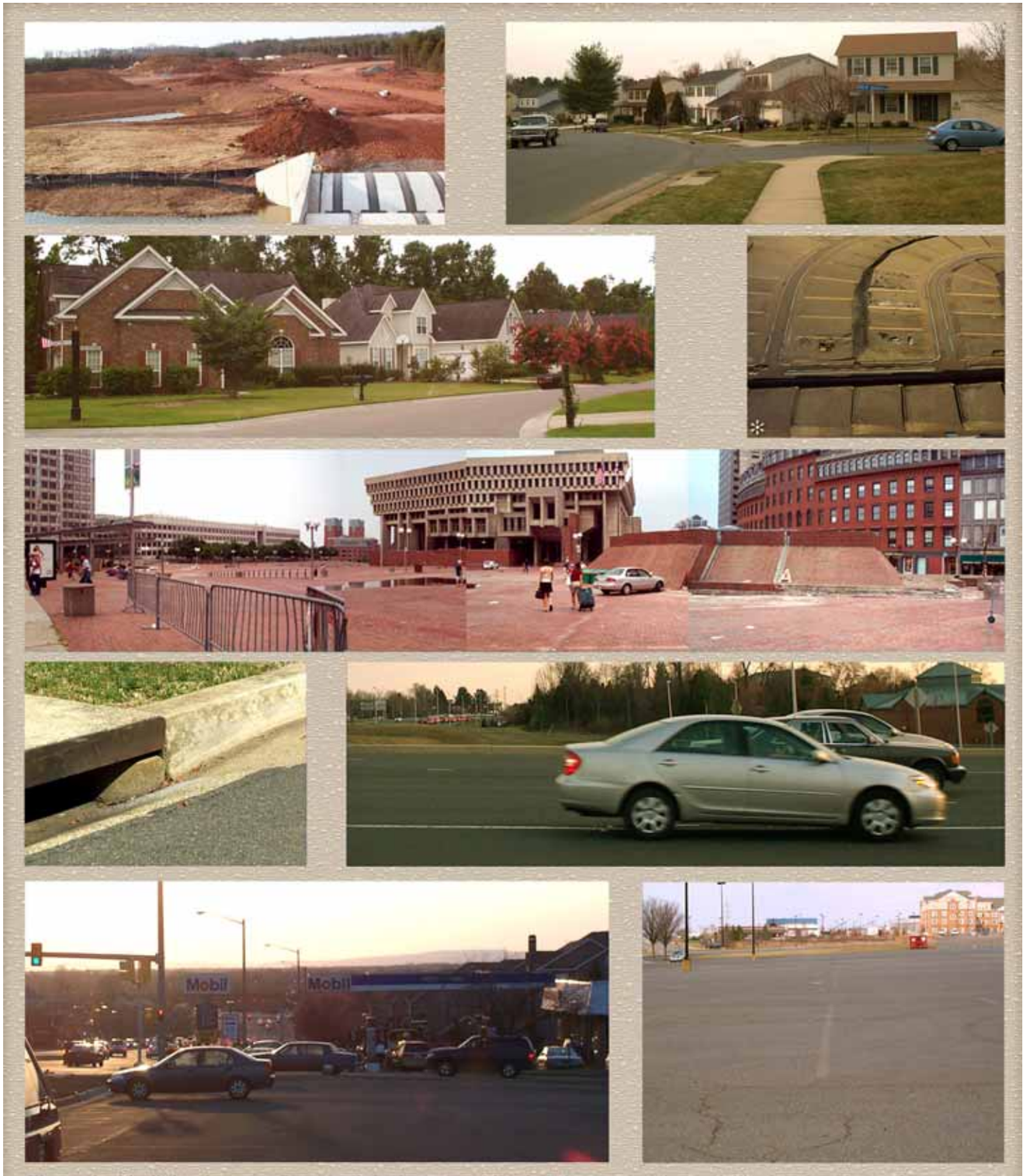
Part 1: The Position

The words leapt off the page at me, causing my heart to flutter, my blood to stir. **I must create a system or be enslav'd by another man's.** The quote is attributed to William Blake, a name with which, for now, I am unfamiliar, a man whose body of work I do not yet know.

Yet, his eleven simple words state so succinctly what will take me many pages to express. This paper is my means of creating a system by which I can practice landscape architecture design. A system created because when I observe the typical built landscapes that surround my urban and suburban existence, I do not see a system to which I wish to be *enslav'd*.

I see an opportunity to define a better way. A way that does not defile what remains of streams and forests, a way that contributes far less pollution and contamination to the air and surrounding environs, a way that helps us see that things we take for granted often cause more harm than good to the environment, and to our own health. A way that actually benefits the natural world, rather than degrades it.

I am setting out to create a system *for myself*. A system that supports my passion for nature and my appreciation for the compatibility of design. Design and nature seem to be at odds. What becomes of nature when a city is built? When a highway is laid? When an agricultural field is treated for pests? When a mountain is topped, or a swamp drained? I do not wish to be enslav'd by a system, or to contribute to the system that operates at odds with nature.



The typical built landscape. *From top left*, cleared-and-leveled site construction; neighborhoods of impervious surfaces (streets, sidewalks, driveways, rooftops, even automobiles and compacted lawns); manicured landscapes requiring irrigation and chemical inputs; imposed geometric property lines (*image MacLean & McKibben 1993, p88); continuous spans of nonporous pavement lacking vegetation and amenities; curbs, gutters and drains redirect rainwater away from where it falls; large land masses dedicated to the automobile; cluttered and ruined vistas; underutilized large single-use spaces.

I believe a better system can exist, and that there is a place in landscape architecture for it. Perhaps attempts for such a system already exist. Ecologically sensitive design is a growing industry, but hasn't "eco-design" become a catch-phrase for anything that can remotely pass as "green"? Has it not been exploited by marketers and reduced to an inconsistent buzzword? What would I mean if I merely said I wanted to practice ecological design?

What I want is a system that honors natural processes as much as it does habitat. One that considers geomorphology as soon as it would materiality. One that respects entropy as well as it respects reductions in energy use. I see enormous potential for this system to exist within the diverse bounds of what is recognized as landscape architecture.

My exploration for that system is what follows. In its pursuit, I explore a number of ideas, attitudes, theories and approaches toward nature that fall beyond the scope of landscape architecture, ***outside*** the discipline so that I may establish for myself a way to gauge the validity of what is claimed to be environmental or ecological design. I ask that you have patience, as the results of my search do not appear until near the end. It is also near the end that the discussion returns to landscape architecture, with the exception of brief notations throughout. As you read, consider this: It is in the journey where enlightenment is often found, rather than at the destination.

This journey begins with a question: Does a better system already exist?

An excerpt in a conservation biology book first attracted me to the idea of what it could mean to have a harmonious relationship with nature; that is, a better system. It mentioned a common sense, gentle Taoist approach to land planning and development, rather than the typical hard-engineered solutions. Realizing I was not the first person in landscape architecture to be drawn to the ideals of Taoism, I wanted to know more, and so my search began with it.

UNIVERSAL CONNECTIONS

One of the greatest gifts Taoism offered me was the sense of universal connectivity, an immense feeling of being somehow connected to other persons, to animals, plants, time, place, to all that exists in the universe. Whether the connection is spiritual, physical, or something other is explored in this section.

A Word to the Skeptic

This paper explores the human–nature relationship from numerous perspectives, spiritually is but one of them. Human spirituality has, historically and presently, been a driving force in the formation of our attitudes about and our actions taken upon the land.

This thesis is established in a sense of universal connectivity, and a belief that we have responsibilities toward the connection. If you are not necessarily a spiritual person who will not be convinced of the idea of a greater connectivity from this particular angle, perhaps some of the other portions of research included herein will have more appeal.

For you, I have included a summation of studies that indicate a striking similarity among most forms of organic matter. Perhaps this provides physical evidence of a universal connection. In later sections I explore the human–nature relationship from ethical, economical, historical, and ecological perspectives as well. Perhaps those will pique your interests more.

For now, I ask that you suspend your disbelief, and consider that there is more to life, and more going on than mere human perception can detect. Humans have a tendency toward a short-sighted, sensory-based view of the world, one that is experienced primarily through our sense of sight (Coren 2004, pp14,35,50). If we do not see a thing or phenomenon for ourselves, or perceive it with any of our other four senses, we doubt its existence. We say things like, "I'll believe it when I see it." Or, "Perception is reality."

But reality does indeed exist beyond one's own set of eyes, beyond one's perception. Therefore, I ask you to proceed with an open mind to the idea that life, and our connection to it, is more than meets the eye.

Connections to an Eternal Pulse

There are times – often when we are unaware of our own seeking – we discover connections to something larger than our individual selves; something universal; some sort of eternal pulse of time and cycles, death and loss and birth and renewal. To appreciate my position, it helps to understand the idea of an eternal pulse and to what I call "universal connections," the notion that we are all connected by some not-fully comprehended thread to one another, to other life forms, to the universe, perhaps even to some higher being.

This is not a new thought; its exploration is age-old. We explore the universality of our being because, once discovered, it can give our lives dimension, our existence an element of longevity beyond a human sense of time, and our souls an answer to an uninhibited primitive yearning. Many are attracted to it, and people of all walks of life search, or stumble upon, these universal connections.

Scientists, for example, search for a physical manifestation of universal connections by researching genetics. Universal connections are what the religious worship and the spiritual revere. They are what mathematicians and artists catch a glimpse of when they find phi repeated over and over in the cosmos, in plant growth patterns, calendric changes of time and season, the rhythmic ebb and flow of the tide, and in proportions of the human body.

With a heightened awareness of the eternal pulse, and a greater sense of universal connection, I hope to find a foundation on which to build my system.

Universal Connections in Spiritual Beliefs: The Tao and Mitakuye Oyasin

Taoism opens the door to the idea of universal connectivity. I quickly grew fascinated with all this ancient philosophy could offer the landscape architect. However, Taoism, especially for the beginner, is difficult to condense into a few paragraphs. Its poignant paradoxes and parables are what give it its depth and energy (qi). To reduce it to only a short, few, simplified terms and definitions is to miss the beauty of Taoism's essence. Nonetheless, a synopsis of what it says about universal connections is attempted.

In Taoism, the *Tao* roughly means (though not completely definable in English) The Way or the course of nature, or the sum of all guidance in the universe (Toropov and Hansen 2002, pp6-9; Watts 2000, pp37-40). Unity is a key component of Taoism, and living and behaving in accordance with The Way is the goal of the Taoist.

In order to live in accordance with the Tao, one must have respect for the course of nature. Understand, the course of nature has about it an endless order and a balanced unity, which is derived from vast and interdependent pairs of complementary opposites, such as light and dark, good and evil, exuberance and serenity, simple and complex.

It is in the esprit of a traditional Taoist teaching about human interconnectedness and continuity with nature that this thesis explores universal connections. When the student asked, "Who am I?" Master Guangfan said, "There is nothing to be found in the entire universe that is not you"(Yakrider.com 2005; Toropov and Hansen 2002, p136).

The intermingling of opposites creates a force of constant energy and change and movement, leading to a fundamental and pervasive oneness. (Toropov and Hansen 2002, pp59-63) Everything oscillates toward its opposite in a natural evolution toward perfection (Lawlor 1982, pp40,42). Where one exists, so does its opposite, without its complement there cannot be one.

Pairs of opposites, represented by the familiar yin-yang symbol, are indescribably vast and intricately interdependent. As such, they create, overcome, and contain bits of one another to form a pervasive, yet evolving unity.

Yin-yang. *top row:* opposites morph into and contain bits of one another; the typical black and white representation; day and night; man and nature. *bottom row*, other ways to consider the paradox: complementary colors suggest a complex intermingling of multiple opposites; the division of opposties is softened; opposites (man and nature) commingled and harmonious.

These opposites transform endlessly, one into the other, creating new formations and phenomena. (Toropov and Hansen 2002, pp63-66) Look again at the yin-yang and try to see its swirling give-and-take as it symbolically morphs black into white/white into black. This transformative "unfolding" represents the unity of Tao.

The Tao is more than pairs of opposites however. It is the combined processes of nature* and it is believed that operating within these processes (or *with* the Tao) is the proper way to live:

> Taoism regards human society itself as a component of the great unfolding [the grand design in which all creatures are children of the universe, on par with the planets and stars, where the universe unfolds in the proper way of its own accord] and tends to view with skepticism any system of thought that ignores the status and ways of life of other animals or entities. (Toropov and Hansen 2002, pp133-35)

* The word "nature" here means not just trees, birds, sky and rain, but natural law; the influence of something universal and vast; an immense complex of principles; the ultimate moral authority (Toropov and Hansen 2002, pp68,131-32,139).

In Chinese, the word *li* speaks of this nature, and is used to express the infinitely complex organic pattern that organizes and guides everything we do, everything around us, (Watts 2000, pp61-62). Li are essentially dynamic formations that reflect the processes which created them. In an abstract sense, li is the principle of energy engaging with that of form.

Furthermore, li:

> fall somewhere between the Western notion of pattern and principle. Li can be seen as a manifestation of the gestalt, the inherent patterns of things. They present an order that arises directly out of the nature of the universe. They account for the appearance of strikingly similar formations in widely different circumstances and in quite unrelated phenomena. These dynamic formations can give the impression of a frozen moment, of a process caught at a particular instance of time (Wade 2003, pp1-3).

Interestingly, halfway around the globe another culture has for thousands of years held similar beliefs in a universal unity. Native American spiritualism is intricately woven with traditions and ceremonies that celebrate the connection of humans, the "two-legged," to their four-legged, winged and swimming brothers and sisters, to Mother Earth and Father Sky, and to the Great Spirit.

"There was no single 'Indian way of life' …it is admittedly dangerous to generalize about the belief systems of hundreds of groups in a period of thousands of years," cautions history professor and author Gregory Nobles. "Despite the significant differences among Indian peoples, the historical record reveals important points of cultural connection and comparison. One of the most striking is religion …some fundamental elements do seem to recur in all parts of the continent." (1997, p28)

The most important recurring element was the "relationship of native people to the earth and to the living things of earth. Indian creation stories reminded people that they were part of nature, that they had a reciprocal relationship with their environment." A common emphasis on connections between humans and all other living things on earth, to include plants, animals, soil, stones and water, and the spiritual relationships they all shared made clear that people were embedded in the natural world, not superior to it. As such, Indian cultures tended to "live lightly on the land, without 'reordering' it, seeming as transient as animals, having no more claim to permanence, much less possession, than the 'foxes and wild beasts' that roamed the forests." (Nobles 1997, pp28-31) (See Appendix One: "Native American Creation Stories.")

Revering the eternal pulse as they did, it was not lightly that warriors prayed forgiveness to "brother buffalo" before projecting an arrow into his flesh during a hunt, or that modern-day tribesmen continue to hold ceremonies to honor sacred animals before their slaying (McGaa 1990, pp192-94,203). The Sweat Lodge, a ceremony prevalent among many North American tribes, is considered a means to "relax in the cosmic flow, be charmed by it, revel in it, celebrate it, be awed by it, and to become wonderfully satisfied that [humans] are truly a part of all that is," (McGaa 1990, ppxvi,46). Respecting such open expressions of homage to universal connections helps in understanding what the Sioux mean by *Mitakuye oyasin*, "we are related to all things," (McGaa 1990, ppxvii,45-46,203,208).

Allan Houser, Chiricahua Apache. *Water Carrier*, 1986. The hole within the figure represents not a void, but the fourth dimension, symbolizing the interconnection of all life. (Located at the Smithsonian National Museum of the American Indian)

From the belief of a pervasive relatedness, Oglala Sioux lawyer, writer and lecturer Ed McGaa suggests, "We should have more respect for an extended family, which extends beyond son or daughter, goes beyond to grandparents and aunts and uncles, goes beyond to brothers and sisters … and further beyond to the animal or plant world as our brothers and sisters, to Mother Earth and Father Sky and then above to [the Great Spirit], the Grandparent of us all," (1990, p208).

We know that we are related and one with all things of the heaven and the earth … the morningstar and the dawn which comes with it, the moon of the night and the stars of the heavens … Only the ignorant person … sees many where there is really one.
–Black Elk, Oglala Sioux sage (Doczi 1981, p24)

Do most people think about or feel a deep connection or relation to the plants and animals they see each day? If those who do not could abandon their practicalities for a moment, if they could allow themselves to embrace a sense of interconnected Oneness, they may find within them a deeper appreciation for other entities and their needs. From this appreciation a person could start formulating an ecological understanding that would apply to the world today. (See sidebar, "The Oneness and Ecology".)

The Oneness and Ecology

Jan Hartke, EarthVoice Executive Director, makes observations about the Oneness from Native American spiritualism, and applies them to today's study of ecology:

> Native American Indians learned how to live with the earth on a deeply spiritual plane. Their intuitive sense of intimate connection with Earth provides deep ecological wisdom that the present-day environmental prophets have rediscovered and begun to teach to an alienated world. At some point, these environmentalists will ask why their passion is so strong, their commitment so intense, their pain from earth's suffering so terrible, their ecstasy with earth's healing so exquisite. They will look inside. When they are ready and their quest sincere, they will experience what the Indians know as the Great Spirit.
>
> If the truth, as seen in the Native American's holy visions, is the profound interconnectedness of all existence, the sin becomes inevitable when one becomes alienated from nature. Yet has there ever been a time when humanity has been so torn from nature's embrace?
>
> Interdependence is at the center of all things. The separation between us and nature is a mirage. It is reinforced by the false teaching that technology has lifted us above the web of life. We do not seek a "back to nature" movement; instead we emphasize the realization that we can never leave nature.
>
> The hope for tomorrow comes from caring hearts. There is a deep, intimate, abiding human need for connecting to the rest of the living world, a kinship with all creation that is aesthetic, intellectual, biological, and spiritual. Our hearts and minds need to be open to hear the cries of the creatures and the cry of the earth. Our concerns need to embrace our moral responsibility to all sentient beings that share our planet, nourishing the noble human capacity for empathy, compassion, and love.
>
> The philosophy of today's ecology is built in accordance with Indian spiritual tradition. If the trillions of cells in our bodies can run amazingly complex functions without our conscious effort, then we can only imagine the wisdom of Mother Earth that we have not yet learned.
>
> (Hartke 2005; McGaa 1990, ppxiii-xviii)

As Taoism offers this thesis the insight of universal connections, Native American spiritualism reinforces the idea, but more important, it provides the inspiration to ask, "What if?" What if humankind dared to feel as brother and sister to animals, plants, even thunderclouds, and son or daughter to the earth and sky? What if we felt strongly passionate about the earth's suffering and its healing? How would we be a different people? How would the earth be a different place?

Universal Connections: Proof in Numbers?

At this point one could argue the idea of "universal connections" is merely feel-good fodder of philosophy and religion. As promised to the skeptics, here is another approach to the concept, one based on mathematics and geometry. If one could actually see a mathematical phenomenon that connects humans intimately with nature and the universe, would the idea of universal connections be more substantiated? Perhaps the prevalence of the ratio *phi* can provide physical evidence of the Oneness.

First, let me say that research on phi was new to me, but it is a phenomenon that has been studied since the ancient Egyptians and Greeks. A quick subject search at the library or on the internet will produce many titles by many authorities in math, geometry, metaphysics, and other areas of study of number, ratio and phenomenon.

The Basics of Phi

I offer this information as a primer on phi. As a number, phi derives from and can perform unique processes; as part of nature, phi is a recurring and surprising element of organic growth. Discussions of phi typically contain explanations of the Fibonacci number series, spirals in flowers, and geometric proportions. Without becoming overly mired in mathematics and geometry, this discussion also includes these examples, but above all, this discussion is framed by the goal of exploring universal connections.

The Fibonacci Numbers: This well-known series of numbers is named after Leonardo de Pisa, known as Fibonacci, who is credited with introducing them, but not discovering them. Fibonacci numbers create a summation series, derived by adding two numbers together to get the next. This particular series starts **1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, etc.**

This additive process of number sequencing produces similar results regardless of the numbers with which one starts. Choose any two

numbers to begin the process, and add together to produce the next. For example -12 and 8 produce:

-12, 8, -4, 4, 0, 4, 4, 8, 12, 20, 32, 52, 82, 134, 216, 350, 566, 916, 1482, 2398, ...

(Lawlor 1982, p57; Stitt 2004; Burger and Starbird 2003; Doczi 1981, p5)

The Ratio: Many people emphasize phi's importance is as a ratio, or proportion, rather than as a particular number. When two adjacent numbers in a summation series are divided one into the other, particularly the larger numerals, the result approximates the ratio 1.618 (when the greater number is divided by the smaller), or .618 (smaller divided by the greater). Both quotients are known as "phi" (in some cases Phi is written to mean 1.618, while lower case phi means .618, however it is most common to see "phi" refer to 1.618).

89 ÷ 55 = 1.6181818	233 ÷ 377 = .6180371
2398 ÷ 1482 = 1.6180836	350 ÷ 566 = .6183745

(Lawlor 1982, pp46-47,57-58; Doczi 1981, pp2-4; Stitt 2004; Burger and Starbird 2003; Meisner 2005)

This proportionality of phi plays an extremely important role in nature, and perhaps in natural process.

Making the Case for Universal Connections With Phi

Now that you are familiar with how phi is derived and with some of its special characteristics (see sidebar, "Unique Characteristics of Phi"), the discussion turns to phi as a phenomenon and a part of organic growth. You will see that nature is full of manifestations of phi and its repetitive tendency.

Spirals: The Fibonacci numbers abound in nature and natural phenomena. Spirals appearing in the heads of daisies, coneflowers and sunflowers, and in seashells, pinecones and pineapples serve as typical tools for illustrating the presence of these special numbers in nature. Each of these elements consist of overlapping clockwise and counterclockwise spirals (which György Doczi calls a *union of complementary opposites*, reminiscent of Taoism's pairs of opposites). The number of spirals is always a pair of adjacent Fibonacci numbers. (Lawlor 1982, p57-58; Doczi 1981, pp1-5,53-57,80-85; Stitt 2004; Burger and Starbird 2003; Meisner 2005)

Mathematics professors Edward Burger and Michael Starbird present the number of spirals found on the typical:

Pinecone	5 & 8
Pineapple	8 & 13
Coneflower	13 & 21
Daisy	21 & 34
Sunflower	34 & 55, 55 & 89, or 89 & 144

(adapted from Burger and Starbird 2003)

Other Natural Manifestations: Spirals in fruits, flowers and shells are but a small sampling of many instances where Fibonacci numbers turn up in nature and natural phenomena. In *Sacred Geometry* (1982, p58), Robert Lawlor explains:

The Fibonacci Series appears in many places in natural phenomena, and a number of studies document its ubiquity. It governs the laws involved with the multiple reflections of light through mirrors, as well as the rhythmic laws of gains and losses in the radiation of energy. It perfectly delineates the breeding pattern of rabbits, and the ratio of males to females in honey bee hives. Philiotaxis is the botanical term describing the arrangement of leaves on the stem of a plant. A plant's leaf distribution produces a ratio based on numbers found in the Fibonacci Series. Branching is another major functional pattern of natural growth which is controlled by the Fibonacci, or phi, series.

Furthermore, Gary Meisner, the "Phi Guy," maintains a website dedicated to all things phi. He submits that this number appears throughout life and the universe, that it has a pervasive appearance in all we see and experience. In the cosmos, phi appears in certain planets' orbits around the sun. Phi is evident in the structure of Saturn's rings. Phi is approximated in the relative distance between planets. There exists an unusual energy source at the frequency of phi that is found in the universe, and a recently released report suggests the very shape of the universe itself is based on phi. (Meisner 2005)

As Robert Lawlor states, these are only a few of the many ways phi manifests itself in number, nature and phenomena. It also appears in geometric proportions, throughout the human anatomy, within the operational systems of the human body, in tonal patterns and music, in art and architecture from ancient eras to modern day, and in rhythmic patterns of calendric changes. For more information and examples, please refer to Appendix Two: Additional Manifestations of Phi.

Why Phi?

When considering the head of the sunflower, it seems "unreasonable to believe that its number of seeds is preordained, yet something like that

Unique Characteristics of Phi

Phi is considered a unique number with unusual qualities. Whether coincidental, mystical, or quite logical, some of its exceptional qualities that still amaze mathematicians and scientists alike are:

All natural numbers can be reduced to some series of Fibonacci numbers (82 = 55+21+3+2+1) (Burger and Starbird 2003).

Phi is the only number divisible by all ones (Burger and Starbird 2003).

$$\varphi = 1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cdots}}}}}$$

The quotient of any two consecutive Fibonacci numbers can be written as a fraction within a fraction within a fraction, comprised of all ones, thus revealing phi's beautiful hidden structure (adapted from Burger and Starbird 2003).

There is one and only one proportional division that can be accomplished with only two terms and still retain a sense of unity: phi, where the smaller is to the larger as the larger is to the whole (Lawlor 1982, p45). A:B :: B:(A+B) This precise proportional division – a single point found on any line – is called the Golden Section, and it produces a uniquely reciprocal relationship between unequal parts of a whole (Doczi 1981, pp2-3).

$A:B :: B:(A+B)$

The Golden Section creates harmony by uniting different parts of a whole so that each preserves its own identity. It has the power to unite and diversify at the same time. Consider this, "If our faces were not similar, we could not distinguish man from beast; if they were not dissimilar we could not distinguish man from man." – Montaigne, 15th century. (Doczi 1981, pp13,82-83)

Phi represents one of only three circumstances where there is a coinciding of the processes of addition and multiplication (musical harmony and the square are the others).
So, where phi (φ) = 1.618:

$1/\varphi + 1 = \varphi = 1 \times \varphi$

$1 + \varphi = \varphi \times \varphi = \varphi + 1$

$\varphi + \varphi^2 = \varphi^3 = \varphi \times \varphi \times \varphi = \varphi \times \varphi^2$

(Lawlor 1982, p56)

Phi is considered the perfect division of Unity because it is an internal division. That is, it provides a model of evolution that reflects and contains the source, rather than one that progresses away from the origin. Phi shows the possibility of an evolution "guided from within, an exaltation of the initial qualities of Divine ideation passing an image of the Divine." (Lawlor 1982, pp46-47)

is exactly what happens." In patterns of organic growth, the presence of phi "reveals that there is indeed an infinite and intangible side to our world." (Doczi 1981, p5)

Yet, the reasons *why* phi appears over and over in organic growth remain a mystery to biologists and mathematicians (Burger and Starbird 2003; Stitt 2004). Some claim it is the most efficient outcome of natural process; others believe it is a universal constant of design – God regarding himself. Some believe phi is a reminder of the relatedness of the created world to the perfection of its source and of its potential future evolution. (Stitt 2004; Meisner 2005; Lawlor 1982, pp53,63)

Phi, as proportion, provides nature with structure and limitations, says architect and author György Doczi. This proportion is an essential part of a basic pattern-forming process. In this manner, phi has helped "shape the human hand and mind, and can continue to guide whatever the hand and mind are shaping." As such, it is through phi that Doczi ponders human civilization; I emphasize the relevance of his words toward our shaping of the environment:

> Whatever else there may be behind such 'coincidences,' it is hard to avoid the conclusion that we are looking at one of nature's most basic pattern-forming processes, here referred to as 'dinergy.' Seeing the hidden and harmonious order built into body and mind, as it is built into every flower and leaf, mirrored by the crafts, echoed by music, one wonders at the origin of the disharmony and disorder that mars our civilization.
>
> Indeed, our fascination with so-called 'primitive' cultures appears to spring from our longing for the lost dinergic relatedness which was once ours, when we ourselves were still 'primitives.' Of course, we very much need science and technology, but we do not need the fragmentation and separation that have come with the differentiations of our civilization. Perhaps the disharmonies and disorders are with us not because our culture has grown up, but because we have not yet grown up. Western civilization is still in its adolescence. Our violences and worries may be but growing pains. (Doczi 1981, pp28,140-41)

That this constantly reoccurring phenomenon exists, and humankind is part of it, contributes to the concept of universal connections and the wholeness and relatedness of all things. In this case, we witness a shared connection of proportion, pattern, arrangement and occurrence between plants, animals, planets, tonal sounds, and other natural phenomena.

This study on phi was meant to provide another, physically grounded perspective on universal connections. However, this thesis also takes from it a deeper sense of wonderment at the physical unity humans share with others on earth and with the universe. To my surprise, it also gave me insight into how awareness of phi's connections can, perhaps, influence our attitudes and actions toward nature.

Universal Connections: Contribution to a "Better System"

I set out on this examination of universal connections wondering if a better system of shaping the landscape exists, and hoping to find a foundation on which to build my own system, if need be. As to the former, my search continues in other sections of this paper. As for a foundation, the insight I gained from Taoist philosophy, Native American spiritualism, and numerical and natural phenomena leads me to believe that I have, indeed, found a basis for a system that can respect and respond to the natural world because it ***gives a reason to care*** about the natural world.

It is simple, really. Once a shared unity is acknowledged, a person naturally assumes some sense of respect toward that with which they are united, in this case, nature. That respect, to a degree, guides the person's attitudes and actions, in this case, those regarding the land and other beings. Later in this paper, in a continued pursuit of a better system, I will examine several theories on how respect, attitudes and actions are linked, and how they affect the environment.

Before I do, however, I am compelled to wonder why the system I seek does not *prevail* in American society today. If we can witness, as Doczi says, a hidden and harmonious order, what *is* the origin of our civilization's disharmony and disorder? If we long for a *lost*, primitive relatedness, how and when did we lose it? How have science and technology contributed to that separation? What does Doczi mean, "Western civilization is still in its adolescence," and are our environmental violences merely growing pains that can be alleviated?

With these questions in mind, my journey continues.

THE DISCONNECT

This section is not intended as an abridged American history so much as it is an historical examination of some of this country's dominant attitudes and beliefs, and how they have translated into behaviors and actions on the land. History professor Lynn White, Jr. wrote in 1967, "What we do about ecology depends on our ideas of the man–nature relationship," (p1206). Here, I explore historic perspectives on that relationship.

This study helped me understand how we, as a society, developed current-day, status quo attitudes and solutions to land cultivation and development. I have come to see the reasons as resulting in histories and persistent patterns of ecological devastation and unsustainable practices, and I view them as barriers to the emergence and prevailance of a better system. I think that now, with hindsight and reflection on our environmental record, our culture is ready to rethink some of the attitudes and methods we have assumed and taken for granted.

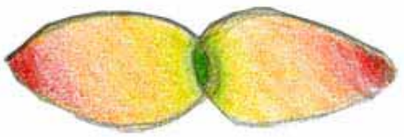
University of Texas professor Robert Mugerauer provided this inspiration for my historical examination:

> If we fail to take into account [the] origins of our unconsidered attitudes and approaches – long since radically [modified] – we cannot then, think or act as responsibly as we might. Recovering and attending to this forgotten origin of our interpretation is crucial for critical self-understanding and for responsible action in the landscape (1995, pp90-91).

With this as my impetus, and finding answers to Doczi's questions as my goal, I set out to discover some of the origins of our disconnect. In undertaking this historical approach, imagine my pleasant surprise to find traces of an improved system that has quietly been growing all along.

Symptoms of the Disconnect

In the previous section I made a case for universal connections as a fundamental aspect of the human–nature relationship. I imagine that relationship ideally as one not at odds with wills in opposition, but instead as harmonious and mutually beneficial.



forced relationship with little common ground

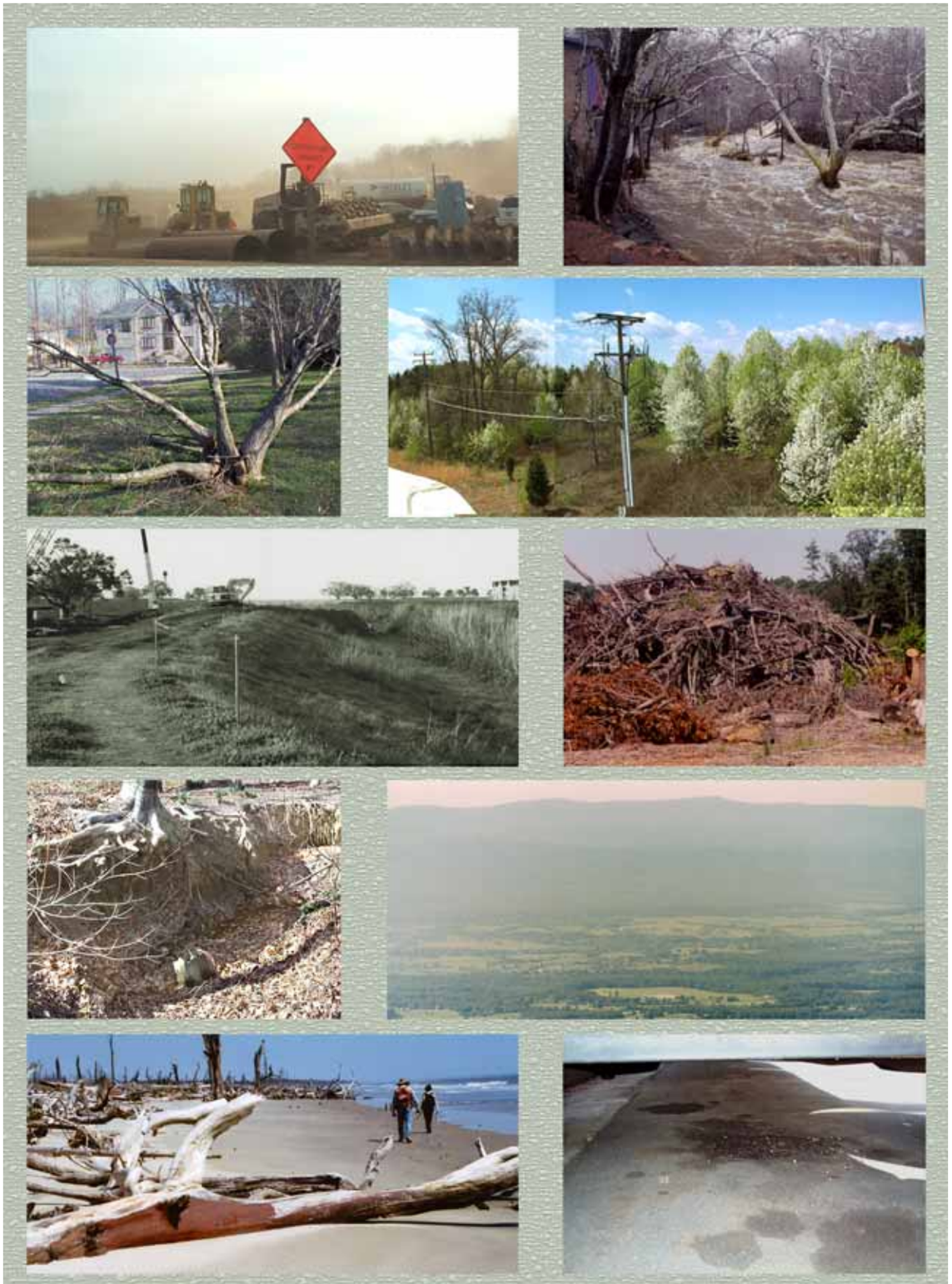
a mutually beneficial relationship

Sadly, I submit as evidence of our disconnect from nature, the many ways we have devastated the environment. Impurities generated from factories and automobiles pollute the air, soil and water. Direct dumping of raw sewage and indirect runoff of chemical fertilizers create dead zones in oceans and other saline water bodies. Ambiguous politically and geometrically drawn property lines respond neither to the land's topography, typology, watershed nor catchment basin area, ecosystem, or bioregion. Suburban roadways, commercial strips and housing decimate forests and habitat. Genetically engineered vegetation cross-pollinates with native plant species, causing natives to permanently mutate in rapid succession. Lingering high levels of mercury persist in waterways contaminating long-lived fresh and saltwater fish species. Nonporous pavements cover the ground preventing water infiltration and reducing aquifer recharge. The list goes on and on. Water. Air. Climate. Soil. Vegetation. Wildlife. Humans have affected all aspects of nature, and we continue to do so at alarming rates. This is not a sustainable relationship; this is blatant disregard for the inherent limitations of nature.

There is a limitless order to our existence, an order of wholeness as unfathomable as the order of the cosmos, and as dreadful when violated as the order of the atom. (Doczi 1981, p139)

A Trifecta of Origin

In human history, the disconnect from the eternal pulse could have been caused by a number of factors. With an expressed interest in those affecting the environment, this thesis examines three factors of particular importance in the United States: early



Environmental results. *From top left*, poor air quality; increased incidence of flash flooding; less vigorous, high-maintenance introduced species; invasive introduced species resulting in monocultures (here, Bradford pears escaped cultivation and now dominate this landscape); technologically dependent landscapes striving for unattainable stasis (here, a New Orleans levee breach under repair); deforestation; erosion and accelerated land loss; widespread smog and pollution; climate change (indicated here by sea level rise and the death of a salt-intolerant forest); leachates that will be flushed into and will contaminate local waterways.

cultural influences, the rapid rise of technology, and the emergence of economics. This trifecta has provided the lens through which the American landscape has for centuries been perceived and shaped, and even today, still is.

These factors did not occur sequentially, one leading to another. Human culture has not been so linear. Rather, these factors are intertwined, one simultaneously influencing and responding to the others, and are by no means mutually exclusive.

Early Cultural Influences

Inhabited by humans since approximately 12,000 to 10,000 BC, the land we know as the Americas was isolated from more technically advanced Europeans until the late 15th century. Prior to that time, human cultures in the Americas evolved at their own pace, under the influence of geographically and technologically similar cultures. These original inhabitants, today called American Indians, were an earth-bound culture of primarily hunter-gatherers, some with more advanced crop cultivation (Staloff 1996, Lecture 3). Their tools and weapons were made of wood and stone, and only a few of bronze. They had not learned the technique of making steel, they did not know the wheel as a tool. They had few domesticated animals, but none large enough to mount and ride. It is clear that they lived closely with nature, and were well aware of the limitations it presented. (Diamond 1999, pp37,74-81) If a culture exploited resources to an extreme, it quickly realized the detrimental consequences and either moved on or perished.

When Spanish ships arrived at the Americas in the 1490s, they found expansive lands teaming with wildlife and forestation (wilderness) the explorers had not known in their homeland. What piqued European interest to travel westward and explore this uncharted part of the world? Several reasons are here distilled:

- Territory. European countries were interested in expanding their land holdings. (Boyer 2001, p235-38)
- Wealth. With more land holdings and resources, countries could produce more goods for trade. (Boyer 2001, p235-38)

- Education. Stable societies supported broad trade interests and renewed pursuits in empirical knowledge, leading to global exploration. (Boyer 2001, p235-38)
- Religion. Diverse Christian-ruled European countries were embarking upon a period of religious upheaval and unrest. Some saw the New World as an opportunity to expand their religious interests and influence abroad.

> Columbus believed he had discovered the Garden of Eden and thus had enabled a significant advance in the conversion of the world and its consequent end. Throughout the 15th and 16th centuries people believed that the time had come to renew the Christian world and this renewal was to be the return to the earthly paradise or the beginning of a new era of sacred history. That is, America was to be the scene where the Church would complete its work and Christ's second coming would occur," (Mugerauer 1995, p59).

- Trade Routes. European countries hoped for a trade route to Africa and Asia that was not controlled by the Christian competitor and enemy, the Islams. Such a trade route could provide the long-awaited advantage they sought over Islamic nations. (Boyer 2001, p235-38)

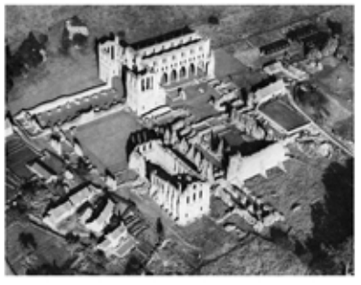
The clash between the American Indians and the Europeans was terrible. Professor and author Jared Diamond claims that the Europeans' advanced technology, specifically their steel weapons and guns, domesticated horses, ability to communicate in writing, and their centralized political organization, gave them distinct advantages. After their initial meetings, the spread of infectious diseases allowed them to handily defeat what remained of approximately 95 percent of the Indian tribes and empires that comprised an estimated 20 million individuals. (1999, pp74-81,211) As such, European explorers, military troops and settlers occupied this "new" land, introducing and spreading elements of their culture.

"Culture" is a large word to define. European technology is directly related to land cultivation and when a surplus is generated trade is possible. For now I will focus on land cultivation and religiously influenced attitudes. The other aspects of my "trifecta," concerning technology, trade and economics, follow.

Survey of European landscapes from the 16th century and earlier.

Villa Capponi, Italy
circa 1572
(Jellicoe and Jellicoe 1995, p169)

Clonmacnois, Ireland
founded 541
(Jellicoe and Jellicoe 1995, p141)



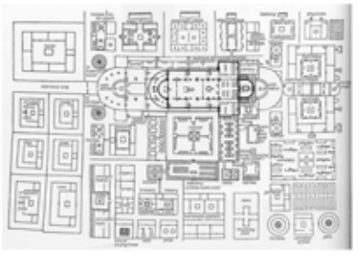
Rievaulx Abbey, England
founded 1131
(Jellicoe and Jellicoe 1995, p143)

Assisi, Italy
founded 1182
(Jellicoe and Jellicoe 1995, p144)

The Generalife, Spain
circa pre-1319
(Jellicoe and Jellicoe 1995, p43)

Chenonceau, France
circa 1515
(Rogers 2001, p157)

Orto Botanico, Italy
circa 1545
(Jellicoe and Jellicoe 1995, p153)



St. Gall, Switzerland
founded 613
(Jellicoe and Jellicoe 1995, p142)

Mont St. Michel, France
circa 1203
(Jellicoe and Jellicoe 1995, p145)

Villa Lante, Italy
circa 1564
(Jellicoe and Jellicoe 1995, p162)

Land Cultivation

Long before the 15th and the 16th centuries, Europeans had become expert at modifying their environment and building impressive, permanent structures. A quick survey of European landscapes (see previous page) reveals the technological knowledge, mastery of tools, workmanship, and the governing class's prevailing attitudes toward the environment.

This survey does not suggest that constructing opulent villas and lavish gardens were priorities for settlers in America; rather it illustrates the competence with which, unlike American Indians, the Europeans were able to subdue nature. In order to provide the basic needs of food, water and shelter, colonists commenced with typical activities of survival: settlement, agriculture, clearing forests and other wild areas, draining marshy areas, hunting animals for food, furs, other products and sport, introducing plants and animals more familiar and useful to them than those found in the new land, and supporting the European trade market (Ponting 1991, p161). These activities quickly began altering – sometimes devastating – longstanding, intact North American ecosystems.

Religiously Influenced Attitudes

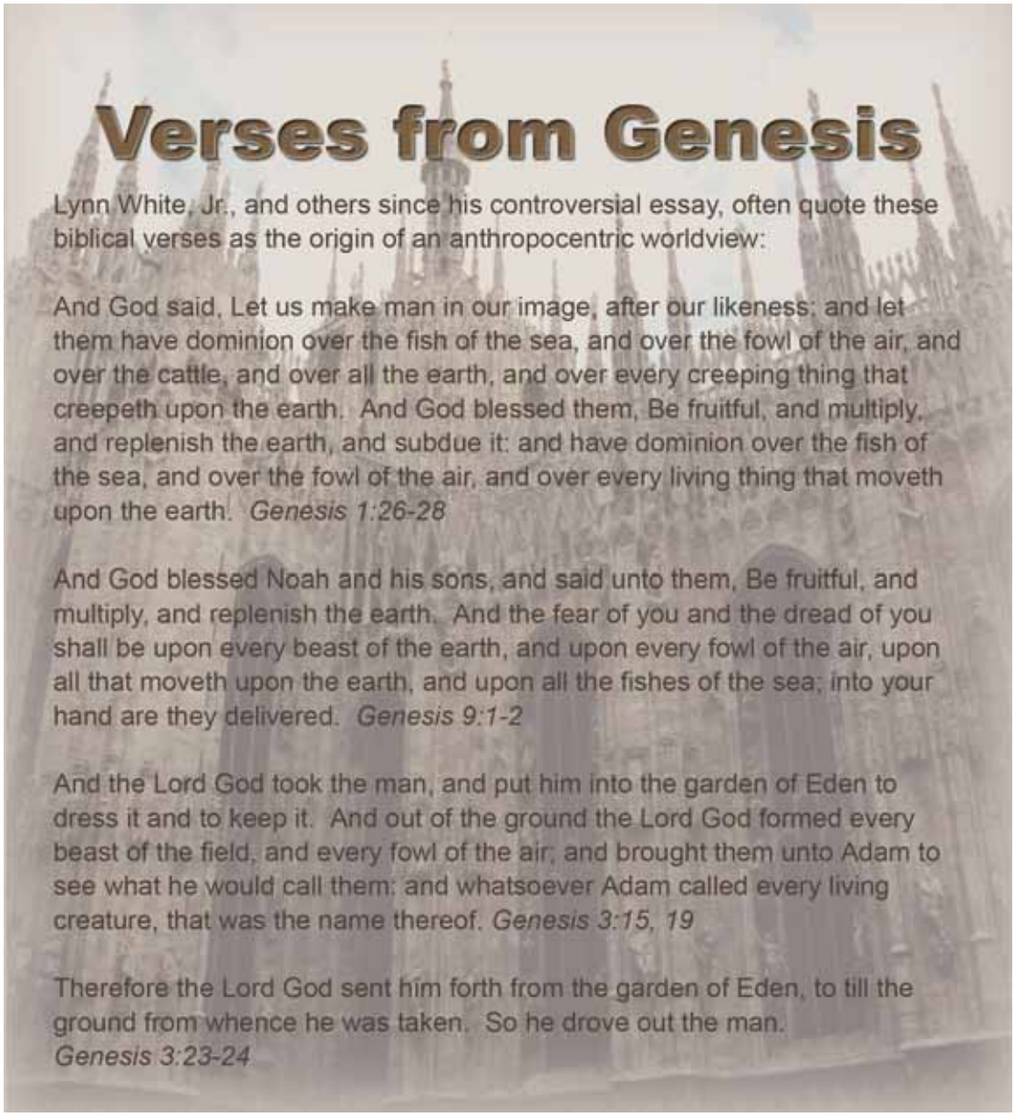
In 1967, Lynn White, Jr. wrote a controversial essay titled, "The historical roots of our ecological crisis." In it he traces Judeo-Christian beliefs as an underlying cause for humans' exploitation of nature. His essay has sparked strong reactions from both the religious and scientific communities for the past 40 years.

Genesis and Anthropocentrism: White claimed that the Jewish and Christian faiths have interpreted particular passages from the shared book of Genesis as granting humans with divine right to dominate, subdue and master nature (see sidebar, "Verses from Genesis"). Furthermore, he said, by destroying the belief in nature's guardian spirits (animism, genius loci), Christianity made it possible to exploit nature in a "mood of indifference to the feelings of natural objects." (White 1967, pp1205-06) "Nature was not seen as sacred, and therefore it was open to exploitation without any moral qualms," (Ponting 1991, p144).

Because man is created in God's image, has a soul and is promised an afterlife, he is decidedly separate from the natural world, ***superior*** to it. "Christianity," White claimed, "not only established a dualism of man and nature but also insisted that it is God's will that man exploit nature for his proper ends," (1967, p1205).

Following this, attitudes were generally characterized by an idea of humans as orderers of nature. The work of human society in altering nature by extending cultivated areas and using the resources of the world was seen as part of a continuous process of improvement on nature.

Beyond the point of mere survival, it was widely held that humans needed to interfere with, or add the finishing touches to, nature in order to maintain civilization, and that nature was at its best when controlled and shaped by humans. Increasing human knowledge brought the prospect of greater control over the natural world and [they believed] that this would be pleasing to God because humans were taking full advantage of the wonders of his creation. (Ponting 1991, pp143,145-47)



This biblical interpretation, it is argued, created an anthropocentric (human-centered) view of the world, and has led to a generally accepted exploitive attitude toward the environment. Furthermore, it was to have a profound and enduring impact on later thought, even when it was not specifically religious. (White 1967, p1205-06; Ponting 1991, p145)

Christian Anthropocentrism Beyond White and Genesis: White's assessments of a Judeo-Christian anthropocentrism apparently do not exist in isolation. Earlier Christian thinkers also exhibited dualistic and/or negative attitudes toward nature. Martin Luther (1483-1546) spoke of a wrathful nature filled with hostile energies, whose purpose it was to teach humans of sin and God's punishment. Nature, to him, was certainly not something with which one would wish to commune, nor was it a place to witness God's glory. (Kinsley 1996, pp111-12)

John Calvin (1509-64) believed that as God's special beings, humans were to imitate God's governance over nature, and emphasized transforming nature and remolding it to God's glory. Thomas Aquinas (1225-74) recognized a goodness within nature, but also saw nature as hierarchical. Humans were considered sublime, all other animals and plants fell among the lower echelons. "Imperfect beings serve the needs of more noble beings," with all plants and animals being subservient to and existing for human use. (Kinsley 1996, pp110-12)

During the 16th to 18th centuries, nature was interpreted "almost exclusively in anthropocentric terms. The pernicious aspects of nature were understood as punishment against Adam and Eve …God made nature turn nasty." During this period, nature is described as "flawed, fallen, rebellious and odious as a reflection of the human condition." A commonly accepted goal of the human endeavor was to "triumph over nature, and much Christian theology of the day was happy to provide the moral rationale for it." (Kinsley 1996, pp112-14)

A Second Chance at the Garden of Eden: Robert Mugerauer, in *Interpreting Environment: Tradition, Deconstruction, Hermeneutics*, explores dual interpretations of the book of Genesis. One understanding resembles White's, but Mugerauer presents a slight twist, focusing on humankind's struggle to return to paradise. His claim is that the American landscape basically has been understood religiously, with "attendant practices [operating] according to a theologically informed economy and politics. From the beginning, America was understood in terms of an earthly paradise," (1995, p58).

In this sense, man considered it his ***duty to God*** to develop raw, wild nature and, therefore, the work of cultivating and improving nature became a moral task of divine providence. Completing the mastery by transforming the natural into the cultivated paradise became the goal; work and progress represented the mature acceptance of responsibility for one's own redemption (Mugerauer1995, pp79-80,90):

> Natural wilderness [was considered] a wasteland or desert, and only the transformation and conquest of that barrenness could generate the second paradise. The subjugation of wild nature became a trial before passage to the promised land, the promised paradise on earth. The task in both its religious and civic dimensions was to control and cultivate the wild and to make nature into paradise in America.
>
> The Puritans saw the American wilderness in light of the expulsion from paradise, and equated the idea of work as their religious task of recovering a place before God. The destruction of the wilderness was the first step toward building the new kingdom; nature became the scene of our conquest.

In Mugerauer's second interpretation of Genesis, he presents an alternative "softer" anthropocentrism. This version focuses on the promised second Garden of Eden, which some considered to be the American wilderness. God is recognized in all of nature; nature is paradise given, although still given primarily to man.

Man, if we look to final causes, may be regarded as the centre of the world, insomuch that if man were taken away from the world, the rest would seem to be all astray, without aim or purpose. – Francis Bacon (Ponting 1991, p148)

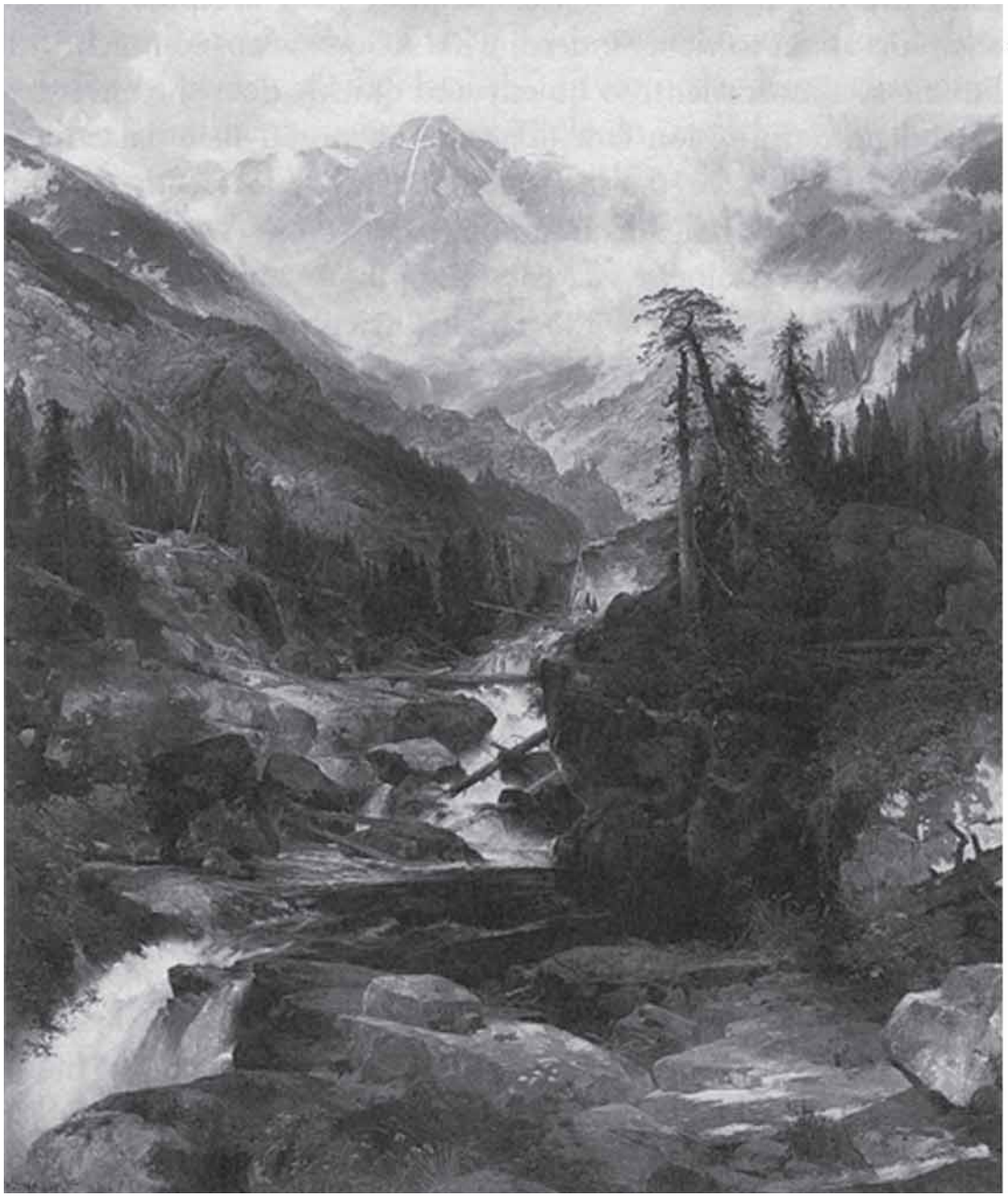
Accordingly, humans inspire to live lightly on the land, causing nature as little interference as possible. (Mugerauer 1995, pp61,65-68)

Where people did inhabit the "new Eden," they completed it and brought forth a sustaining vision for it. In this softer anthropocentrism, humans must change their dominant view and transform *themselves* so as to be worthy to enter the given natural paradise, and avoid attitudes that led to the original expulsion from Eden. (Mugerauer 1995, p90)

Religion and Land Stewardship: With White's unpalatable conclusions drawn from selected verses of Genesis came varied reactions from the religious community. Some philosophers and theologians presented counter-verses and counter-interpretations as more loving, caring guidance toward nature (see sidebar, "Biblical Verses of Stewardship"). Others touted historic religious figures who spoke tenderly of and acted gently toward the natural world. Their point was that Judaism and Christianity promoted a message of environmental stewardship, in which humans are given the task of *caring for* nature on God's behalf, not selfishly ravaging it.

White himself acknowledged, "When one speaks in such sweeping terms, a note of caution is in order. Christianity is a complex faith, and its consequences differ in differing contexts," (1967, pp1205-06). Philosopher K.S. Shrader-Frechette echoes the sentiment, "Judeo-Christian history, like all history, is complex and even contradictory, just as human beings are; hence it is probably not capable of being

Paradise given, as depicted by early American landscape painters. Images embrace natural scenery, often bathed in heavenly light, with very little, if any, interference by mankind (Mugerauer 1995, pp 77(left), 70(right, top), 69(middle), 67(bottom)).

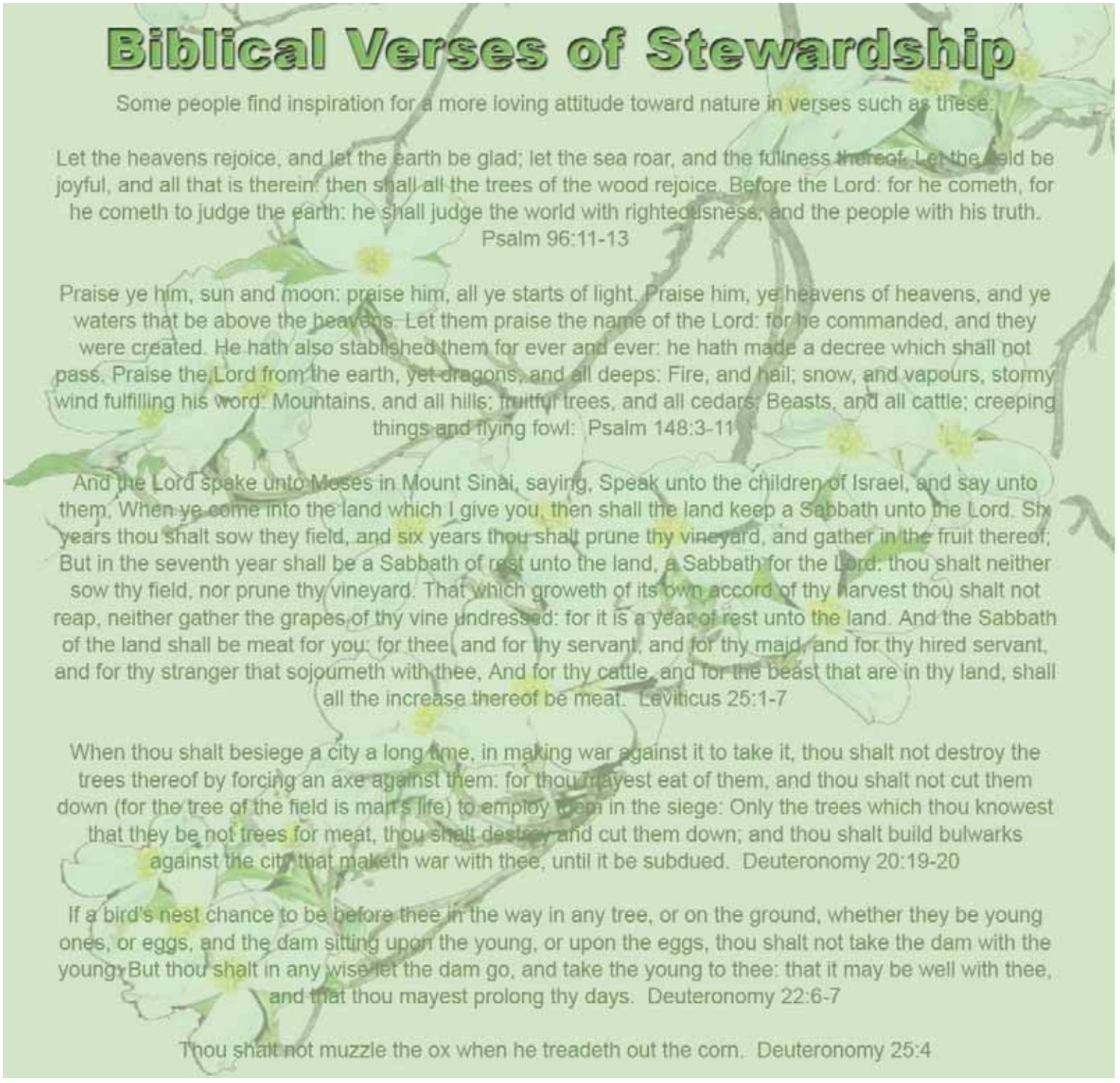


The Mountain of the Holy Cross, 1875; Thomas Moran

New England Scenery, 1851; Frederick Edwin Church

To the Memory of Cole, 1848; Frederick Edwin Church

Daniel Boone at His Cabin at the Great Osage Lake, 1825-1826; Thomas Cole



interpreted in [a] single way," (Friedman 2004, p20). And while nowhere in the bible does it teach tyranny over nature, neither does it directly obligate humans to care for nature (Kinsley 1996, p118; Friedman 2004, p20).

Perhaps the most cited historic figure for a Christian stewardship is Saint Francis of Assisi (1182-1226), whose Christian love was openly extended to all of nature. Among his teachings were that of nature as an "illustration of the nature of God," and of all creatures as holding an equal place in creation because each is a part of God's plan. According to Saint Francis, creatures were not put on earth merely for the utilitarian purposes of humans. (Ponting 1991, p146) In fact, Saint Francis felt a deep kinship with nature. In a manner similar to Native American spiritualism, he addresses in one of his most famous works (Canticle of the Sun), the Sun, Air, Fire and Wind as his brothers, he sings of Moon and Water as his sisters, and he praises the Earth as his mother (Doczi 1982, p28; Kinsley 1996, p122).

White, too, lauded Saint Francis. "The key to an understanding of Francis is his belief in the virtue of humility – not merely for the individual but for man as a species. Francis tried to depose man from his monarchy over creation and set up a democracy of all God's creatures," (White 1967, p1206). And although White highly praised Saint Francis – so much so, that when calling upon society to "rethink and refeel our nature and destiny," he proposed Francis as the "patron saint for ecologists" – White muses that the "prime miracle of Saint Francis is that he did not end up at the stake, as many of his left-wing followers did" (White 1967, p.1206-07).

There are numerous other notables in the Judeo-Christian tradition who held nature in a higher esteem. Influential Jewish thinker Maimonides (1135-1204) taught that all other beings did not exist merely for human utility; instead, he suggested, they were intended for "their own sakes" (Ponting 1991, p145). Irenaeus (130-200 AD) taught that nature is full of goodness, and is a whole part of God's divine plan of renewal. Augustine (354-430 AD) affirmed the beauty and goodness of the creation, and its purpose of glorifying God in all his splendor. (Kinsley

1996, pp119-120) And what of Benedictine monasteries that operate under "explicit environmental ethics [rooted] deep within the Judeo-Christian tradition?" (Friedman 2004, p20)

While it is undeniable that Christianity remained vigorous and dominated Western European and American culture, history, art and politics during the 16th to 18th centuries (Kinsley 1996, pp112), Shrader-Frechette suggests it was not necessarily religion that sweepingly led to anthropocentric worldviews:

> Rather than a religious tradition being responsible for environmental degradation and resource depletion, is it not true that greed, egoism, and shortsightedness have caused most environmental problems? Judeo-Christian beliefs have never sanctioned such vices … I suspect the ultimate 'blame' must be laid at the door of human behavior, in general, and not one religion, in particular (Friedman 2004, p20).

Worship or Excuse?: If, as Shrader-Frechette suggests, anthropocentrism derives from human behavior, why has religion not seemingly curtailed the greed or egoism? With a track record of environmental problems, how could society continue to claim "shortsightedness"? Perhaps because in some circumstances, "religion" has been used merely as an excuse for progress, a guise for the greed and egoism. Consider this: During the 16th to 18th centuries, some religious themes were drawn upon to support and reinforce aspects of modernism. "The themes of anthropocentrism, human domination of nature, and the superiority of human beings over all other creation were the themes that were most popular in justifying many aspects of the modern period, such as technology, science and colonialism," (Kinsley 1996, pp112-116).

Scientific knowledge of that era seemed to "be in harmony with the theological emphasis on human domination of nature as a God-given right." Scientists typically phrased their goals and purposes in theological imagery, a theology that was dominated with a sense of nature as "a constraint against the human campaign." (Kinsley 1996, pp114-16) Scientists claimed their task and reward were to "think God's thoughts after him," but it is hard to judge when "men explain why they are doing what they want to do whether they are offering real reasons or merely culturally acceptable reasons," (White 1967, p1206).

For centuries, these views were hardly challenged. Some did object, "but for the most part human beings felt quite self-righteous in their quest to tame, civilize, and otherwise dominate nature even if that meant destroying large parts of it," (Kinsley 1996, pp115-16).

I wonder about religion being used as an excuse, as a means to other ends, or as White said, as a culturally acceptable reason. For example, consider Jared Diamond's historical account of Francisco Pizarro's confrontation with Incan Emperor Atahuallpa. Do the Spaniards' motives seem true to Christian ideals, or do they seem driven by some of the other aspects of European colonization?

Pizarro deceived Atahuallpa by offering false friendship and brotherhood in order to secretly position his men for attack. Pizarro sent a friar to "speak" to Atahuallpa, which was more like a threat for the Incan leader to "subject himself to the law of our Lord Jesus Christ and to the service of His Majesty the King of Spain." The friar "explained" that he taught Christians the "things of God," and that he came to teach the Incans these things. "On the part of God and of the Christians, I beseech you to be their friend, for such is God's will, and it will be for your good." When Atahuallpa refused a Bible (how could he even begin to understand the friar's concepts, much less his language?), the friar instructed the hidden troops to, "Come at these enemy dogs who reject the things of God." With that, Pizarro gave the signal, and shortly thereafter 7,000 Native American soldiers were slaughtered, Atahuallpa captured (and later killed) and the Incan Empire defeated. (Diamond 1999, pp67-73)

Four hundred years later, this use of religious appeals for other means persisted during the period of aggressive westward expansion around the 1840s. Due to explosive population growth, political tension with Great Britain, economic hardships, and opportunities for expanded commerce, the United States government decided to expand the country's borders westward. While the "champions of [so called] Manifest Destiny were at best a motley collection of interest groups, motivated by a number of divergent objectives, and articulating a broad range of uniquely American concerns," (Haynes 2005), many citizens assumed "the West was already theirs by divine right," (Nobles 1997, p156). With a strong desire for more land ownership came increasing contempt for the current landholders, the American Indians. While some Euro-Americans argued for limits and more peaceful means of land acquisition, often the movement was marked with hostility, destruction and violence.

At the time, most European Christians understood Indian spirituality as polytheistic paganism and the worship of false gods (Nobles 1997, p29); Indian beliefs were considered heretical and inconsequential, and were ultimately denied (Mugerauer 1995, pp106-07). Therefore, when it came to eradicating the Indians and taking their land, Christian theology provided Anglo-Americans a moral framework in which to justify the land-lust and "to accept the often unsettling implications of their national history," (Nobles 1997, p152). Not alone in his sentiment, one

Georgia congressman, who wanted Indian holdings east of the Mississippi in order to expand the South's cotton-growing fields, said it all, "We should take direct control of Indian land. …When gentlemen talk of preserving the Indians … you mean to convert them from their miserable and horrible superstitions to the mild and cheering doctrines of Christianity," (Nobles 1997, p128).

It has been some 160 years since Manifest Destiny. I am curious, does the practice of calling upon and misusing religion as a culturally accepted reason still exist in our society today, as it did during the 400 years prior? If so, what are the direct effects on the landscape and the environment?

Anthropocentric Twenty-first Century America

Today, American culture is dominated by the same anthropocentric worldview that undeniably prevailed during 16th-18th century Western Europe and early America. From this study, I am convinced that attitudes established during this period still influence our culture today.

That these "biblical and Christian themes continue to influence modern attitudes toward nature is readily apparent," (Kinsley 1996, p115). Perhaps it is too strong an accusation to "blame" Judeo-Christian theology for our disconnect from nature; as Shrader-Frechette pointed out, human history and Judeo-Christian tradition are complex and cannot be defined singularly. As we have seen from biblical verses and notable figures, exceptions to the widely held rule have existed throughout history.

Whether anthropocentrism originated from religion or from human nature is unclear. I do, however, think it best to conclude that religion has been a strong influence on our attitudes toward nature and the environment. For some, religion has reinforced a human domination over nature, for others it has inspired a softer anthropocentrism, for others still it has instilled a loving sense of land stewardship. Of course, American history is not without those who claimed religious motives, but only as a ruse for greedy, egotistical or other ends.

"No matter what early European settlers might say about setting sail on behalf of God and country, their anticipation of New World wealth cannot be overstated; it underlay all European efforts at conquest, colonization, and even religious conversion," (Nobles 1997, p44).

But an anthropocentric mindset only opens the door, society accepts or denies ensuing behaviors. Technology and economics drove us, as a society, further from nature and, to a large extent, away from a religious context whatsoever. Let us move on to the other aspects of our environmental trifecta.

Technology and Economics

We have seen how cultural and religious attitudes have played a part in transforming the American landscape, now we add two more layers of impact: physical means and monetary driving forces. By continuing to focus on our history, we can reveal more of the factors that have led to and still influence contemporary ecological and environmental conditions. A list of dates and technological advancements will not serve our purposes. Instead I present a brief evolution of genres and just a few notable examples of technology that helped change and define the human–nature dynamic. And while this discussion of economics admittedly suffers from oversimplification, it serves us well as a synopsis with relevance to environmental impact.

Technology

Technology has been one of history's strongest forces, yet there has existed significant variations in the speed and geographic location with which technology has been embraced and advanced. "Technology begets more technology," explains Diamond. "Most technology is not invented locally but is instead borrowed from [and expanded and diffused throughout] other societies." As such, technology has typically flourished among societies with cooperative relationships with other societies rather than those which exist in geographic isolation. "Different rates of development on different continents from 11,000 BC to 1500 AD were what led to the technological and political inequalities of 1500 AD." (Diamond 1999, pp16,251,254-61)

An example: Not to ignore agriculture's effects on the environment since its inception some 11,000 years ago (Diamond 1999, p86), it was around the 7th century AD that man's relation to the earth was profoundly changed (White 1967, p1205). Farmers in Northern Europe borrowed scratch-plow technology from the Near East and Mediterranean, but because their soils were wetter and stickier, the Europeans required an improved, sturdier plow to cut and turn their heavy soil. Their new technology required more oxen to operate, which forced peasants to pool their oxen and work together. The new plow produced a more efficient, although violent, means of manipulating the land, and in order to support the new community effort, larger swaths of agricultural fields were created. "Thus the distribution of land was determined by the capacity of a power machine used to till the soil rather than by the agricultural needs of a single family. Formerly man had been part of nature; now he was the exploiter of nature." (White 1967, p1205)

The technological differences of 1500 AD between technology-sharing European societies and isolated American Indian cultures is clear. "Even though native peoples had complex cultures, they did not have the technology and machinery that could destroy and disrupt entire ecosystems," (Des Jardins 2001, p166). Metallurgy, weapons, tools, agriculture, animal domestication, and transportation provided important advantages to the Europeans.

As was depicted earlier through the survey of pre-16th century European gardens, the Europeans had a developed capacity to manipulate nature with methods, efficiency and speed formerly unknown to these lands. The ax was used to fell forests, the wheel allowed the movement of resources, the shovel allowed excavation and mining, the production and release of more familiar and readily usable non-native plants and animals altered the face of the landscape (see sidebar, "The Introduction of Plant and Animal Species"), and of course the ship delivered all of these implements and more to the shores of the once-isolated land.

Whether or not religion was the impetus for land cultivation by early American settlers (as previously has been suggested), some notable occurrences happened by the 19th century. The 1700s marked the beginning of the Industrial Revolution; a "sudden fusion" of science and technology in the 1800s united "theoretical and empirical approaches to our natural environment," broke social barriers, and expanded humans' ability to utilize and transform resources (White 1967, pp1203-04); religious reasoning gave way to secular thinking (Ponting 1991, pp146,151; Mugerauer 1995, pp78-79,86,88-89); and a faith in perpetual progress and continual improvement became an almost universal assumption (White 1967, p1205; Ponting 1991, p150).

> The religious interpretation of American nature as a paradise to be wrestled by work from the wilderness came to an abrupt end. American nature was no longer a scene for a religiously understood mission because the radically secular view, which at first depended on and was fed by a religious understanding, gained enough power and became so taken for granted as the assumption of regular activity that it surpassed its source and thus overlooked it.
>
> The success of technological progress displaced its own foundation: religious understanding gave way to material accomplishment. In the end it dissolved in the achievement of its goal, its own success. By the time the frontier had fallen into settlement, the religious understanding had played out, absorbed into and then dissipated into secular beliefs in progress. (Mugerauer 1995, pp88-89)

By the time of Manifest Destiny, progress became particularly reliant on technological advancements. Manifest Destiny brought with it the power of new technologies and rapid environmental decline. Infrastructure in the form of new rail systems, modes of communication, and "improved" waterways for steamboats were introduced and hailed as economic boons and religious victory, to the extent that religion played a role at this point. This, from 1829: The steam-engine in five years has enabled us to anticipate a state of things, which in the ordinary course of events, it would have required a century to have produced. (Mugerauer 1995, pp83-86)

The Introduction of Plant and Animal Species

Settlers brought with them familiar plant and animal species that were not originally found in the Americas. Introduced species consequently imposed extensive damage to the once-native environment, exterminating native plants and animals, and multiplying without predators of their own:

The peoples of the Americas had virtually no animals suitable for domestication and the Europeans therefore took their own animals with them. When these escaped and went wild they spread rapidly into a large variety of habitats.

Many animals and plants of European origin, such as pigs, cattle, sheep, horses, camel, honeybee, rabbits, mice, rats, starlings, goats, and plants of all types were spread around the world, disrupting natural ecosystems and again causing the extinction or decline of many native species. European domination of the world greatly increased the pressure on animals which could be killed for food or to provide furs, skins, oil and feathers to meet a wide range of utilitarian or luxury requirements, either for the settlers themselves or, more important, for the European market. (Ponting 1991, pp170-74)

Throughout history, "the invention of new techniques and more complicated production processes" (i.e., technology) and progress have had two faces. One is that of human societies controlling and modifying the environment, and utilizing resources in order to meet their needs, respond to challenges and engage in problem solving by means of sophisticated inventions and production processes. The other, from an ecological perspective, is that progress "appears as a succession of more complex and environmentally damaging ways of meeting the same basic human needs." (Ponting 1991, p396)

We can see that technology has had an immense impact on the human–nature relationship, enabling humans to modify and dominate the environment with increased relative ease. "The impetus behind technological development and scientific mastery is still understood by many people to be mastery of nature," (Kinsley 1996, p115). With technological advancements, however, come the ability to consume natural resources in greater abundance at faster speeds – in many cases faster than they can rebound. Technology has also led to greater amounts of waste byproducts, and has directly contributed to the creation of and reliance on fallible, artificially maintained systems.

Forward progression is still generally assumed today, and although far removed from its Jewish and Christian origins, it is still typically understood to have a transcendent mandate (Ponting 1991, p151; Kinsley 1996, p115). Many still believe that human actions on the land are not only beneficial, they are part of an unbroken chain of progress that will inevitably continue into the future (Ponting 1991, pp146-47,150-51).

Recalling György Doczi, we, of course, very much need science and technology, but not the fragmentation that has traditionally accompanied them (1981, p28). My concerns lie in the amounts of consumption, waste and unsustainable ecosystem alteration technology permits us, and how much the environment can withstand. Some feel that environmental problems can be solved with more sophisticated technology – after all, technology begets technology. I am not one of those people. Like Lynn White, Jr., and most ecologists, I agree that, "More science and more technology are not going to get us out of the present ecologic crisis until we…rethink our old axioms… rethink and refeel our nature and destiny" (White 1967, pp1206-07).

Economics

Finally, I once again begin this examination of the human–nature dynamic by reflecting on pre-Colombian America as an environmental and economic benchmark (a methodology borrowed from the Chesapeake Bay Foundation). Based on European explorers', settlers' and colonists' written and artistic portrayals, we can consider the wilderness state of the land, "as God made it," (Mugerauer 1995, p61), in conjunction with the anticipation of New World wealth. In so doing, we may gain a better understanding of the landscape's transference from pure wilderness to today's conditions of deforestation, sprawl, pollution, and the like. Remember, cultural attitudes define acceptable behavior. I submit, much of what was acceptable and valued then remains just as much so today, although the means and measures may be different. The point to ponder is how economics can and/or should continue to affect the landscape and the environment – and vice versa – in the future.

Explorers and early settlers left us with lively descriptions and images of the land as they first saw it. Their accounts provide a glimpse of the "teeming mass of life that untouched ecosystems could support," (Ponting 1991, pp165-66). They were "stunned by the sheer profusion of wildlife," reporting waters so full of fish they broke the nets when scooped, bison herds totaling no less than 40 million strong, birds so thick in the air they easily spanned a mile wide for four or five hours at a time, butterflies in the millions that crowded the air and trees for a space of three or four acres (Ponting 1991, pp165-68), partridges too big to fly, and turkeys as fat as lambs (Mugerauer 1995, p59). Captain John Smith, in the 1600s, described a Chesapeake Bay with "clear water revealing meadows of underwater grasses, oyster reefs so prodigious they

What had been a landscape of religious mission disappeared into the secular landscape, an amazing transformation of meaning, to which we do not give a second thought because it now seems so obvious to us. (Mugerauer 1995, p89)

So noisome and offensive are some animals to human kind, that it concerns all mankind to get quit of the annoyance, with as speedy a riddance and despatch as may be, by any lawful means. –Edmund Hickeringill, 17th century English clergyman (Ponting 1991, p164)

Although God told Noah all beasts on earth would be instilled with the fear and dread of man, Captain Cook found flocks of thousands of birds that could easily be shot since they had no fear of humans, early trappers described vast numbers of animals and ermine so tame they would come up to the houses and be caught by hand (Ponting 1991, pp166,180), and Indians were depicted easily gathering seabirds in *Historiae Canadensis* (1664) (Mugerauer 1995, p59).

This then is a sufficient reason to prove our going thither to live lawful: their land is spacious and void, and they are but few and do but run over the grass, as do the foxes and wild beasts. They are not industrious, neither have they art, science, skill or faculty to use either the land or the commodities of it; but all spoils, rots, and is marred for want of manuring, gathering, ordering, etc. …so it is lawful now to take a land which none useth and make use of it.
– Robert Cushman, early Puritan promoter of migration to America (Nobles 1997, pp30-31)

posed threats to navigation, and abundant fish," (Chesapeake Bay Foundation 2005).

The land's abundance and Europe's trade demands were an explosive combination. The resources Europeans came to value from the new world were furs and hides, tobacco, precious metals, and crops (rice, indigo, coffee, sugar, spices, medicinal plants) (O'Rourke & Williamson 2001, pp3-10,13,37-39,47-51). "The profusion of wildlife appeared to early explorers and settlers from Europe as a huge and readily available living food store. They proceeded to draw freely on this, without concern for the fate of any individual species," (Ponting 1991, p166).

Pre-Colombian Native Americans were no strangers to trade – many tribes regularly exchanged goods, such as food, tools, minerals, pelts, ornamental items and pottery (Nobles 1997, p25). Some, such as the Incans, even accumulated and valued impressive wealth including gold, silver, jewels and fine dress (Diamond 1999, p71). Once established, trade with Europeans was for some tribes a blessing and they learned new techniques, acquired wealth, guns, horses, cloth, and iron weaponry and tools (Addis 2005, p225). For others it was a curse as they engaged in violent battles, were expropriated of land and property, exposed to deadly disease, and forced to work as slave labor (Nobles 1997, pp44-45). Later trade came with some trepidation of developing too much reliance on and being manipulated by the Europeans (Nobles 1997, pp51-53,121; Staloff 1996, Lecture 3; Addis 2005, pp226-28).

European trade in the Americas grew from mere shipping of resources to actual production of goods, which supported the growth of settlements into permanent towns. However, with progress and the explosion of wealth came a rapid decline in environmental conditions. The expansion of settled areas and the establishment of extensive agriculture reduced habitat that indigenous plants and animals depended on for their survival. Tradesmen and commercial hunters, trappers and fishermen over-harvested marketable plants and animals at rates too rapid for populations to rebound, which quickly led to the near-extinction, local or widespread extinction, or the complete extinction of whole species. A dangerous pattern was established of exploiting an area to the point it was no longer economically viable, then moving on to other lands or waters and depleting them, leaving behind a trail of destruction and a wake of damaged ecosystems. (Ponting 1991, pp,162-63,174,177,180-82,192,193)

In *A Green History of the World*, Clive Ponting includes a poignant, if not disturbing, chapter titled, "The Rape of the World" where he presents case after case of this destructive pattern that has persisted throughout history. Victims of over-harvest that he cites include: the American bison, passenger pigeon, many fish species, numerous fur-bearing species such as beaver, sable, white fox, martens and otter, animals with specialist skins such as seal and walrus species, and many whale species. In so doing, he recounts how generally accepted attitudes became injurious actions against nature with virtually no moral reproach, and to what extent those actions continue today. (Ponting 1991, pp161-93) Readers are encouraged to review this account of how Western thought has lead to the devastation of the environment. Also, see sidebar, "The Tragedy of the Commons."

Trade became industry, and economic pressure sought to maximize short-term gains despite mounting evidence that hunting practices were not sustainable. "In most cases, industries were extremely reluctant to react to the rapidly diminishing resources." Today, industry encompasses many goods, services and technologies, but still very much relies on and affects resources and the environment. As industry's driving force, economics is a crucial determinant of how life is organized, the world is seen and analyzed, and scarce resources used and distributed. (Ponting 1991, pp141,155,179,191-93)

Adam Smith, now considered the father of modern economics, brought about pivotal thinking regarding individual wealth around 1776. "He argued that individuals acting in their own self-interest, in the pursuit of greater wealth, would produce the most beneficial outcome for the whole of society." In his

view, continual improvement came from investment, greater productivity (particularly manufacture and labor), and the accumulation of individual wealth. These assumptions of classic economics were widely accepted in western, industrialized societies. (Ponting 1991, p155; Czech 2000, p6)

As the Industrial Revolution unfolded, a neoclassical theory of economic growth was developed. Neoclassical theory, which is the typical economics taught in American schools and universities today, places importance on capital (i.e., human-made capital, such as buildings and machines) as a factor of production, and technological development that enables ever more efficient production processes. (Czech 2000, pp6-7) It emphasizes consumer decisions, meaning that "all or most decisions should be relegated to what consumers are willing to pay," (Hall, et al 2000, pp 17,19). Human-made capital is regarded as the ultimate resource, making possible *limitless* economic growth, (Czech 2000, p6).

The production of goods is the center of economics. In the 1930s, economists evolved the Gross National Product (GNP) as a measure of the amount of a country's production, consumption and investment activity (similarly, the Gross Domestic Product measures all wealth produced within a nation's boundaries by citizens of any country). The success of an economy is now generally judged by the rate at which the GNP increases in a given timeframe. For industrialized countries, the ability to produce large quantities of goods is the mainstay for increased GNP, and, therefore, a healthy economy. So in the United States the expansion of production and consumption have become the center of attention and concern. (Ponting 1991, p156; Hall et al 2000, p21)

Little regard, however, is typically given for the sustainability of natural resources – that is their ability to replenish and/or purge themselves. As a result, "there have been catastrophic losses of wildlife around the world. Human actions, whether deliberate or indirect have drastically affected the ecosystems of the world," (Ponting 1991, p192).

The Tragedy of the Commons

Trappers, hunters and tradesmen indiscriminately killed enormous populations of game animals, reducing their numbers below natural replacement rates, in some cases to the point of extinction. The mass slaughter was often rapid, taking mere decades to reduce a species from population numbers in the millions to its complete annihilation.

Ponting raises questions worthy of an answer: Why did the slaughter go on indiscriminately? Why wasn't it seen as ultimately counterproductive? Ecologist Garrett Hardin dubbed the reason the "Tragedy of the Commons," (also known by ecologist William Ophuls's term, the Problem of the Commons):

No one "owned" these animals and no one therefore had an interest in controlling the rate of killing and in ensuring a sustainable basis for continued exploitation. Because there was no ownership and because the cost of exploitation was very low many hunters were tempted into the market.

In a highly competitive situation the most rational action of any individual hunter was to seek to maximize the immediate kill before a competitor did the same. The faster the overall population fell, the greater the temptation to kill as many as possible as quickly as possible.

All the pressures, therefore, encouraged people to treat the animals as a short-term resource to be exploited as quickly as possible -- indeed anybody who took the opposite view and tried to limit the numbers they killed would be far less successful economically and only increase the opportunities open to their competitors.

This pattern of seeking to maximize the immediate short-term gain at the expense of any longer-term considerations is a central feature of the way in which modern societies have hunted and exploited animals. Little or no effort has been made to devise mechanisms that ensure that species are not overexploited and driven to the point of extinction. The history of four major areas of exploitation – fishing, the fur trade, sealing, and whaling – all illustrate the same dismal truth. (Ponting 1991, pp168,174-75)

The Tragedy of the Commons continues to take a toll on the environment and harvestable species today.

These destructive practices of misuse of common resource pools for private gain, can occur whenever a common, publicly "owned" resource (such as land, oceans or clean air) is used for private gain without tight internal or external controls on that use, controls that are designed to ensure long-term sustainability. Often the resource is overused and may be destroyed. This pattern has also been termed "commonized costs, privatized profits," that is, costs are shared publicly among many, while profits are realized by a few.

The tragedies of the commons occurring today are too numerous to enumerate, and occur virtually anywhere a publicly owned, unregulated resource exists. Ocean fisheries, grazing on rangelands, timber operations in national forests, and pollution and toxification of the environment are but a few examples of where these practices are readily taking place today. (Meffe & Carroll 1997, pp663-65)

The productivity of the land can be infinitely increased by the application of capital, labor and science. – Economist, Friedrich Engels (Ponting 1991, p158)

In effect, there is no such thing as the laws of thermodynamics in economics to constrain economic activity. Instead, the basic model essentially portrays the economy as a perpetual motion machine, with no limits. (Hall et al 2000, p21)

> The process of moving from a pre-industrial society to an industrialized one has been dubbed ***development***. As with the idea of progress, it has been acclaimed not only as desirable but inevitable if more people are to be supported and the seemingly insatiable desire for higher material standards is to be met. The goal of development is accepted worldwide. (Ponting 1991, p398)

Historically, little regard has been given to long-term environmental impacts or sustainability of this heightened utilization of resources (see sidebar, "Flaws of Economics, Problems with the GNP"). However, since the 1970s, a series of international conventions and treaties have been designed to protect important sites and species, but their effectiveness has proved limited because participating countries have been less willing or able to ***enforce*** regulations. "Many have turned a blind eye to the continuing trade of precious resources," explains Ponting. While the growing movement for conservation has raised public awareness, it has been, and continues to be "overwhelmed by the tidal wave of destruction that continues to sweep across the world." (Ponting, 1991, pp192-93) (See sidebar, "Human Economic Activity.")

Today, the United States contains about five percent of the world population, but consumes 30 percent of the world's energy, and 40 percent of its other resources (Ponting 1991, p403). Furthermore, it is estimated that if all of the world's population enjoyed the consumption levels of the average American, the resources of four more earths would be needed (Sierra Club 2005). Unfortunately, four additional earths do not exist.

Ongoing Challenges

Our society relies on and prides itself in a strong economy and technology that maintains vigorous growth. This examination has helped me understand how deeply embedded these concepts are in defining who we are, and have been, as a people. The very reason Europeans were originally interested in the Americas was for trade opportunities and monetary gain.

I have also come to better understand the scope of devastating environmental affects that frequently accompany economic growth and technological development, and why this seems to be a matched set. But I wonder, does it ***have*** to be this way? Is our blind acceptance of the ecological trade-offs a necessary part of a robust national well-being? And how robust can our existence really be if we know it is unsustainable and short-lived? Additional points with relevance to those in landscape architecture are presented by environmental science and forestry professors Hall,

Human Economic Activity

At the national level, human economic activity is directly responsible for species decline. "As measured by the GNP, the scale of this activity in the United States has increased from approximately .8 to 7.7 trillion dollars during the period 1929–1997," (Czech 2000, p6). The major categories of human economic activity include:

Urbanization
Agriculture
Outdoor recreation and tourism
Domestic livestock and ranching
Reservoirs and other water diversions
Pollution
Mineral and petroleum extraction
Industrial activities
Logging
Silviculture
Road construction and maintenance
Aquifer depletion
Harvest
(Czech 2000, p6)

Jones, Donovan and Gibbs:

> To what degree do these traditional concerns and approaches still make sense when applied to an increasingly urbanized world where economic growth is essentially the most important national goal, development is spreading rapidly across the landscape, and resources are increasingly demanded? How can we maintain wildlife diversity when prime wildlife habitat is needed for agriculture, resource extraction, or simply space for urban expansion? What do we say when economists generate analyses that show that a new shopping center is far more

Flaws of Economics, Problems with the GNP and GDP

While economics supports the expansion of production and consumption, and the mainstay for an increased GNP and GDP is a country's ability to produce quantities of goods, there are inherent problems with the system. The environment bears the brunt of most of them:

Flaws of Economics: Unsustainability

- Classic economics and modern systems derived from it ignore the problem of resource depletion.
- The earth's resources are treated as capital, a set of assets to be turned into a source of profit.
- The price of natural resources, and therefore the value of any product, is simply the cost of extracting them and turning them into marketable commodities; some intangible, peripheral resources (like air) are not factored in.
- Economics overlooks the basic truth that earth's resources are not just scarce, they are finite.
- Economic systems encourage both producer and consumer to use up available resources at whatever rate current conditions dictate.
- Economics assumes, in defiance of all logic, that resources (materials and energy) can continue forever, and that substitution of one material or form of energy can continue indefinitely.
- While economics suggests humans should pursue immediate self-interest, no consideration is given to posterity.
  (Adapted from Ponting 1991, pp155-56)
- Wildlife, like any other commodity, is protected, enhanced or saved based only on how people value it monetarily. Those species or ecosystems to which people do not assign high monetary value are much less likely to be saved.
- Although it appears that wealth is produced through economic policy, wealth generation normally occurs only through the increased exploitation of natural resources, normally in an increasingly nonrenewable manner, and almost entirely via increasing use of fossil fuels.
- Although economics is sometimes defined as the study of the allocation of scarce resources, in fact it is only about relative scarcity and essentially ignores absolute scarcity, such as the depletion of critical resources (fossil fuels, habitat). Thusly, neoclassical economics rarely addresses scarcity except as it influences prices.
- Neoclassical economics pays almost no attention to the biological or physical characteristics of economic systems.
  (Hall et al 2000, pp19-21)

Problems with the Gross National Product and Gross Domestic Product

- GNP does not measure every sort of economic activity.
- The way GNP is calculated provides a distorted view of economic success.
- GNP only measures certain monetary flows within an economy and cannot cover the 'black economy' of undeclared activities or non-monetary transactions (such as barter, subsistence agriculture, housework, volunteerism).
- While GNP measures the size of an economy, included are many items that are not benefits to society as a whole (for example, the purchase of a defective product improves the economy through repairs and replacements, but is not good for the purchaser's individual wealth).
- GNP calculations take no account of the social costs of some production (like pollution or elevated crime levels).
- Items that are hard to put a price on are typically left out of most economic models and pricing mechanisms.
- GNP takes no account of whether production and consumption levels are, at any given time or in the long-run, sustainable.
  (Adapted from Ponting 1991, pp156-57)
- GDP is only a partial measure of those conditions that contribute to human happiness and well-being.
- GDP says nothing about what consumer needs are being satisfied or whether the needs are required for human survival or are luxuries.
- GDP can be used in such ways as to ignore questions about the distribution of wealth.
- GDP is not an accurate measure of production, especially where development is being introduced.
- GDP does not measure nonmarket transactions, therefore its use undervalues environmental services and nonmarket sources of materials.
- There is no provision in GDP for including the economic benefits of properly functioning ecosystems, or their degradation.
- GDP does not measure the actual wealth citizens enjoy, but rather the flow of new wealth into the economy. Paradoxically, GDP actually grows when inferior products are produced, or regions destroyed by floods are rebuilt.
  (Hall et al 2000, pp21-22)

> valuable than the wetland it will replace? Are the tools we are giving students in our classes adequate for the challenges of wildlife conservation today? (Hall, et al 2000, p16)

For fear of otherwise falling into despair, I now turn to evidence – as promised earlier – of an improved system that has existed throughout history. The challenges for those who wish for a more environmentally benign way are, of course, ascertaining how to bring these alternative histories forward, and then applying and expanding them in 21st century America.

History's Alternative Undercurrent, Optimism for the Future

Ours is an anthropocentric society. While the anthropocentric worldview has been supported by the absolute majority of people throughout history, its apparent and serious problem is that earth's resources cannot support the growing human population at levels of consumption known by industrialized nations. If such production were possible, the output – waste and pollution – would be catastrophic (Ponting 1991, p404-06). As less technologically developed countries such as India, China, Singapore, Chile, Mexico, Brazil, and Thailand progress toward a Western-modeled industrialization, the threat of a global crisis becomes abundantly clear.

Such is our trajectory. However, throughout history, this dominant worldview has faced opposition, though in the past the alternatives have by-and-large been ignored and have ultimately held little sway over public opinion or the development of Western culture.

The conservation-minded Amish farming technique of contouring fields to follow the rolling topography of the land prevents soil loss (from MacLean and McKibben 1993, p19).

Tzu-jan: Inherent Nature

The Taoist term *tzu-jan* means that which is of itself or by itself. It is the inherent nature of a thing, and is basically what is meant when something "happens automatically." Consider, for example, the beating heart or breathing lungs. A person or animal puts forth no effort, nor controls them, they just happen. The Tao operates the same way:

> All that is natural operates of itself with nothing standing over it and making it go on. Since there is always a basic element of life that cannot be defined, in the same way the Tao cannot be defined, it cannot be controlled. Laozi [legendary sage and author] said that since man is an integral part of the natural universe, he cannot hope to control it as if it were an object quite separate from himself. You can't get outside of nature to be the master of nature.
>
> Whenever we have the feeling of being able to dominate ourselves, master ourselves, or become the lords of nature, we do not really succeed in getting outside of nature or of ourselves at all. Instead we have forced our way of seeing these things to conform to an illusion that makes us think they are controlled objects, and in doing this we invariably set up a conflict inside the system. We soon find that the tension between our idea of things and things as they are put us out of accord with the way of things.
> (Watts 2000, pp41-43)

We have previously discussed the work of the most often cited religious mentor, Saint Francis of Assisi, whose lessons of love toward nature continue to resonate and inspire generations today. Jewish Mosaic Laws and Amish traditions promote gentler means of physically cultivating and farming the land, recognizing its limits and allowing it periods of rest.

Eastern religious traditions have generally rebuked an anthropocentric worldview (such as the Chinese Taoists) and emphasized a less aggressive approach toward the natural world (see sidebar, "*Tzu-jan*: Inherent Nature"). For these traditions, "humans are only a small part of a much greater whole, and human gifts of greater intellectual and spiritual capabilities should be directed toward enlightenment and enable them to act wisely toward other creatures, and not take life unnecessarily. A need for universal compassion was central to their way of thinking." (Ponting 1991, p152)

A different type of opposition came with increased scientific knowledge of the 18th and 19th centuries, one based not on moral interpretation, but

rather on natural law. Some thinkers, such as Reverend Thomas Malthus, began to regard human impacts on the land. Malthus asserted in the late 1700s that history moved in cycles in which human numbers increase until they were "too high for the available food supply, at which point famine and disease would reduce the population until it was again in balance," (Ponting 1991, p151). Perhaps for the first time, earth's carrying capacity, or its ability to sustain life, was being contemplated.

Opposition in the realm of economics has just begun to develop, although neoclassical theory has always had skeptics from the field who questioned the possibility of infinite economic growth. The book, *Limits to Growth* (1972), was the result of a meeting of 30 intellectuals in the 1960s who used computer models "to predict a halt in economic growth prior to the year 2100, simultaneous with environmental catastrophe. Neoclassical economists have adamantly disagreed with the book's conclusions, and the groundswell of support for the book has been actively suppressed." (Czech 2000, pp9-10)

A few years after *Limits to Growth* was published, the idea of ecological economics was born, although it was almost another two decades, with the 1989 incorporation of the International Society for Ecological Economics, that the movement started to gain popularity. Ecological economists advocate a "stationary and sustainable GNP, whereby stocks of capital (soil, trees, fish populations) remain constant in the long run." Ecological economists hope to bridge the gap between economics and natural science by integrating and

Economists are forced to try to adjust the behavior of people and institutions to conform to their theories instead of adjusting theories to reality. (Hall et al 2000, p22)

Current Alternatives to Neoclassical Economics

Some educators in environmental and wildlife studies believe a school of economics that dispels neoclassical theory is needed. "There is abundant academic support for perpetual growth, especially in neoclassical economics. If [environmental and] wildlife professionals were conversant with an [alternative] school of economics, they would be better situated to address economic growth as the limiting factor for [environmental and] wildlife conservation," (Czech 2000 pp8-9).

Ecological economics offers hope for ecological and economical sustainability. Practitioners believe it offers significant advantages over neoclassical economics, in that ecological economics:

- Recognizes low-entropy energy and natural capital (air, water, minerals, wood) as primary factors of production.
- Classifies land, labor and capital as intermediate production inputs.
- Views the market as far less sufficient for the equitable allocation and distribution of resources.
- Theorizes that there are biophysical constraints to the scale of the economy and that testing these constraints threatens our ecosystems and, ultimately, the economy itself.
- Comprises a broader interdisciplinary scope and welcomes the participation of diverse natural and social sciences.
- Views economics as a subset of ecology, and the economy as a subset of the ecosystem.
- Considers ecological economics to be the science and management of sustainability. (Czech 2000, p10)

Another alternative economic theory, biophysical economics, emphasizes a biophysical rather than a social perspective. Considered by some as a subset of ecological economics, biophysical economics focuses on the land, energy and materials required for economic production. "Whereas more traditional economics has tended to focus on the importance of human ingenuity to increase economic production, biophysical economics has tended to focus on energy and other resources that must be increasingly exploited for additional production to occur," (Hall et al 2000, p24). Hall, Jones, Donovan and Gibbs propose that biophysical economics is most productively practiced as a distinct field separate from and complementary to ecological economics.

A sense of the past makes civilization possible and helps us all grasp the larger meaning and context of our individual lives. (Boyer 2001, pvii)

synthesizing "perspectives from a wide range of disciplines in order to achieve an ecologically and economically sustainable world." (Czech 2000, p10) (See sidebar, "Current Alternatives to Neoclassical Economics" for more information.)

Despite this alternative undercurrent, the idea that as stewards, humans have a responsibility to preserve the natural world has basically remained in the minority (Ponting 1991, p142). Many have viewed nature as nothing in itself, just a utility. Where once landscape was very much understood as creation and sacred symbol, was seen as "a sign or counter in the larger play of divine creation and human re-creation, and the material medium between God and humans where the spiritual nature of the two is all that mattered," today it is widely understood as a set of raw material resources for human use. "Its value [has been] reduced to our aesthetic, social and economic desires." (Mugerauer 1995, pp107-09)

However, "from our contemporary vantage point we can see that nature, as physical, is something in itself." If we, as a society could comprehend nature not as the "object of our positive knowledge and technology," but rather as something of its own accord, how might our alternative understanding be structured, and how would it shape who we become? (Mugerauer 1995, p109) If the goal is to expand an ecologically benign alternative undercurrent, does that suggest a challenge to – or even a change in – worldview is required, whether toward some "softer" anthropocentrism or toward something other?

The Disconnect: Final Reflection for Future Improvement

Economics, technology and early cultural influences that have shaped a society's predominant worldview, to me, hardly seemed as obvious concerns for a landscape architect, yet the answers I sought led me to these varied but enmeshed topics. This examination of the "trifecta of origin," as I call it, has provided me an important appreciation for how and why things have come to be; that is, the attitudes and behaviors we, as a society, accept, value and reward, and how they affect our landscapes.

My examination of the trifecta was not intended to uncover the better system of relating to the landscape that I seek; rather it provided insight to the challenges that lie ahead by reflecting on the environmental history we have left behind. After all, without this basic understanding of the issues, how could I continue asking the questions that could reveal or define a better system?

I am captivated by the sense of empowerment that Mugerauer's words instill: Historical reflection can lead toward an alternative understanding that "would be a kind of earthquake into the future, shaking up and informing at least our meager attempts at an appropriate ecology, if not a once-again spiritual attitude toward the earth, heavens, and all life," (Mugerauer 1995, p112).

I see direct implications for the landscape architecture I wish to practice, for what I seek is a compassionate, yet impassioned ecological approach to design. I do not know that I will ever contribute to Mugerauer's "earthquake," but I hold that as a personal goal. So, for myself, a modern alternative to the anthropocentric worldview is needed, one that readily informs my professional practice and design work.

For help, I turn to theories of environmental ethics which combine and resolve a respect for nature with one's attitudes and actions. Environmental ethics deals with the norms that guide moral relations between humans and the natural world. In the same sense that universal connections provide a reason to care about nature, environmental ethics can help define *how* to care. Certainly there I will find implications for landscape design, perhaps it could even lead me closer to the system I seek.

THE RECONNECT ENVISIONED

To continue along this journey with me, I hope I have made two fundamental points clear: our society needs to care about the environment as more than an anthropocentric (human-centered) utility, and it needs to be concerned with the ways in which we live (at least psychologically) separate from the natural world. My hope, however, is to make less dichotomous the human–nature relationship and try to resolve some of the differences the previous section brought forward.

For this reason it will no longer suffice to continue on in perfunctory terms of "environmental" versus "anthropocentric." We will never begin to attain a yin–yang-like harmonious order and balanced unity if we remain in the realm of what can seem to be uncomplementary opposites. In order to progress beyond conflict and toward solutions, I now turn to environmental philosophies and ethics.

From philosophy and ethics, I began to understand that the human–nature dynamic is defined along quite diverse lines, and is in no way an either/or condition. Rather, many shades of gray (or perhaps green) exist within the numerous considered concepts and constructs regarding our relationship with the natural world. By expanding our vocabulary and explaining the differences that exist within the overarching term, "environmental," this study moves the conversation from vague ambiguities to more concrete definitions and deeper levels of interpretation. Produced in the process is an enriched and more meaningful way of thinking about the natural world and how one can and should ethically act toward it.

Overview

This was an exciting section to research and write because it helped me envision a reconnect with the natural world and the eternal pulse. You will see that I dug deeper and deeper into the theories to resolve my inner conflict between participation in anthropogenic activities, such as landscape architecture design, and my concern for the healthy wholeness of sustainable ecosystems. Through this examination I began to establish my own constructs and measures, that is, definitions and guidelines for the type of design work I wish to do. I call it "biocentric landscape architecture," a name inspired by an important environmental ethic that you will read more about a little later.

Before we get to Biocentricity, though, we first will briefly look at traditional philosophies that have for centuries influenced many aspects of society, and why these philosophies fall short of providing the resolution I seek. Next I present a number of contemporary environmental ethics – some that tend toward nature, others that emphasize the person in the landscape – exploring them individually, filling in gaps with each subsequent ethic, and reflecting on design implications as I go along. After discussing these different theories, I put them to the test on a current and very significant environmental crisis, illustrating how different actions and outcomes taken upon the land are based on the type of ethics one follows. Finally, I reflect on the implications this study has on my search for the "better system."

A Philosophical Framework

There is a fine line between philosophy and ethics, so we should take a moment to hash out a few definitions. Philosophy professor and author, Dr. Joseph Des Jardins explains ethics is actually a branch of philosophy that seeks a "reasoned examination" of what customs tell individuals and societies about how one ought to live. Philosophers recommend *normative* ethics, the manner in which they believe societies and individuals ought to behave. Normative ethics are then tested against deeper *philosophical* ethics, i.e., abstract concepts and principles that examine a culture's values and mores. (Des Jardins 2001, pp17-19)

Philosophies and ethics are important to a society, and have helped shape public policy in the western world with applications in areas such as government, business, economics, law, medicine, and property rights. Environmental ethics, both of the normative and philosophical types, specifically ponder the moral relations between humans and their natural environment. Environmental ethicists assume that moral norms can and do govern human behavior toward the natural world. (Des Jardins 2001, pp11,19)

Lord John Fletcher Moulton had an interesting view on the role of ethics. He distinguished "the three great domains of human action:" positive law, free choice, and manners (or ethics). On one end is the domain of law, which must be obeyed. At the opposite end is the domain of free choice, where lies complete freedom, spontaneity and originality. Between them lies a "large and important domain in which there rules neither positive law nor absolute freedom … yet we feel that we are not free to choose as we would. It grades from a consciousness of a duty nearly as strong as positive law. It is the domain of ***obedience to the unenforceable***." This middle ground is the domain of ethics. (Kidder 1995, pp66-67)

Western Philosophical Traditions

In some ways, western philosophical traditions recall the western religious traditions discussed in the previous section. Both are often considered strongly anthropocentric, and have held long-term influence over culture and public policy. "Some scholars have suggested that both are equally culpable for the exploitation and dominance of the natural world, and are partly responsible for the present environmental predicament," (Des Jardins 2001, p97).

The origins of the philosophical traditions we will briefly consider span an extensive length of time:

Natural Law	Aristotle (4th century BC) and Thomas Aquinas (13th century AD)
Cartesian	Rene Descartes (17th century)
Deontology	Immanuel Kant (18th century)
Utilitarianism	Jeremy Bentham and John Stuart Mill (19th century)

These traditional philosophies follow from the beliefs that only humans have moral value, and while humans have a responsibility *regarding* the natural world, they have no direct responsibilities *to* it. Briefly,

- Natural Law. This provides an interesting blend of biology and ethics that seeks to understand any being's natural function or activity, and suggests that every being has a "good" of its own. This philosophy exhibits little sympathy to the moral status of nonhuman natural objects, claiming that animals and other living beings do not possess an intellect or soul, and are incapable of thinking and choosing. They, therefore, are not considered morally relevant. (Des Jardins 2001, pp22-26,95-96)

- Cartesian. This point-of-view of Rene Descartes sees the substances of the world as either mechanistic physical bodies, or thinking, conscious minds. Moral standing is given only to those beings with a conscience – humans. Plants and animals were deemed as thoughtless brutes, and could be treated without concern for their well-being. (Des Jardins 2001, p96)

- Deontology. The focus here is not on consequences, but rather on the principles, or maxims, on which one chooses to act. It suggests that duties and rights stem from the fact that humans are ethical and rational beings with free choice. Humans can be held responsible only for those things that they can control. Deontology operates within the "categorical imperative" – people are treated only as ends and never as means. Kant clearly indicated that the categorical imperative applied only to humans, and that duties regarding nature are indirect and exist insofar as they are ultimately for other humans (such as future generations). Animals and plants have no moral standing, and are viewed merely as objects. (Des Jardins 2001, pp29-31,96; Kidder 1995, pp24,157-58)

- Utilitarianism. The goal of this philosophy/ethic is to "produce the greatest good for the greatest number for the longest time." It calls for consideration of the consequences of an act, and judges the act's ethical status by its consequences. Environmental protections are, in theory, built-in because there is a moral obligation to future generations to provide the greatest good for them as well. Preference utilitarianism is closely tied to free-market economics, and directs people to satisfy as many individual preferences as possible. As with economics where pricing controls access to products (think a 99¢ hamburger versus $30 Maine lobster), access to scarce resources would also be limited, making conservation the natural outcome. One criticism of this ethic is that the economic analysis which often goes with it does not have any ethical basis at all: why should it be assumed the satisfaction of individual preferences, given the wide variety of harmful, decadent and trivial preferences that exist, is the overriding goal? It ignores that sometimes having preferences frustrated can be in one's best interest by teaching patience, diligence, modesty and humility, or that sometimes satisfying preferences can be disappointing. Another criticism insists that all consequences cannot be foreseen. Once an unpredicted consequence results, will it, in retrospect, be connected back to its cause? (Des Jardins 2001, pp26-29,43,51-60; Friedman 2004, pp21-22; Kidder 1995, pp24,155-57)

Can these traditional philosophies provide ample normative ethics for a sustainable human–nature relationship? This is a contested philosophical debate; some say yes, these traditions have served us well since the founding of this country and can offer significant application to environmental issues. Others say no, as long as the environment is understood only as utility or as less important than humans, these philosophies cannot respond to current environmental conditions. I personally fall among the latter group. I wonder where the mainstream of landscape architecture lies.

Consider for a moment the Mission Statement of landscape architecture's foremost professional organization, the American Society of Landscape Architects (ASLA): The Society's mission is to lead, to educate, and to participate in the careful stewardship, wise planning, and artful design of our cultural and natural environments (ASLA 2005). Furthermore, the society's Vision Statement names the ideals of "harmony" and "sustainable balance," and its Code of Environmental Ethics instructs members to make every effort to "enhance, respect and restore the life sustaining integrity of the landscape for all living things," (ASLA 2004).

With explicit attention to careful stewardship, harmony, sustainable balance and all living things, ASLA clearly touches on an environmental ethic that applies to the field, apparently one that promotes striking a balance between mankind and the natural world. This unnamed ethic, while open to interpretation, seems quite different than what western philosophical traditions promote. While Utilitarianism may apply in part to ASLA's ideals, it is clear that some other ethic has a stronger influence, one that bears upon its members some degree of *direct* responsibility toward nature and the environment. In this vein, we now explore nonanthropocentric philosophies and contemporary environmental ethics.

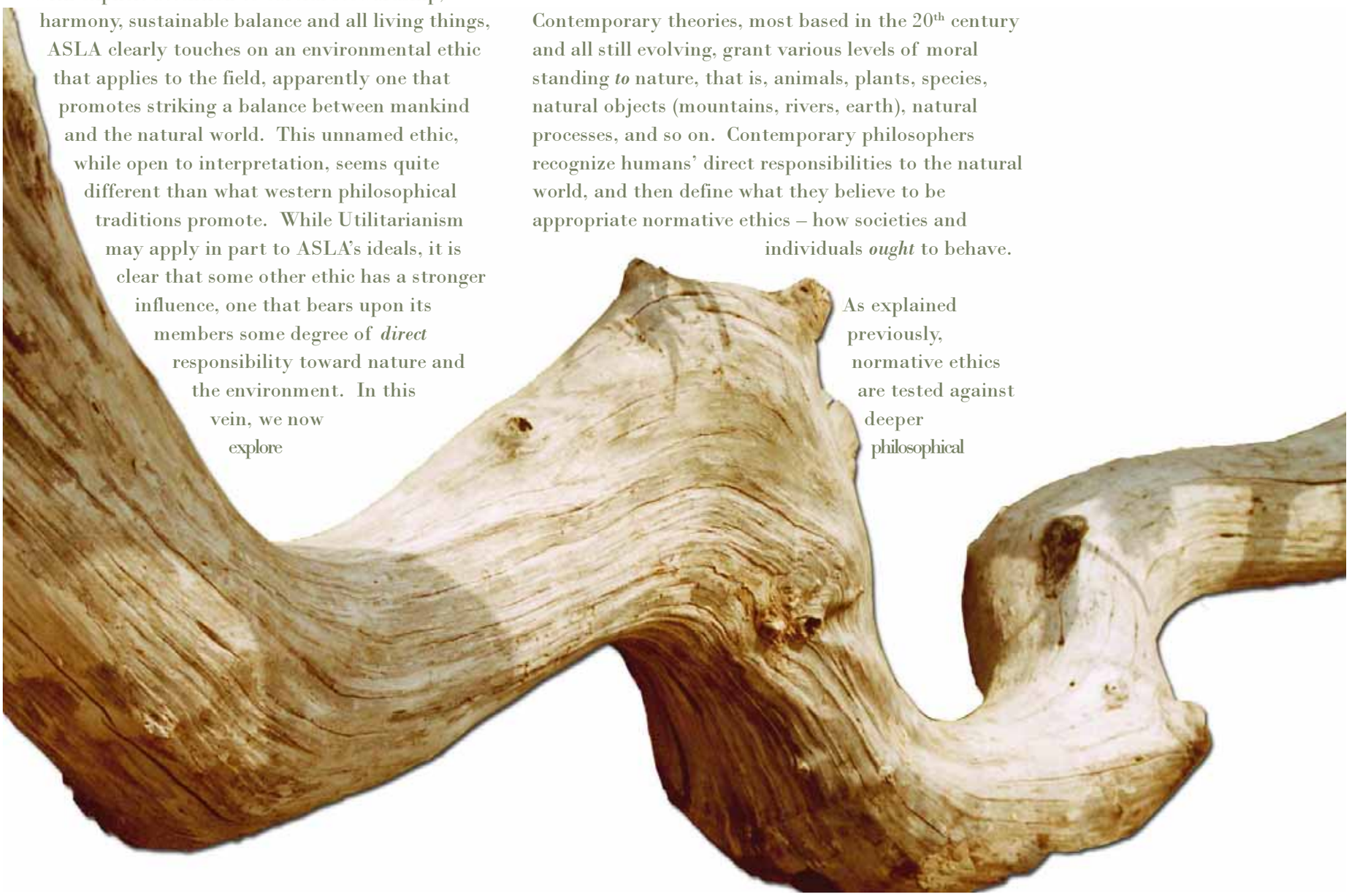
Only if men can first learn to look sensuously at the world will they learn to care for it. – John Passmore, utilitarian philosopher, 1974 (Des Jardins 2001, p99)

Philosophy, Ethics and the Natural World

Upon my final reflection of The Disconnect, I concluded a personal need for an alternative worldview. After this examination on western philosophical traditions, that notion has already been made clearer, though I cannot yet express the alternative or its significance on my professional career. Studying nonanthropocentric philosophies and contemporary environmental ethics will cast light on other dimensions of the human–nature relationship, and directions in which it can evolve.

Contemporary theories, most based in the 20th century and all still evolving, grant various levels of moral standing *to* nature, that is, animals, plants, species, natural objects (mountains, rivers, earth), natural processes, and so on. Contemporary philosophers recognize humans' direct responsibilities to the natural world, and then define what they believe to be appropriate normative ethics – how societies and individuals *ought* to behave.

As explained previously, normative ethics are tested against deeper philosophical



ethics, resulting in a back-and-forth process of assessing the fit between prescribed behaviors and social mores. It is through this process that contemporary ethics continue to develop and progress as modern thinkers strive toward an ethic (a systematic method or framework) for answering questions about the human–nature relationship. (Des Jardins 2001, pp11-12,17-19)

Some modern philosophers believe a single environmental ethic would facilitate decision-making for the individual determining their own actions, as well as for a society determining public policies regarding the environment. Others suggest that instead of one all-encompassing ethic, multiple ethics ("moral pluralism") may be the answer. Because of these differing opinions and the nature of the testing process, today there exists a number of contemporary, nonanthropocentric ethics. (Des Jardins 2001, pp262-66)

All nonanthropocentric ethics recognize that elements of nature have some degree of *intrinsic* value of their own, that is the innate importance of natural beings, objects and processes independent of the worth humans assign them. Remember, to the anthropocentrist, nature's value is purely instrumental; its value lies not within nature itself, but in the ways it can be used to attain something that is of value, like happiness or safety. In contrast, contemporary environmental ethics recognize that nature has a good in and of itself, for itself, and that humans have a moral obligation toward that good.

Many nonanthropocentric theories focus on the interconnectedness of nature and consider wholes like species, ecosystems, biotic diversity, and biological, chemical and geological cycles. They respect the relations, communities, systems and processes that are so important in the science of ecology. For many who follow these approaches, an act is wrong if it treats an element of nature as if it has value only in relation to humankind. (Nash 1989, pp56-57,59,71; Des Jardins 2001, pp130,132)

Of the numerous contemporary ethics (sometimes called movements), I chose five that I understood as having particular relevance toward landscape architecture: Animal Rights, Biocentricity, Ecocentricity (The Land Ethic), Deep Ecology, and Social Ecology. In addition, spiritual and religious traditions also contribute significantly to the discussion. As you read through them, notice how one theory informs and enhances the next, building a momentum that further identifies design implications and possibly alternative worldviews.

Animal Rights: The Valued Life of the Individual

One of the earliest contemporary discussions of the moral standing of animals and other beings is Joel Feinberg's *The Rights of Animals and Unborn Generations*, 1974 (Des Jardins 2001, p104). Feinberg extended basic human rights to animals, focusing on individual animals, not species. For him, moral standing should be granted to beings with a "conative life," those with conscious wishes, hopes, desires, impulses, or unconscious drives and goals (Des Jardins 2001, pp104-05).

Peter Singer wrote of "speciesism," the prejudice in favor of one's own species and against others. Singer introduced "sentience" as the measure for moral standing: Can a being suffer and/or experience enjoyment? (Singer 2000, pp54,56-63; Des Jardins 2001, pp114-15) Singer's was a utilitarian view; it was Tom Regan who presented a rights-based defense of animals. According to Regan, utilitarianism fails to account for the value of the individual, nonhumans included, and instead builds a "rational justification" for extending rights to animals based on the experience of subject-of-a-life: having a life rather than just being alive. Having a life, or individual welfare, involves having beliefs, desires, memories, perception, an emotional life, all of which grant the being inherent value. (Regan 2000, pp70-73; Des Jardins 2001, pp116-18)

Based on the arguments of these prominent writers, Animal Rights has an obvious shortcoming: the ethic applies to individual beings which are most humanesque. As extensions of human rights, it holds human characteristics as the standard, and fails to recognize the intrinsic value of those beings least similar to humans. An individualistic ethic, it is argued, is not sufficient protection of, and can actually be detrimental to, the environment. (Des Jardins 2001, pp119-22) We will come back to this important concept later.

Biocentricity: Widespread Recognition of Intrinsic Value

With Animal Rights we begin moving toward a philosophical framework that extends ethics beyond human beings, but its individualistic emphasis is too limiting to provide the answers I need. Biocentricity is more inclusive and recognizes intrinsic value throughout the natural world. As such, it has become an important theory for my work.

Humble Beginnings: *Ehrfurcht vor dem leben*

Biocentricity began as a fundamental attitude with roots in Albert Schweitzer's ***ehrfurcht vor dem leben*** – reverence for life. As an ethic of virtue, reverence for life did not offer formal normative ethics, but instead was concerned with moral character, and asked people for a different view of themselves. (Des Jardins 2001, pp135,137-38)

Through reverence for life, Schweitzer recognized value in all living things, a value that commanded awe, respect, fear and honor. He suggested that all life was inspiring and good in itself, and was concerned that modern industrialized societies had "moved away from a worldview

that connected the goodness of life with the goodness of nature." This separation, he believed, was caused by conflict in the world, such as war, bureaucracies, meaningless work and cultural decay. (Des Jardins 2001, pp135-36)

Schweitzer sought to reestablish the bond between nature and ethics, and through reverence for life, encouraged people to make more conscious decisions about their interactions with nature. For example, according to reverence for life, people should become aware of the implications and take a compassionate sense of responsibility when choosing to kill a thing; sacrificing any life (including germs and insects) should be done only when absolutely necessary to enhance another life. (Nash 1989, pp60-62; Des Jardins 2001, pp135-37)

As a ***normative*** ethic concerned with human actions, however, reverence for life is difficult to define and uphold. Des Jardins illustrates this point through the example of a homeowner who installs a patio in the yard, thereby killing many individual blades of grass, microbes, insects, and the like (p146). "The ethical person," Schweitzer said, "shatters no ice crystal that sparkles in the sun, tears no leaf from its tree, breaks off no flower, and is careful not to crush any insect as he walks. [Furthermore, in order to compensate for the sacrifice of life for humanity and the needless cruelty humans cause, people] need to do as much good as we possibly can to all creatures in all sorts of circumstances," (Nash 1989, p61). Assuming responsibility and restitution for each one of those living things, though virtuous, would be extremely difficult. With the theory of Biocentricity, contemporary ethics begins moving away from the individual entity and its problematic scale and starts considering holistic, ecological systems.

Life-Centered Theory

From humble beginnings, Biocentricity now includes any theory that views all life as possessing intrinsic value, and literally means life-centered. In ***The Ethics of Respect for Nature*** (1981), Paul Taylor, a renowned author on Biocentricity, presents a careful defense for why nature deserves an attitude of respect. In so doing, he effectively challenges some traditional reasons for humans' alleged superiority over nonhumans:

> From the perspective of a life-centered theory, we have prima facie moral obligations that are owed to wild plants and animals themselves as members of the Earth's biotic community. We are morally bound (other things being equal) to protect or promote their good for ***their*** sake. Our duties to respect the integrity of natural ecosystems, to preserve endangered species, and to avoid environmental pollution stem from the fact that these are ways in which we can help make it possible for wild species populations to achieve and maintain a healthy existence in a natural state. Such obligations are due those living things out of recognition of their inherent worth. They are entirely additional to and independent of the obligations we owe to our fellow humans.
>
> The claim that humans by their very nature are superior to other species is a groundless claim, and must be rejected as nothing more than an irrational bias in our own favor. We are different from nonhuman beings, but why should our capacities be a mark of superiority? If one believes human capacities are more valuable, then to whom are they valuable, and on what grounds? Why should standards that are based on human values be assumed to be the only valid criteria of merit and hence the only true signs of superiority? Is it not unreasonable to judge nonhumans by the value of human civilization, rather than by values connected with what is for a member of ***that*** species to live a good life?

If, then, the total, final, absolute extermination of our species (by our own hands?) should take place and if we should not carry all the others with us into oblivion, not only would the Earth's community of life continue to exist, but in all probability its well-being would be enhanced. Our presence, in short, is not needed. If we were to take the standpoint of the community and give voice to its true interest, the ending of our 6-inch epoch [short existence on the geological timeline] would most likely be greeted with a hearty, 'Good riddance!'
– Paul Taylor (2002, p208)

Rejecting the notion of human superiority entails its positive counterpart, the doctrine of species impartiality which accepts all living things as possessing inherent worth, the same inherent worth since no one species has been shown to be either higher or lower [in orders of life] than any other. Just as no rational, factually informed person can conceive the idea today that varying degrees of inherent worth are awarded to humans based on the social position one is born into (as in rigid class-structured societies where one's hereditary class determines one's social status), species impartiality rejects the idea that human inherent worth is greater than the inherent worth of nonhumans, merely because they were born into the species *Homo sapiens*.

If we were to accept the doctrine of species impartiality and, subsequently, a life-centered theory of environmental ethics, a profound reordering of our moral universe would take place. (Taylor 2002, pp202,207,210-14)

He encourages the view that human superiority is an irrational and self-serving prejudice, and instead promotes an improved conceptual framework – a new ethical role – that looks at other species as humans look at themselves, seeing nonhumans as beings which have a good they are striving to realize just as humans have a good they themselves are striving to realize. (Taylor 2002, pp213-14) This certainly resonates Schweitzer's, "I am a life which wills to live, in the midst of life which wills to live," (Des Jardins 2001, p136).

Criticisms

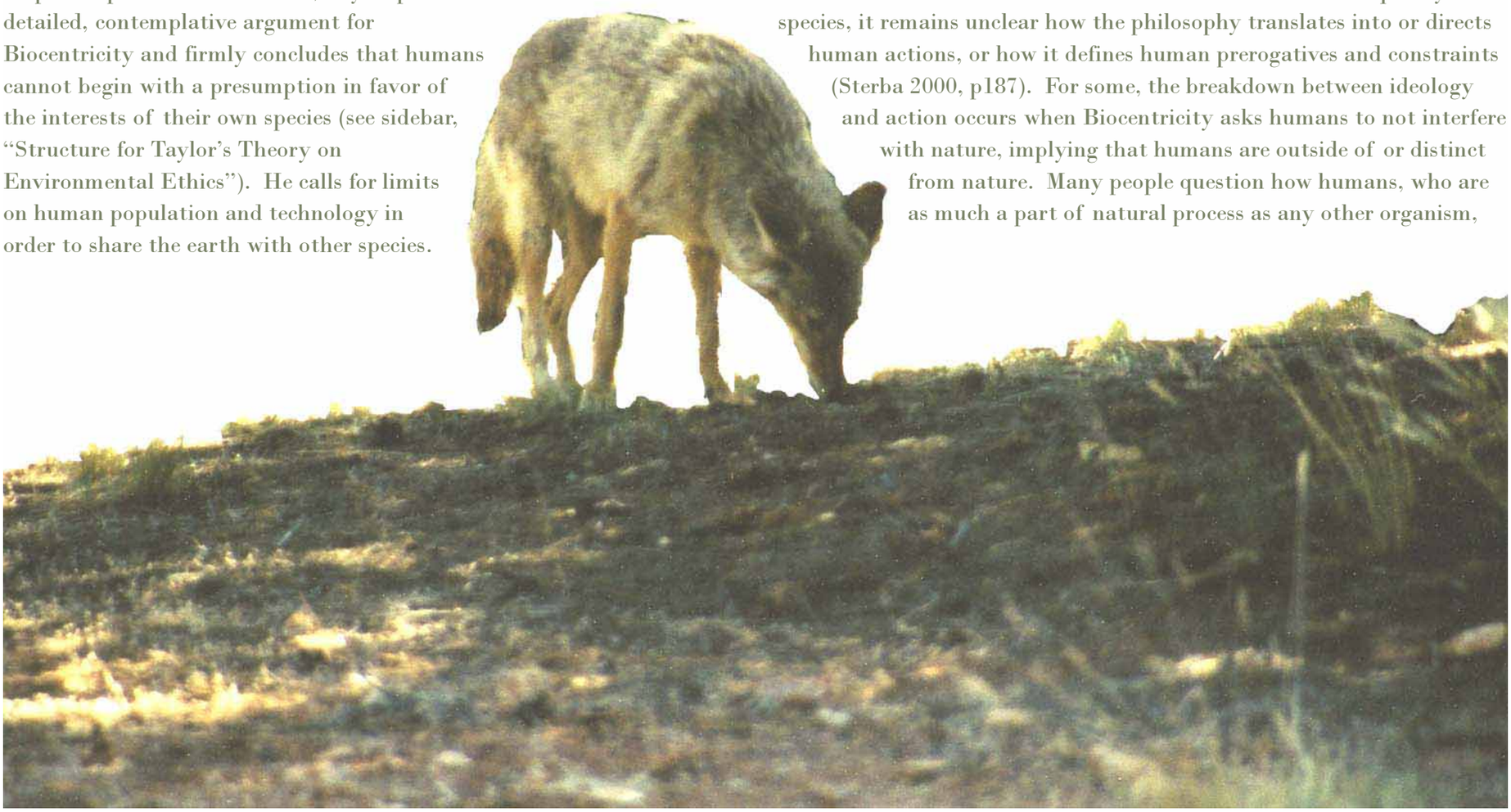
Although I draw significant inspiration from Biocentricity, the theory is not without problems. Some of its faults (actual or perceived) are:

- despite the theory's best efforts, its normative ethics remain biased in favor of humans
- it is a theory based on an erroneous view of ecology, one that tends toward stability and harmony rather than recognizing that healthy ecosystems exist in a state of constant flux
- it fails to distinguish what has intrinsic value and what does not.

(Sterba 2000, pp186-88,191-93)

As philosophers are wont to do, Taylor presents a detailed, contemplative argument for Biocentricity and firmly concludes that humans cannot begin with a presumption in favor of the interests of their own species (see sidebar, "Structure for Taylor's Theory on Environmental Ethics"). He calls for limits on human population and technology in order to share the earth with other species.

While biocentrists are known for their commitment to the equality of species, it remains unclear how the philosophy translates into or directs human actions, or how it defines human prerogatives and constraints (Sterba 2000, p187). For some, the breakdown between ideology and action occurs when Biocentricity asks humans to not interfere with nature, implying that humans are outside of or distinct from nature. Many people question how humans, who are as much a part of natural process as any other organism,



can commit an unnatural act? (Des Jardins 2001, p145) Holmes Rolston provides an intriguing answer:

> While humans are part of the natural world, the ***extent and rate*** of change due to human activities is significantly different from [other] natural change [emphasis added]. This is particularly true of modern, technological societies. To say that humans are part of nature should not imply that all human activities are equally compatible with natural processes. (Des Jardins 2001, p166)

Likewise, Meffe and Carroll explain:

> Anthropogenic (human-caused) changes imposed on nature are no less natural than any other. The problem with anthropogenic perturbations is that they are far more frequent, widespread, and regularly occurring than are nonanthropogenic perturbations; they are well out of the normal spatial and temporal range of disturbances experienced by ecosystems over evolutionary time. (1997, p51)

Structure for Taylor's Theory on Environmental Ethics

Paul Taylor constructed his "ethic of respect for nature" based on three basic elements: a belief system, an ultimate moral attitude, and a set of rules of duty and standards of character. The elements are connected as such: A person believes certain things about nature. These beliefs inform his or her attitudes about moral actions toward nature. Once a moral attitude is adopted, the person can commit to certain rules of duty, conduct and standards of character. (Taylor 2002, p206) Following is more detail about these three elements.

• ***The belief system*** – called the "biocentric outlook on nature." This outlook is based on a major tenet from the science of ecology: [there exists an] interdependence of all living things in an organically unified order whose balance and stability are necessary conditions for the realization of the good of its constituent biotic communities. (Taylor 2002, p206)

The Earth's natural ecosystems as a totality are seen as a complex web of interconnected elements, with the sound biological functioning of each being dependent on the sound biological functioning of the others. In the long run, the integrity of the entire biosphere of our planet is essential to the realization of the good of its constituent communities of life, both human and nonhuman. (Taylor 2002, pp207-09)

• ***The ultimate moral attitude*** – this attitude, named "respect for nature," parallels the respect humans grant other humans, and extends that respect to nonhumans. "Ultimate" because it is not derived from any higher norm, not grounded on some other, more general or fundamental attitude, and cannot be justified by a more basic philosophical principle. "Moral" because it does not require personal interest or feelings toward nature; rather, it is a disinterested matter of principle, a stance to be held categorically. (Taylor 2002, p204)

Humans are members of Earth's community of life, with the same terms applying for them as for all nonhuman members. We do not deny the differences between ourselves and other species, but remember that we are but one species among many in our planet's natural ecosystems. In this light, we are one with them, not set apart from them. We are aware of the fact that the well-being of humans is dependent upon the ecological soundness and health of many plant and animal communities, while their soundness and health do not in the least depend upon human well-being. (Taylor 2002, pp207-08)

• ***The rules of duty and standards of character*** – when a person adopts the attitude of respect for nature, that person makes a commitment to live by certain normative principles, and assumes certain dispositions. Rules and standards [which Taylor further delineates in his 1986 book, *Respect for Nature*] include:

- promoting and protecting the good of organisms, species populations and life communities in natural ecosystems as an end (not as a means of self-interest);
- considering actions that realize those ends as a prima facie obligation; and
- basing positive and negative feelings toward states of affairs in the world because they are favorable or unfavorable to the good of organisms, species populations, and life communities in natural ecosystems. (Taylor 2002, pp204-05)

Each individual organism is conceived of as a teleological center of life, pursuing its own good in its own way. As our knowledge of living things increases, as we come to a deeper understanding of their life cycles, their interactions with other organisms, and the manifold ways in which they adjust to the environment, we become more fully aware of how each of them is carrying out its biological functions according to the laws of its species-specific nature. Besides this, we are becoming aware of the uniqueness of each individual organism. One is therefore better able to look at the world from [the organism's or species'] perspective. We need not anthropomorphize their characteristics to consider them as centers of life. (Taylor 2002, pp207,209)

Toward a normative ethic, practical rules include nonmaleficence – we do no harm to any organism; noninterference – we do not interfere with the freedom of organisms, ecosystems or biotic communities; fidelity – we do not deceive or betray wild animals; restitutive justice – we make restitution to other living organisms when we cause them harm; and conflict resolution – we do not automatically favor humans in conflicts between humans and nonhumans. (Des Jardins 2001, pp143-44)

Another criticism of Biocentricity is it remains too focused on the individual organism, and as such is too cumbersome to apply, especially when prescribing normative ethics. As mentioned in the accompanying sidebar, Taylor elaborates on his normative ethics in the 1986 book, *Respect for Nature*, as does James Sterba in several writings spanning the past decade. The details of their extensive discussions fall beyond the bounds of this thesis. For our purposes, suffice it to say that loopholes for anthropocentric views and judgments present significant gaps and tend to be at odds with the theory's descriptive ethics.

The charge that Biocentricity is individualistic is a serious one. As mentioned in the Animal Rights section, a partiality toward the individual can produce detrimental effects on the environment. Ecologists, environmentalists, and any concerned party with a preference toward holism recognize the danger of neglecting the whole system. Clive Ponting explains:

> In the 17th century, René Descartes emphasized a scientific process of analysis designed to reduce wholes to their constituent parts. The widespread adoption of this reductionist approach to scientific inquiry had a profound impact on the shaping of European thought, and inevitably led to a fragmented view of the world. It placed a focus on the individual parts of a system rather than on the organic whole; on how the constituent elements operated separately rather than the ways in which they interacted, both by competition and cooperation. This tendency was reinforced by a mechanistic approach to natural phenomena. (1991, p147)

Admittedly, Taylor does speak of individual organisms as teleological centers of life, but to a greater extent he discusses ecosystems, species, biotic communities, the whole system of nature, *all* living things. Even Schweitzer wrote of "the ethic of love for all creation," (Nash 1989, p62). It is unclear to me that Biocentricity is individualistic and not (at least somewhat) holistic. I suggest that earth, with all her powerful geophysical and biological processes, is a living, evolving entity, and therefore is included in the theories of Biocentricity and deserves moral standing.

In fact, through the Gaia hypothesis, James Lovelock and Lynn Margulis argue that the earth itself can be understood as a living superorganism. Frederick Clements and Henry Cowles' organic model of nature supports the idea of the natural world as having a teleos of its own. (Meffe and Carroll 1997, p677; Des Jardins 2001, pp174,168; Mugerauer1995, p114) Peter Ouspensky wrote of an earth that was very much alive, "vastly less alive than ourselves in degree, but vastly greater than ourselves in time and space – a being that was old when the morning stars sang together, and, when the last of us has been gathered unto his fathers, will still be young," (Nash 1989, p66).

Foundation for a Personal Design Ethic

Regardless of the charge of individualism and other criticisms, Biocentricity provides a significant basis on which to begin establishing my personal design ethic. Whatever heady theoretical discussions remain, I leave for the Biocentric philosophers. With its egalitarian perspective toward all living things, I accept that "the biocentric approach pushes the bounds of moral standing about as far as they might ever go," (Des Jardins 2001, p148). I agree that nature deserves a sense of respect and obligation from mankind, and if widely accepted that "profound reordering of our moral universe" could occur. I especially appreciate that Biocentricity introduces logic and reasoned definition to my earlier thoughts on the more emotive "primitive relatedness" of universal connections. But I also recognize that gaps remain.

Biocentricity alone cannot provide full inspiration for the worldview or the design implications I seek. It lacks adequate justification for human-imposed changes to a landscape, the means to determine appropriate design goals and "behavior," and an apparently holistic approach toward nature. While Biocentricity helps me make great strides toward substantial answers, it is merely a springboard for a deeper understanding of what it could mean to be "environmental" or "nonanthropocentric." Therefore, I press on to consider other contemporary ethics that are specifically holistic, that explicitly view earth as a living entity and acknowledge the importance of natural processes, and that address the person in the landscape.

Ecocentricity and The Land Ethic: Decisively Holistic

If Biocentricity falls short of holism as some charge, and fails to extend inherent value to entities that are not alive in an obvious sense, Ecocentric theories push the discussion in this much needed direction.* By introducing the idea of *ecological* ethics, Ecocentric theories emphasize relationships and ecological wholes (such as ecosystems and species), with explicit inclusion of nonliving natural objects, natural systems, and biotic–abiotic interdependencies.

The Land Ethic

The most influential example of Ecocentrism, and probably the most recognized attempt toward an environmental ethic, is Aldo Leopold's Land Ethic. Leopold was a game resources manager who, early in his career, viewed wild game as mere crops and resources, and their natural predators as varmints. Through his own field experiences and research, and influenced by Charles Darwin's *The Descent of Man*, Leopold gained an understanding of ecology. During the 1920s–40s, this renowned author on game management recognized problems with the conservation methods he himself once espoused (see sidebar, "Leopold's Epiphany"). (Meffe and Carroll 1997, pp48-52; Des Jardins 2001, pp184-86)

Writing the Land Ethic in the late 1940s, Leopold describes an ecological holism that grants moral standing to the land-community, and views "land" as a living organism, as the foundation of flowing energy, as a community that includes soils, waters, plants and animals. He changes the role of *Homo sapiens* from "conqueror of the land-community to plain member and biotic citizen of it," and calls for a respect toward the community. He speaks of an ecological conscience that holds individuals responsible for the "health of the land," *health* meaning the land's capacity for self-renewal. Leopold appraises health in terms of a pyramid of tropic levels and energy flow, and measures human perturbations by the "probability of successful readjustment in the pyramid." The Land Ethic culminates with its moral maxim: ***A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.*** (Leopold 1949, pp237-264; Meffe and Carroll 1997, pp48-52; Des Jardins 2001, pp186-192)

Implications for Normative Ethics

Normative principles can be drawn from the Land Ethic. With reference to Leopold's pyramid which represents the complex and organized structure of the land-community, humans should preserve diversity in life forms so as not to interfere with ecology's balance. Human perturbations should be humble and constrained so that the land-community can adjust and self-renew, a process that occurs slowly over time. The use and protection of native plants and animals are best suited for a particular locale. Individuals and societies should recognize and respect the land-community is characterized by countless interdependencies, and each member of the community is a resource to be used by others and recycled into the system. People should give moral consideration to earth's parts and processes, as part of a coordinated whole. (Leopold 1949, pp237-64; Des Jardins 2001, pp188-91)

The Land Ethic is decisively holistic, and therefore could compensate for Biocentricity's alleged individualism. A single red cedar can be killed without moral deliberation, while killing populations to the point of species endangerment is wrong. The overriding concern is the well-being of the community, not its individual members. This viewpoint is considered both the Land Ethics' greatest contribution

*As one who interprets Biocentricity not as an individualistic theory, but rather as one that includes the interrelatedness of wholes (species, communities, natural systems), I submit that there is little difference between Biocentricity and Ecocentricity, except that one is more implicit while the other more explicit. In my view, the terms are perhaps interchangeable. Ecocentricity is mostly understood through Aldo Leopold's reverent Land Ethic; the theory is awarded far less recognition than is Leopold's pivotal statement. For this reason I present Biocentricity and Ecocentricity as two separate theories. For my personal use, however, I understand them as redundant and interchangeable notions. This is important to my selection of the term *biocentric* landscape architecture.

We see repeated the same basic paradoxes: man the conqueror *versus* man the biotic citizen; science the sharpener of his sword *versus* science the searchlight on his universe; land the slave and servant *versus* land the collective organism. (Leopold 1949, pp260-61)

Not all human-environment conflicts are life and death issues; most are choices between human *lifestyle*, and biodiversity. We should be prepared to override less important human interests for the sake of the vital interests of other forms of life, and for ecological health and integrity. (Meffe & Carroll 1997, p51)

Paul Taylor's Principle of Proportionality prohibits humans from satisfying nonbasic human interests at the expense of basic interests of nonhumans. (Des Jardins 2001, p145)

Science is by definition a descriptive field of study and its job is to describe the way the world 'is.' *Ethics* is by definition a field that describes how we 'ought' to behave. Scientific investigation alone cannot provide all the necessary premises to affect what one ought to do; presuppostional beliefs – religious or philosophical – must also be in place. Can science inform ethical judgment, sure. Will scientific observations alone ever lead to necessary conclusions about appropriate behavior – no, never.
– D.R. Bork, 2005
(Interview by author)

to environmentalism and a major vulnerability to criticism.

Criticisms

The Land Ethic has been accused of "environmental fascism," because the good of the whole outweighs the rights of the individual. Leopold never abandoned the idea of nature as resource, and for him land stewardship meant management. As such, management sometimes meant weeding out individuals that threatened the balance of the biotic community, reducing their numbers in order to maintain integrity, stability and beauty. Animal rights activists, for example, have considerable misgivings with this line of reasoning. Since the Land Ethic's inception, criticism of fascism has proved a philosophical challenge difficult to overcome. (Des Jardins 2001, pp195-99; Meffe and Carroll 1997, pp50-51)

The Land Ethic has faced other related criticisms. One is that ecologists now reject the idea that ecosystems mature to a stable climax status, and instead are constantly evolving as subjected to natural processes and energy cycles. Any attempt to preserve a system could deny its natural evolution. (Meffe and Carroll 1997, pp51-52; Des Jardins 2001, pp169-73) Another criticism is that the Land Ethic does not necessarily overcome the "naturalistic fallacy," the gap that exists between a statement of fact or description, and the assigned judgments of value as either good or bad. Facts themselves are never sufficient for drawing normative conclusions. These critics say Leopold's argument is weak because he does not go far enough in justifying the assumption that the overall stability and integrity of a system should be valued. (Des Jardins 2001, pp174-76,192-94,201-04)

Relevance to Modern Ecology

Despite the challenges the Land Ethic faces, Leopold's attention to ecosystems and relationships, and his explicit statement that ecological wholes are worthy of serious moral consideration can no longer be ignored (Des Jardins 2001, p206). Leopold spoke of the "evolution of a land ethic as an intellectual and emotional process," and suggested "evolution never

Leopold's Epiphany

A poignant scene in the film Powder involves a hunter who is made to feel the pain of his dying kill, a deer. From this scene, one can nearly bear witness to Leopold's similar transformative experience, his with a wolf. Along with colleagues, Leopold happened upon a mother wolf greeting her grown pups in a "mêlée of wagging tails and playful maulings. In those days we had never heard of passing up a chance to kill a wolf. In a second we were pumping lead into the pack, but with more excitement than accuracy. When our rifles were empty, the old wolf was down, and a pup was dragging a leg into impassable slide-rocks. We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes – something known only to her and the mountain. I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view."
–Aldo Leopold in A Sand County Almanac (1949, p138)

stops," (Leopold 1949, p263). Interpreting this as his acknowledgement that the Land Ethic, too, would continue to evolve, he seemingly would be pleased that after nearly 60 years, writers continue to reflect and build upon his original statement, keeping it as relevant today as when it was written.

J. Baird Callicott, for example, has written extensively on Leopold's ethic, providing interpretations and defending its ongoing applicability, while Boris Zeide critically examines it, not to undermine Leopold's work, but rather to use it as the basis for an improved method toward ecosystem management and a sustainable environment. Both explore Leopold's actual work for modern applications. (Callicott 2002, pp224-36; Zeide 1998, pp13-19; Callicott 1998, pp20-26; Zeide[2] 1998, pp25-26)

Authors and professors Gary Meffe and Ronald Carroll look beyond Leopold and ask, "Has the paradigm shift from 'the balance of nature' to 'the flux of nature' in contemporary ecology invalidated the Land Ethic?" (1997, pp51-52) No they say, basing their answer on recent developments in ecology, to include consideration of temporal and spatial scales, normal climatic oscillations, and the inclusion of natural

The flux of nature is a dangerous metaphor. The metaphor and the underlying ecological paradigm may suggest to the thoughtless and greedy that because flux is a fundamental part of the natural world, any human-caused flux is justifiable. Such an inference is wrong because the flux in the natural world has severe limits … Two characteristics of human-induced flux would suggest that it would be excessive: fast rate and large spatial extent. – S.T.A. Pickett and R.S. Ostfeld (Meffe and Carroll 1997, p52)

An intact, undisturbed land mass.

The land mass experiencing some type of fragmentation. Disturbances modify or destroy some component of the existing biota and create a patch of an earlier successional stage.

Advanced fragmentation, isolated patches, narrow corridors, and significantly reduced biota. Fragmentation has two major negative components on biota: the loss of total habitat area, and the creation of smaller, more isolated remaining habitat patches.

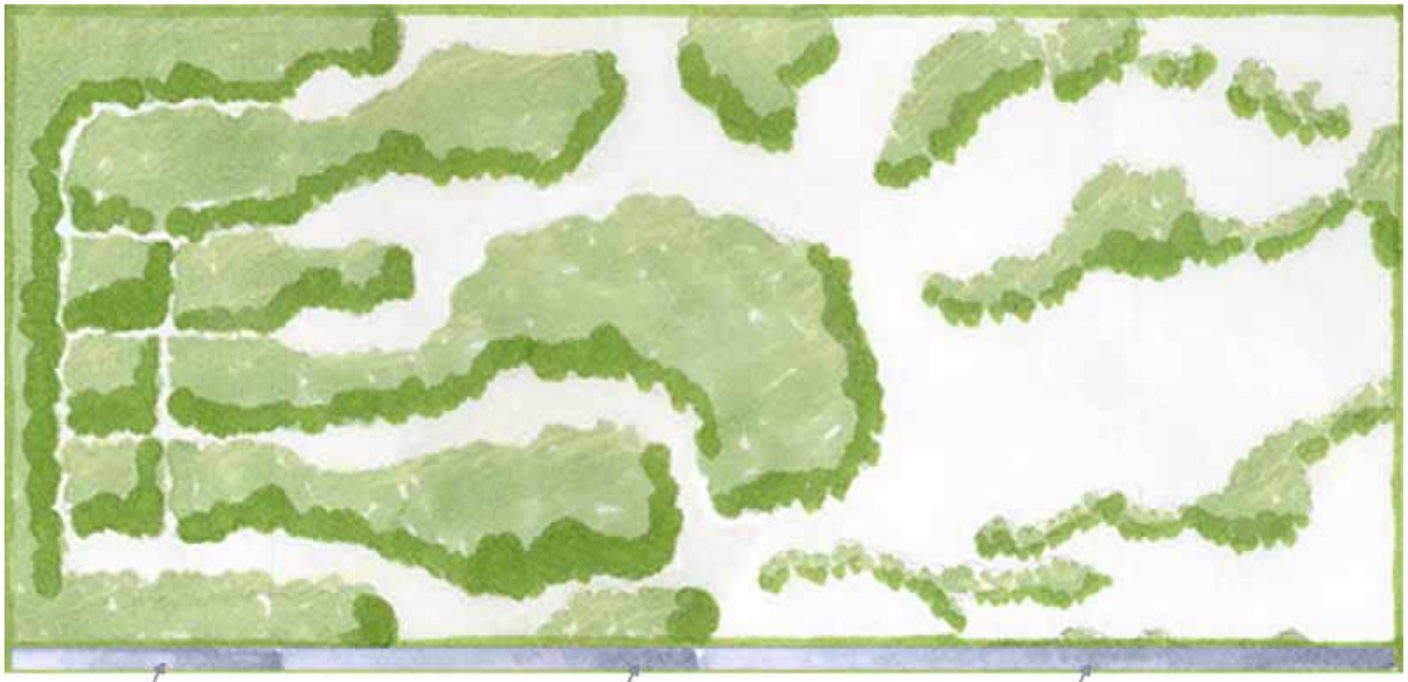
Patch and Landscape Ecological Dynamics: Fragmentation

Fragmentation is the disruption of continuity in pattern, process, or extensive habitats, and is caused by natural disturbances (storms, fire, drought), manipulation by man (road cuts, agricultural fields, city building), or a combination of both. Naturally disturbed landscapes typically have more complex species composition, population densities and dispersions, and organic geometry than do anthropogenically fragmented areas. The point in the fragmentation process at which biological integrity declines dramatically usually is not known, as few fragmentation studies have been conducted over a long enough period. However, developments in ecological science, such as the study of patch dynamics, are making strides in exploring and understanding this tenuous relationship.

(Adapted from Meffe & Carroll 1997, pp51,243-45,274-81,316-19,677-78)

disturbance in theories of patch- and landscape-scale dynamics (see "Patch and Landscape Ecological Dynamics" sidebar series).

For them, "temporal and spatial scale in combination are the key to the evaluation of direct human ecological impacts." Compared to other natural disturbances (fire, flood, hurricane, drought) which occur at small spatial scales and are widely distributed and infrequent, human-caused disturbances are far more frequent, widespread and regular. In light of this new information, Meffe and Carroll suggest this update to Leopold's famous maxim: ***A thing is right when it tends to disturb the biotic community only at normal spatial and temporal scales. It is wrong when it tends otherwise.*** (Meffe and Carroll 1997, pp51-52)



Finite Scale
Occurs in minutes to a few years.

Landscape is perforated with small cuts (roads, trails, fences, drainage ditches).

While most vegetation remains intact, native biodiversity, ecological processes, and ecosystem functioning are more likely to be disrupted at this scale.

Intermediate Scale
Occurs in decades.

Larger gaps begin to dominate the landscape and significantly reduce connectivity in habitat.

Biogeographical Scale
Occurs over centuries.

Wide expanses of natural vegetation are reduced to isolated patches and narrow corridors.

Landscape is dominated by anthropogenic habitat.

Patch and Landscape Ecological Dynamics: Temporal & Spatial Scales

Temporal and spatial scales play an important role in our understanding of ecological and evolutionary changes within landscapes and ecosystems. In combination, temporal and spatial scales are the key to evaluating human-caused impacts on a land mass, which is also influenced by natural disturbance regimes. Disturbance regimes are determined by the scale, intensity and frequency that natural processes occur, and have an important influence over the patterns and character of biodiversity in a landscape. Anthropogenic fragmentation often occurs at a greater size and intensity than do natural disturbances. However, theories on patch and landscape dynamics emphasize that natural disturbance regimes generally should not be controlled or eliminated, since the lack thereof would impair earth's regenerative abilities.

(Adapted from Meffe & Carroll 1997, pp51,243-45,274-81,316-19,677-78)

Design Implications

Among Ecocentrism's contributions to the current discussion, its most essential are these: an explicit extension of ethical consideration for ecosystems and ecological interdependencies, an awareness of how the rate and extent of change impact ecological functions and the land's capacity for self-renewal, and a recognition of the fact that "one of the requisites for an ecological valuing of land is an understanding of ecology," (Leopold 1949, pp257-58,262; Des Jardins 2001, p195).

Although I interpret Biocentricity as implying an interconnectivity exists throughout the natural world, Ecocentrism states the case more obviously. After this examination of Ecocentrism and the Land Ethic, the design implications (or normative ethics) begin to take shape for the would-be nonanthropocentric (i.e., biocentric or ecocentric) landscape architect:

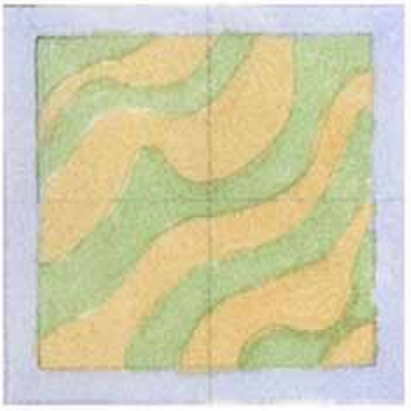
- Gain an understanding of ecology to include the flux of nature, biotic–abiotic interdependencies, temporal and spatial scales, and patch-scale and landscape-scale dynamics;
- Collaborate with professionals who can predict natural disturbance probability and assess anthropogenic disturbance tolerance;
- Plan and design within the limits of this knowledge.

A Question About Land Stewardship

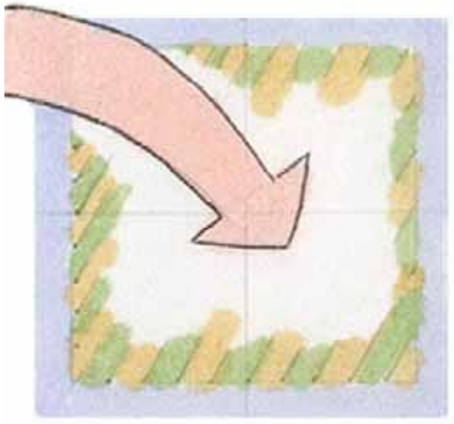
Before concluding this section on Ecocentrism and the Land Ethic, however, an important issue remains unresolved regarding ecosystem management and land stewardship. For Leopold, ecosystem management, whether on an Iowa farm or a protected wilderness site, was the responsibility of a clearly defined authoritative body, i.e. landowner or government. It was the science-based judgment of, essentially, one voice which determined the health of the land-community and the maintenance measures (weeding out) needed in order to protect the integrity, stability and beauty of the system.

Landscape architecture's land stewardship typically is not so cut-and-dry or limited to one overriding ecological voice. It is not unusual for the very definition and responsibility of "stewardship" to change project-to-project, between clients, collaborators (scientists, engineers, architects), local, regional or national governmental agencies, or by the building standards being applied (ASLA, American Institute of Architects, US Green Building Council). This lack of singular voice causes growing concern for some practitioners in the field, fearing that landscape architecture is

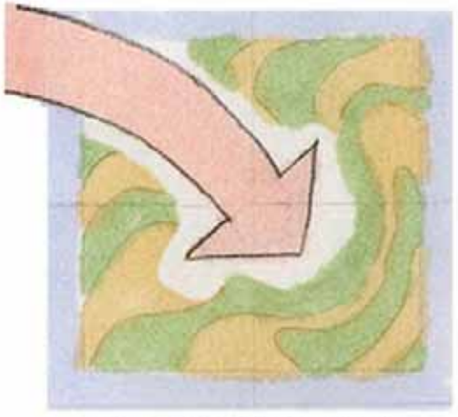
Homogeneous landscapes have simplified patches, high-contrast or harsh conditions between patches with intense edge effects, and threatened habitat availability. Anthropogenic disturbances often result in homogeneous landscapes.



A heterogeneous landscape with a patchwork of habitat types of different sizes, shapes, successional stages and persistence times, as well as a landscape 'grain' determined by the size and distribution of natural disturbance-generated patches. Heterogeneity is the distribution of vegetation types, changes in elevation, temperature and precipitation gradients, slope, soil moisture gradients, and soil parent material.



Spatially and temporally homogeneous (having little variation) patches are generally inferior to heterogeneous patches in maintaining biological diversity, and in recovering and rebounding after disturbances.



Heterogeneous patches accommodate disturbances better and develop richer, more complex internal structure with low-contrast conditions between adjacent patches, and a diversity of habitat types.

Patch and Landscape Ecological Dynamics: Heterogeneity & Homogeneity

Heterogeneous and homogeneous patches and landscapes respond differently to disturbance and fragmentation. Heterogeneity in successional vegetation stages, soil moisture gradients, typography, and other features enables a land mass to absorb the impact of and recover from a disturbance. The emphasis on heterogeneity results from the realization that processes are important, rather than just patterns, in ecological systems. A patch and landscape dynamics approach fosters the continuation of natural processes, and the evolution of landscape heterogeneity.

(Adapted from Meffe & Carroll 1997, pp51,243-45,274-81,316-19,677-78)

underrepresented as a leader in ecological stewardship and sustainable design (ASLA PPN 2005).

Recognizing that landscape architecture is not necessarily involved with "ecosystem management" per se, landscape architecture *is* concerned with "land stewardship" (recall ASLA's Mission Statement). This raises a pressing question about the role of the profession and ecosystem management: How far does or ***should*** landscape architecture's responsibility to land stewardship go in the realm of ecosystem management? To what extent can landscape architects be involved in overseeing the well-being of the holistic system?

I submit the answer lies in the empowerment and leadership capabilities of landscape architecture. I believe it would be a positive outcome if our stewardship assumed some degree of ecosystem management – not in the Leopoldian sense of ongoing maintenance, but in the sense that designs should work within existing ecological and evolutionary systems and functions, and restore and/or maintain health to the land-community. If truly successful, little ongoing maintenance would be required.

That adds another point to my burgeoning normative ethic for becoming a biocentric (or ecocentric) landscape architect:

- Embrace the empowerment of voice and assume a stance of leadership to help others work inside ecological bounds.

Competing perspectives, grounded in differing myths or paradigms, create vast gulfs between people. Myths shift only when what people know no longer fits what they believe, so that the beliefs must change to conform to their experience of reality. (Meffe & Carroll 1997, p595)

Missing: Human Culture in Environmental Ethics

Through this exploration of Biocentric and Ecocentric environmental ethics, I feel I have made progress in establishing an approach to landscape design that can respond to ecological concerns and the well-being of the land-community. But the environmental approaches explored thus far tend toward nature, its values and the ways it is regarded. What has not been sufficiently covered is human culture within the environment, for in landscape architecture culture is half of the equation. After all, design is an anthropogenic, if not anthropocentric, activity. Even restorative design imposes human solutions to environmental problems. Therefore, bringing the ethics discussion to a close at this point could lead one to a misanthropic worldview or worse, could reinforce a dichotomous human–nature relationship.

If that were the case, there could be a temptation to draw a sharp division between human culture and the environment, and to cordon off all the undeveloped landscapes that remain. I strongly recognize that yes, there are innumerable instances where wilderness preservation is or should be an imperative, and I in no way suggest all landscapes should be developed or utilized. That said, humans are part of nature and therefore, no sharp delineation – as a commonplace rule of thumb – can realistically exist. To suggest that across-the-board societal and environmental separation be the objective would negate all that biocentric landscape architecture could offer the discipline and the environment. Mugerauer's shake up would die on the vine; landscape architecture's authoritative voice would never be heard.

With that in mind, three final viewpoints on the human–nature relationship are briefly examined, each valued for its emphasis on the person in the landscape: Deep Ecology, Social Ecology, and Spirituality.

Deep Ecology: Rethinking Perception and Reality

Deep Ecology is a movement interested in determining and exposing the underlying causes of environmental devastation, not just treating the symptoms. Deep Ecologists have pinpointed the main cause as a dominant worldview among modern industrialized societies that favors individualistic and reductionistic tendencies (see Descartes within Biocentricity). One proponent, professor Eric Katz, explains "the underlying cause is an inappropriate set of values concerning the human relationship with the natural world," (Meffe & Carroll 1997, pp668-69).

A Shift in Worldview

Understanding the dangers of an individualistic perspective, Deep Ecologists reject the notion of individuals as apart from the system. Theirs is a

longer, broader view on ecology. Individual organisms grow and die – it is the chemical and biological *processes* that persist, that are bigger than the individual, that endure for millions of years and are worth continuing for millions more. (Naess 2002, p272; Des Jardins 2001, p219)

The movement's goal is to cause a shift toward an alternative worldview, one that probes deeper and addresses fundamental causes of environmental issues, taps into an ecological consciousness, seeks a radical reinterpretation of the human place in the natural world, and calls for personal and cultural transformations that result in a way to live more lightly upon the earth. (See Appendix Three, "Basic Principles of Deep Ecology"). (Meffe & Carroll 1997, pp668-69; Devall & Sessions 2002, pp263-64; Naess 2002, pp270-72; Des Jardins 2001, pp213,218-19)

Deep Ecologists know that a person's worldview depends on his or her view of reality:

> One's ethics in environmental questions are based largely on how one sees reality, how one understands the difference between the objective world and the subjective world. The objective world exists independently of human understanding. The subjective world consists of human judgments, perceptions and valuations. Subjectivity should never be mistaken as truth." (Des Jardins 2001, pp221-22)

Defenders of the status quo easily dismiss many environmental concerns as sentimental and irrational. This dismissive attitude, Deep Ecologists say, makes communication between the two camps difficult, and at times places an extra burden on environmentalists when presenting and debating their positions. To level the playing field of rationality, they explain that realities can differ based on the "relational properties and contexts" that are applied to a given situation or environmental question. (Des Jardins 2001, pp220-24)

To promote their view of reality, Deep Ecologists rely on an "immense variety of sources of joy opened through increased sensitivity toward the richness and diversity of life," (Naess 2002, p272). As such, they frequently draw upon stories, narratives, poetry, myths, rituals and spiritual beliefs to pose their view of reality, to communicate the alternative worldview, and to make understandable unfamiliar concepts, norms, values and metaphysics (Des Jardins 2001, p223).

Accessible For All

Proponents of Deep Ecology are careful to ensure that the movement is open for all people, and it benefits human and nonhuman life alike. Despite the inspiration taken from ecology, Deep Ecology surprisingly warns against too great a reliance on ecology and "ecologism," the view that ecology is the ultimate science and the final authority on environmental disputes. Deep Ecologists are concerned that an over-reliance on ecology could cause citizens to remain passive and leave decision-making to scientists. (Devall & Sessions 2002, p264; Des Jardins 2001, pp216-17; Meffe & Carroll 1997, p25)

Ecologists themselves recognize the science is imperfect, and that ecosystems are complex, unique and unpredictable, and all the reactions occurring throughout an ecosystem simply cannot be anticipated. Furthermore, not all environmental problems are ecological; many are epistemological and philosophical with political implications. Deep Ecologists realize that institutions and individuals who defend the status quo can use ecology as a means of merely treating the "symptoms" of environmental destruction (pollution, land fragmentation, resource depletion), introducing remedial or technological quick fixes, and derailing movements that question basic assumptions about culture. (Devall & Sessions 2002, p264; Des Jardins 2001, pp216-17; Meffe & Carroll 1997, p25)

In order to achieve a more democratic, less hierarchical equality among human and nonhuman interests, and to liberate involvement in this movement to any concerned citizen, Deep Ecologists put direct action in the hands of all persons:

- Humans ought to live in simple, relatively nontechnological, self-reliant, decentralized communities.
- Communities ought to be organized regionally, existing as a "bioregion" rather than as traditional political organizations.
- Lifestyles ought to be simple in the sense that consumer or material desires should be kept to a minimum, materials wants need to be recognized as artificial products of human society.
- Humans should live with minimum impact on other species and on the Earth in general.
- Local communities should exist in a harmonious and self-regulating relationship with their surroundings.

(Des Jardins 2001, pp226-27)

With Deep Ecology, nonhuman life clearly includes the living earth. The movement, and specifically its most outspoken proponent, Arne Naess, explicitly recognize the intrinsic value of earth's processes. Just as Animal Rights, Biocentricity and Ecocentricity expanded inherent worth and moral obligation toward nonanthropocentric interests, so too does Deep Ecology. Essential processes and cycles that occur over time are necessary to sustain life of individuals and communities. "An individual organism is alive only if certain chemical and biological processes are occurring. Each living thing does not endure in and of itself but only as a result of the continual flow of energy in the system. In this sense, we can say that processes are at least, if not more, real than the individual organism." (Des Jardins 2001, p219) Real, and deserving of moral obligation.

Implications

Finally, Deep Ecology helps bring human culture back into the equation. For me, this discussion helps frame a simple concept, that is, people regard the landscape depending on their worldview. A person's worldview is dependent on his or her view of reality and belief in an overriding paradigm. If that paradigm were to shift, people would have to reexamine their belief structures, which will inevitably alter their actions toward the earth because people will seek to act in accordance with their beliefs. The current paradigm supports a dominant culture that considers nature as a resource to be utilized for economic gain. A shift in paradigm would recast nature as something of its own, with an inherent life (or a Tao) of its own. Humans would still benefit from nature, but not necessarily with a primary interest in economics.

Can landscape architecture be part of a paradigm shift, or help recast our understanding of nature? It is not likely to happen quickly, but I believe the answer is, "Yes." I certainly sense implications for my design work as a biocentric landscape architect:

- Deep Ecology places the power to persuade and to educate directly into the biocentric landscape architect's hands. Given my desire for a new worldview, the tools of story, poetry and ritual, and the ability to challenge views of reality, landscape architecture is a perfect discipline to communicate these ideals via the most appropriate medium of all: the land itself.

Admittedly, Deep Ecology is a movement for the dreamer. I now turn to the insights of Social Ecology for more practical and expeditious means of shaping a worldview and addressing human behavior.

Social Ecology: Equitable Distribution

The final contemporary environmental theory I will examine is Social Ecology. Like Deep Ecology, Social Ecology is concerned with underlying causes of our ecological crisis, but disagrees that a dominant worldview is the cause. Its proponents realize that Deep Ecology does not acknowledge those who live by or follow an alternative worldview, particularly when doing so is not of their own accord. Social Ecology also criticizes Deep Ecology for being overly mystical (drivel from the "mystically over-baked world of the American sunbelt" that degrades social issues), and presents a more pragmatic approach to the human–nature relationship (Bookchin 2002, pp273-74).

Social Ecology is based in social and environmental justice, views that are concerned with the disproportionate distribution of environmental risks and benefits among diverse members of a society (such as those who are exposed to toxic contamination versus those who enjoy impeccable vistas). Social Ecologists are interested in increasing public participation in evaluating and apportioning risks and benefits. (Shrader-Frechette 2002, pp3-6)

Murray Bookchin, a major advocate of Social Ecology, argues that "specific, unjust human institutions and practices are the cause of environmental destruction, not a dominant worldview," (Des Jardins 2001, p235). Bookchin points to certain social factors and patterns of domination, oppression and hierarchy, not dissimilar to racism, sexism, class structures, private ownership, bureaucracies, capitalism. These social factors can lead to an attitude that encourages humans to dominate and destroy one another, as well as the natural world. (Bookchin 2002, pp274,277; Des Jardins 2001, pp235-37,243-44)

Social Ecology states that an alternative ecological vision should be "a nonhierarchical, communitarian society based on directly democratic confederal communities, and an ecologically oriented network of communities," (Bookchin 2002, pp274,277). The just community is one created to serve common needs and goals, and abstains from domination over humans and nature. "Changing to a more benign relationship with the natural world will provoke changes in social arrangements. Changing social relationships to less hierarchical, more decentralized associations will encourage a more felicitous relationship with nature," (Des Jardins 2001, p247).

Bookchin emphasizes that societies are human creations, organized by humans to serve human ends. It is important to examine the ends served by institutions causing environmental problems, and how serving those ends affects people living in a society. He proposes a set of analytical questions for establishing and maintaining equitable distribution of societal and environmental risks and benefits. His approach seems quite appropriate for the practice of landscape architecture:

- Who is benefiting from and who is being harmed by social practices?
- How are the burdens and benefits of society distributed?
- Are the current distributions fair, and on what basis?
- What kinds of character traits, values, attitudes are being reinforced by society?
- What are the environmental benefits and burdens?
- Who carries the burdens of environmental harms, who benefits from the practices that cause them?
- Who would benefit from environmental policies that change the causes, and who would bear the burdens of these policies? (Des Jardins 2001, p239)

Let's face it, when you say that a black kid in Harlem is as much to blame for the ecological crisis as the president of Exxon, you are letting one off the hook and slandering the other.
– Murray Bookchin
(Des Jardins 2001, p248)

Despite Bookchin's disparaging remarks for Deep Ecology, I consider Deep Ecology and Social Ecology as unlikely partners in scope and time. Deep Ecology's long-range goals and visions do not necessarily have to be in competition with Social Ecology's more immediate actions and attention to social and environmental justice. Social Ecology's challenges can produce results now, while Deep Ecology's focus on the long process of slow change can effect more aspects of an environmental consciousness.

Social Ecology supports my stance against human domination over nature, and encourages the building of harmonious ecological communities by way of social justice. Additionally, the movement offers these contributions toward my biocentric landscape architecture:

- Avoid misanthropic attitudes and overly mystical solutions.
- Strive for truly democratic and confederal land plans and designs at all scales.
- Analyze ecological ***and*** social conditions and problems.
- Participate in and present timely and visible solutions.

Spirituality: Inspiration and Motivation

Though not a contemporary environmental ethic, spirituality acknowledges and brings forward a unique quality that my exploration of the reconnect so far lacks: a softer, loving appeal in a less confrontational approach. After all, for many people spirituality and religion are the basis of the only rules of ethics they know (Kidder 1995, p25). What Rushworth Kidder, founder of the Institute for Global Ethics, calls "care-based thinking," spirituality appeals to the emotive side of humanity and, as Deep Ecologists know, has tremendous power to inspire and to motivate.

For Kidder, care-based thinking hinges on the Golden Rule: "Do to others as you would like them to do to you," (1995, p25). With roots in a number of spiritual and/or religious traditions, including Christianity, Judaism, Islam, Taoism, Confucianism, Hinduism, Buddhism, Zoroastrianism and other major religions, care-based thinking puts love for others first. It sets limits on an individual's actions and encourages people to promote the interests of others. It does so by virtue of its *reversibility*. By putting oneself in another's shoes individuals are able to "test the rightness or wrongness of an action by imagining [themselves] as the object rather than the agent of the action and consulting [their] own feelings," (Kidder 1995, p159). Apply this care to the nonhuman world, and the implications can run deep. (See sidebar, "Environmental Implications of World Religions").

When considering environmental degradation caused by factors such as human consumption, loss of wilderness, loss of land, loss of species, devastation of indigenous peoples, genetic engineering, toxic waste and global climate change, most people have emotional reactions that range from fear and despair to rage. Spirituality can help direct those feelings by uniting people with similar pains and trepidations, and providing guidance for healing and taking action. Many ecotheologians are concerned about a natural world threatened by humanity, and encourage people to consult their deepest concerns about what is truly of *lasting importance*. "Religious attitudes turn on a sense of 'ultimate significance.' They seek to orient us to that which is of compelling importance beyond or within our day-to-day concerns." (Gottlieb 1996, pp3-12)

Care-based thinking, spiritualism and religion touch humans as no other logic or sensibility can. There is undeniable depth, power and beauty in the softer side of humankind, and from it has sprung great inspirational ideas of tenderness and strength. The natural world, indeed *all* living things, potentially can benefit from the gentleness of the human spirit. Landscape architecture that is not necessarily of a religious nature can still appeal to and summon this gentleness. Such is spirituality's implication for my biocentric design work:

- Spirituality prompts designs that spark the human spirit and direct it toward ecological issues.
- These designs have the ability to uniquely touch and educate people, perhaps more effectively than the interpreted landscape.

Robert Mugerauer understood this when he wrote of the "urge to account for nature in some sort of spiritual manner, in terms of a kind of wholeness to which we can belong and from and toward which we can responsibly act. Perhaps here we can catch a glimpse of the next epoch of the manifestation of what was nature, a hint of the next historical era," (1995, p115).

Competition Among Worldviews, Implications for the Environment

After exploring these varied theories about how society and individuals should regard and interact with the environment, I am pleased with the tremendous insight I have gained. I wonder, though, as transcendental theories and philosophies, do they really have an application in actual events, projects, practice, or public policy making, as I previously suggested? Do these theories describe real thought processes and activities that determine the way we shape our environment? To find out, I will test some of them against an important current environmental crisis, the hurricane-ravaged United States Gulf Coast.

The Scenario

In the weeks between August 29 and September 24, 2005, two severe hurricanes, Katrina and Rita, devastated the United States Gulf Coast. The country's 35th largest city, New Orleans, was rendered a ghost town for nearly a month. Storm damage spanned five states from Florida to Texas, affecting millions of people. Many lost their homes, businesses and communities. Too many lost family members and beloved pets. Thousands have been displaced, relying on temporary housing in other states. Cities that absorbed substantial portions of the fleeing population have endured the pressures of a rapidly expanding population of their own. Consumers who rely on resources drawn from the Gulf area have paid exorbitant prices. Some governmental officials and employees lost, or will lose, their jobs. Recovery and rebuilding efforts along the coast will cost billions of American taxpayer dollars.

The Dichotomy

On the one hand is the human perspective, which enjoys, even expects, a high level of stasis. We like things to stay the same, we like feeling in control of our lives and communities, we do not react well to upheaval. On the other hand is nature and natural processes. The environment depends on processes for its replenishment, renewal, successive growth and decline. It favors flux, needs it. Nature often reacts dramatically when long-term physical stasis is attempted.

When we build, we often build to last (usually to last at least a few generations) believing nature can be held at bay by developing greater technology, using enriched resources, and allotting enough funding. In so doing, we perpetuate our anthropocentric traditions, usually precluding any opportunity to explore nonanthropocentric alternatives that could be at least as beneficial to public well-being.

Consider how quickly an anthropocentric attitude came forth regarding rebuilding efforts after Hurricane Katrina (referred to as "a cruel and wasteful storm"), and a human – nature dichotomy was established:

> In the life of this nation, we have often been reminded that nature is an awesome force, and that all life is fragile. We are the heirs of men and women who lived through those first terrible winters at Jamestown and Plymouth, who rebuilt Chicago after a great fire, and San Francisco after a great earthquake, who reclaimed the prairie from the dust bowl of the 1930s. Every time, the people of this land have come back from fire, flood and storm to build anew and to build better than what we had before. *Americans have never left our destiny to the whims of nature and we will not start now.* [emphasis added]
>
> – George W. Bush, addressing the nation September 15, 2005

The human death toll and turmoil is undeniably a horrible tragedy. But can we not try to see these storms as the beneficial natural phenomenon and essential earth process that they are? Environmental analysts, coastal geologists, conservation biologists, NOAA research meteorologists, and many others understand that hurricanes "are good for the ecosystem, even if they're bad for us" because of their replenishing, purifying and restorative powers (Carlson 2003).

Environmental Implications of World Religions

Meffe and Carroll (1997, pp40-45) explore a number of world religions and their relevance to the environment to learn how effective conservation ethics can be formulated in terms of sacred texts. Basing their exploration largely on J. Baird Callicott's Earth's Insights: A Multicultural Survey of Ecological Ethics, they summarize the following:

Characteristic	Islam	Hinduism	Jainism	Buddhism	Taoism	Confucianism
Source of value in nature	External; Allah (God)	Internal; *Atman-Brahman*	Internal; soul (*jiva*)	Internal; Buddha-nature	Emergent; the Tao (Way)	Emergent; relational
Human attitude toward nature	Respect for creation is respect for Creator	Identification; self-realization	*Ahimsa* (noninjury)	Loving-kindness, solidarity	Harmony; cooperation	Interrelated; interdependent
Conservation practice	Conserve resources for future generations	Conserve trees and other beings that manifest *Atman-Brahman*	Low on the food chain; low level of consumption	Still desires; reduce consumption; contemplate nature	Adapt human economy to nature's economy	Conserve nature to preserve human society

Judeo-Christian – the Judeo-Christian Stewardship Conservation Ethic emphasizes the responsibility of humans as caretakers of nature, and "confers objective, intrinsic value on nature and species." The ethic recognizes that "God cares for humanity, so we who are created in the image of God must care for the earth."

Islam – shares similar beliefs with Judeo-Christians. The Islamic Principles for the Conservation of the Natural Environment were drawn from teachings in the Koran. While the traditional Islamic worldview focuses on the instrumental value of nature, the Principles for Conservation encourage the attitude of man as manager of the earth, and the just distribution of natural resources.

Jainism – Jains believe that "every living thing is inhabited by an immaterial soul, no less pure and immortal than the human soul. Ahimsa (non-injury of all living things) and asceticism (eschewing all forms of physical pleasure) free the soul … hence, Jains take great care to avoid harming other forms of life and to resist the fleeting pleasure of material consumption."

Hinduism – views all beings as manifestations of the one essential Being, called Brahman. Emerson, Thoreau and Naess found in Hinduism an element of unity of all organisms to the whole. Hinduism "invites human beings to identify with other forms of life; the suffering of one life-form is the suffering of all others. To harm other beings is to harm oneself."

Buddhism – the Buddhist Perception of Nature Project was launched to "extract and collate the many environmentally relevant passages from Buddhist scriptures and secondary literature" in order to raise conservation consciousness. Because of Buddhism's focus on the interdependence of all things, restraint of desire, goal of enlightenment through contemplation, and ethic of noninjury and boundless loving kindness for all beings, it provides the "essential elements for a relationship to the natural world characterized by respect, care and compassion."

Taoism – believes there is a Way of nature that humans can discern because natural processes occur in an orderly and harmonious fashion. When human activities are adapted to the Tao, goals are accomplished with "ease and grace and without disturbing the natural environment." If activities go against the Tao, they are met with difficulty at the price of considerable disruption to social and natural systems. Therefore, an appropriate conservation measure is to act in accordance with the Tao.

Confucianism – conceives individuals as a unique center of a network of relationships. Individuals are bound to their social and environmental context, therefore the "destruction of one's context is equivalent to self-destruction. Thus, if 'context' is expanded from its classic social to its current environmental connotation, Confucianism offers a very firm foundation upon which to build a contemporary conservation ethic."

Interfaith Ecotheology – Whether a formal interfaith movement, such as the Alliance of Religions and Conservation, or a creative synthesizing of elements of different traditions, interfaith ecotheology employs an ecumenical approach to conservation. By embracing a mix of spiritual traditions, common ground is established where diverse peoples can work together, local and indigenous peoples are engaged in conservation efforts, established customs and rituals are expanded to take on new life, and religious ideals complement and enrich one another, spawning unique perspectives on ancient traditions and contemporary issues. (Gottlieb 1996, p10; Toropov and Hansen 2002, pp230-32)

"Hurricanes are Mother Nature's way of keeping the earth in balance," (McBride 2004).

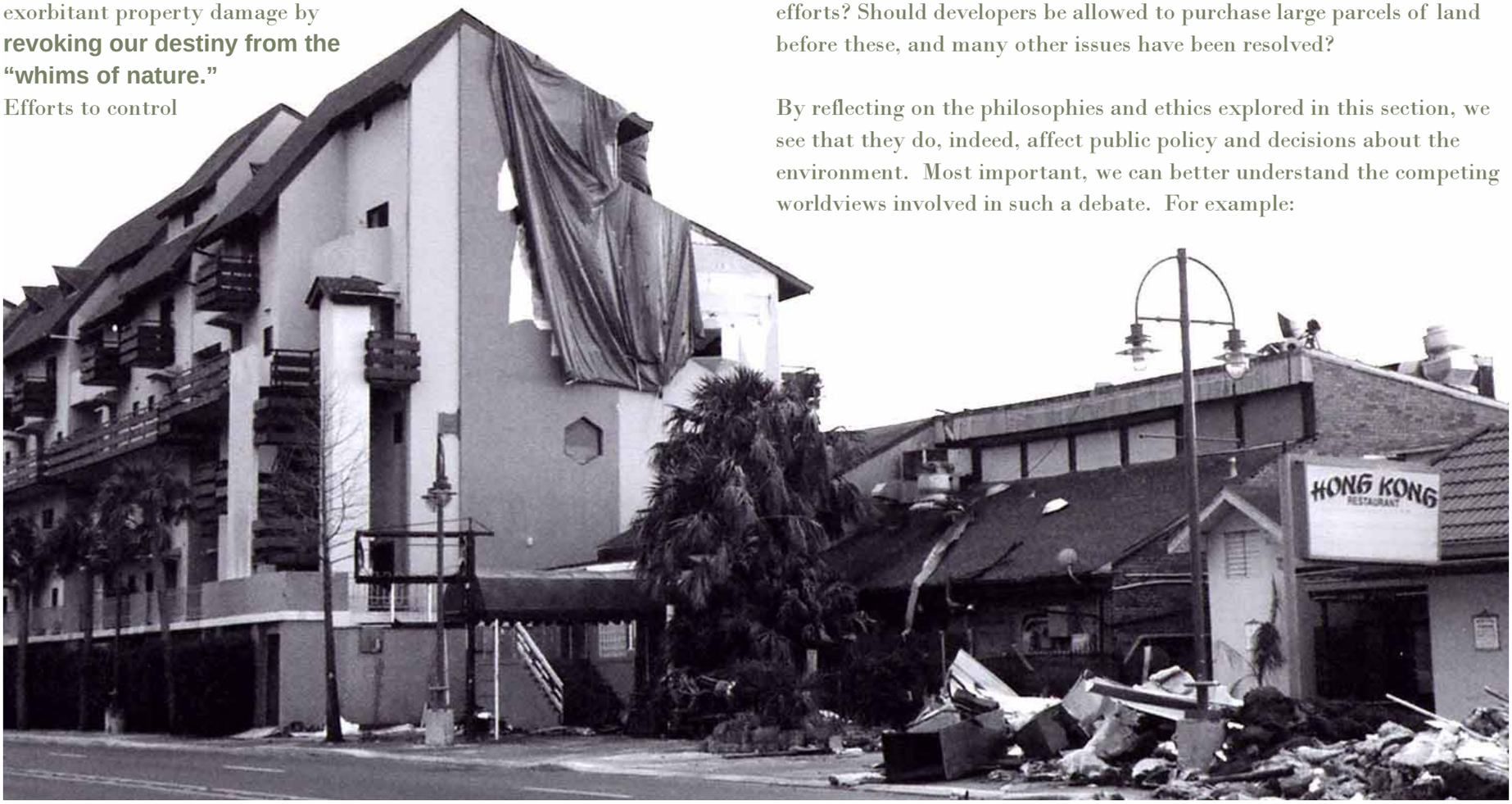
> Natural disturbances and the biological legacies produced by them are often poorly misunderstood by policy-makers and natural resource managers. To many ecologists, natural disturbances are key ecosystem processes rather than ecological disasters that require human repair.
>
> Recent ecological paradigms emphasize the dynamic, nonequilibrial nature of ecological systems in which disturbance is a normal feature and how natural disturbance regimes and the maintenance of biodiversity and productivity are interrelated. Major disturbances also can aid ecosystem restoration by recreating some of the structural complexity and landscape heterogeneity lost through previous intense management of natural resources, (Lindenmayer, et al 2004, p1303).

Despite the necessary aspects of natural phenomena and processes, scientists are currently studying ways to curtail human suffering and exorbitant property damage by **revoking our destiny from the "whims of nature."** Efforts to control hurricanes (i.e., directing their paths or dissipating them altogether), though still embryonic, are being explored. Some ideas include altering the storm's initial temperatures and wind speeds, cloud seeding, using earth-orbiting solar power stations for atmospheric heating, applying biodegradable oil slicks to ocean waters to reduce available energy, altering air pressure to stimulate change at the jet stream level, directing aircraft flight paths to increase cloud cover, and varying crop irrigation to enhance or decrease evaporation (Hoffman 2004). These strategies, allegedly, would alter the conditions in which hurricanes develop and strengthen – thus **reducing nature to the whims of humankind**, a notion that concerns me deeply.

The Analysis

Portions of five states along the Gulf Coast were so altered by the powerful storms that some city and town planners are working with near *tabla rasa* conditions. Much debate abounds as to how rebuilding efforts should proceed. Should more land mass be dedicated as natural barriers (riparian forests and wetlands)? Is, instead, more waterfront development (resorts, big business tourist attractions, industry) needed to drive a stronger economy for the area? Who should provide financial assistance and incentives to displaced homeowners in their rebuilding efforts? Should developers be allowed to purchase large parcels of land before these, and many other issues have been resolved?

By reflecting on the philosophies and ethics explored in this section, we see that they do, indeed, affect public policy and decisions about the environment. Most important, we can better understand the competing worldviews involved in such a debate. For example:



- The Utilitarian perspective might favor taller flood walls for New Orleans, and more casinos in Mississippi that generate jobs, capture tourist dollars, and provide tax revenue, thereby providing the greatest good for the greatest number.
- The Deontology perspective may argue that the government has a categorical imperative to rebuild homes so local citizens may return to and reclaim their communities.
- The Social Ecology perspective might largely agree, adding that rebuilding opportunities must be equal for all even if that meant city-wide redistricting, and any further damage to the recovering environment must be avoided.
- The Biocentric–Ecocentric perspective may argue for the restoration of natural barriers and wildlife refuges that buffer the inland effects of future storms and provide safe retreat to the biotic community.
- The Deep Ecology perspective could embrace the hurricanes as a necessary natural process, and encourage reflection on the types of development and infrastructure that worked with the storms and those that did not. It might argue for new solutions that respect natural disturbance regimes rather than hastily employing standard development techniques that try to contain them.

Few debates regarding the environment compare in scope and complexity to the situation along the Gulf Coast, New Orleans in particular. However, the same competing worldviews appear at any scale affecting the environment, from the small backyard to the larger watershed to the entire region.

Having knowledge about the differing philosophies and ethics of clients, collaborating professionals and stakeholders, and understanding how to communicate with each of them gives a person the special ability to facilitate debates, decision making and interdisciplinary design work. Constraints become more easily identified, and solutions more quickly reached.

For this reason, I am fortunate to have this opportunity to explore different philosophies and ethics, and to reflect on how they generate actions that shape our landscapes. This exercise will prove to be an advantage, an invaluable tool, when I contribute my own ideas on biocentric landscape design to the debate .

The Reconnect: Vision for the Biocentric Landscape Architect

Architect Sim Van der Ryn states beautifully the power worldviews have in determining the way we shape our landscapes. We have to ask ourselves, how long can we continue with our current predominant view?

> The everyday world of buildings, artifacts, and domesticated landscapes is a designed world, one shaped by human purpose. The physical form of this world is a direct manifestation of what is most valued in our culture. In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used.
>
> Philosophers call a filter that determines what counts as knowledge an *epistemology*. Design manifests culture, and culture rests firmly on the foundation of what we believe to be true about the world. Conventional design is failing because its epistemology is flawed.
>
> Our present forms are derived from design epistemologies incompatible with nature's own. We have used design cleverly in the service of narrowly defined human interests but have neglected its relationship with our fellow creatures. Design professionals have gotten trapped in standardized solutions that require enormous expenditures of energy and resources to implement. Such myopic design cannot fail to degrade the living world, and, by extension, our own health.
> (Van der Ryn 1996, pp8-10,13)

I approached this study of an envisioned reconnect with the natural world hoping to find a personal alternative worldview that would inform my design work and, really, all aspects of my career and life. A person cannot change their entire worldview overnight, but they can experience a sudden epiphany, much as Aldo Leopold did while watching the green fire die in the eyes of a wolf. From this study of philosophies and ethics, I have experienced something of an epiphany – certainly inspiration by way of combined environmental theories and their relevance to landscape architecture.

My worldview recognizes the individual welfare of other species, plant and animal alike. It embraces species impartiality, and avoids a constant assumption in favor of humans. It accepts a moral bond to protect and promote members of earth's biotic community, and accepts humans as 'life which wills to live in the midst of life which wills to live.' My worldview extends the moral bond to abiotic elements as well, such as natural processes and the materials they affect, and ecology's interrelatedness of wholes. Though I feel strongly toward the natural world, my worldview is not misanthropic because in it there is hope for a harmonious human–nature relationship. Education and communication

We can conclude that there are two extreme viewpoints of man–nature. In the first, anthropocentric man – ignorant of man's dependence, his allies and cohorts, low-browed and brutish – destroys as he goes, while adulating man and his works. The opposing view is less certain of man's place. It reserves the right to justify man as not only a unique species, but one with the unequaled gift of consciousness. This man, aware of his past, his unity with all things and all life, proceeds with a deference born of understanding, seeking his creative role. (McHarg 1992, p44)

are highly valued, social justice is highly sought, the ability to inspire and motivate is an important goal.

Through this exploration, I have considered how a worldview can inform my personal design ethic and how that ethic can manifest in practice. I have wondered about landscape architecture's contributions toward a shift in predominant worldview – Mugerauer's "earthquake into the future." I have envisioned how a better system might look and function. I suggest it all begins with commitment to three basic tenets:

- In order to promote care toward the earth, the ways of the earth must first be understood. Given what we know and are continuing to discover about ecological systems, interdependent functions, disturbance regimes and age-old processes, it seems obvious the first step is grounded in this knowledge.
- Resolving to tone in the interests of humans with the interests of the biotic-abiotic community is next. Humans cannot be held separate from the natural world, neither physically nor psychologically. Yet, extensive environmental devastation exists because of the "unnatural" rate at which humans alter the landscape, a rate that far exceeds the land-community's ability to renew and recharge. Our society needs to adopt a mainstream lifestyle with sustainable patterns and practices.
- Address and/or confront prevailing assumptions, attitudes and the justness of social and environmental mores, and where necessary invoke the sensitivities of heart and mind to inspire change. The means with which to accept people into the landscape are here introduced through Deep Ecology's examination of social and individual causes of environmental destruction, Social Ecology's challenges to domination and oppression, and Spiritualism's appeal to the softer side of humanity. The insights of these perspectives have the potential to lead toward a more harmonious balance in the human–nature dynamic.

From this commitment, the built landscape – at any scale – can be designed as ecologically more benign, holistically more functional, and culturally more significant than is conventional. Where such a landscape exists is where the shift has already begun. Where these landscapes thrive is where one could catch that glimpse into the next epoch, the next historical era of the human–nature relationship. Ensuring that these landscapes proliferate is my vision for the biocentric landscape architect.

Part 2: In Search of a Reconnective Design

With a vision toward biocentric landscape architecture, I believe I have begun to reveal a better system for myself. In Part 1, I determined some of the goals I can strive toward in my practice of landscape architecture. I must confess, however, a fear that my worldview and this system are doomed to failure because commonly accepted but unsustainable economics are not the primary driving factor in my outlook – that is largely what makes mine an *alternative* worldview. I am concerned whether my ideas regarding landscape design and the role of the landscape architect can thrive. Is the system I contemplate viable? Furthermore, I still wonder has the better system existed all along, and are there examples of its successful execution?

In Part 2, I explore examples of environmental design, and compare them with the principles, ethics, and goals I laid out in the previous three sections. Earlier I noted that "environmental," "ecological," or "green" design can encompass many techniques, styles, purposes, and solutions. This exploration helps me understand why the question I posed, "What would I mean by saying that I wanted to practice ecological design?" has been difficult to answer. More important, this exploration reveals how the better system I postulate may exist, in whole or in part, in built landscapes today.

Alternative Design: Ecological–Environmental–Sustainable–Green

Many designers share the goal of utilizing and developing environmentally benign or even beneficial techniques, materials and systems in their built works. What to call and how to define these ways of designing and building varies tremendously, reflecting the differences in professionals' backgrounds, visions, purposes, intents, collaborations, and concerns.

A brief review of the principles, strategies or measures of some highly regarded experts in the field (both living and deceased) reveals the diversity in approaches of what can be considered as ***responsible*** design. While some overlap occurs, the differences far outweigh the commonalities, especially once one moves past these over-arching guidelines to the designers' divergent methodologies and executions. These "different shades of green" explain the vagueness and confusion in saying one wishes to be an ecological, environmental, sustainable, green, or otherwise alternative designer.

> Those who wish to build sustainably need to think and feel deeply about their own beliefs. (Thompson and Sorvig 2000, p23)

Ten Principles of the Sustainable Landscape

J. William Thompson, Editor *Landscape Architecture* and
Kim Sorvig, Architecture and Planning Professor
(Thompson and Sorvig 2008, ppix-xii,37,71,113,133,152,
198-99, 224, 262,293,312,318,320,323,326,335)

1. *Keep healthy sites healthy.* Prevention of damage to a healthy site is usually more successful – and less expensive – than cure.
2. *Heal injured sites.* Instead of consuming virgin landscape to make a place to live and work, start to think in terms of recycling existing sites.
3. *Favor living, flexible materials.* Bioengineering combines living and inert structures into something stronger and more flexible than either. These living structures reinforce vulnerable interfaces between soil and water.
4. *Respect the waters of life.* Essential to life, water is also a powerful force of change and destruction. In addition, besides regional and seasonal water scarcity, water quality is threatened by pollution. Construction affects water and water quality in many ways. Carefully planned landscapes can compensate for some of these changes.
5. *Pave less.* For all its popularity and functionality, paving has been implicated in a wide range of ecological problems. There are many practical and well-tested alternatives to overpaving.
6. *Consider origin and fate of materials.* Almost every construction material is extracted from somewhere; some extraction processes are more destructive than others, some products are renewable or reusable. Realistic alternatives do exist: local materials, reused or recycled materials, even materials found on-site.
7. *Know the costs of energy over time.* Energy is the core of life, central to doing, living, building. Despite energy's increasing importance in building design and construction, it is still rare to find energy conservation principles systematically applied to landscape construction. Construction, design, and planning professionals should help develop practical methods and reliable standards for energy evaluation.
8. *Celebrate light, respect darkness.* Extravagant lighting can be wonderful for temporary effects, but as a permanent landscape feature it wastes resources and causes direct damage to living things. Research and consider using outdoor lighting products and practices that follow dark-sky initiatives, as well as LED lighting and streetlamps, solar power and new ways of storing it. Tone down or eliminate excessive lighting. Designers, contractors and manufacturers can ensure that efficiency and appropriate design become standard.
9. *Quietly defend silence.* Noise has physiological and psychological effects on living things, and constant noise is unhealthy. Silence is worth respecting. Decrease the psychological perception of noise. Fight noise with pleasant noises. Reduce noise by eliminating or quieting it with at-the-source noise controls.
10. *Maintain to sustain.* Maintenance practices can contribute to sustainability. Rather than thinking of maintenance as keeping things the same, rethink it as responding to change. Coordinate design, construction and maintenance in the very first design stages.

Five Principles of Ecological Science with Implications for Land Use

Bart Johnson, Janet Silbernagel, Mark Hostetler, April Mills, Forster Ndubisi, Edward Fife and MaryCarol Rossiter Hunter
Landscape Architecture and Ecology Professors
(Johnson, et al. 2002, p308)

1. Ecological processes occur within a temporal setting, and change over time is fundamental in analyzing the effects of land use.
2. Individual species and networks of interacting species have strong and far-reaching effects on ecological processes.
3. Each site or region has a unique suite of organisms and abiotic conditions that influence and constrain ecological processes.
4. Disturbances are important and ubiquitous ecological events whose effects may strongly influence population, community, and ecosystem dynamics in all places.
5. The size, shape, and spatial relationships of habitat patches on the landscape affect the structure and function of ecosystems.

Five Guiding Principles of Eco-Effectiveness

William McDonough, Architect and Michael Braungart, Chemist
(McDonough and Braungart 2002, pp181-86)

1. *Signal your intention.* Commit to a new paradigm, rather than to an incremental improvement of the old.
2. *Restore.* Strive for "good growth," not just economic growth.
3. *Be ready to innovate further.* No matter how good your product is, remember that perfection of an existing product is not necessarily the best investment one can make.
4. *Understand and prepare for the learning curve.* Recognize that change is difficult, messy, and takes extra materials and time. Retain the ability to adapt and innovate.
5. *Exert intergenerational responsibility.* Ask: How can we support and perpetuate the rights of all living things to share in a world of abundance? How can we love the children of all species – not just our own – for all time? Imagine what a world of prosperity and health in the future will look like, and begin designing for it right now.

Principles of Sustainable Architecture

Alanna Stang, Editor *I.D.* and Christopher Hawthorne, Architecture Critic
(Stang and Hawthorne 2005, pp12-13)

1. Build as small as possible.
2. Position buildings to take advantage of winter sun and summer shade.
3. Minimize damage to the plants, animals, soil, etc. already on site.
4. Build as close to public transportation, workplaces, schools, and/or shopping as realistically possible.
5. Recycle materials, even existing foundations and building shells.
6. Use wood that is sustainably managed and easily replenished.
7. Use materials that are low in embodied energy.
8. Take advantage of daylight to reduce electricity needs.
9. Water gardens or toilets with collected rainwater or treated gray water.
10. Utilize strategies that ensure a building's long life: comfortable, architecturally significant, adaptable to future uses.
11. Rely on natural ventilation for cooling rather than air-conditioning.
12. Install technology to the building to turn sunlight into electricity.
13. Promote good air quality and minimize chemical emissions from interior materials and finishes.

Five Principles of Ecological Design

Sim Van der Ryn, Architect and
Stuart Cowan, Ecological Designer
(Van der Ryn and Cowan 1996, pp54-57,82-83,103,146,160)

1. *Solutions grow from place.* Ecological design begins with intimate knowledge of a particular place.
2. *Ecological accounting informs design.* Ecological accounting traces the environmental impacts of existing and proposed design, and links our actions to the health of sometimes distant ecosystems.
3. *Design with nature.* By working with living processes, we respect the needs of all species while meeting our own. Engage in processes that regenerate rather than deplete.
4. *Everyone is a designer.* Listen to every voice in the design process, and honor the special knowledge that each person brings.
5. *Make nature visible.* Making natural cycles and processes visible brings the designed environment back to life. Effective design helps inform us of our place within nature.

A Conservation Credo

John Ormsbee Simonds, Landscape Architect and Environmental Planner
(Simonds 1998, pp377-78)

1. A long-term strategy for the wise and sustainable use, restoration, and replenishment of our natural resources
2. The preservation of our ecologic, historic, and scenic superlatives
3. Public access to beaches, shores, and open-space lands for compatible use and enjoyment
4. The provision of scenic parkways, hiking and biking trails, and cross-country greenway corridors
5. Controlled-access highways that sweep around, not through, plant and animal communities and human settlements
6. The logic of "carrying capacity" in land use management, rather than (superficial) area zoning
7. Communities fitted to and around the best features of the landscape
8. An end to urban sprawl and the scourge of scatteration
9. More compact and efficient cities and towns spaced out within a protected open-space frame of productive farmland, forest and nature preserves
10. The fostering through education of a caring concern for the well-being of planet Earth

Strategies for Regenerative Design

John Tillman Lyle, Landscape Architecture Professor
(Lyle 1994, pp37-45)

1. Let nature do the work.
2. Consider nature as both model and context.
3. Aggregate, not isolate.
4. Seek optimum levels for multiple functions, not the maximum or minimum level for any one.
5. Match technology to need.
6. Use information to replace power.
7. Provide multiple pathways.
8. Seek common solutions to disparate problems.
9. Manage storage as a key to sustainability.
10. Shape form to guide flow.
11. Shape form to manifest process.
12. Prioritize for sustainability.

Six Ways to Recognize the Sustainable Landscape

J. William Thompson, Editor *Landscape Architecture* and
Kim Sorvig, Architecture and Planning Professor
(Thompson and Sorvig 2000, pp19-20)

1. The sustainable landscape does not exclude human presence or even human engineering; however, it does not blindly glorify human intervention nor equate gentle human influence with massive human domination.
2. The sustainable landscape does not waste energy or resources on trying to disguise human influence. Rather, it eliminates influences that are destructive or disruptive. Other influences it reveals and even celebrates.
3. The sustainable landscape follows natural and regional form whenever this can improve the ecological functioning of a built or restored landscape.
4. The sustainable landscape integrates and balances human geometries with natural ones.
5. The sustainable landscape is unlikely to be dominated by the visually simple and near sterile extremes of urban or engineered space.
6. The appearance of the naturalistic landscape often contributes to the ecological function, but does not guarantee it. For this reason, neither naturalistic nor sustainable landscapes should ever be viewed as substitutes for wild places, which will remain critically important no matter how "ecological" built landscapes become – or appear.

Ten Measures of Sustainability

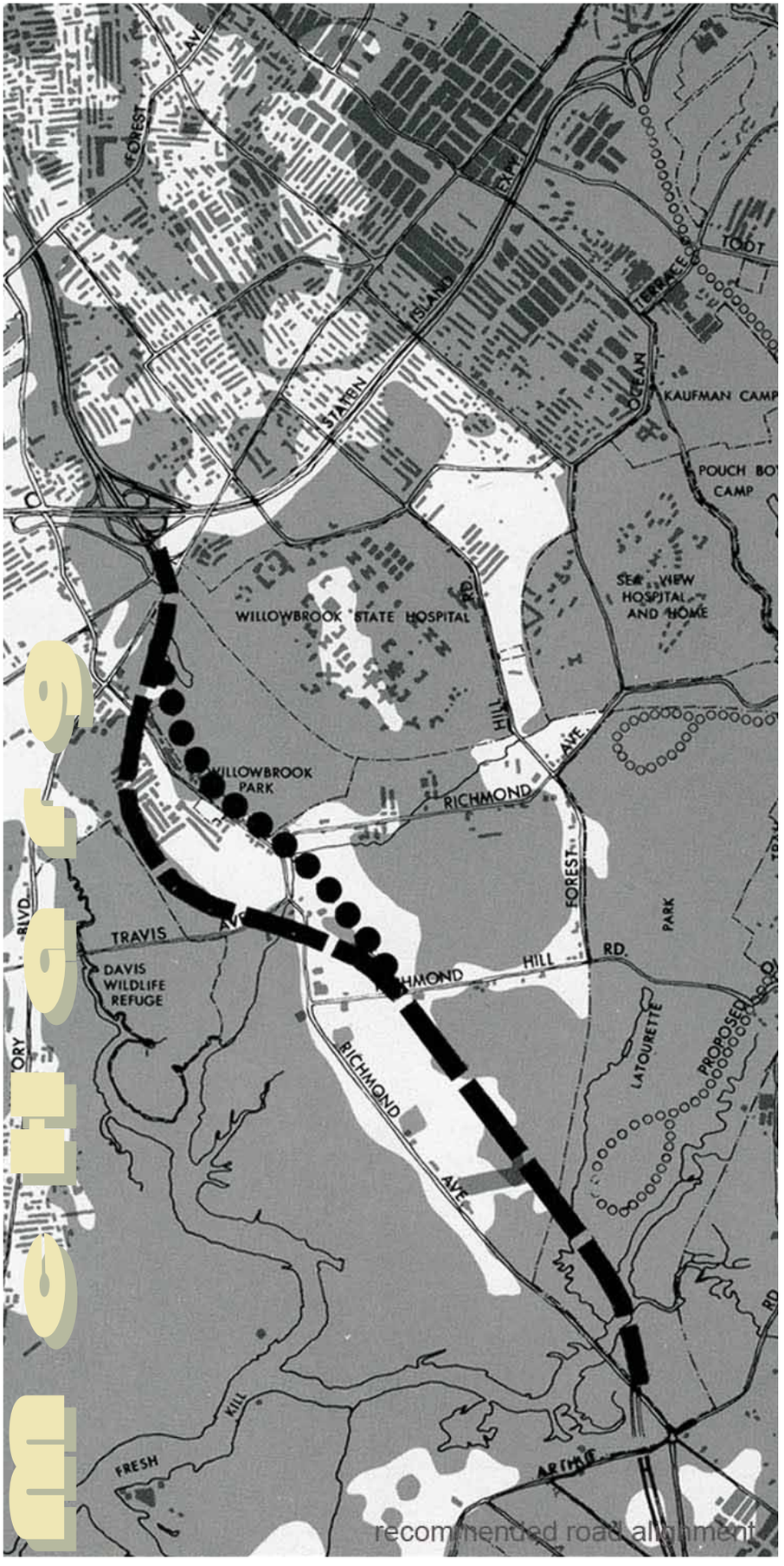
Committee on the Environment of the
American Institute of Architects
(COTE on the AIA website: www.aia.org/cote 2006)

1. *Sustainable design intent and innovation.* Sustainable design embraces the ecological, economic, and social circumstances of a project.
2. *Regional/Community design and connectivity.* Sustainable design recognizes the unique cultural and natural character of a given region.
3. *Land use and site ecology.* Sustainable design reveals how ecosystems can thrive in the presence of human development.
4. *Bioclimatic design.* Sustainable design conserves natural resources and maximizes human comfort through an intimate connection with the natural flows and cycles of the surrounding bioclimatic region.
5. *Light and air.* Sustainable design creates and maintains a comfortable interior environment while providing abundant daylight and fresh air.
6. *Water cycle.* Sustainable design recognizes water as an essential resource for all life on earth. Building and site strategies conserve water supplies, manage site water and drainage, capitalize on renewable sources, and/or reuse rainwater, gray water and/or wastewater.
7. *Energy flows and energy future.* Good design of building mechanical and electrical systems and integration of those systems with passive design strategies is essential for conserving natural resources and improving building performance. Sustainable design carefully considers the long-term impact of current decisions in order to protect quality of life in the future.
8. *Materials and construction.* The careful selection of materials and products can conserve resources, reduce impacts of harvesting, production and transportation, improve building performance, and enhance occupant health and comfort.
9. *Long life, loose fit.* Sustainable design seeks to maximize ecological, social, and economic value through long-term flexibility and adaptability.
10. *Collective wisdom and feedback loops.* Sustainable design recognizes that the most intelligent design strategies evolve over time through shared knowledge within a larger community.

Design Analyses

Presented here are brief analyses based on my observations of works by some acclaimed landscape architects, architects, and others from related fields, many of whom I consider among my "heroes." The projects I chose represent a range in intent, scope and scale, from philosophy and method to landscape typology and design element. Some of my observations are taken from firsthand experience of the place, others are taken from perspectives written by the designers or by other reputable reviewers.

I respect all of these works because the designers adhere to many of the ecological principles and environmental ethics that formed my ideas of responsible design. Therefore, my intent is not to *criticize* these thoughtful masters, but merely to reflect on some of the perceived outcomes of these projects, and compare and contrast that with what I consider ideal outcomes. In doing so, I am able to ponder how the biocentric landscape architect vision and normative ethics are, or might be, actualized.



Ian McHarg, Richmond Parkway and The Ecological View

Before there was GIS, there was landscape architect and environmental planner Ian McHarg's Ecological View, a method of using transparencies to delineate and map physical, biological *and social pro*cesses, important natural resources, and physiographic obstructions. McHarg's method compiled data "reflecting social, resource and aesthetic values" (where social values considered both social and natural processes) as an attempt "to reveal the least-social-cost areas for the placement of new and important social considerations." The goal was to maximize social benefit at the minimum social cost. McHarg consulted ecology's "diagnostic and prescriptive powers," as the basis of his method: "nature is interacting process, a seamless web, that it is responsive to laws, that it constitutes a value system with intrinsic opportunities and constraints to human use." (McHarg 1992, pp33-35)

For the Richmond Parkway in New York, McHarg delineated physiographic obstructions (slopes, surface and soil drainage, bedrock and soil foundations, susceptibility to erosion) and social values (tidal inundation, and land, historic, scenic, recreation, residential, water, forest, wildlife and institutional values) in order to recommend a new interstate highway alignment that would "avoid areas of high social costs, incur the least penalties in construction costs, and create new values." Creating new value was an important factor; McHarg's highway alignment would create "a delightful experience for the motorist, an added convenience to the traveler, and "a conscious public policy to create new and productive land uses at appropriate locations." (McHarg 1992, pp32,34-35,36-39)

Ideals Discovered

Consideration for natural processes and nonanthropocentric interests and needs

Philosophically driven land planning and design

Goal of a healthy, mutually beneficial human–nature relationship

Extensive ecological research and analyses

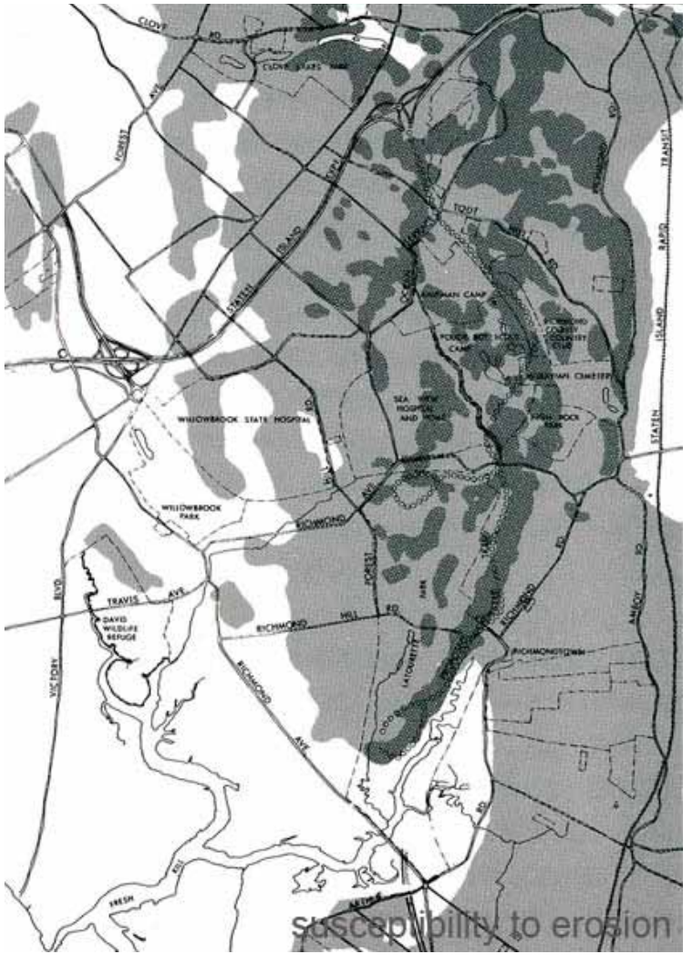
Strong leadership exhibited throughout project

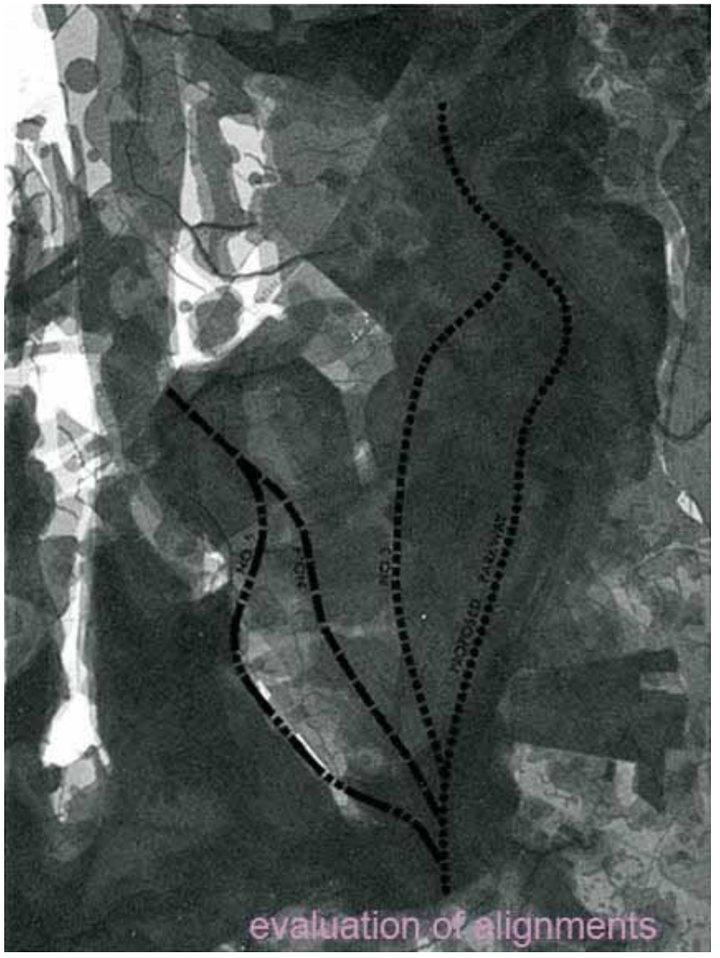
Clearly defined project objectives

Willingness to embrace concepts and conditions that could fall beyond the scope of traditional landscape architecture

Visionary and clearly a contribution to the idea of Mugeraurer's "shake up"

Values education as an important part of design process





Gaps: Value Judgments

As it turns out, much of my ideal design approach exists in the pages of McHarg's *Design with Nature*. Finding gaps with this classic text proved difficult. However, from a biocentric perspective, a couple of concerns come to mind.

Having worked with GIS, which is based on McHarg's Ecological View method of compiling data on features of a landscape, I know that the results of an analysis depend on the data available or collected. Just as any funded research or statistics can be skewed to favor a desired outcome, so too can McHarg's type of analysis. Therefore, the goals and scope of the project must be determined and understood by all teammates before data collection begins. Appropriate categories and values within the categories must be determined objectively and agreed upon. The ranking of the values can be contentious, so the process requires considerable organization, transparency, strong leadership with long-term guidance, commitment and constancy, and ample time for gathering, compiling and analyzing data. This can be extremely time consuming, and considering that the appropriate data required will be dictated by each project's goals and objectives, research should, theoretically, be unique to each project.

McHarg experienced problems in data collection for the Richmond Parkway: data can be hastily assembled; social value can be overly influenced by residential value (i.e., land and building values) and can give too high social value to the wealthy and too little value to the poor; data can be classed into too few categories, excluding the variety of conditions which truly exist in a community or landscape; important distinctions and conditions can be neglected and omitted altogether (1992, p35).

Finally, though it was important to McHarg that his recommendation for the highway alignment added value, all the added values were strictly anthropocentric (convenience, economic, scenic). While animals in the adjacent wildlife refuge have little use for a road, could there be any added values for nonanthropocentric interests? Could the highway make some greater ecological contribution?

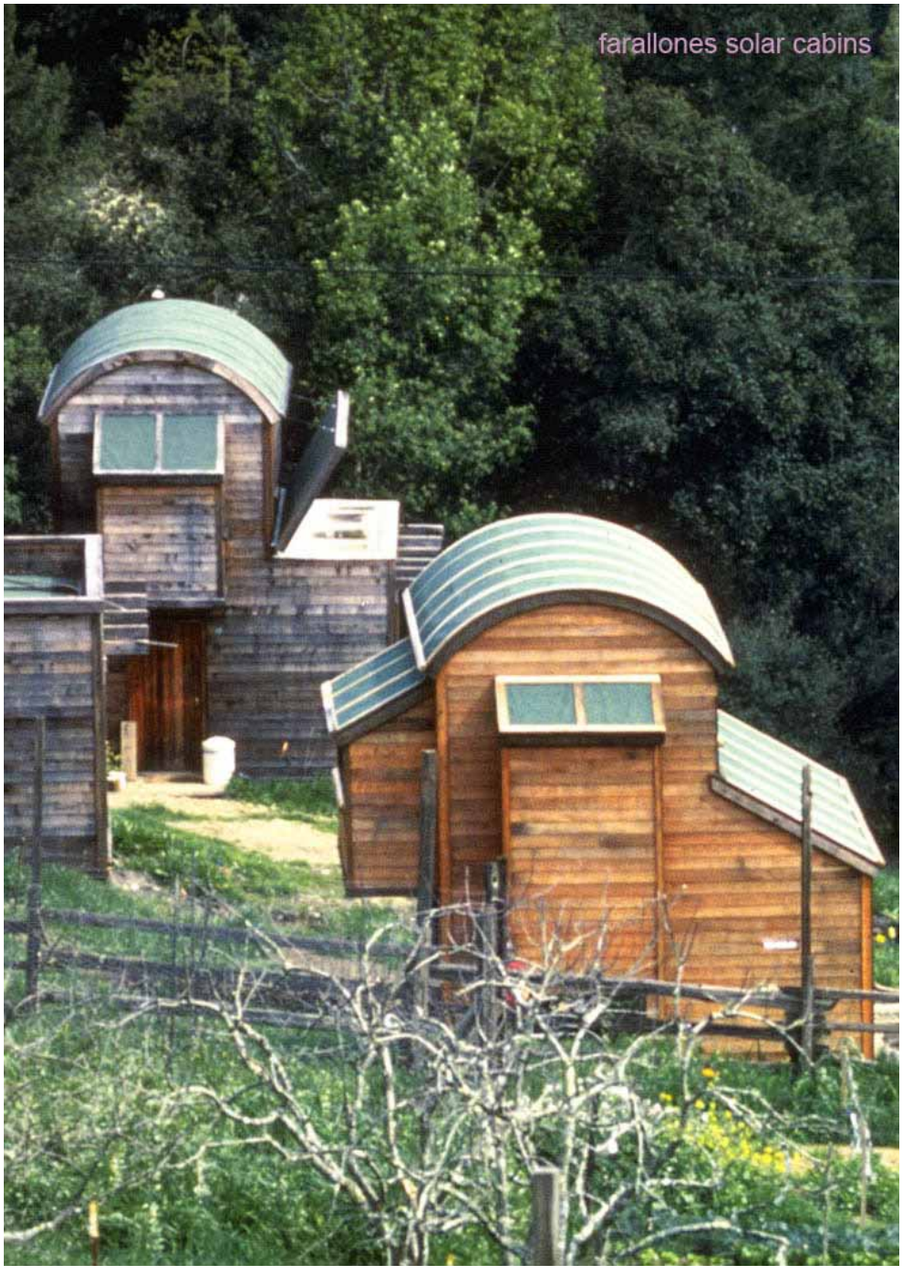
Images: McHarg 1992, pp36,41

Sim Van der Ryn, Farallones Rural Center/ Occidental Arts and Ecology Center

In the 1970s, architect Sim Van der Ryn was among the founders of the Farallones Rural Center, a rural village and experimental school for ecological design. Situated on an 80-acre family-owned ranch in Northern California, the center's purpose was to "design, teach and build a center that demonstrated more environmentally friendly designs for rural living, integrating shelter, food, energy, water, and waste systems." Drawing on the founders' expertise, the school offered hands-on instruction in building design and construction, farming (small livestock) and gardening, energy systems, ecosystem management, and community living skills. (Van der Ryn 2005, pp52-53)

In the late 1980s, the center struggled financially, and quickly recognized its biggest attraction was the garden created as a food source for the village/school, and used to teach intensive high-yield, low maintenance agricultural techniques. Eventually, a small group of friends purchased the center and created its current life as the nonprofit Occidental Arts and Ecology Center (OAEC). (Van der Ryn 2005, pp56-57)

Today, the garden has been expanded to approximately 10 acres and is one of the most acclaimed organic flower and vegetable gardens in Northern California. An extensive permaculture educational program and art classes and workshops have replaced the architectural course offerings. The Center has been expanded as a retreat with overnight lodging for area businesses and organizations. Other added amenities include orchards, hiking trails with many quiet places for reflection and meditation, designated camping areas, a swimming pond, and an outdoor theater. (oaec.org 2006)




monitoring solar performance in the early years

Gaps: Permaculture's Biodiversity, for Our Purposes

Today, permaculture is a major foundation of the OAEC, and it underlies the center's philosophy, techniques, and teachings. Permaculture, a term coined by naturalist and forester Bill Mollison as a contraction of "permanent culture" and "permanent agriculture," is "a set of techniques and principles for designing sustainable human settlements. The aim is to create ecologically sound, economically prosperous human communities." (Hemenway 2001, pp4-5) As far as an environmentally friendly gardening technique and a demonstration in self-reliance and less consumption, permaculture is, in my opinion, ecologically viable. However, when permaculture is considered as a panacea, as the ultimate form of ecological design that "represents the only long-term hope for humanity"* (Hemenway 2001, pxii), then I believe permaculture severely lacks ecological integrity.

It is clearly anthropocentric, and maintains a constant assumption in favor of humans. While permaculture does offer benefits to nature, the benefits are reserved for "useful" nature, making it guilty of speciesism. Per permaculture's terms, "biodiversity means having a semi-wild but well-designed palette of useful plants that will attract and sustain the helpful insects, birds and other animals we need." (Hemenway 2001, p21) Permaculture is said to create a "cultivated ecology" (oaec.org 2006), but seems to me as a selective ecology: it often overlooks the ecological order that may already exist on a site; it mostly is concerned with a short evolutionary time span; the garden can demand additional, sometimes extensive landscape modifications for support; true biodiversity and ecological processes are likely to be stunted; it attempts to "decode the language of natural systems" in order to select and mimic the systems which best serve humanity, potentially at the expense of the ecosystem as a whole. While permaculture provides environmentally sound solutions for gardening, it cannot be an all-encompassing ecological design solution.

Images: Van der Ryn 2005, pp55,56

Ideals Discovered

An emphasis on education

Exploring ecologically appropriate technology

Organic gardening without herbicides and pesticides

Modest architecture that relies on renewable energy

Operates according to a pervasive environmental philosophy

Demonstrates living lightly on the earth by using and consuming fewer resources

Restoration efforts for the wildlands

* As quoted from Dr. John Todd's introduction in *Gaia's Garden: A Guide to Home-Scale Permaculture.* Todd is the renowned founder and/or president of a number of environmentally based businesses and nonprofit organizations, a distinguished lecturer, and inventor.

Frank Lloyd Wright, Taliesin West

The year was 1937; a 70-year-old Frank Lloyd Wright had suffered a terrible bout of pneumonia and was instructed by his physician to endure no more Wisconsin winters. For the coldest months, Wright retreated to the Arizona desert, a challenging, captivating landscape which had grasped his enthusiasm years earlier while working on the Arizona Biltmore. This time, with his health as the impetus, Wright approached the desert with a new vision: to create a winter home and studio that would "marry the ephemeral character of [his previous temporary camp in Arizona] with the eternity of the pyramids." (Hildebrand 1991, p106)

Constructed of modest materials (a vast tent of redwood and canvas atop a substructure of concrete-held boulders), Taliesin West paid homage to the difficult terrain. "The desert, in its harsh aridity, is also imbued with hazard, and is immediately and intuitively understood to be so," (Hildebrand 1991, p108). This notion is reflected in the central wood-frame pergola, which "gently suggests a tenuous refuge," (Hildebrand 1991, p110) as it directs breezes toward the shaded entrance.

Over the years, both during Wright's lifetime and after, Taliesin West has undergone modification and expansion from the original design to accommodate changing circumstances. Today, more than 60 people live at Taliesin West, some of which, along with other employees, remain year round. The 550-acre site, which lies along the foothills of the McDowell Mountains, is now home to The Frank Lloyd Wright Foundation and Archives, the Taliesin Fellowship, the Taliesin Architects, and serves as a campus and residential community for the FLW School of Architecture. In the near future, it is expected to become a national park. As such, Taliesin West is "far more accessible to the public than it was in its early years." Resident apprentices' "private space" has always ranged from small tents and simple shelters with few amenities, to small apartments with modest kitchens and bathrooms. Some Fellowship members in more recent time have "elected to build individual homes located at varying distances from the main complex of buildings." (FLW Foundation 2003, pp7,11,14)

Although the FLW Foundation is committed to preserving the integrity of the original design, the "ephemeral" characteristics of Wright's original "tent-dream" (Hildebrand 1991, p114) have been maintained with more permanent materials and systems. Steel beam construction replaces the redwood (which warped in the extreme desert heat). Translucent plastics and fiberglass panels replace canvas roof panels, while glass windows replace side canvas flaps. Added pools, fountains and green gardens reinforce the idea of *desert refuge*. The site's electrical,

sewage and water facilities, originally built to serve about 50 partial-year residents, have been updated, yet remain overwhelmed as the number of visitors tops over 120,000 annually (FLW Foundation 2003, p9).

Now, nearly 70 years since its inception, Taliesin West still quietly sits among the Sonoran desert flora and fauna, in the shadows of stone-shielded mountain peaks and atop the bustling resort city of Scottsdale. Considered one of Wright's greatest achievements and one of the world's great architectural masterpieces (FLW Foundation 2003, p4), it stands as exemplary study of the dramatic interplay between vision and intent, and growth, flux and longevity.

visual relief: pool and ornamental gardens

modest housing: shelters and tents

a captivating though harsh terrain

Ideals Discovered

Design poetic in its symbolism and function as refuge in the harsh desert

Highly aesthetic with intuitive sense of place

An initial climate-appropriate use that responded to environment's extremes

Essential wildlife preserve

Shared use of compact space by multiple entities

Commitment to education and promotion of architectural principles

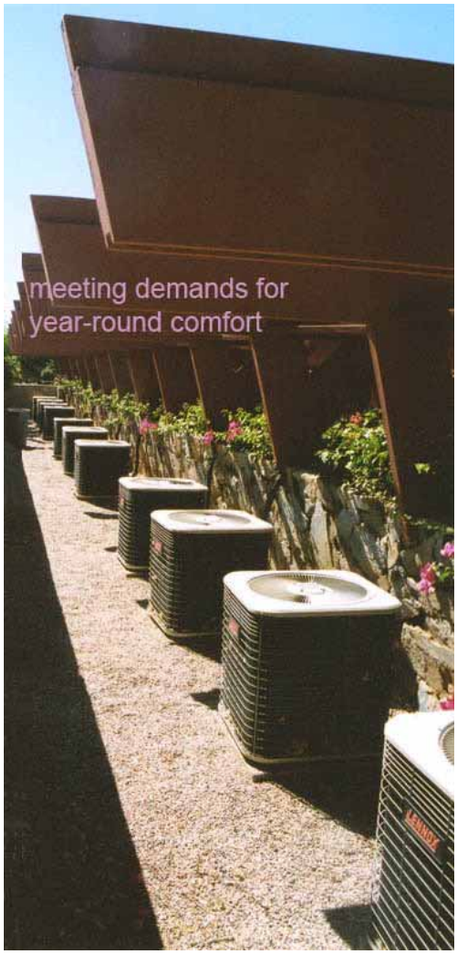
Value of on-site residents and governing board as stewards and sentinels

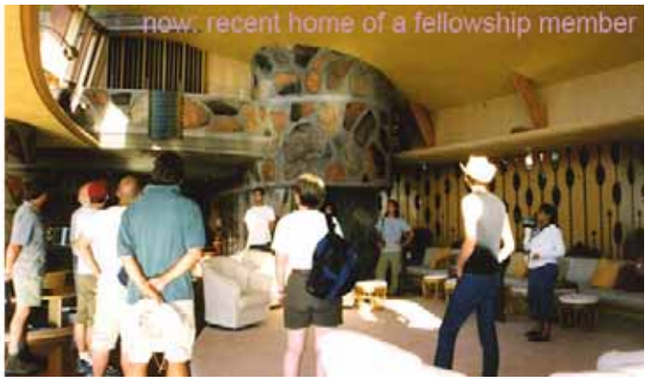
Humble and humbling

Simple, ephemeral apprentice shelters

Original local construction materials

On-site wetlands wastewater treatment





Gaps: Stasis in Policy, not Place

In the 1930s Scottsdale, Arizona was a simple crossroads in a vast desert terrain. Today it is a sprawling city whose boundaries push hard against the outer edges of Taliesin West. Signs designating the property as a wildlife preserve adorn the entry drive, for as the surrounding desert is swallowed by golf courses, retail strips and manicured lawns, wildlife increasingly depends on open spaces such as this.

Wright intended, designed and built his camp for limited part-year use only, and as such could achieve a desired level of ephemeron. In this way, there was an acknowledgment of man's limits in this environment, though Wright masterfully pushed those limits. His modest touch sat lightly and compactly on the expansive landscape – wildlife was a welcome neighbor, and man was nature's gracious guest.

Today, structures at Taliesin West are built or renovated for durability and permanence, some utilizing exotic materials from around the globe. Extensive climate-control facilities (air conditioning and electricity) have been installed for year-round living. Pools and ornamental, non-xeric gardens tap precious water supplies. Simple roadways crisscross the Taliesin property as more individual homes are built away from the complex, disrupting the desert ecology and wildlife, and destroying the desert floor's delicate water-collecting fungal layer.

While Wright himself spent years modifying and expanding his creation, I can't help but wonder what he would think of the changes in policies, the move away from the ephemeral toward conquered nature and human permanence. This raises questions for me about respecting original intent amid growth and changed expectations.

Taliesin West aside, this makes me wonder how ecological planning and design philosophies, intentions and purposes can be carried out into the future. As development pressures bear down, how can landscapes remain protected in perpetuity? Some type of guidelines or rules for maintenance and foreseeable growth are needed, but how can their enforcement be guaranteed? Taliesin's architects and apprentices are proud of and diligent to uphold the traditions that have been handed down, but in how many generations removed will those traditions be relaxed? I wonder, once ecological principles and policies are established, how can *they* be maintained, instead of static anthropocentric interests?

Image: Cerver 2000, p248

Andy Goldsworthy, Storm King Wall

Goldsworthy created a stone wall sculpture that seems to assemble itself from a river's strewn rubble deep in the forest, weaves between an emergent tree line, dips into an old farm pond, reemerges on the other side as a straight line occasionally pierced with open gates, then terminates short of a busy highway in Mountainville, New York. According to Goldsworthy, "the wall is a line in sympathy with the place through which it travels;" it is a dialog between the past and the present, between the old farm wall and the forest that reclaims the field. "Its sense of movement and rhythm is the passage of people that traveled from Europe to [America]; the movement of the river of stone that wraps in and out of the trees; the movement of the river of growth that is the forest. We are made aware of the flow around the world, of the veins that run around the world." (Goldsworthy 2004)

Goldsworthy's art speaks of a collaborative relationship between nature and man, not a human-dominated one. He often sets up "perplexities" in natural landscapes – in the form of art built of the natural elements of the place (stones, leaves, logs, ice, soil) – that make the viewer ponder "the dichotomy between or perception of nature and the use we make of it. Man constructs limits, separating the things which appear to have none." Storm King Wall expresses the artist's concern about the ownership of the land and its division: "the absurdity of marking out limits in a forest, drawing out lines to separate in two, the perplexity of coming up against a wall in the middle of the woods." (Cerver 2000, p249)

Gaps: Features not Functions

While Goldsworthy's art speaks of certain ecological processes and the human–nature relationship, its strongest attribute is more as an influential art feature rather than a provider of ecological function. Though his art does no harm to the environment, neither does it offer direct, immediate healing (with rare exception); this is particularly true of his ephemeral works. As such, his art exists primarily for humans.

Ideals Discovered

Modest or no alteration of environment

Restorative (occasionally)

Welcomes time and change

Spiritual qualities

Communicates a story about man and nature

Reflective

Simple, temporary to semi-permanent construction

Local materials

Contributes an understanding of ecological processes

Inspirational

Landscape Typology: Wetlands Mitigation Bank

To stand in the middle of a vast wetland, surrounded by unique vegetation, brightly colored birds, unusual sounds emitted from secret places, and the rich, earthen smells of moist soil is to stand among the heart of nature. Once considered cursed wastelands by our forefathers, wetlands are now revered by many as sacred nature reserves.

Wetlands mitigation banks serve an important function in urbanizing areas – they "collect" smaller wetlands that are lost to development, and amplify their functionality. Under the United States' No Net Loss policy, compensation for disturbed wetlands must be made on-site or elsewhere. However, "compensation" does not necessarily mean square-footage replacement; it means the replacement of wetland function and value. Compensation can be made in several forms: as on-site created wetlands, stream preservation with wetland buffers, conservation easements, in-lieu fees, or as credits purchased in mitigation banks.

Because wetland mitigation banks operate on a purchased-credit basis, they very much are investments. Mitigation Bank Review Teams establish standards to measure the successful establishment and functioning of the wetland bank, with built-in financial incentives (more financing made available) paid as benchmarks are reached. Therefore, steps are taken by wetlands mitigation bank designers and managers to safeguard against failure.

Ideals Discovered

Ecological benefits abound in large created wetlands that small, scattered wetlands cannot provide

Because of their size, wetland banks offer protected habitat and breeding grounds (especially important to endangered species), water purification, water storage, and significant biodiversity

Secure in their long-term existence because they are financed and monitored

Create one easily managed area, rather than many that could be overlooked

Ensures wetland mitigation actually occurs

Compensation made in advance of the actual loss of a wetland

Designed, monitored and managed by experienced professionals

Likely to be cherished by stakeholders and visitors

Provide educational and inspirational experiences


infrastructure: girdling guy wire


infrastructure: water monitoring wells


infrastrcture: culverts


infrastructure: paths


infrastrcture: clemson water leveler


wetland function and value

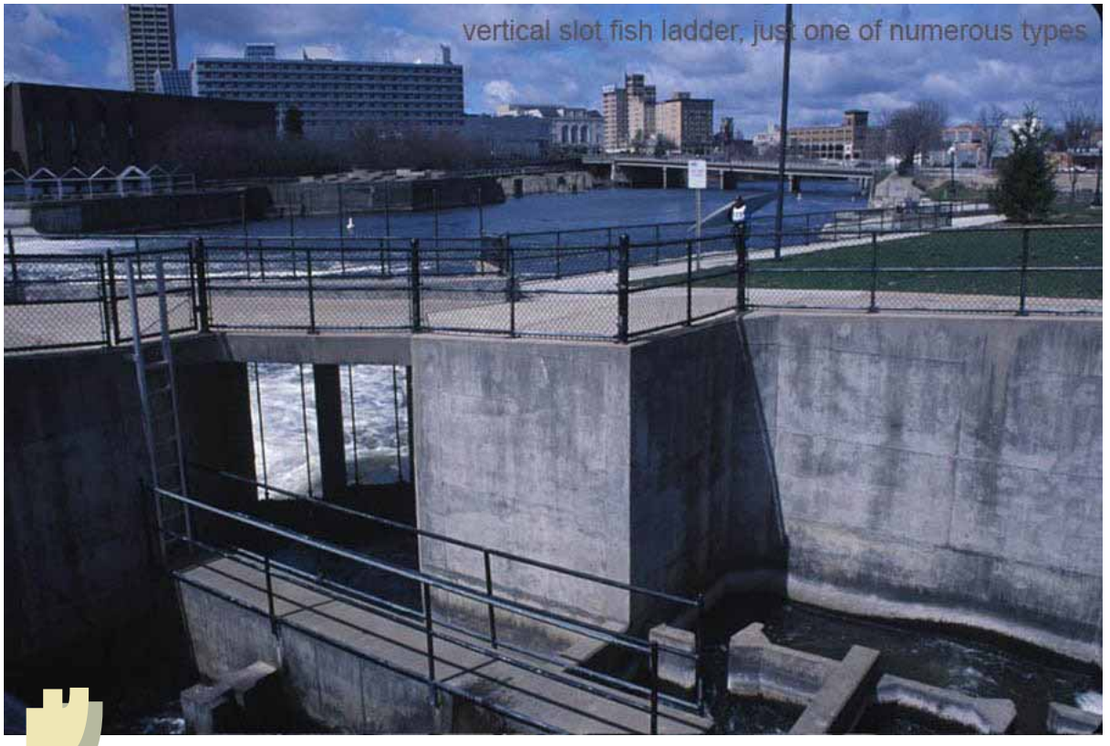
Gaps: Managed Nature

When I stood in the middle of a wetlands mitigation bank, I saw the vegetation and birds, heard the mysterious sounds and smelled the earth. But I also saw the devices and infrastructure installed in order to safeguard the establishing man-made ecosystem. From forgotten stakes and guys that still support maturing trees, to electronic monitoring wells, water levelers, weirs, culverts, pipes, slide gates, riprap, gabions, deep excavations, filter fabric, outlets and routine use of pesticides and herbicides, I was surprised to find a complex artificial life-support system in place. Understanding that these systems and precautions are necessary to ensure the mitigation bank's health, survival and protection against disease, pest, natural disturbance, modification of off-site conditions, or other uncontrollable alterations, I still felt a bit duped.

To think that this vast manufactured wetland represents a diverse array of smaller, once-intact wetlands that have been destroyed – valuable ecosystems that developed and evolved over many years, ecosystems that other species relied on, that supported successive plant growth, perhaps a different type of hydrology and overall evolution on the original site – I cannot help but sense a loss for ecology. Although legal compensation has been made, can original function truly be replaced? Can human-engineered and maintained ecological systems substitute for those which had naturally evolved over so many years?

Perhaps the question comes down to the ecosystem's ability to sustain itself. The original wetlands were self sustaining. The wetlands bank, and its hydrologic infrastructure, is required to be monitored and managed for 10 years; beyond that the system will either sustain itself, it will require ongoing human input, or it will be abandoned. Either way, the original wetland and the on-site functions it performed are gone. Those functions, at least in theory, have been transferred to the mitigation bank where they are monitored, measured and protected in a sort of quasi-stasis inside a highly specialized and maintained incubator. But if ecological services are effectively being performed, is managed nature just as good as, maybe even better than, evolved nature? The new ecosystem's ability to perform those services independent of human input is key.

Photos are of the Julie J. Metz Wetlands Bank (227 acres), the first wetlands bank in Northern Virginia approved by the US Army Corps of Engineers.



Photos: Courtesy of U.S. Geological Survey

Environmental System: Fish Ladder

This country's waterways are full of dams. The US Army Corps of Engineers "has catalogued approximately 75,000 dams greater than six feet tall … [additionally,] tens of thousands smaller dams also plug our rivers. The National Research Council estimates that the number of US dams is over 2.5 million." One former Secretary of the Interior put these numbers into perspective: "We have been building, on average, one large dam a day, every single day, since the Declaration of Independence." (Maclin and Sicchio 1999, pvii)

For centuries, these dams have provided Americans with hydropower, irrigation, flood protection, navigation, transportation, municipal water supplies, and recreation, but at a price to the environment. Negative impacts include, but are not limited to, altering a river or stream's physical, chemical and biological processes, affecting fish and wildlife migration, reproduction and habitat, hindering the flow of nutrients and sediments, changing water temperatures and oxygen levels, and threatening the health of ecosystems. (Maclin and Sicchio 1999, ppix-xiv)

Restoring health to waterways through the removal of abandoned dams is an option that is gaining widespread support in this country, as well as in other parts of the world. But not all dams can be removed. One alarming affect these dams continue to have on the environment is the population decline of anadromous fish species, those that would migrate miles upstream to spawn if barriers did not prevent them from doing so.

To help these fish species overcome obstacles and complete their reproduction cycles, fish ladders are sometimes an option. Installed in waterways and ranging from simple rock clusters to elaborately engineered concrete and metal, water-filled and flow-controlled mazes, these environmental systems enable fish to swim around, over or through the blockage. With names such as rock-ramp, step-pool, vertical-slot, denil, and locks-and-elevators, one can get a sense of the variety of these systems, and the varying environmental and societal conditions and circumstances to which they respond.

Ideals Discovered

Recognition of environmental hazards and application of corrective action

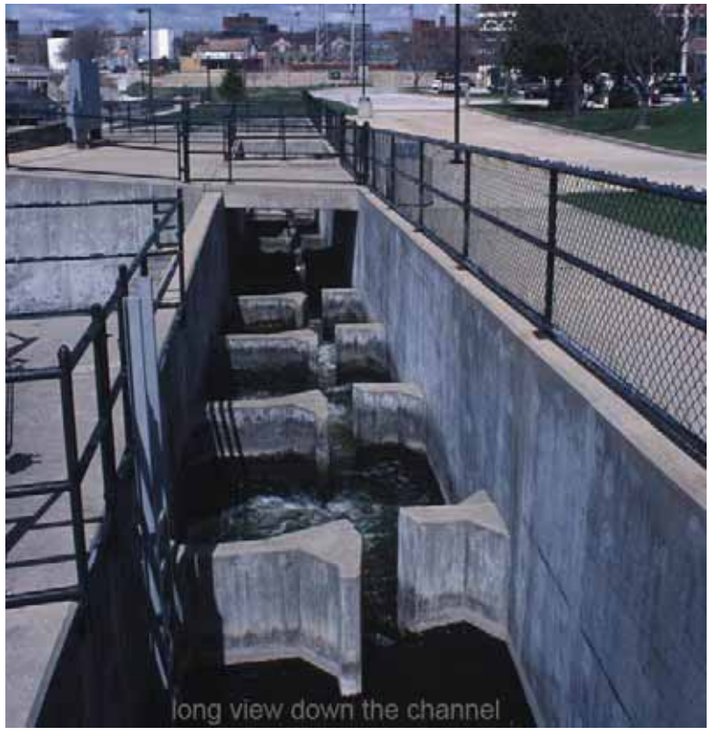
Biocentrically focused environmental system designed and built for non-humans

Unique design for specific conditions at each location

Protects fish from predators and over-exertion

Cameras can be installed for human viewing and education

Some non-native species can be cordoned off and removed from the migration route



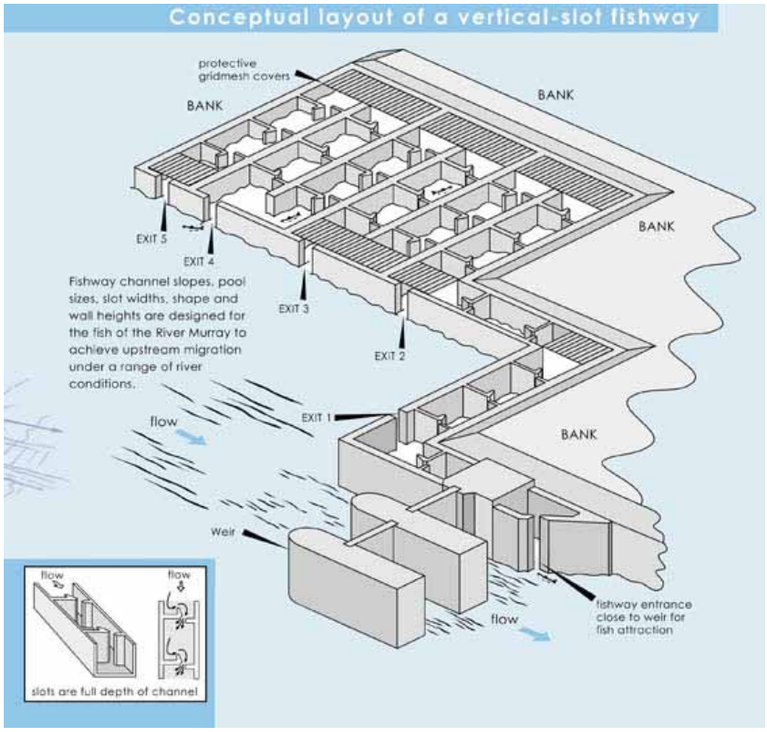


Diagram: Murray-Darling Basin Commission 2003, p3

Gaps: Impacts Made, Impacts Missed

I applaud municipalities, engineers, wildlife managers and environmentalists for their work in saving fish. I can only imagine the jeers and criticism they endure from irate taxpayers who see little value in going to such extremes for a few fish. As much as I personally want to embrace the benefits of fish ladders, the biocentric perspective recognizes flaws and shortcomings, and understands that more appropriate solutions must be explored.

For one, fish ladders are designed to meet the needs of specific, preferred fish species – they epitomize speciesism. The needs of other fish species and non-finfish species are typically overlooked. Examples include the need for lower velocity flows, less turbulence, suitable climbing surfaces, access to stream bank environments, parasitic transportation on species for which the ladder was not designed, ladder slots and channels large enough for safe passage, and less artificial lighting, particularly at night (Meehan 2003, pp5-15). Furthermore, improved sediment and nutrient flows often go unaddressed.

Two, I previously noted a caution about relying on new technology to solve environmental problems caused by old technology. When fish ladders are installed widespread without significant comprehension of or consideration toward potential new ecological impacts, additional issues could be set in motion, ultimately undermining the possibility of more appropriate environmental solutions. For example, if fish ladders allow safe passage for certain fish species, but not the invertebrates on which the fry feed, a sustainable food supply will not exist for the newly restored fish population. Commitment for restoration could wane as new ecological impacts are translated into ongoing costs to the community.

Three, fish ladders typically lack aesthetic design integrity. Now, I recognize that they are built solely for the use of non-humans and, per the biocentric perspective, there is no need for direct human benefit (although humans usually benefit economically from them). But ladders are not sustainable, maintenance free systems; they require regular human input, and they utilize materials of significant embodied energy – concrete and metal. And though they provide some educational opportunity, it is rather limited. Once the structures and concepts are grasped, there is little to ponder, little left for the imagination, little new to experience. They are mechanical, most people would agree they are not spiritual in the least. Fish ladders merely become accepted as another form of our infrastructure.

My call for aesthetic design drives to the heart of the human–nature interaction: just because these structures are not directly *for* humans, they are a human creation which becomes part of the fabric of both nature and human society. Aesthetic design would serve both communities by primarily addressing the ladders' ecological shortcomings, while also creating educational and experiential opportunities that would be carried forth as important lessons in ecology, increasing awareness, providing inspiration, and raising the human conscience.

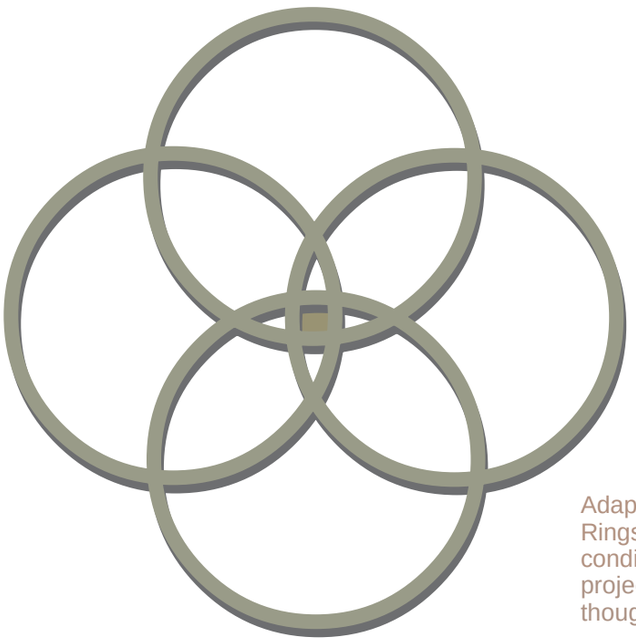
The Reconnect: Actualized and Emerging

Though I have not yet found a single design example that parallels my ideals of a biocentric landscape architecture, I am convinced that a better way, indeed, exists. Actually, I believe it to still be emerging, coalescing.

Many have been at the table far longer than I; I am merely stepping up to it. Through some of their projects I found bits of "reconnective design" that a would-be biocentric landscape architect could hold up as shining examples of how design can be more harmonious with, even beneficial to the environment. While those I analyzed represent only a small segment of ecological design – there are many other designers, built and conceptual works, and realms of what is ecological – I sense that those who are interested in design integrity and aesthetics have a predominant disposition toward the anthropocentric; those who promote wildlife and biological integrity fail to recognize the important contributions of design integrity. None of the above analyses revealed what I seek most: examples where both are embraced, with particular benefits for nonhumans.

I purposefully omitted economic considerations from this discussion – it is far easier to evaluate outcomes and ecologic principles when unburdened by financial realities. Undoubtedly, economics factor into the execution of every project, and not all dreams can be attained, especially not at one time. Project management is the precious link between vision and sustained application. Sometimes that requires prioritizing, negotiating and modifying without compromising. Perhaps the design philosophy of landscape architecture and planning firm Design Workshop best reflects this reality. Represented by four interlocking rings, their high ideals are environment, economics, art and community. While some projects may place greater emphasis on one or more of the ideals, the goal is to hit the center where all ideals overlap. It is when all four are "combined in harmony with the dictates of the land and the needs of society, magical places result – sustainable places … that lift the spirit." Those they call legacy projects. (www.designworkshop.com/design-philosophy).

Maybe the best the biocentric landscape architect can hope for is to keep the vision and adhere to ***many*** ideals ***most*** of the time. By pooling the knowledge and experience of and collaborating with other disciplines, perhaps ***most*** of my ideals can be realized ***all*** of the time. And while it may be rare that I achieve ***all*** my ideals in a single project, I am going to have a lot of fun trying.



Adaptation of Design Workshop "Legacy Rings." Each ring represents an ideal condition to be attained. Strive to create projects with all ideals represented, as though all rings overlap.

Part 3: Biocentric Design Studio

Theories are not created to be static notions resting on pages of books. They are intended as guides or inspiration, intended to breathe dynamic life into discussions and actions, they may be tested, challenged, strengthened. When Aldo Leopold wrote the Land Ethic, he wrote his guiding thoughts to not only right the wrongs he felt he had committed, but also to change wildlife management practices to be more ecologically sustainable. He wrote the Land Ethic to challenge and influence the thoughts of others. Consequently, Leopold's theory has successfully been applied and tested by wildlife managers for nearly 60 years.

Applying a deeply revered theory to design has produced some of our most powerful works. The pyramids and ziggurats were designed to honor the gods and the heavenward ascension of royalty. Great works of Renaissance art, literature, architecture and landscape sprang from religious beliefs and theories regarding man's place in the world. The designers of the United States Constitution believed democracy and freedom were the cornerstones of a great society. Arts of the modern era reflect diverse theories about humanity, politics, power, technology, and the environment.

Putting theory into practice is perhaps the most satisfying means to communicate ideals. Design adds a dimension of emotion, beauty, experience, and a show-me sensibility. Therefore, in Part 3 my ideals are tested as I attempt to unite design integrity with ecological stewardship, **the hopeful result being a public landscape that actually benefits the natural world**.

Review: Ethic for Biocentric Landscape Architecture

From theoretical ideals, we develop ethical strategies by which we hold ourselves accountable. For me, personal design ethic is as important a design resource as one's experience, skill and knowledge. Ethic defines the designer's style, provides the basis for design decisions, makes work substantial and not arbitrary, and is the constant that runs through one's entire body of work – design and beyond. I believe designers owe it to themselves to establish their personal ethic rather than adapt to an incompatible ethic of another.

In the section, *The Reconnect Envisioned*, I gained insight from a number of environmental theories and ethics, and created a list of design implications (normative ethics) for the biocentric landscape architect. For review, that list includes:

- Gain an understanding of ecology to include the flux of nature, biotic–abiotic interdependencies, temporal and spatial scales, and patch and landscape dynamics.
- Collaborate with professionals who can predict natural disturbance probability and assess tolerance of anthropogenic disturbance.
- Plan and design within the limits of this knowledge.
- Embrace the empowerment of voice and assume a stance of leadership to help others work within ecological bounds.
- Persuade and educate via the most appropriate medium of all: the land itself. Utilize the tools of story, poetry and ritual, and the ability to challenge views of reality to communicate essential ideals.
- Avoid misanthropic attitudes and overly mystical solutions.
- Strive for truly democratic and confederal land plans and designs at all scales.
- Analyze ecological and social conditions and challenges.
- Participate in and present timely and visible solutions.
- Design to spark the human spirit and direct it toward ecological issues.
- Design to uniquely touch and educate people.

Furthermore, I suggest it is the vision of the biocentric landscape architect to ensure that the built landscape is ecologically benign, holistically functional, and culturally significant. This vision can be attained through commitment to three basic tenets:

- Understand the ways of the earth.
- Develop and promote sustainable patterns and practices that are harmonious with the interests of the biotic-abiotic community.
- Address and/or confront anthropocentric assumptions and attitudes, and assess the justness of social and environmental mores. Where necessary, invoke the sensitivities of heart and mind to inspire change.

With this theory and these ethics as my compass, I present my studio work in four sections: Project Strategy (goals, description and objectives); The Site (selection, background and program); Research and Analysis; and Concepts and Design. A discussion of my findings and design criteria follows this presentation, and brings this thesis to a close.

PROJECT STRATEGY

Project Goals

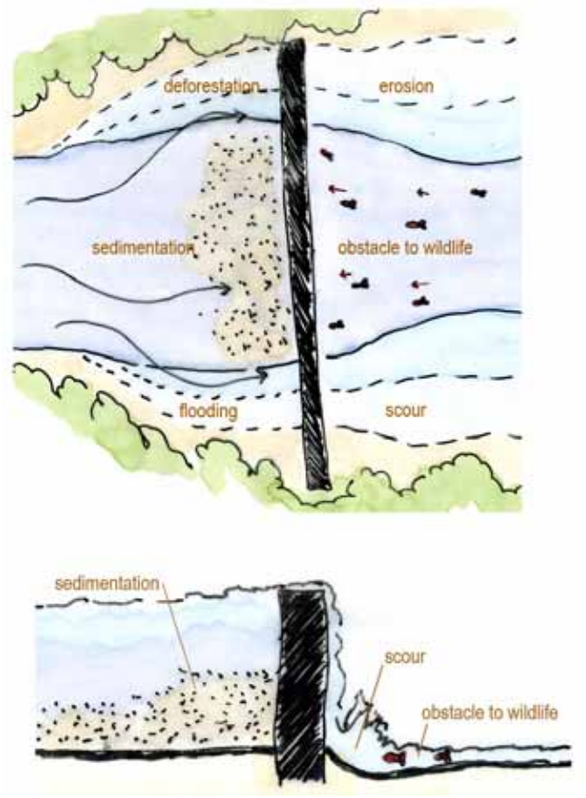
Through studio work, I apply certain aspects of environmental theories to landscape design while adhering to a specific design ethic. Through design, I will:

- Determine criteria and methods of land planning and design that will produce a public landscape in harmony with and attentive to natural processes;
- Explore the restoration, protection and/or maintenance of a healthy, functioning ecosystem while creating a dynamic place which teaches of ecological systems; and
- Delineate the decision-making process of a biocentric landscape architect.

Project Description

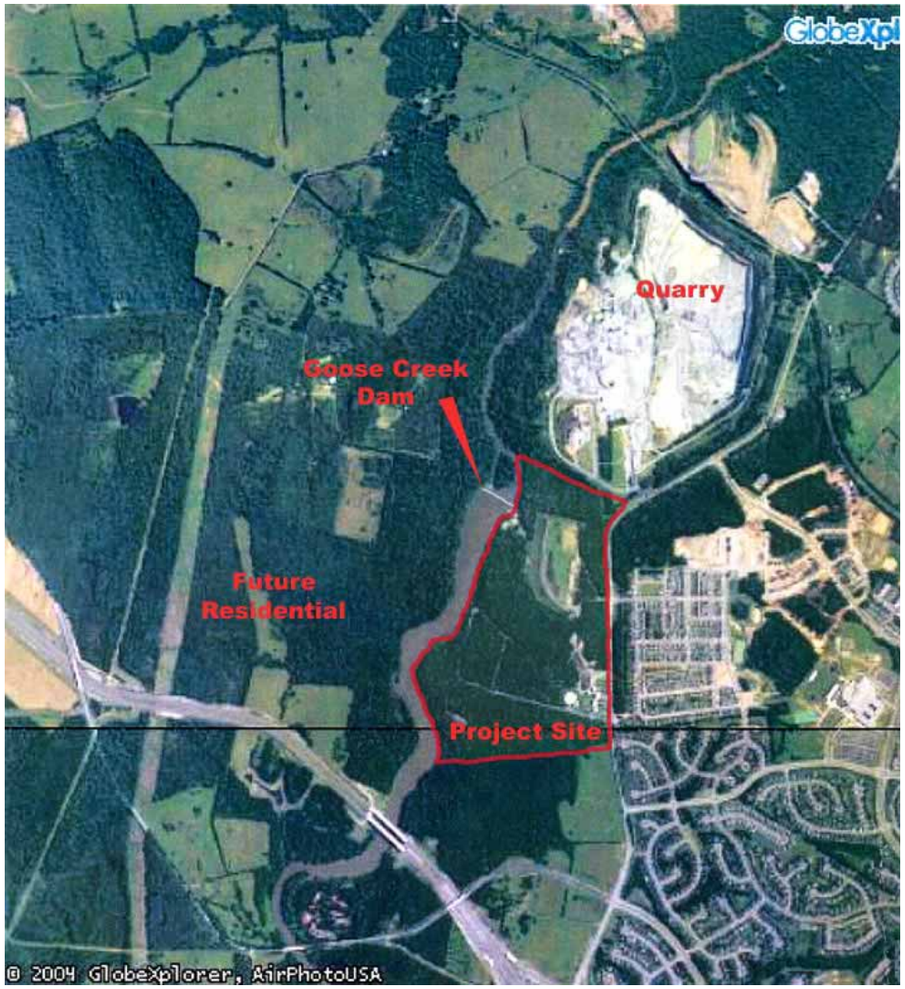
For me, engineered structures uniquely represent man's interaction with nature. A society's understanding of and attitudes toward ecology, as well as how it defines and fulfills human needs, can be witnessed in the structures it builds.

The interaction between those structures (along with the ways they are used) and the natural world is of particular interest. For that reason, I chose a site where I could study the interplay between structure and natural process, specifically a dam and the processes of species reproduction and survival, geomorphology and entropy.



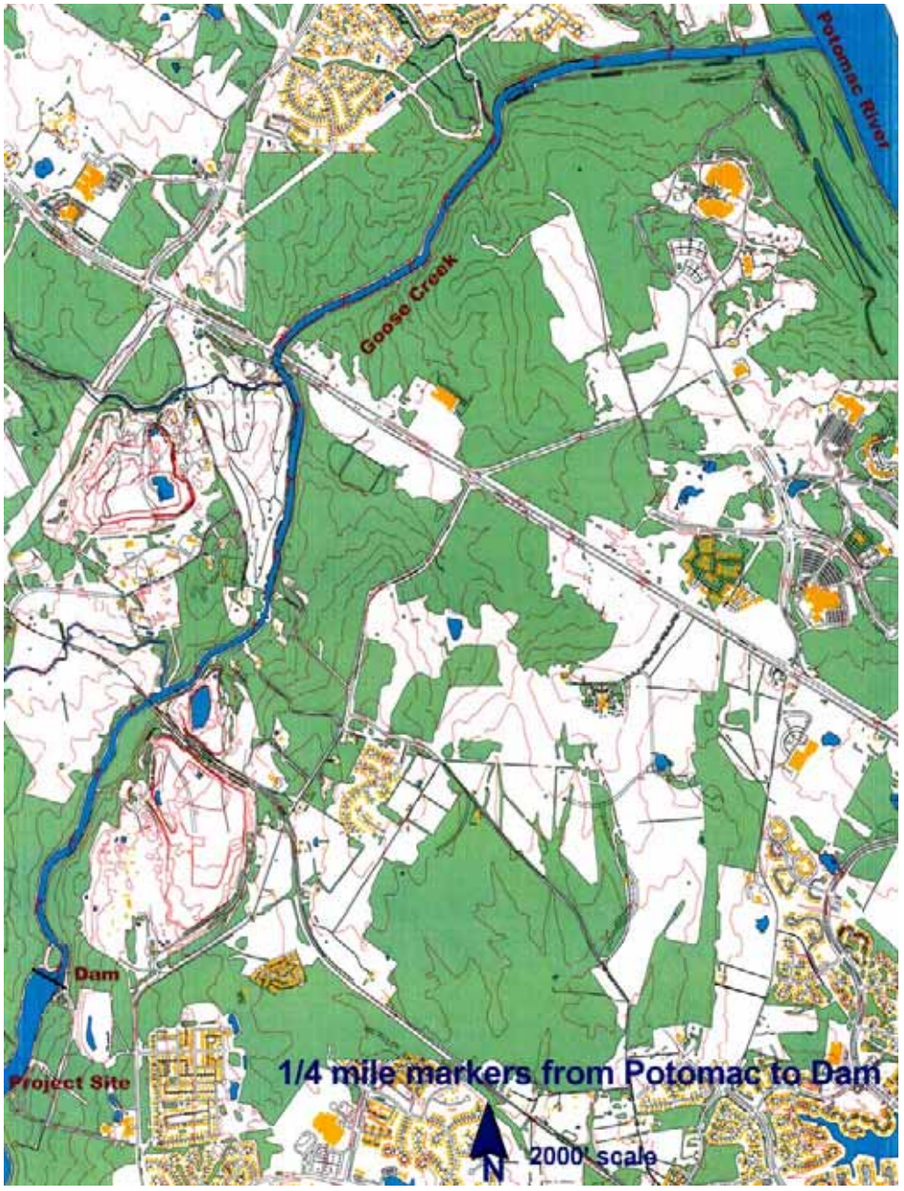
Dam and ecology diagram in plan view (top), and section (below).

The dam creates a reservoir which supplies water to the City of Fairfax, Virginia and neighboring jurisdictions. Located in Loudoun County, Virginia, the dam is situated on a tributary creek just under five miles from the Potomac River. The site consists of approximately 175 acres of mixed hardwood forest zoned as Extractive Industry, along with buildings and service roads related to the on-site Water Treatment Plant. The property is adjacent to an active quarry and areas of rapid residential and commercial development. It is currently closed to the public.

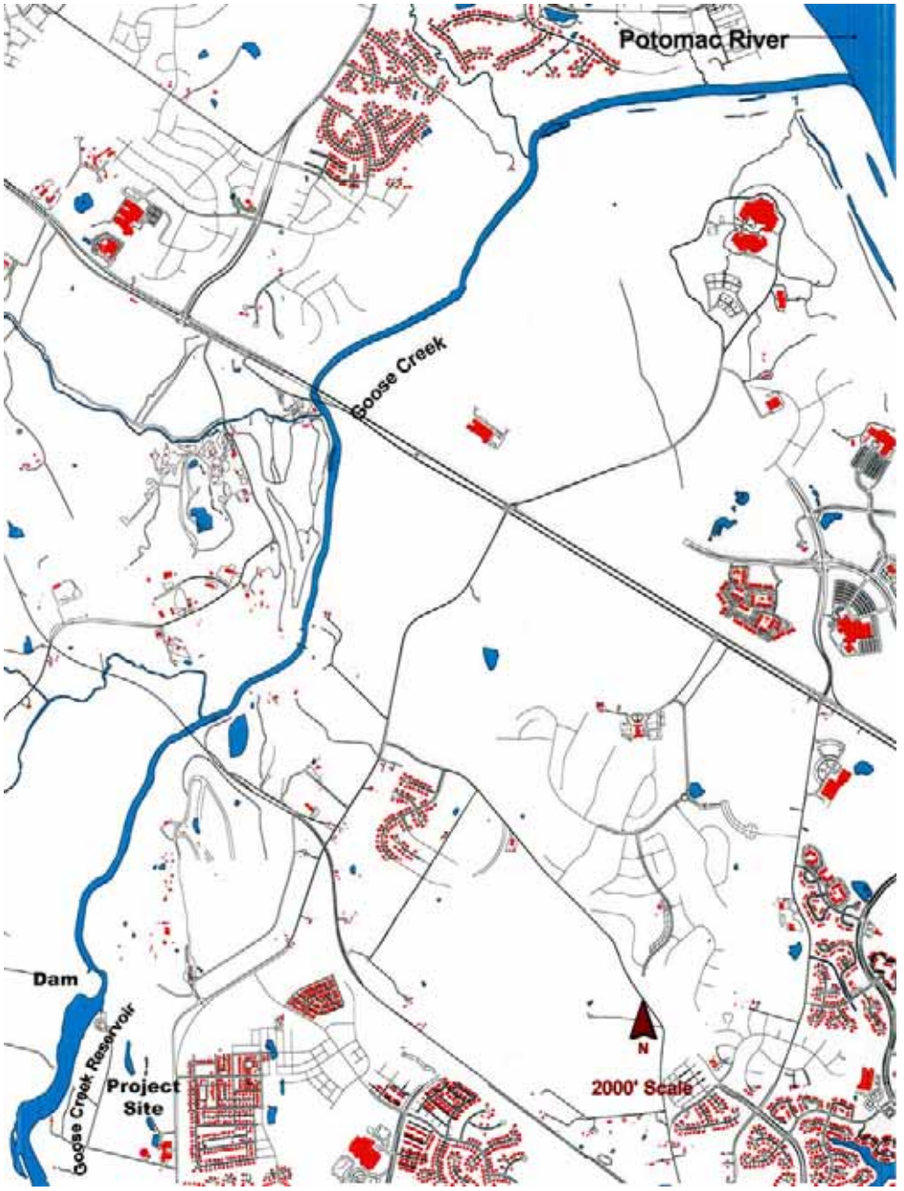


Goose Creek Dam and surrounding environs in Loudoun County, Virginia. The Potomac River is located approximately five miles to the north. (Image courtesy of USGS)

Human intervention is needed to reduce some of the ecological impacts made to this riparian forest and water course. By proposing eco-friendly land use and employing environmentally sensitive planning and design, my plan reopens the property to the public as a recreational and educational nature reserve.



GIS image showing five miles of forestation, roads and buildings along Goose Creek between reservior and the Potomac River.



GIS image highlighting existing roads and buildings between Goose Creek Reservior and the Potomac River.

Design Objectives

Structured around a number of specific objectives, my design work strives to:

Minimize further land fragmentation. A green corridor exists along the five-mile stretch from the project site to the Potomac River, however aerial photos and GIS data show the corridor is disappearing due to intense development. I must make efforts to keep intact the approximately 175 mostly heavily forested acres on this site.

Provide habitat. Closely linked to the issue of land fragmentation is providing general habitat for various species within the ecosystem. Habitat here includes food sources, shelter and breeding/spawning grounds, and involves the preservation and creation of safe routes for mobility between resources.

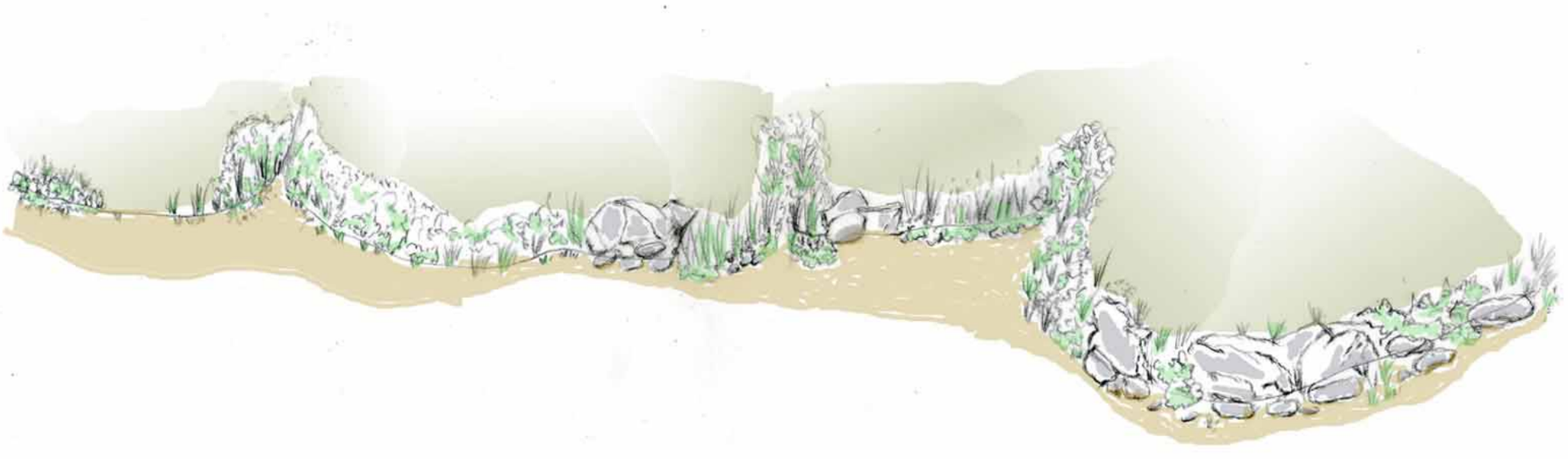
Reduce on-site pollutants and avoid introduction of contaminants. Pollutants from automobiles are to be kept to a minimal by a variety of measures, such as perimeter parking, limited use of solar powered or electric vehicles, and encouraging travel by foot and bicycle. Construction materials should not introduce noxious contaminants, and should be allowed to recycle back into the ecosystem as appropriate. As a matter of ongoing maintenance, the removal of exotic invasive species is desirable, but the use of toxic herbicides and pesticides is to be avoided.

Promote a spirit of learning. Situated in an area of rapid development and environmental change, the project site provides a precious learning opportunity. As one who values education, it is imperative that I incorporate learning and experiential opportunities, including classrooms, hands-on demonstrations and design elements that reveal aspects of the ecology.

Preserve the naturalized waterfront. Animals, amphibians, reptiles, and maturing aquatic species require unimpeded access to the land-water margin. These marginal areas, dominated by rock outcrops and wetlands, should be left intact with little exception. Where human access is allowed, it will be designed with the utmost sensitivity.

Accomplish multiple functions with fewer resources. In order to reduce land fragmentation, disruption to the ecosystem, and the depletion of natural resources, design interventions should be multiplistic with each intervention accomplishing more than one task. It would be imprudent for an element to be designed to serve merely one purpose, particulary one that is anthropcentric. Therefore all efforts should be made to adhere to *a standard of multiplicity*. This design concept applies at all scales, from land use planning, to design detail, to raising the social conscience.

Multiplicty: Not just an interesting garden detail, but also a toad house. (Image: Gardeners Supply Company)



Sketch of naturalized waterfront along Goose Creek Reservoir. This marginal zone provides a rich complex of habitat types and food sources for many species.

THE SITE

Site Selection

Intrigued by Taoist balancing of opposites, I was interested in sites that offered dichotomies: man and nature, land and water, steep and flat, urbanized and naturalistic, forested and open sky. In ecological terms, I was interested in heterogeneous landscapes, and the range of human experiences they provide: passive reflection or high energy activity, generalized use or highly specific use, leisure or challenge, calming or exhilarating. Jay Appleton's ideas of prospect and refuge became a driving influence.

Dichotomies in the Landscape. During site selection, I considered dichotomies in the land, and the experiences people seek from the land or how they approach it. Here, continuous-line drawings represent pairs of opposites: each pair consisting of a passive or general use that requires little skill, and a specialized use that requires a high-level of particular knowledge.

Some of my dichotomies included
BASE jumping from a cliff/Jumping off a pier.
Exploring the depths of a cave/Exploring the earth at our fingertips.
Kayaking on rapids/Kayaking on a lake.
Competitive cycling/Leisure bike ride with friends.
Reaching new heights in rock climbing/Reaching new spiritual heights in yoga.
Ritual dance ceremony/Dancing in the street.
Running along rocky peaks/jogging down a city street.
Walking a narrow ridge/walking through a marsh.
Hiking the summits/bird watching from the foothills.

Continuous-line drawings blurred the distinction of people and earth, and helped me contemplate the idea of a pervasive unity.

The desire for a heterogeneous and dichotomous landscape, coupled with my interest in engineered structures and the environment led me to consider sites with bridges, bridge abutments, highway overpasses and dams. Factoring in ecological and societal conditions associated with each structure, I chose Goose Creek Dam, located in Ashburn, Virginia.

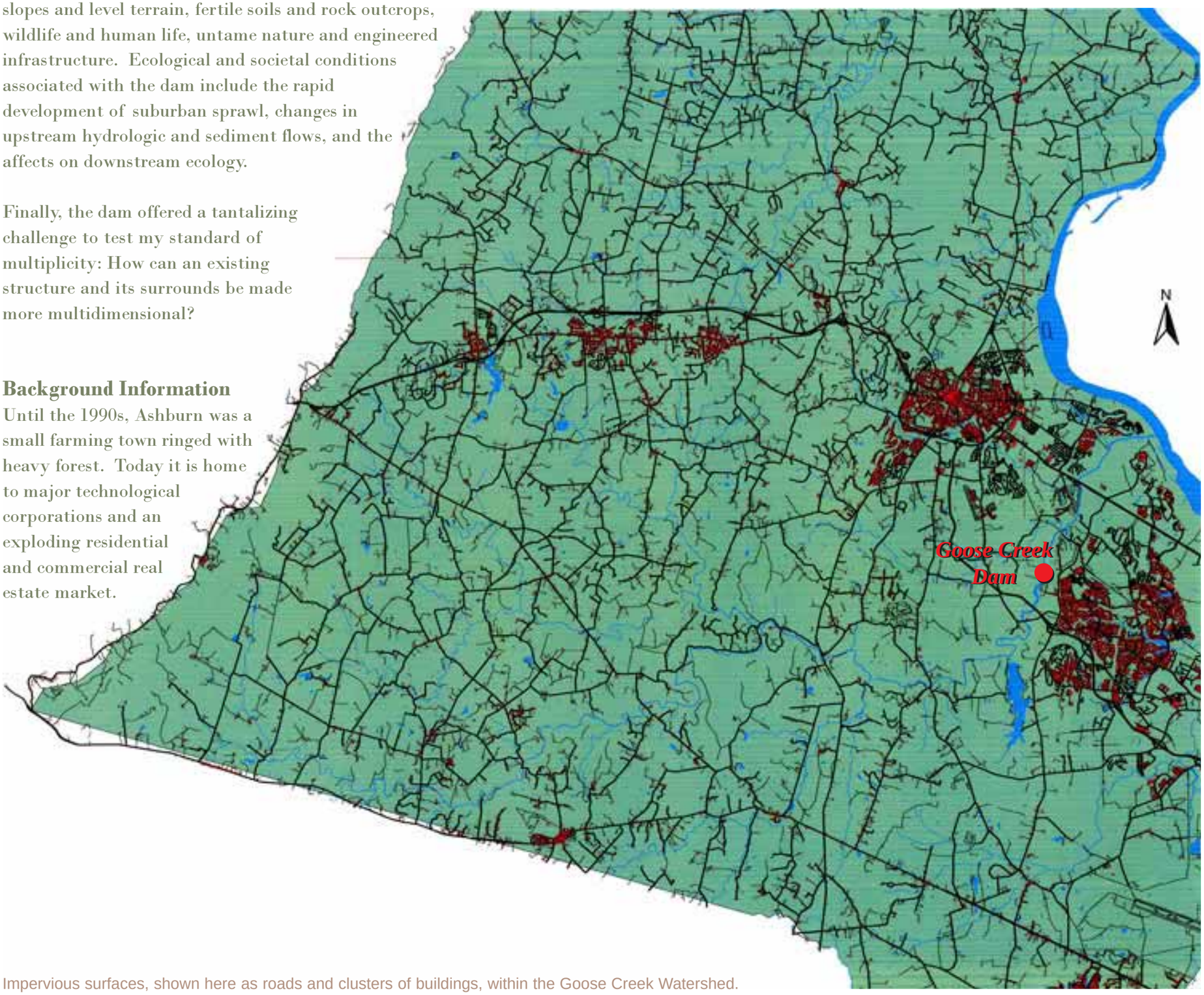
The site is a place of contradiction: heavy forest and large creek, steep slopes and level terrain, fertile soils and rock outcrops, wildlife and human life, untame nature and engineered infrastructure. Ecological and societal conditions associated with the dam include the rapid development of suburban sprawl, changes in upstream hydrologic and sediment flows, and the affects on downstream ecology.

Finally, the dam offered a tantalizing challenge to test my standard of multiplicity: How can an existing structure and its surrounds be made more multidimensional?

Background Information

Until the 1990s, Ashburn was a small farming town ringed with heavy forest. Today it is home to major technological corporations and an exploding residential and commercial real estate market.

Goose Creek Dam is located in the eastern portion of Loudoun County's largest watershed. As one of the fastest growing county's in the United States, Loudoun County is currently undergoing significant environmental change. Deforestation and increases in impervious surface, landscape homogeneity, runoff, stream erosion and channelization within the Goose Creek Watershed have direct impacts on the reservoir and Goose Creek Dam.



Impervious surfaces, shown here as roads and clusters of buildings, within the Goose Creek Watershed.

Although the dam is in Loudoun County, it is owned and operated by the independent City of Fairfax, Virginia. Prior to the property's purchase circa 1954, the Town of Fairfax sought autonomy from Fairfax County, a feat accomplished only when the town could procure sufficient revenues and provide adequate utilities for its residents. In essence, the 1961 completion of the dam secured the town's independence.

Since that time, the property along the east bank of Goose Creek has remained mostly forested, the exception is the water treatment plant along Belmont Ridge Road and its service facilities including siltation ponds, several service roads, a few small out buildings, a power station and tree cuts for power lines.

Prior to 2001, the site was open to the public for fishing, canoeing, kayaking, and very limited camping. Due to general terrorist threats to the nation's water supplies, an increase in gang activity on the site, and a surge in unsupervised usage as the population in this once bucolic area grows, the City chose to close the property to the public. Unfortunately, this decision has done more to keep the watchful eyes of well-intended visitors out, than it has to prevent illicit activity.

Goose Creek Dam in proximity to ...

Chesapeake Bay Watershed

District of Columbia Region

City of Fairfax, Virginia

Loudoun County, Virginia










Images of Goose Creek Reservoir and its east bank. *From top left*: Top of the dam. Goose Creek below the dam. Water Authority buildings. One of numerous streams crossing the property. The typically calm reservoir. Looking up from foot of large mound. Looking down to road from on mound. Tree cut for service road on property. Tree cut for utilities. Forest and rock: boulders and outcrops.






Diverse shoreline conditions along Goose Creek Reservoir's east bank. *From top left*: Low, soft mucky soils. Steep bluffs with large deltaic landforms. Stiff upright wetland stands. Billowy, lush marshes. Flat rocky floodplain. Steep, jagged rock outcrops.

The Program

I recommend the property be reopened to the public as a park and learning institute, yet it must also function as a nature reserve. In this place of increased development and disappearing wilderness, Goose Creek Reservoir and its east bank provide an ideal testing ground for a more harmonious human–nature relationship and a biocentric landscape architecture.

The standard of multiplicity has been applied to the program as the multiplicity of purpose and use. Four entities – the water authority, the public, the learning institute, and the ecosystem – will share space and facilities as appropriate. Entities' purposes and usage are not to be mutually exclusive, but rather concentrated and optimized, with ecology benefitting over all others.

1. The dam and site must remain as a public utility. The need for water in the Washington, D.C. metropolitan area steadily increases as population grows, therefore design must account for and incorporate essential Water Authority operations and interests.

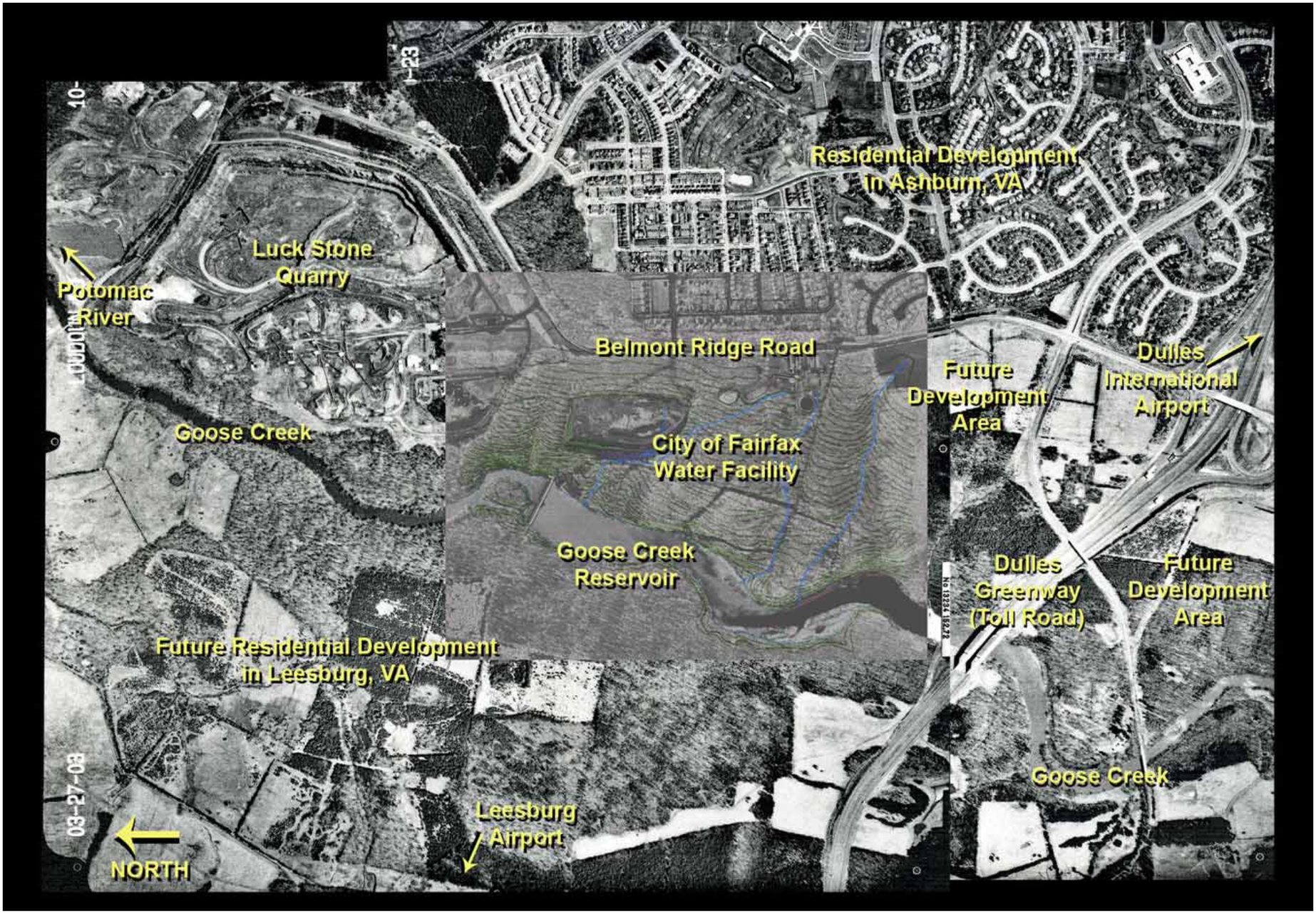
2. As a public park, a number of passive recreational opportunities could include walking, picnicking, fishing, and photography. Active recreational opportunities may include hiking, bicycling, boating, and rock climbing. Diverse landscape conditions naturally lend themselves to diverse experiences.

3. The establishment of an ecological learning institute provides educational and research opportunities that range from passive (individual observations), active (hands-on demonstrations), structured (classes and lectures), and informal (self-guided programs).

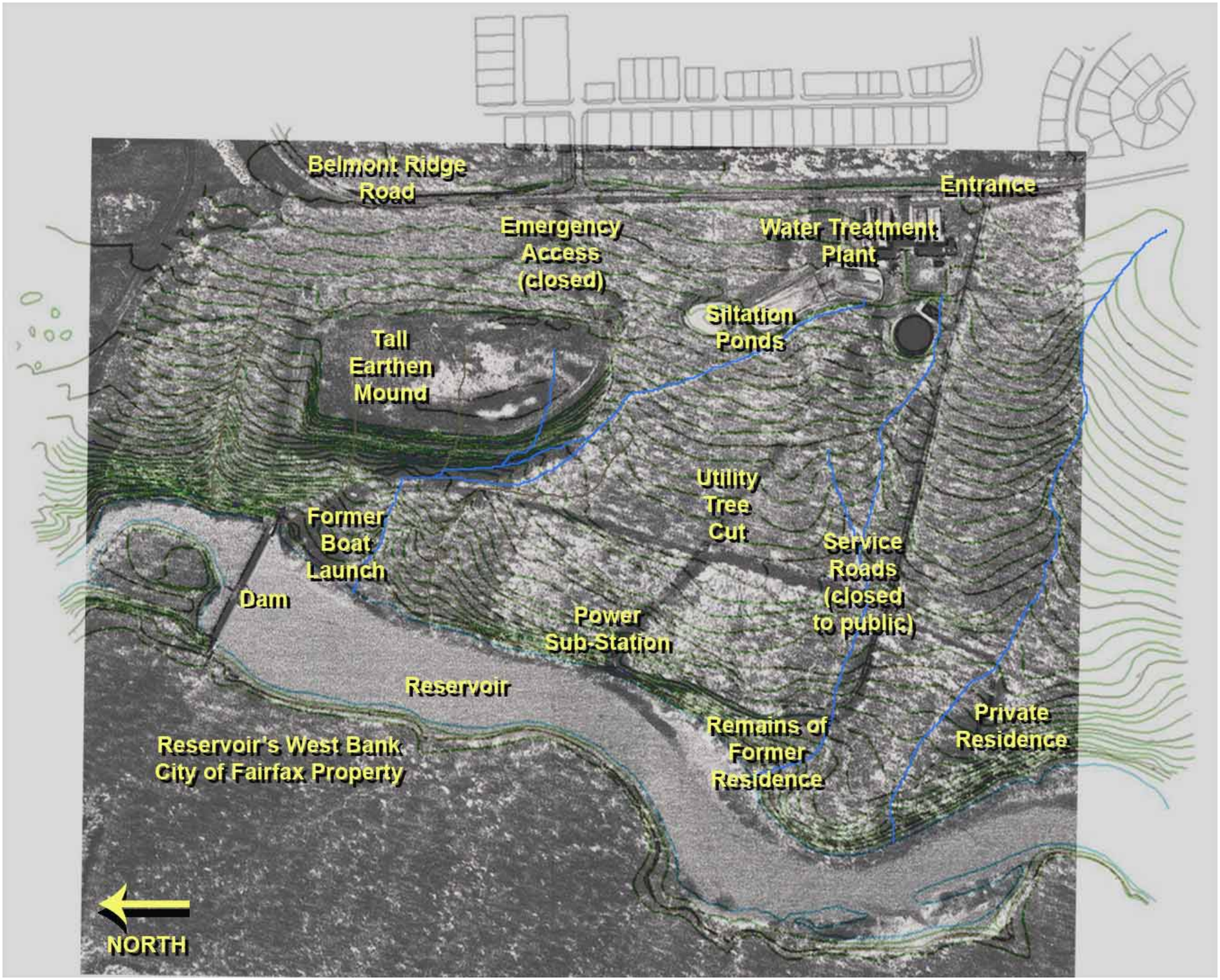
4. Ensuring a functioning ecosystem calls for native wildlife and natural processes to be consulted as a client. As a nature reserve, human activities are consistently checked against ecological principles and functionality. The needs for habitat, food, water, mobility, and cycles of change will be honored, protected, guaranteed.

This project helps human visitors understand the ecosystem and a more sensitive manner in which to regard it. That knowledge is of particular importance to citizens within the Goose Creek Watershed – or *any* area in transition – as they consider options and face decisions about future growth and development of their communities. My hope is to raise awareness of alternative planning and construction techniques that are less intrusive, and even beneficial, to the ecosystem. To that end, designed elements are to serve the ecosystem by improving and/or maintaining its health. The result is a landscape that truly functions *for* the ecosystem and, on a lesser note, happens to be an exciting recreational and educational place for people.

RESEARCH & ANALYSIS



Surrounding Conditions. The project site (center) is surrounded by extractive industry, residential development, a major throughfare, and two airports. Situated in a high-growth area, the surrounding landscape is currently undergoing extensive change. (Image courtesy of Loudoun County Office of Mapping and Geographic Information)



On-Site Conditions. The Goose Creek Reservoir's east bank currently combines wilderness with engineered landscape as mixed hardwood forest co-exists with a water treatment plant and its facilities. At approximately 175 acres, this parcel likey will become the largest undeveloped open space in the Ashburn, Virginia area. It is closed to the public. (Image courtesy of Loudoun County Office of Mapping and Geographic Information)

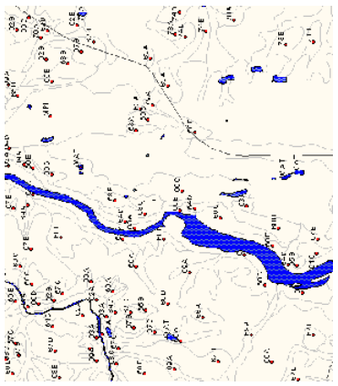
Environmental Data

In order to narrow the scope of this project, target issues were determined and related data was collected and analyzed.

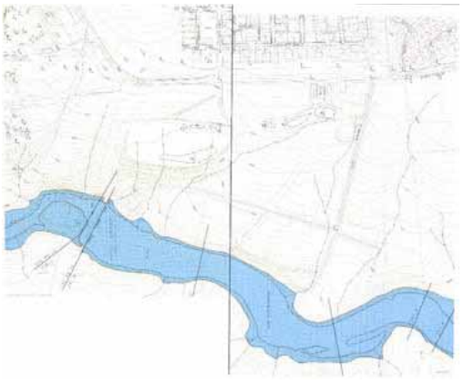
Issue: Geomorphology

Research Data. County soils maps and descriptions; GIS topographic data.

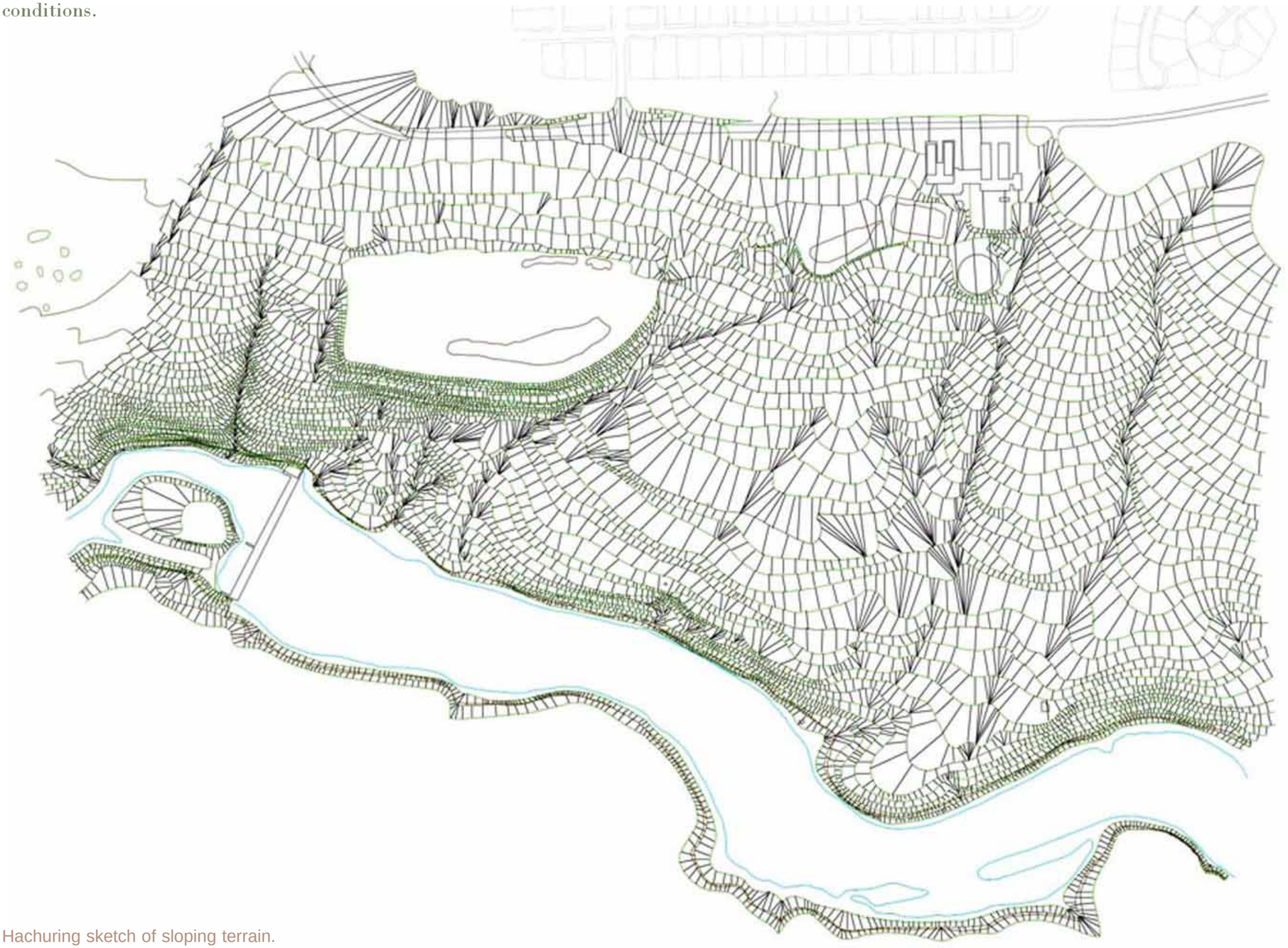
Analysis. Individual soils were mapped and combined with topographic data, then translated into geomorphic typologies based on common characteristics. Follow-up visual observations on-site confirmed these typologies. Consideration was also given to underlying geologic conditions.



Soils data.

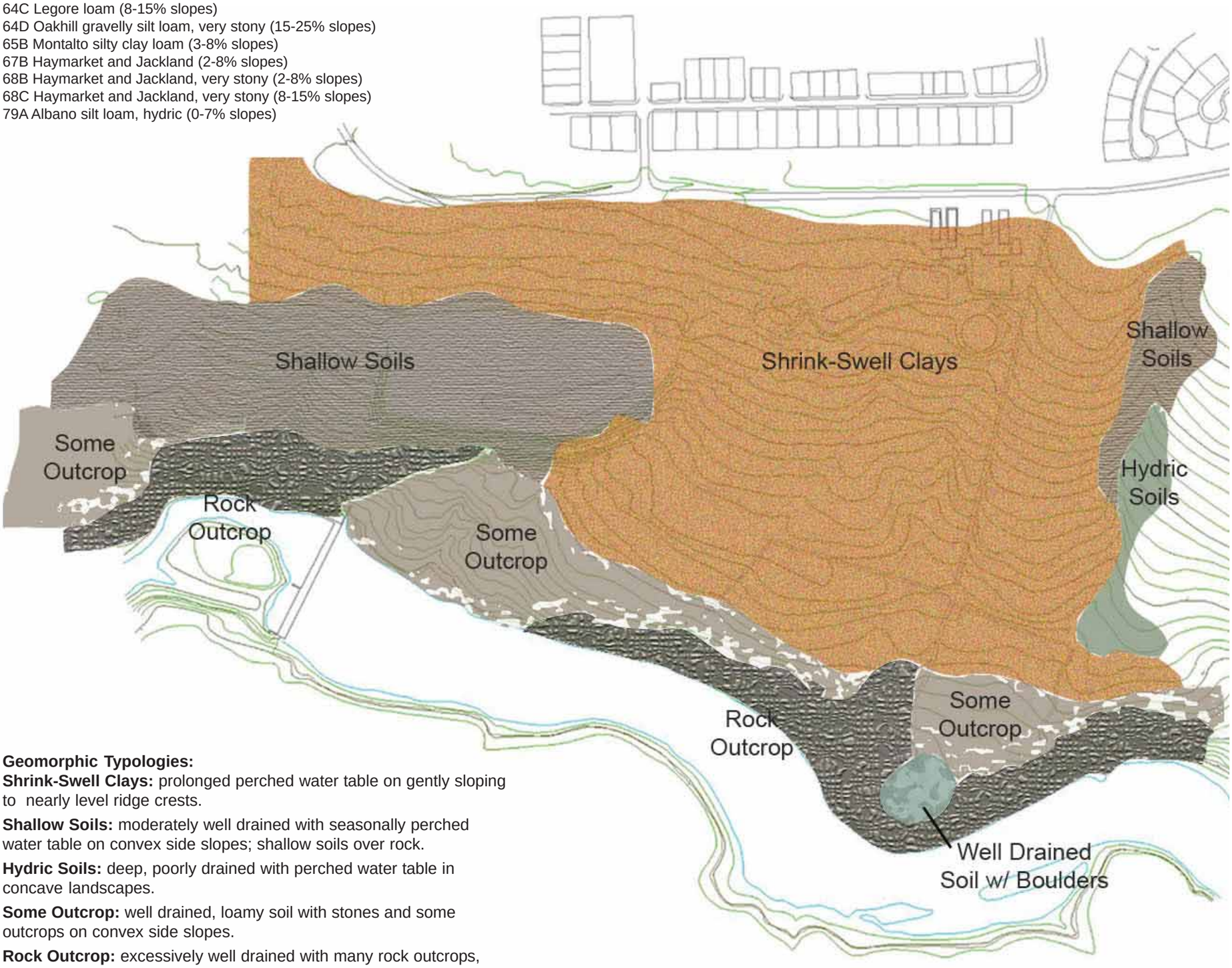


GIS data.



Hachuring sketch of sloping terrain.

Individual Soils:
60C Sycoline-Catlett complex (7-15% slopes)
60E Catlett-Rock outcrop complex (25-45% slopes)
62B Kelly-Sycoline complex (3-8% slopes)
63A Kelly silt loam (0-3% slopes)
64C Legore loam (8-15% slopes)
64D Oakhill gravelly silt loam, very stony (15-25% slopes)
65B Montalto silty clay loam (3-8% slopes)
67B Haymarket and Jackland (2-8% slopes)
68B Haymarket and Jackland, very stony (2-8% slopes)
68C Haymarket and Jackland, very stony (8-15% slopes)
79A Albano silt loam, hydric (0-7% slopes)



Geomorphic Typologies:
Shrink-Swell Clays: prolonged perched water table on gently sloping to nearly level ridge crests.

Shallow Soils: moderately well drained with seasonally perched water table on convex side slopes; shallow soils over rock.

Hydric Soils: deep, poorly drained with perched water table in concave landscapes.

Some Outcrop: well drained, loamy soil with stones and some outcrops on convex side slopes.

Rock Outcrop: excessively well drained with many rock outcrops, stones, gravel and boulders on steep to very steep side slopes.

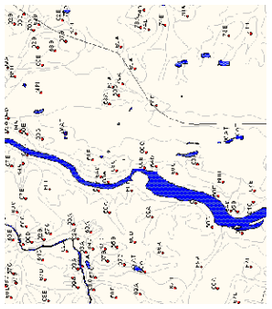
Well-Drained With Boulders: deep well drained with many stones and boulders on convex gently sloping uplands.

Soil analysis and typologies.

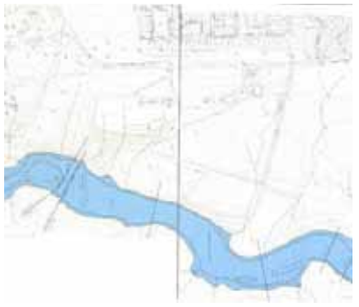
Issue: Water, Energy and Entropy

Research Data. County soils maps and descriptions; GIS topographic and hydrologic data.

Analysis. Based on John Tillman Lyle's theories on the regenerative capacities of landscape and basic energy processes of ecosystems (in *Regenerative Design for Sustainable Development*, 1994), the site was divided into "hydrologic energy areas" of storage, filtration and distribution. Two additional processes Lyle discusses were also mapped on the project site: areas of high and low assimilation, and areas particularly influenced by human thought.

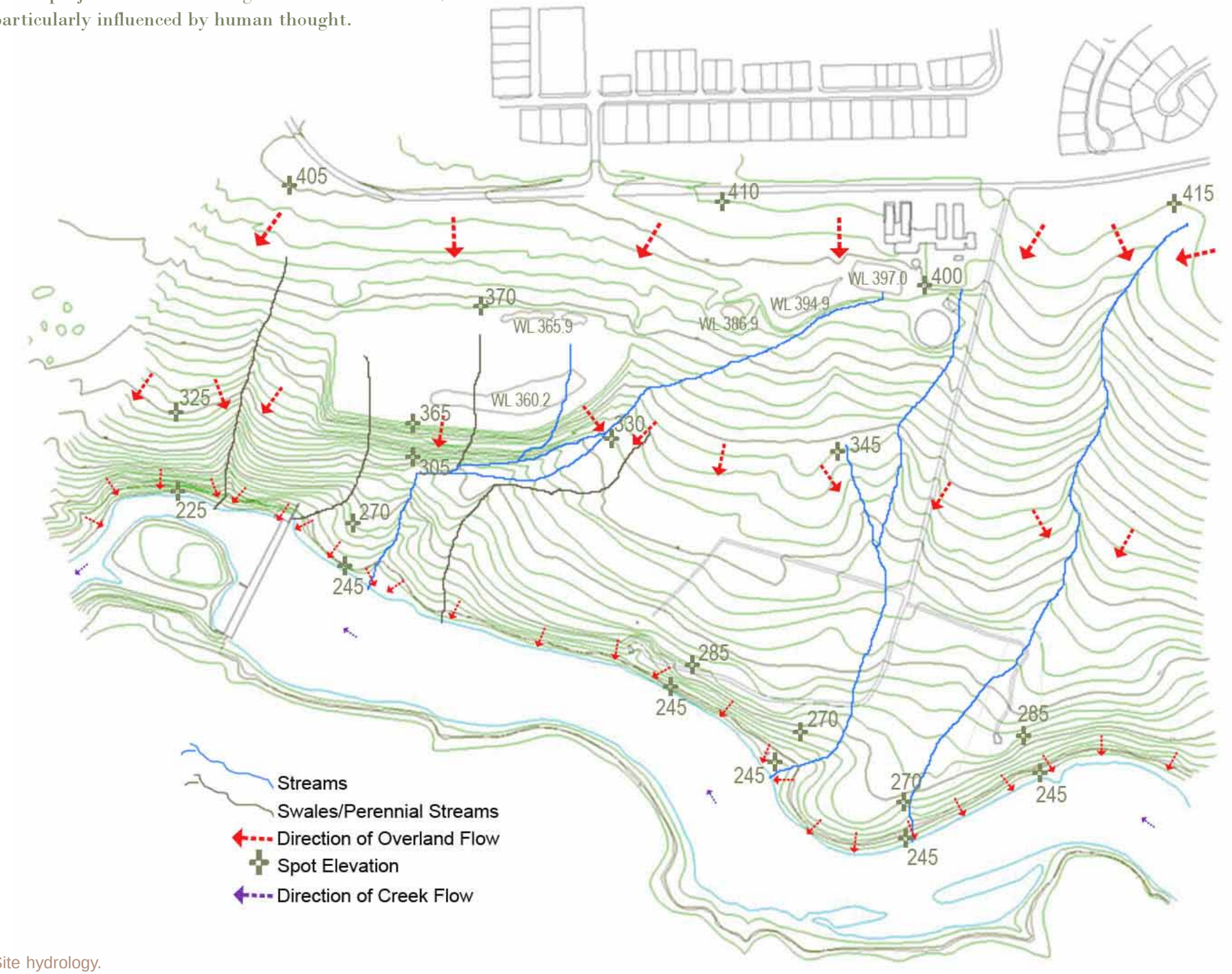


Soils data.

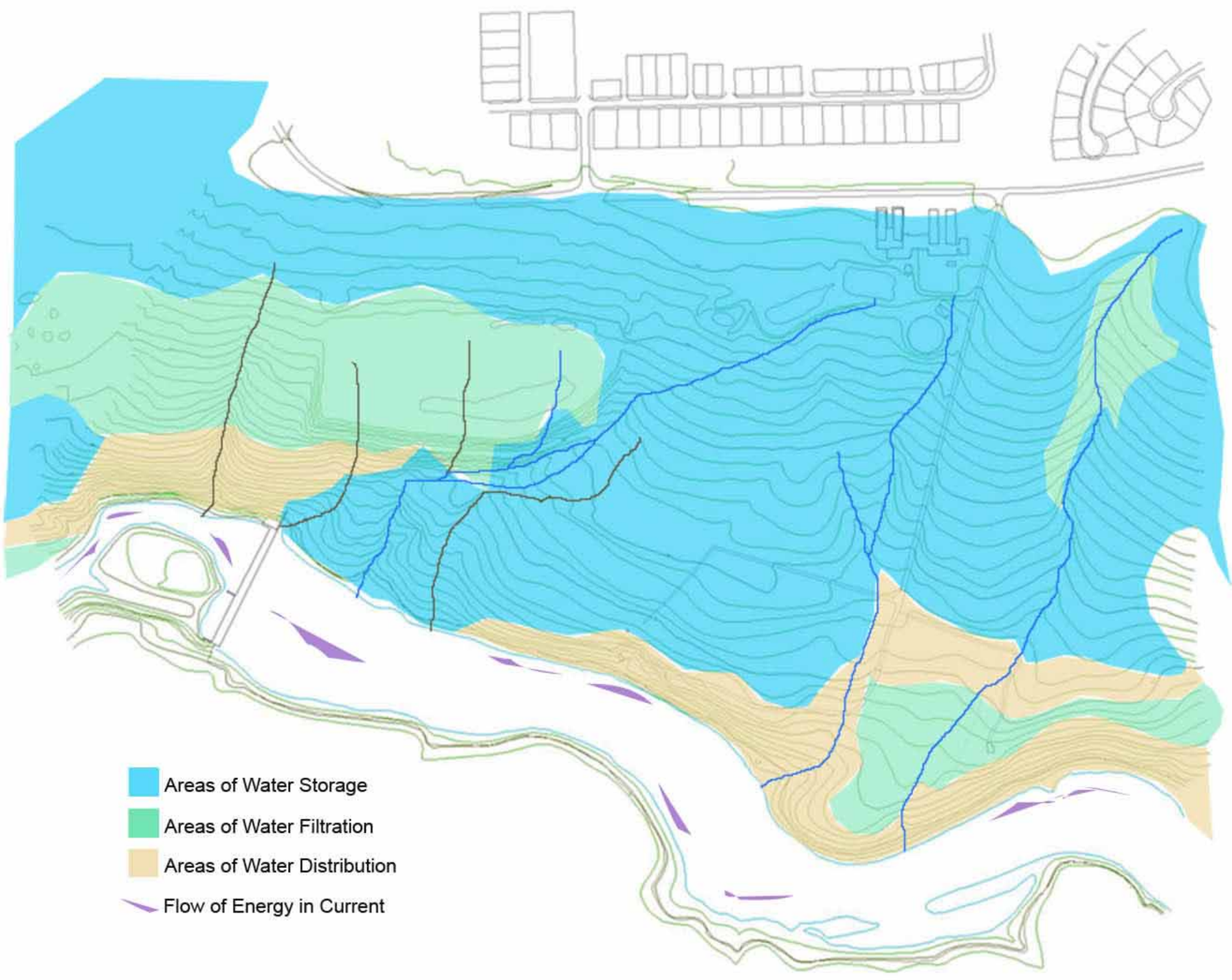


GIS data.

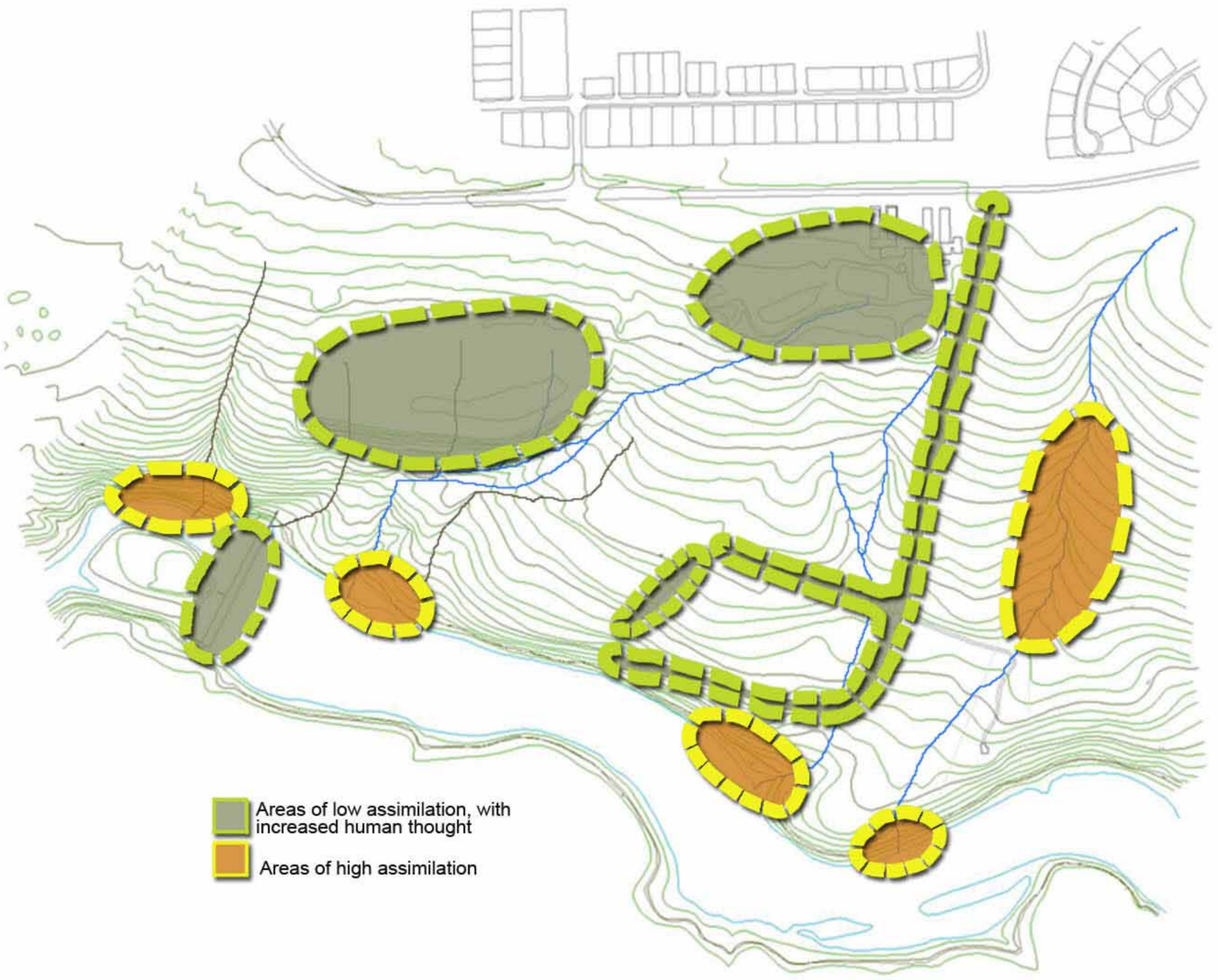
Energy processes of ecosystems. (Lyle 1994)



Site hydrology.



John Tillman Lyle's idea of ecosystem energy processes and water mapped on site. This map distinguishes a second set of landscape typologies - water storage, filtration and distribution - each with distinct ecological functions, visual qualities and experiential opportunities.



Two additional John Tillman Lyle basic processes of regeneration are assimilation and human thought (1994, p27). Assimilation is the basic process of revitalizing earth through decomposition; human thought influences nature's processes and land's ability to regenerate. Here, key areas of the project site are highlighted as particularly susceptible to high and low levels of assimilation. Where assimilation is low, human thought is particularly influential, such as at the dam, the water treatment plant and its service facilities, including roads and siltation ponds.

Issue: Watershed Delineation

Research Data. County-prepared zoning maps and data; City of Fairfax records; personal follow-up

Analysis. Goose Creek is the major recipient of tributary waterways in the county's largest watershed, the Goose Creek Watershed. A comparison of county growth projections (see Social Data) and tributary locations reveals that anticipated land-use changes within the watershed will impact conditions on the dammed project site.

Historically, siltation has been a significant concern for the Goose Creek Reservoir. Within the first 33 years of operation, silt deposits of up to 22 foot depth decreased its holding capacity from 300 million gallons to 125 million gallons, a 58 percent reduction in available water. In the coming years, such extensive siltation is predicted to occur in shorter timespans. Furthermore, changes in runoff rates and water quality are new concerns. The need for dredging operations is expected to persist on the project site.

County population data.

Historical record of dredging.

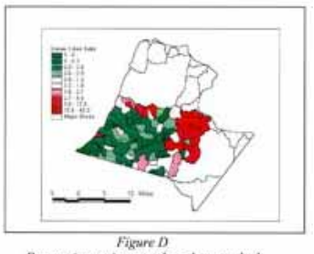
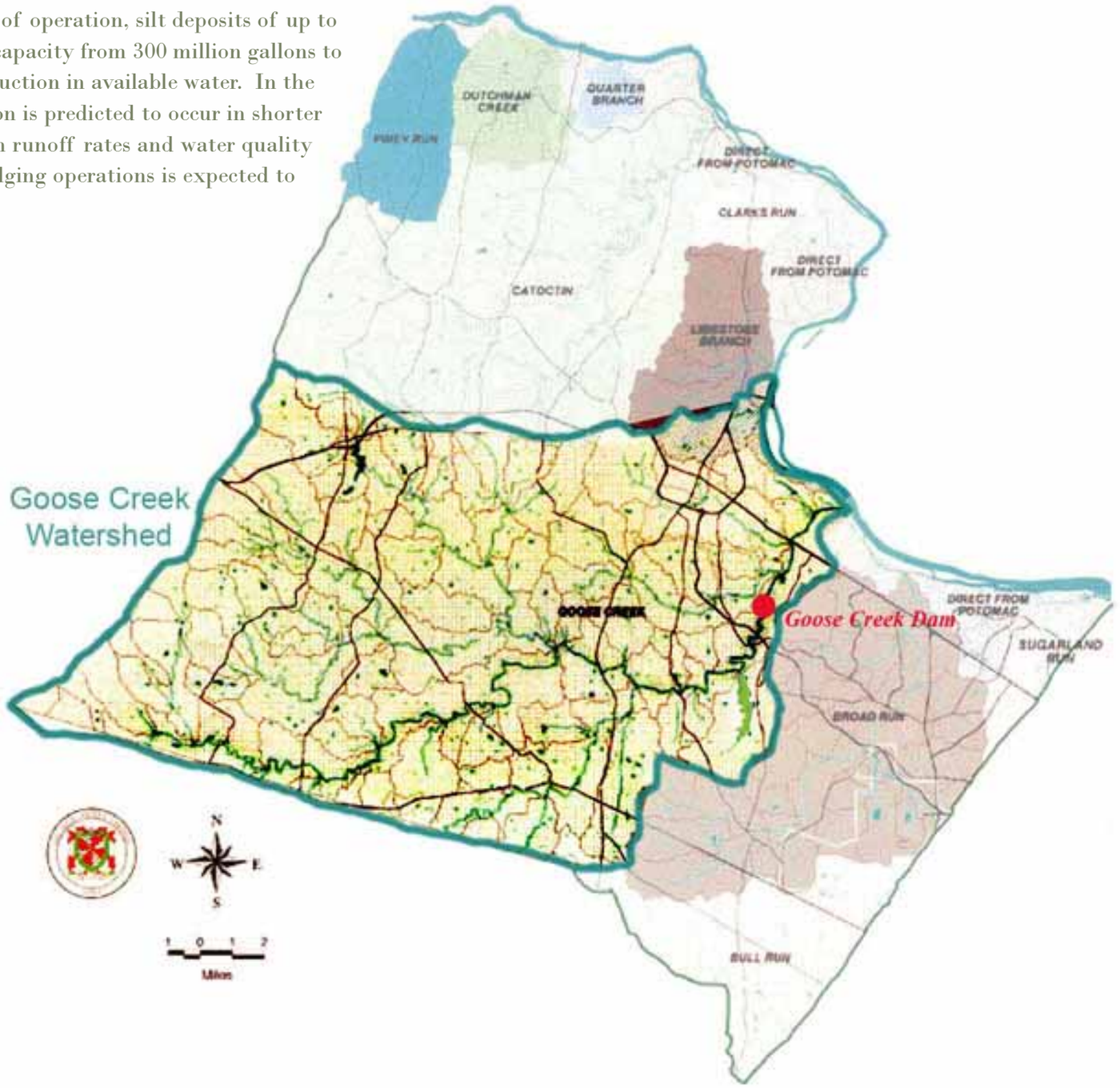


Figure D
Percent imperviousness by sub-watershed within the Goose Creek major watershed in October 2001.

Impervious surfaces in the Goose Creek Watershed. (Fuller 2002)



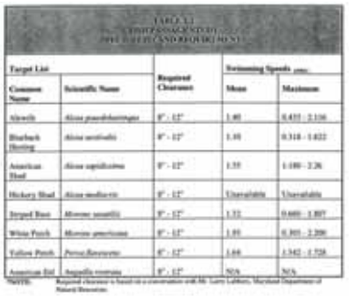
Issue: Affected Species

Research Data. The Virginia Fish and Wildlife Information Service; Woodrow Wilson Bridge Center information on fish obstacles; United States Geological Survey.

Analysis. Information on species known and suspected to be present at the project site was gained by conducting a Virginia Fish and Wildlife Service species point search, which documented 178 species confirmed to exist within a 3-mile radius of the site, and another 269 species with known potential to exist in that area. Twenty-nine species appear on federal and/or state "threatened species" or "species of concern" lists.

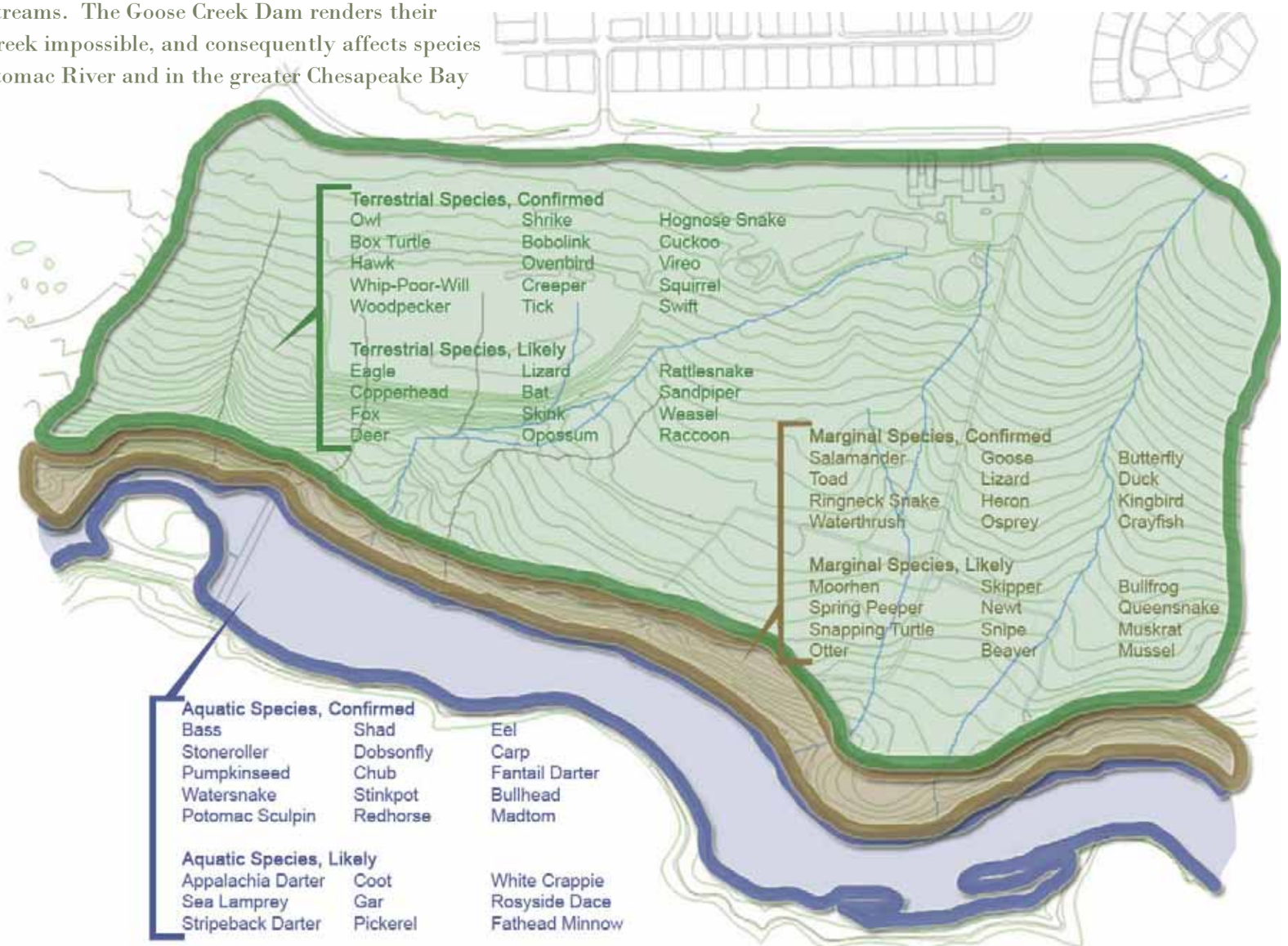
Additionally, anadromous fish species such as the American Shad, Alewife Herring, American Eel and Striped Bass are known to inhabit the Potomac River, which flows less than five miles from the Goose Creek Dam. These species typically travel up to 20 miles or more to spawn in freshwater streams. The Goose Creek Dam renders their migration up Goose Creek impossible, and consequently affects species populations in the Potomac River and in the greater Chesapeake Bay watershed.

Species within 3 miles of project site.



Fish species of the Potomac River affected by obstacles in tributaries. (Woodrow Wilson Bridge Center Report, 2000)

USGS information on American Shad in the Potomac River.



Issue: Native Riparian Forest

Research Data. GIS data; Aerial photography; Visual observation; Historic accounts from pre-settlement era.

Analysis. As can be depicted by GIS data and sequential years of aerial photography, the native riparian forest between the Goose Creek Reservoir and the Potomac River is thinning and disappearing due to clearing for agriculture, industry and development. Protecting and restoring a wildlife corridor is important. Therefore, as one of the largest persisting green spaces along the five-mile stretch, a particular emphasis is placed on maintaining or increasing wildlife habitat on the project site. Fragmentation on-site should be limited, and preferably reduced.

GIS data.

Aerial photography.

Plant identification confirms the historic records of eastern deciduous forest dominated by mixed hardwoods. Today, as was the case some 200 years ago, oaks, hickories, walnut, sycamore, locust, ash, maples and poplar are the dominant woody species (Williams 1938, p1). Any planting plans designed for this project would include among them these native species.

The disappearing native riparian forest along Goose Creek. Each year, acres fall to development pressures.

Fragmentation of the riparian forest on the project site. Any additional fragmentation should be avoided, therefore, permanent deforestation should be minimized while opportunities to restore existing tree cuts should be maximized.

Many of the native trees recorded from pre-European settlement still flourish among these hills today. Tree of heaven and weeping willow represent established introduced species.

Issue: Current Circulation and Views

Research Data. GIS data; Aerial photography; Visual observation.

Analysis. The majority of on-site land fragmentation consists of service roads for the water authority. Belmont Ridge Road, along the site perimeter, is currently a two-lane state highway, which is becoming a major throughfare for Ashburn, Virginia. A state maintained gravel entrance road crosses the southern side of the property, and provides ingress and egress for a single private residence. Other road cuts are maintained by the City of Fairfax, and are now closed to the public. The longest of these roads terminates near the dam, and provides emergency and maintenance access. These trodden gravel roads are wide (30'-60'), with some low successional vegetative growth.

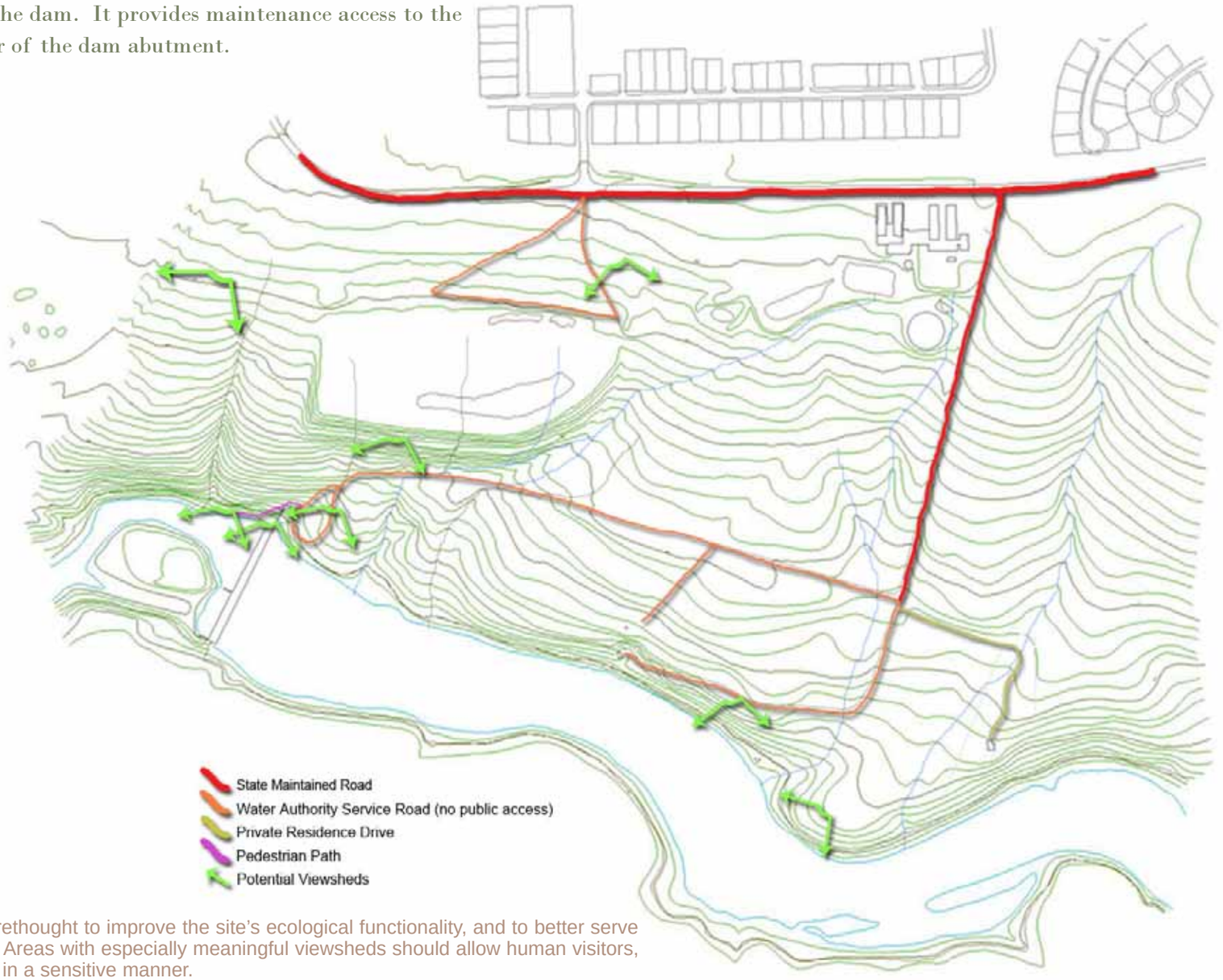
One path for pedestrian-specific use is maintained with rip-rap down a steep slope behind the dam. It provides maintenance access to the interior and exterior of the dam abutment.

GIS data.

Aerial photography.

Personal account.

Unique and diverse views abound on the site, and include views toward water authority facilities and especially the siltation ponds, into the adjacent quarry, from atop the earthen mound into swaying treetops, of the tranquil reservoir and the rugged downstream, down into a deep ravine with a wide floodplain and large creek, and of the upstream divergent and shifting currents.



Circulation should be rethought to improve the site's ecological functionality, and to better serve a diverse set of users. Areas with especially meaningful viewsheds should allow human visitors, to the extent possible, in a sensitive manner.

Summary of Findings: Environmental Research and Analysis

Research and analysis conducted on this landscape revealed significant aspects of its heterogeneous character and some of the natural processes that shape, change, and revitalize it. Its rolling terrain can be understood as six main drainage basins divided by streams and perennial streams/swales. The 190-foot difference in elevation results in unique landscape typologies based on soil characteristics, which include nearly level shrink-swell clay, rolling shallow soils, sloping terrain with some rock outcrop, steep slopes with abundant rock outcrop, low lying hydric soils, and a toe slope with particularly rich well drained soil and boulders.

When these typologies are mapped by regenerative function and land +

water interactivity, an interesting pattern of storage, filtration and distribution forms, suggesting differences in vegetation type, density, and detritus, signs of erosion, and potential human experience and safety. Additional mapping of regenerative functions associated with current land use indicates areas particularly influenced by human thought and a desire for stasis, and areas of high assimilation and undisturbed "wild nature."

Most of the Goose Creek watershed drains to the point of the site. Since the construction of Goose Creek dam, siltation, erosion and scour have been ecological conditions affecting the waterway at the project site. These conditions can be expected to increase in severity as land use within the watershed changes, and hydrology, sedimentation, and water quality and quantity are altered. Land use changes also fragment the native riparian forest and diminish the wildlife corridor along Goose Creek to the Potomac River. Safe migration, habitat, and breeding and hunting grounds are threatened for 447 species believed to exist in the vicinity of the project site. The dam itself presents an impassable obstacle for a number of anadromous species.

Key vantage points for important viewsheds are mapped for determining potential pedestrian circulation routes. Via these vantage points, visitors witness the extreme contrast between hard engineered and maintained elements, such as the dam, siltation ponds and adjacent quarry, and untamed nature, such as a billowy marsh and the serene forested hills filled with bird song. The juxtaposition of these unified opposites adds a dynamic energy to the experience of the place that should be allowed to play out on its own with little interference from me, as designer.

Biocentric design on this project site should address the wildlife corridor and issues of safe passage on land and in water, should make allowance for the removal of siltation and attached persistent toxins from the reservoir, and should reveal nuances of the land and water to human visitors, educating them on natural processes and human impact.

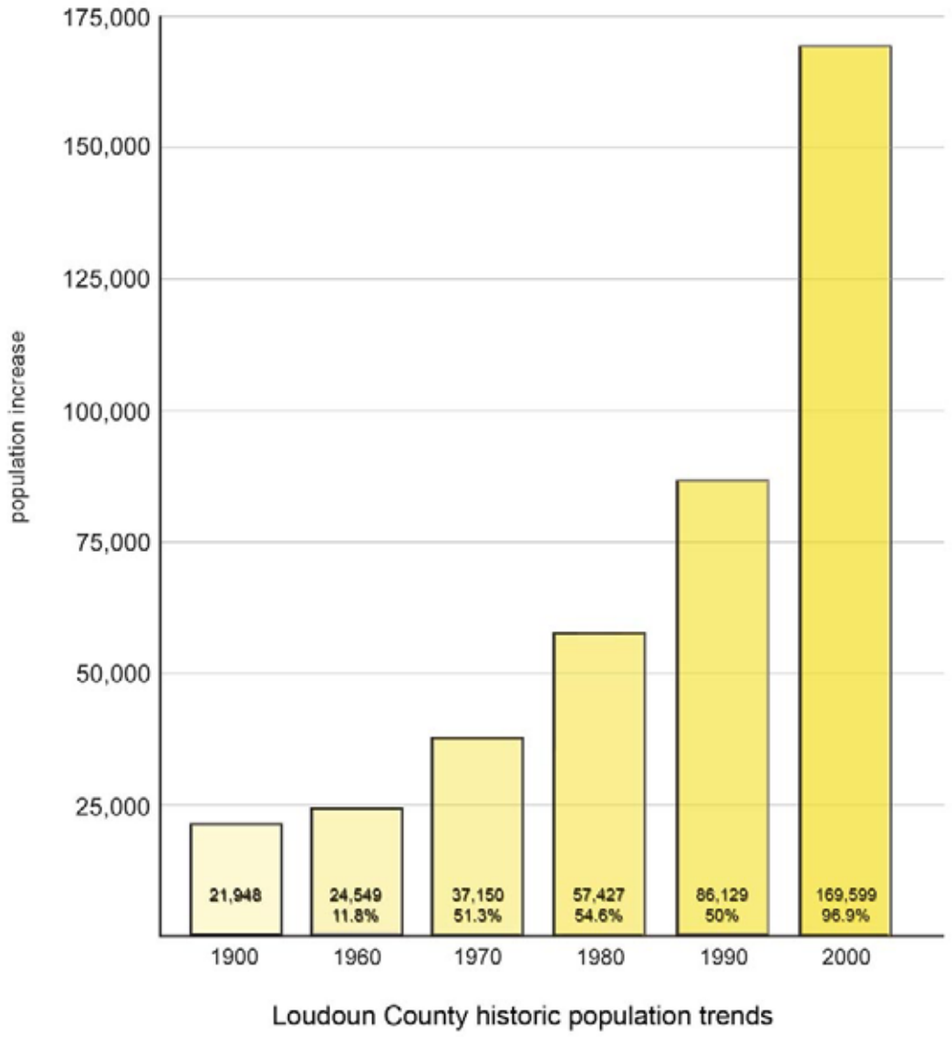
Water treatment plant and siltation ponds. Aerial view of the dam. (Photos Netherton et al. 1997, pp 99,93 respectively)

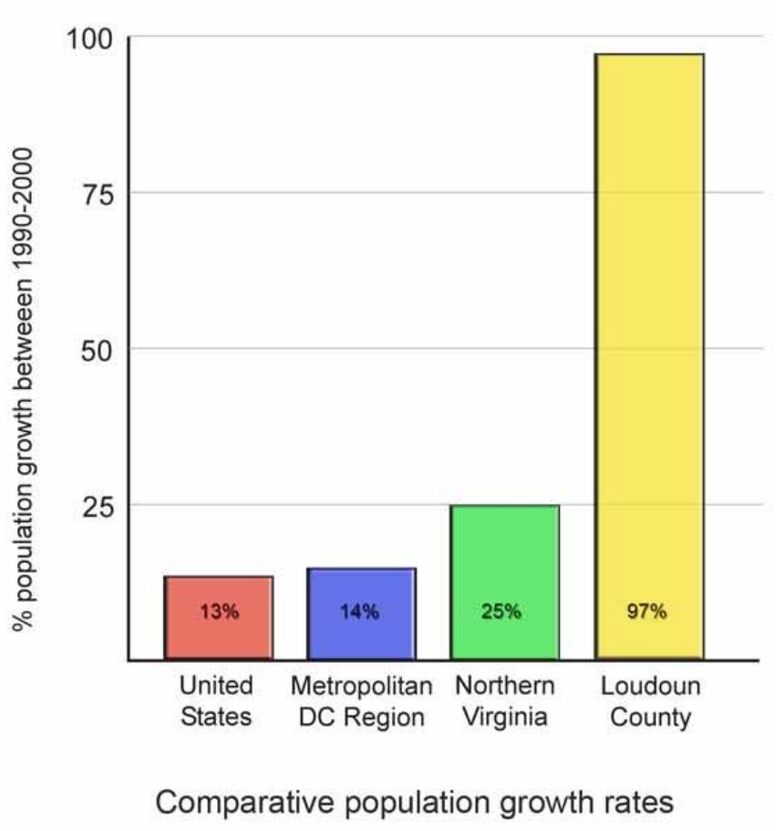
Societal Data

In order to better understand Loudoun County's expected growth and potential impacts on the Goose Creek watershed and the project site, I consulted county-prepared population and land use data.

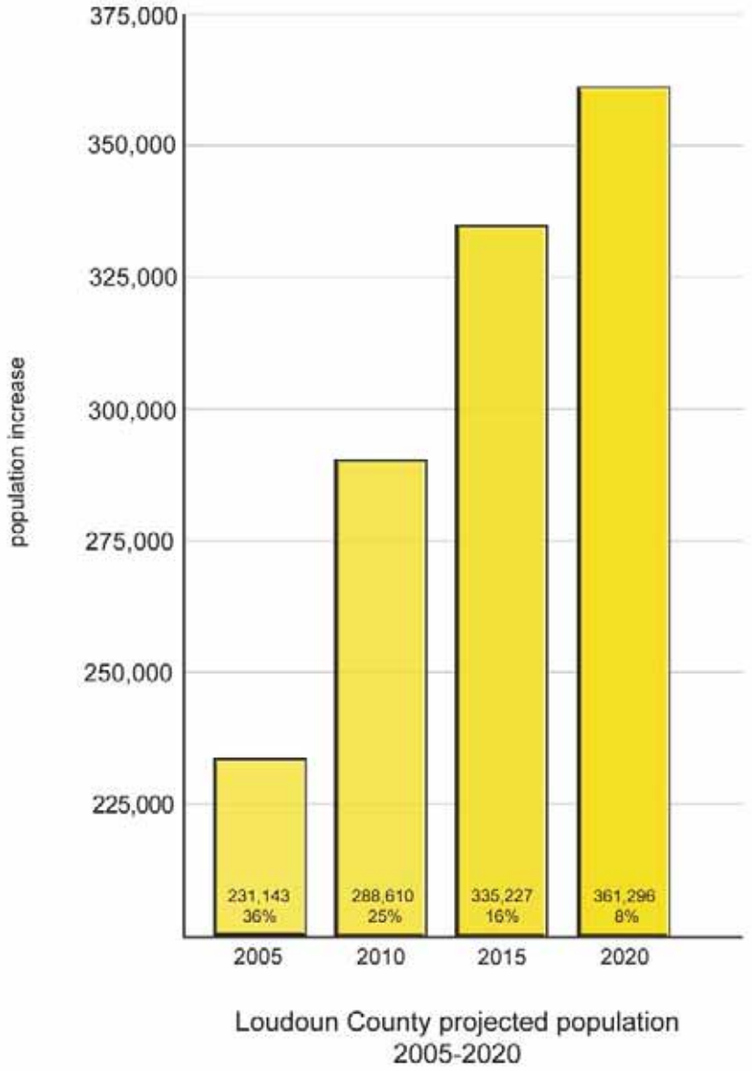
Issues: Demographics and Population

60,000	*households (96% increase in 10 years)*
2.82	*persons per household*
29,200	*minority population (237% increase in 10 years)*
33.6	*years median age*
$97,987	*average household income in 2000*





Unprecedented growth rates in Loudoun County greatly exceed national and regional averages. Demographics, based on data from the 2000 census, provide information on Loudoun residents. (Charts and graphs are based on data found in the Loudoun County Revised Comprehensive Plan, 2001.)



Loudoun County projected population
2005-2020

Issue: Nonresidential Construction

Office
7,040,233 square feet

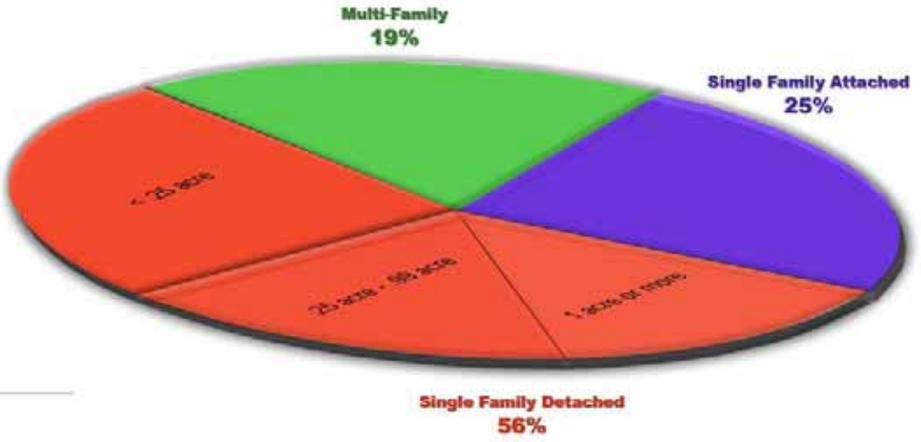
Retail
4,919,702 square feet

Industrial
7,946,491 square feet

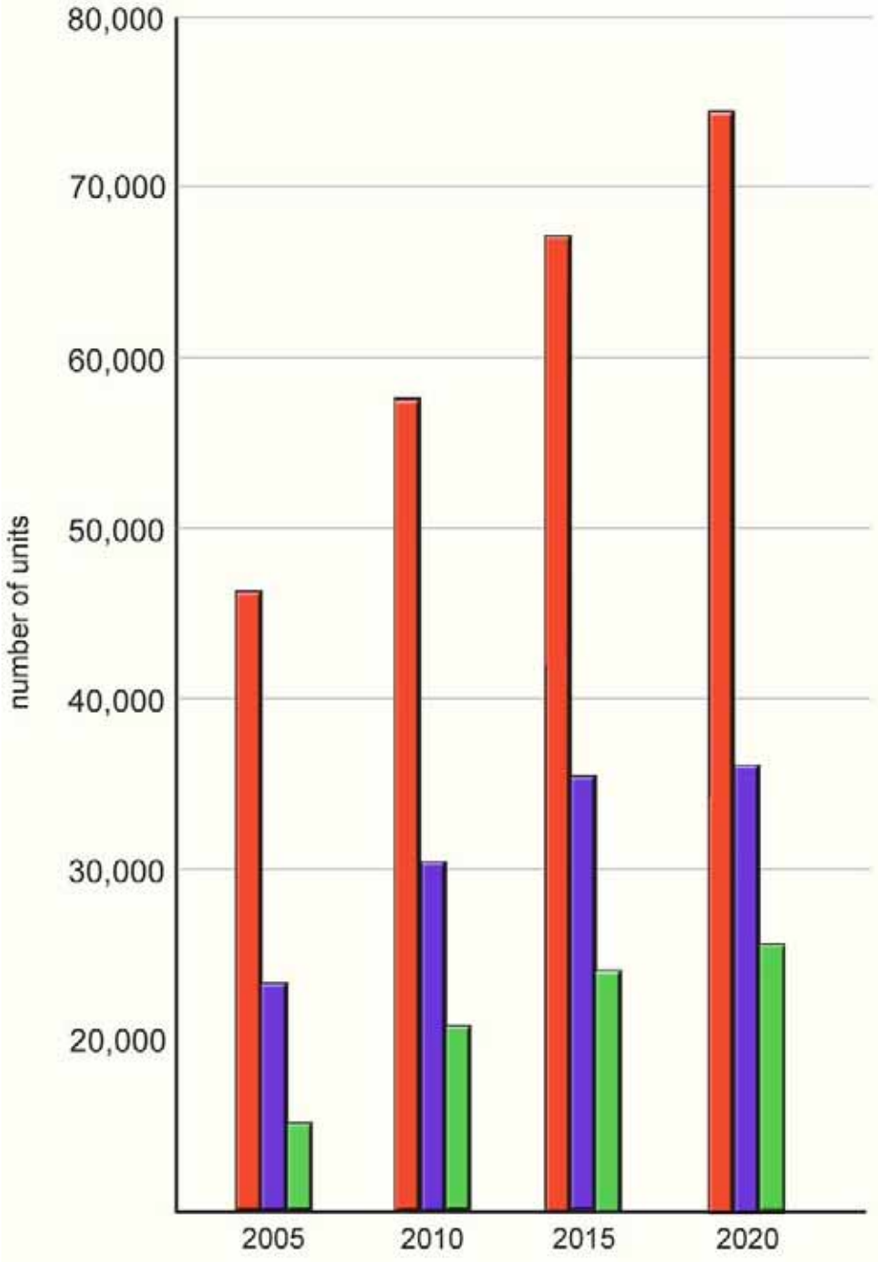
Other
(schools, libraries, hotels/motels, etc.)
8,194,766 square feet

Loudoun County nonresidential construction, 1990-2000
10 year total = 28,101,192 square feet

Projections show a 56.3% population increase in Loudoun between 2005 and 2020. Betweeen 1990 and 2000, nonresidential construction consumed 645 acres of Loudoun's land. (Charts and graphs are based on data found in the Loudoun County Revised Comprehensive Plan, 2001.)



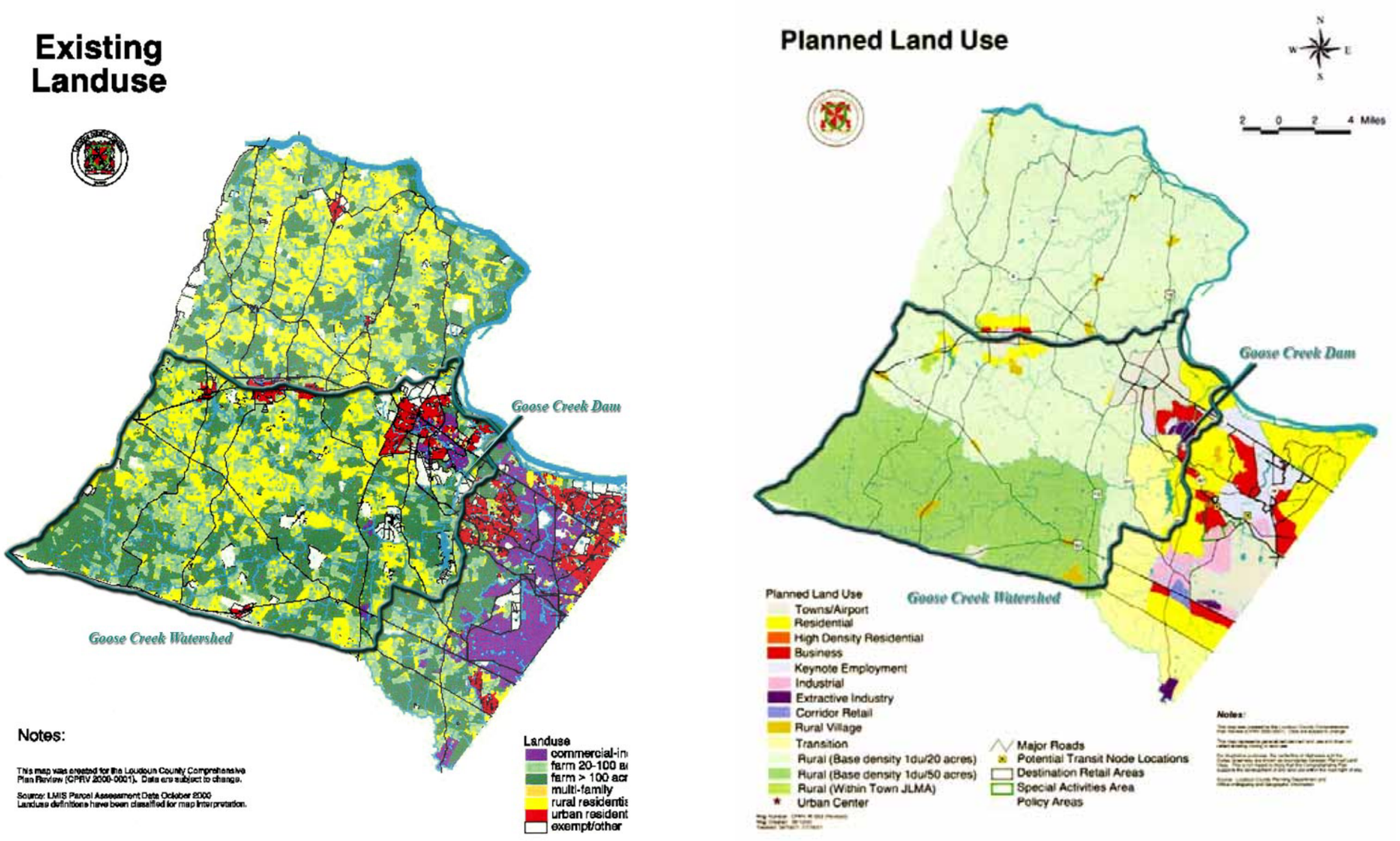
Loudoun housing by type, 2000



Demand for housing by type, 2005-2020

Total Housing Units, 2020	135,659 units
Single Family Detached	74,199 units
<.25 acre: 51.4%	
.25-.99 acre: 21.8%	
1 acre or more: 26.8%	
Single Family Attached	35,581 units
Multi-Family	25,879 units

Single family detached housing is expected to remain in the greatest demand in Loudoun through the year 2020. More than half of SFDs will be built on less than a quarter acre of land. (Charts and graphs are based on data found in the Loudoun County Revised Comprehensive Plan, 2001.)



County-prepared maps (modified to highlight the Goose Creek Watershed) provide graphic representation of existing and planned land use. (Maps appear in the Loudoun County Revised Comprehensive Plan, 2001.)

Summary of Findings: Societal Research and Analysis

Loudoun County's population is projected to increase above current national and regional averages through the year 2015. Loudoun's demographics are quickly changing toward a young, affluent culture, typically with little or no history with Loudoun's past characteristic environment, a vernacular that is disappearing as housing and nonresidential construction meet the demands of rapid expansion.

Within the Goose Creek watershed, planned land use consists of towns and airport, keynote employment, business, industrial, extractive industrial, high density residential, residential, rural villages, transitional, and the infrastructure needed to support these uses. The majority of new construction in Loudoun County remains single family detached homes on smaller than quarter acre parcels, suggesting continued sprawl and individually maintained lots. These conditions will likely increase the amount of impervious surfaces, the use of toxic chemicals (pesticies, herbicides, cleaners, fuel) and fertilizers, and will alter hydrologic flows.

Biocentric landscape architecture responds to these changing conditions on the forefront, by preserving and restoring a wildlife area and corridor, by exposing human visitors to aspects of Loudoun's vernacular (landscape typologies), and educating visitors to more ecologically responsible ways of considering and interacting with the environment. Citizens obtain information they can apply when making decisions that shape their communities and the greater environment around them.

CONCEPTS & DESIGN

Environmental and societal research and analysis set my design in motion and helped further define those things my biocentric landscape architecture ought to achieve on this site. Research and analysis was a key step in the planning and design process because my environmental philosophy alone would not be enough – it was the existing conditions, as well as conditions forthcoming, and ecological patterns that provided the scientific basis for sound decision-making and gave the design its "tooth." Said differently:

"Environmental philosophy ought to be a form of applied philosophy (practical philosophy): its argumentation should be inspired by problems in the real world and by the need to solve them." Therefore, the most effective philosophy starts "from questions and arguments that are raised in real-life, public debates," where the public's "intuitions, claims and theories [are] the starting point for a philosophy aimed at policy change." (Light and de-Shalit 2003, pp10,15)

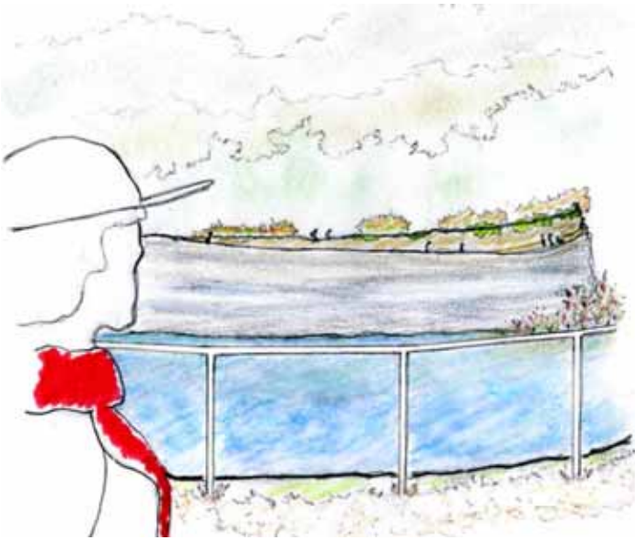
Reflective Equilibrium and Eco-Revelatory Design

Environmental philosophers use the term "reflective equilibrium" to describe the process by which people test their moral beliefs against other beliefs they hold. In order to attain coherence among our beliefs, we continuously revise and modify our theories and intuitions. Reminiscent of Deep Ecology's desire to reconcile belief structures with actions taken, Andrew Light and Avner de-Shalit offer three types of reflective equilibrium: private, contextual, and public. (Light and de-Shalit 2003, pp11-16)

In my design, as visitors move through the site they experience the three types of reflective equilibrium:

The visitor emerses himself in nature while walking down "Water's Dance Path."

Private reflection: one arrives at the site with some level of belief and understanding about ecological issues and his or her role in the environment. This setting of water and forest fosters private reflection about what it means to be in nature.



At the "Fishway," he studies geological layers and water's movement below.

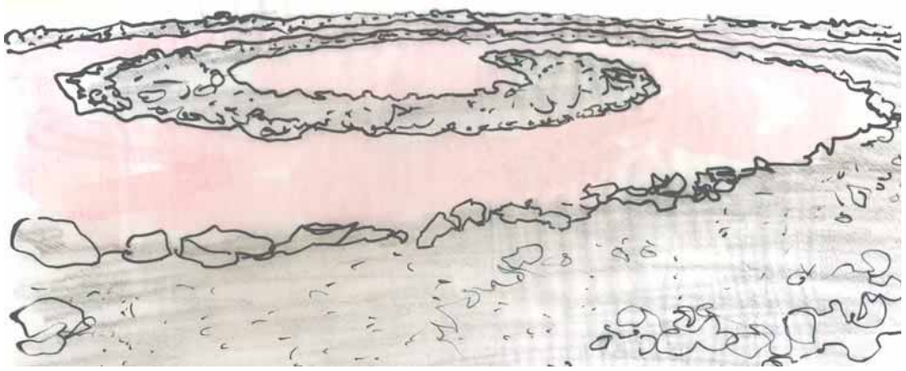
Contextual reflection: the visitor reflects more deeply on how his beliefs and understanding fit within the cultural or moral context of the place. This context is exposed through eco-revelatory design*, which presents unexpected juxtapositions of elements to help the visitor broaden his understanding of ecological function, make new connections in his beliefs, and draw new conclusions about environmental responsibility.

The visitor becomes a participant in public discussion at an Outdoor Classroom along the foot of the "Mound."

Public reflection: Light and de-Shalit assert that private and contextual reflection are not enough to solve real world environmental problems. It

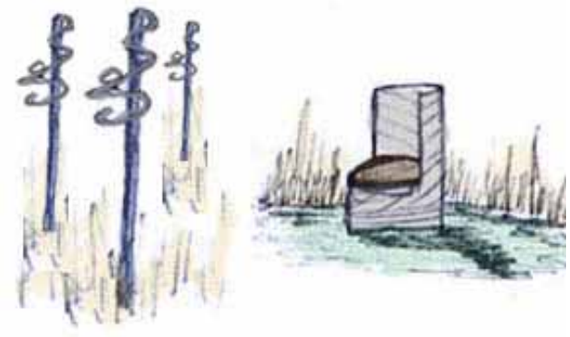
*Eco-revelatory design is a form of ecological design which reveals and interprets ecological phenomena, processes and relationships. Eco-revelatory design helps bring issues forward for public – as well as professional – education, discussion, debate and practice. It produces reference sites for what we understand about our environment and its workings, and sensitizes us to what is known about an environment's interlocking complexities. It can be assumed if one is more aware of and is able to see and comprehend phenomena and processes, he or she is better able to make wise decisions concerning them. (Helphand and Melnick 1998, px)

Examples of Eco-Revelatory Design



Robert Smithson's *Spiral Jetty*, 1972

Herman Prigann's *Hanging Tree*, 1985



Kathryn Gustafson's *Wind, Sound & Movement*, 2001
Spinner and Chair

is the public's ability and willingness to express and debate issues that matter to them which brings about policy change. Visitors who experience this site gain a language and understanding that should be carried forward in community involvement and public debate.

Overview of Concepts and Design

Although it appears quite linear here, the design process was anything but. It proved a more circuitous journey of give-and-take, where research influenced design work, and design work, in turn, required more research.

Organized to showcase the more important resulting elements of the design process and major aspects of site design, I present the remainder of my studio work in the following order:

Exploration of ideas. Earlier studio work on project strategy and research and analysis combined with science-based information introduced to me by my committee and formed the driving concept for my design work: how to reveal the interplay of land, energy, and water-flow.

Need assessment. Holding true to the goal of multiplicity, I identified four users who will share this space: the Fairfax Water Authority, the general public, an education and research institute, and native wildlife and natural processes. The needs and interests of each are identified and diagramed with special recognition given to conflicts among users. In a manner similar to McHarg's method, this process made more apparent the opportunities created.

Christo and Jeanne-Claude's *Running Fence*, 1972-76

Concept diagram. Research, analysis and need assessment come together with designer insight and ethic to form the concept diagram. Site design begins to take shape.

Master plan. This portion begins the presentation of the major aspects of final design work. Here, concepts have been refined and given shape, and are shown as the plan for the entire site.

Tian. Specific areas of the site are highlighted from here on, and design elements within are presented through focused drawings and descriptions. The area I call "Tian" is the heart of the site, and is the main focal point for most users. Because of this emphasis, I divided the discussion into three subsections that detail the Fishway and two path systems, Birdsong Path and Descent into Earth. The site's visitor/ research center is part of Tian as well.

Water's Dance Path. This is the main thoroughfare of the site and leads visitors from the site entrance to Tian. As a design element that exists mainly for anthropocentric reasons, it proved a great challenge to my ideas of biocentric design. Special considerations had to be given to wildlife migratory routes and difficult shrink-swell clay soils within this area. The final design produced a unique pedestrian experience that reflects the past vernacular of the region.

Boat Island. Goose Creek provides a dynamic backdrop to this forested site, and I would be remiss if I didn't provide sensitively and sustainably designed access to the water. From its location and the materials used, to the way it is accessed and the nonhuman functions it serves, Boat Island is another successful element of biocentric design on this site.

Final considerations. Studio work is concluded here with a brief presentation of rough concepts I had for Outdoor Classrooms at the Mound and for Remediation Knolls. Finally, I give my closing thoughts on this, my inaugural attempt at biocentric design.

Exploration of Ideas

As mentioned previously, I am interested in natural processes. Considering the prevalence of water on the site (as hydrologic flow and extractive resource), I wanted to tell a story about water, wanted visitors to understand more about this precious resource and reflect on their attitudes toward it.

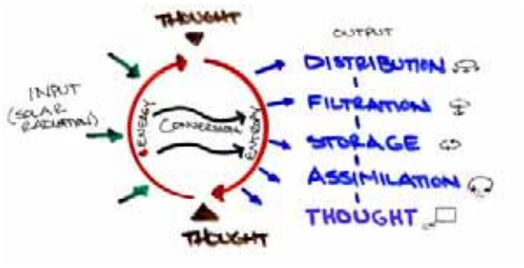
But to establish the design as *eco-revelatory*, I needed an added dimension of water's important role in a healthy ecological system. Furthermore, I set forth for myself a standard of multiplicity. My design had to bring true ecological function, and not merely result in a sequence of land features or interpretive art. After all, design work is ultimately the test of my ideal – biocentric landscape architecture.

On the advice of my thesis committee, I explored the Second Law of Thermodynamics – an ever-present, often misinterpreted yet important natural process and fundamental aspect of sustainability. (See Appendix Five: Energy –Entropy: The Laws of Thermodynamics for more on this topic.) When the connections I drew between energy and entropy resonated with my understanding of Taoism's oscillating evolution of complementary opposites (see Universal Connections section), and with my interest in dichotomies in the landscape, a spark of excitement told me I was on the right track.

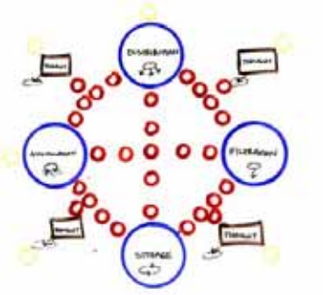
From this groundwork, two main ideas evolved: water flow-through, and energy flow and entropy. These became the processes I wanted to reveal.

Erosion along Goose Creek, below the dam: How to reveal to visitors the processes at work?

Entropy in the Landscape: marks time, transformation, energy input



System of energy infusion.



System of continual recycling.

Processes of Energy — Processes of Water

John Tillman Lyle

Conversion	a thing becomes something else
Distribution	energy and materials reaching members of the ecological system
Filtration	restores relative purity of the air and water in preparation for the next phases; plants soil and decomposing rock act as filters
Storage	materials and energy are held inactively at some points awaiting eventual reuse
Assimilation	process of revitalizing the earth; products of landscape (including "waste") returns to the landscape
Thought	people have deprived nature of its independence, and that is fatal to its meaning — nature's independence *is* its meaning

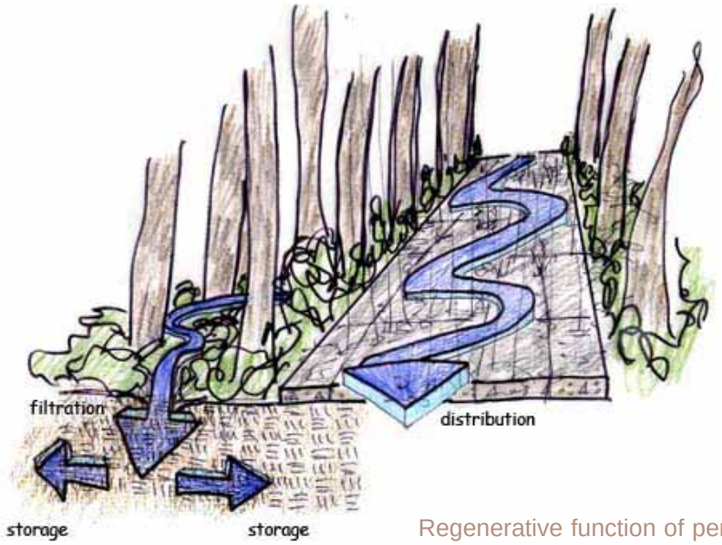
the human intellect has become a dominate force in the global landscape; humanity has no choice but to provide the mind within nature; human thought becomes part of the natural process, we provide the mind of nature

the human mind is nature's consciousness, *not* its master

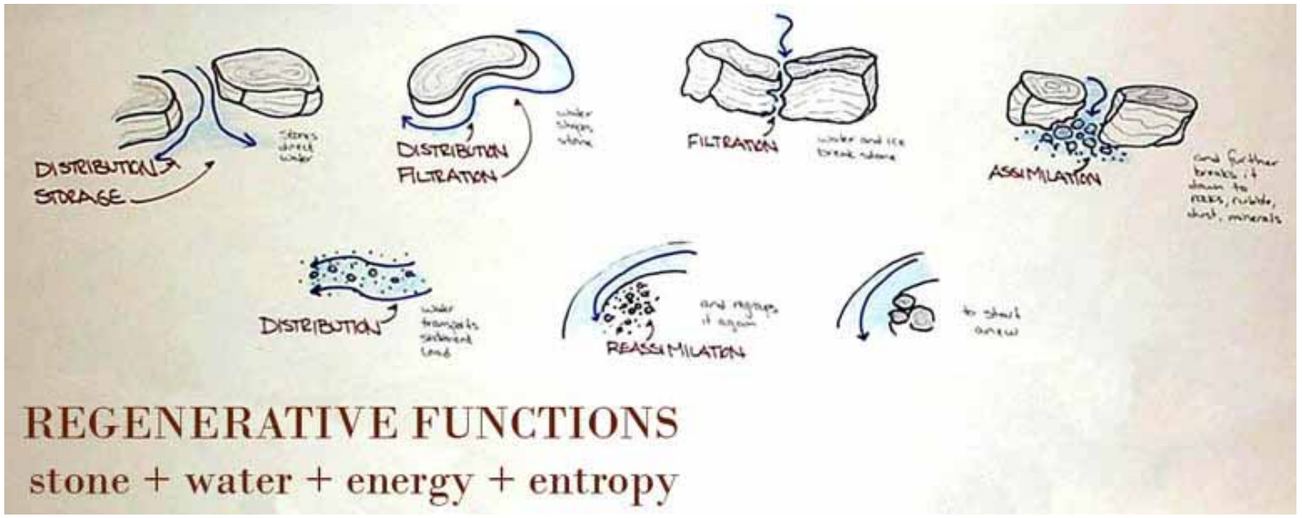
Lyle 1994, pp26-28

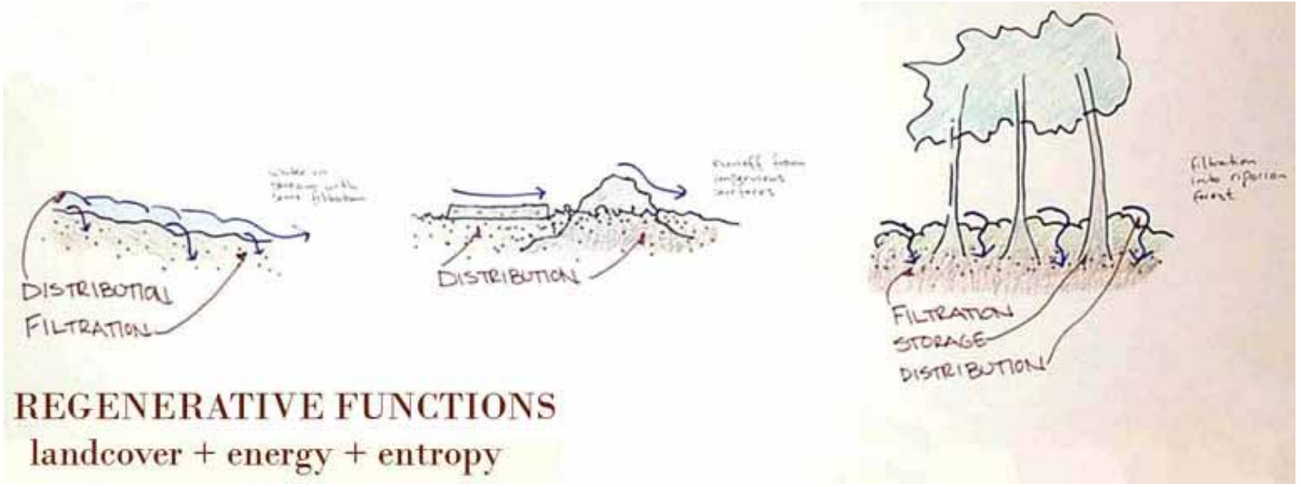
When my committee introduced me to John Tillman Lyle's writings on regenerative function (in *Regenerative Design for Sustainable Development*), I found the inspiration for my ideas of Land + Water Interactivity, which led to the mapping of Hydrologic Energy Areas (see Research & Analysis section). For me, energy and water-flow combined, and we can see their interplay on land if we learn to read the signs. *This* was the story I wanted to reveal to my visitors. *This* became the driving concept for my design work.

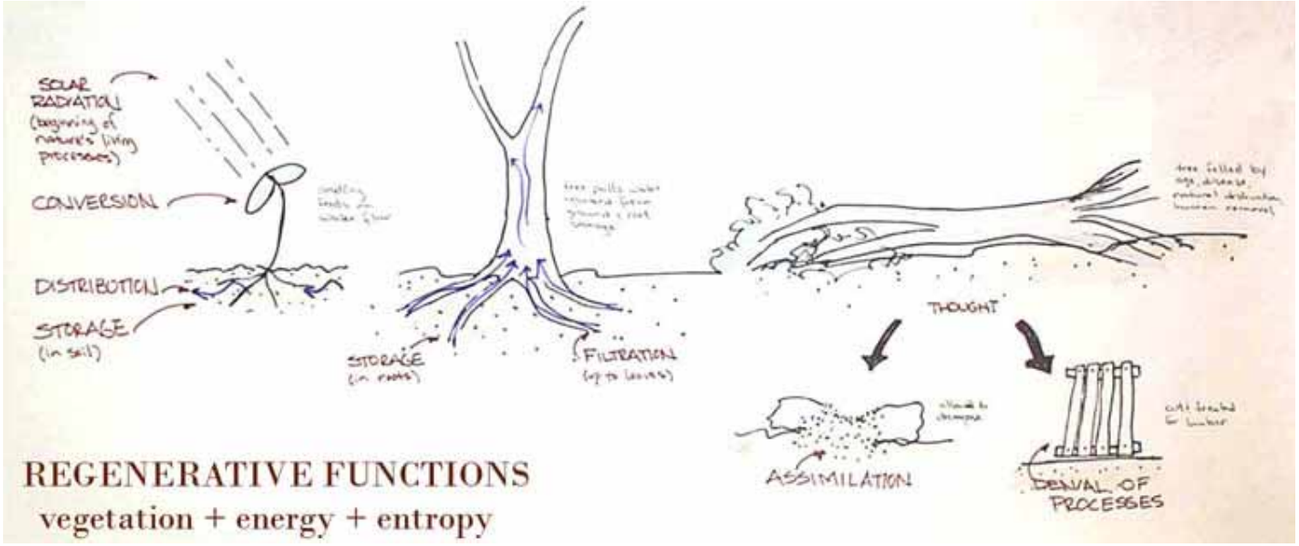
It's a story with a sense of urgency for the citizens living within this landscape of rapid change. As they engage in public reflection regarding the shaping of their communities and the extent sustainability exists among their guiding principles, I think it important that the Land + Water Interactivity is understood as a linchpin of healthy, functioning ecosystems.



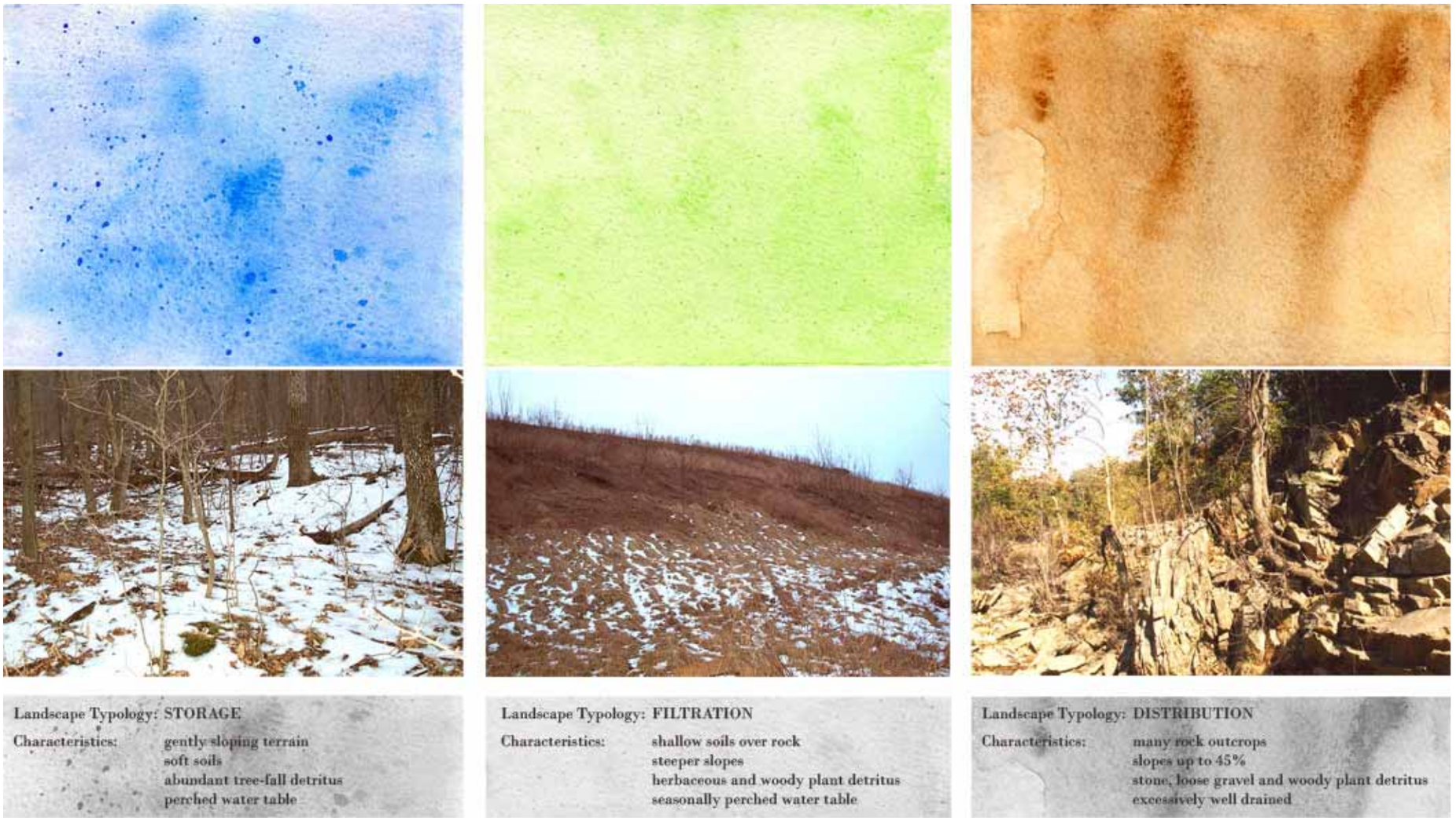
Regenerative function of pervious and impervious surfaces.







A look at regenerative functions existing on the project site. Like li, Land + Water Interactivity manifests in subtle patterns of process. Once signs of these patterns in the landscape are revealed, visitors gain a broader understanding of ecological processes, as well as their own role as the mind within nature.



Here, a watercolor experiment demonstrates the Land + Water Interactivity. Hydrologic Energy Areas of storage (left), filtration (middle), and distribution (right) are differentiated as abstract movement of paint (stained water) across paper (the "land"), and as actual landscape typologies on the project site.

Why is that so important? I'll illustrate with an example. Consider the time involved for the Land + Water Interactivity to take place, and the extent at which humans alter that process. Some interactivity is instantaneous, such as flooding, while others play out on a geological time scale, such as continental drift and the formation of precious soil (see sidebar *Patch and Landscape Ecological Dynamics: Temporal and Spatial Scales*).

Humans interfere with the natural processes of Land + Water Interactivity at alarming rates. By some measures, we have become "arguably the premier geomorphic agent sculpting the landscape, and the rate at which we are moving earth is increasing exponentially. The total earth moved in the past 5,000 years would build a 2-1/2 mile high mountain range 25 miles wide and 62 miles long [3,875 cubic miles]. If current rates persist, we could double the length of our mountain range in the next 100 years." (Hooke 2000, p843-45).

Since my project challenges commonly accepted attitudes toward the human-nature relationship, and explores landscape planning and design that benefits the natural world, I will repeat Roger LeB. Hooke's concluding sentiment, "One may well ask how long such rates of increase can be sustained, and whether it will be rational behavior or catastrophe that brings them to an end" (Hooke 2000, p845). Through biocentric landscape architecture, as demonstrated by the design work that follows, it is my hope to help inspire the "reflective equilibrium" and "rational behavior" that grows into real environmental change.

Need Assessment

I wanted to explore an idea I had early in thesis work: If we must interrupt an ecosystem, let us accomplish more than one task without additional disruption, especially if this helps reduce ecological impact. To demonstrate this notion, I identified the four main users of this site who would share space, coexist with a diversity of activities, and combine resources to fulfill their purposes. Human users are required to respect the needs of other users by looking beyond their own needs and wants and considering the environment, an idea reminiscent of *Mitakuye oyasin*, (see Universal Connections section). The users are:

The Fairfax County Water Authority. Its main interests are providing safe public utility (source of drinking water) by maintaining the dam and other water treatment facilities.

The General Public. They want public parkland for recreational opportunities and conservation. Additionally, they gain an eco-revelatory experience.

An Education and Research Institute. The institute's interests involve ecological conservation, ecosystem monitoring and maintenance, land stewardship outreach programs, key sites to conduct research and training, and office-related facilities.

Native Wildlife and Natural Processes. The needs of nature will always be elevated to client status in biocentric landscape architecture. Habitat, breeding grounds, food, water, functioning ecosystems, and the ability to complete cycles of growth and formation are key interests at this site.

In order to accomplish this experiment of multiplicity, I returned time and again to the environmentalist's mantra: reduce, recycle, reuse. The outcome was less land fragmentation, minimized footprints and number of new structures, concentrated and optimized user benefits, and maximized utility *and* conservation of resources. The following three pages demonstrate my methods for organizing information on each of the users and creating concept diagrams to help direct site design.

Identifying Needs: The Matrices

After listing the needs I identified with each user, I wanted a more interactive tool to explore the relationship between those needs. For example, what type of, if any, relationship exists between the Water Authority's need for a safe dam structure and a need for fences or barriers.

The following matrices proved to be an interactive tool. I created a hierarchy of relationships – significant and immediate relationships are designated by red dots (•), secondary relationships with black dots (•), and insignificant or no relationships are left blank – and created a matrix for each user to note the relationship between all needs listed. (For more information on creating and reading the matrices, please refer to Appendix Four: Using Matrices to Track Connections.)

Needs on Land: The Diagrams

Once needs and their relationships were explored, I mapped this information as concept diagrams to show each user's ideal conditions for the site. Points of access, viewsheds, protected areas, circulation routes and attitudes toward water use were the most important findings of this exercise.

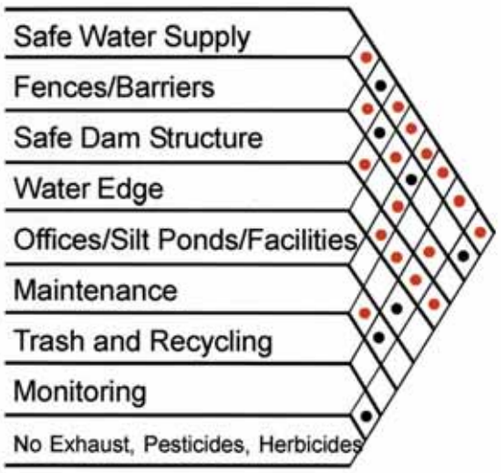
When individual matrices and diagrams were compiled, the challenge for me became combining the information into a unified whole that responded to and respected all users' needs. After all, my previous design experience dealt with one identified user or client at a time, not a multiplistic layering of numerous clients. It became clear that conflicts among users exist, and that *needs* had to be distinguished from *wants*.

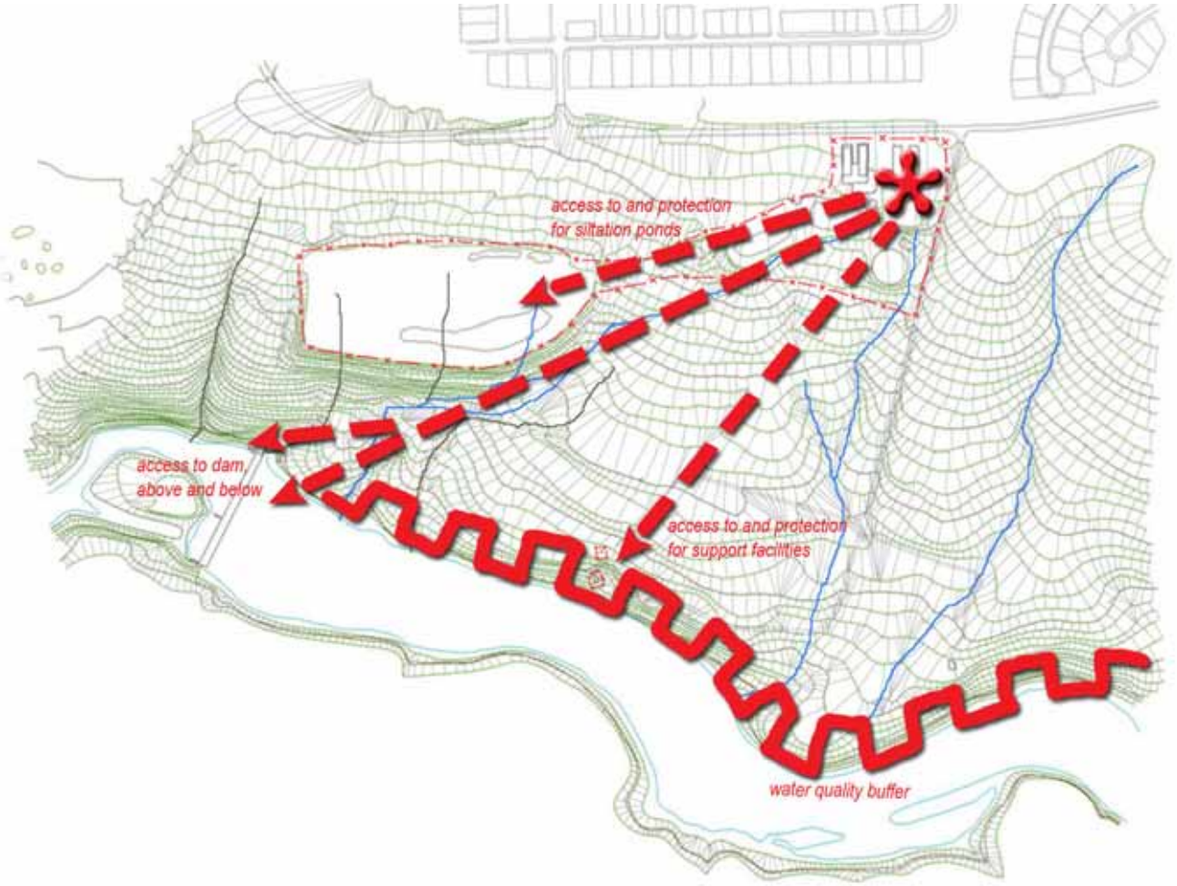
Obstacles to Opportunities: The Conflict Matrix

Until now, I focused on the needs of the individual user. Here, all the needs of every user are presented together with an emphasis on conflicts that arose. For example, the relationship between the Public's *want* for access to the water's edge is in direct conflict with Native Wildlife's *need* for access to the water's edge (as indicated by a red dot). In contrast, the Education & Research Institute's purpose of monitoring is in lesser conflict with Wildlife's need for access to water (black dot), and is more easily resolved (the purpose of monitoring is to improve ecological conditions, so when done correctly, monitoring will benefit Wildlife).

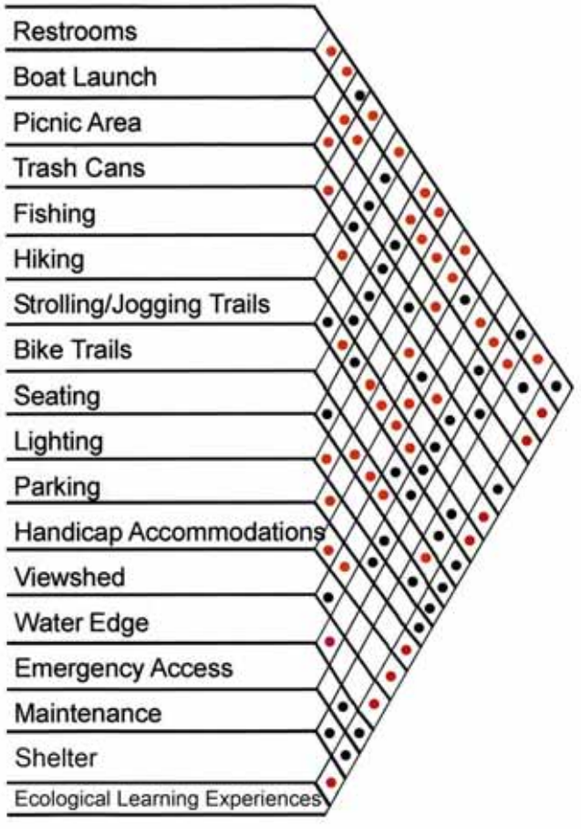
From the conflict matrix, the relationships among user functions became more apparent, both those in conflict with one another, and those that were more benign to one another. By studying both types, I was better able to identify the areas and functions to which I could most meaningfully apply biocentric design solutions.

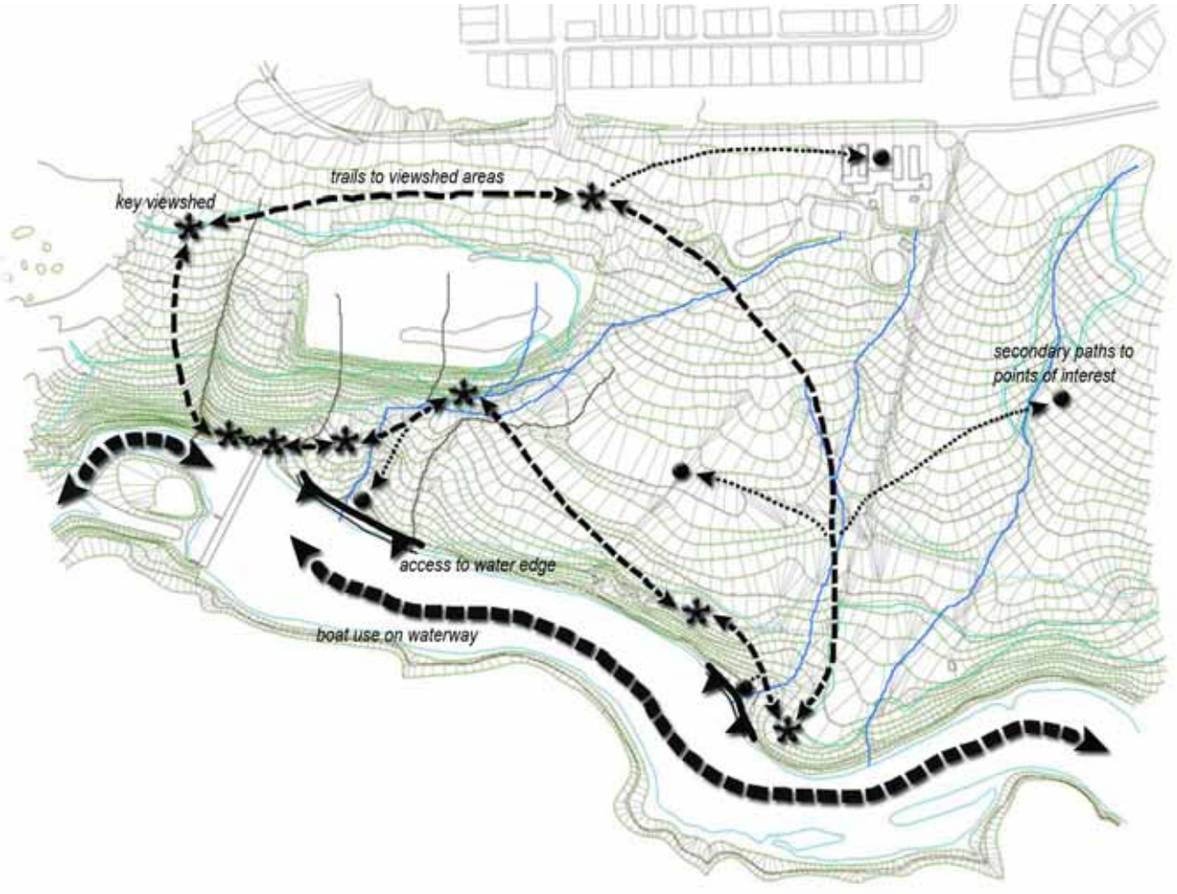
Water Authority Interests



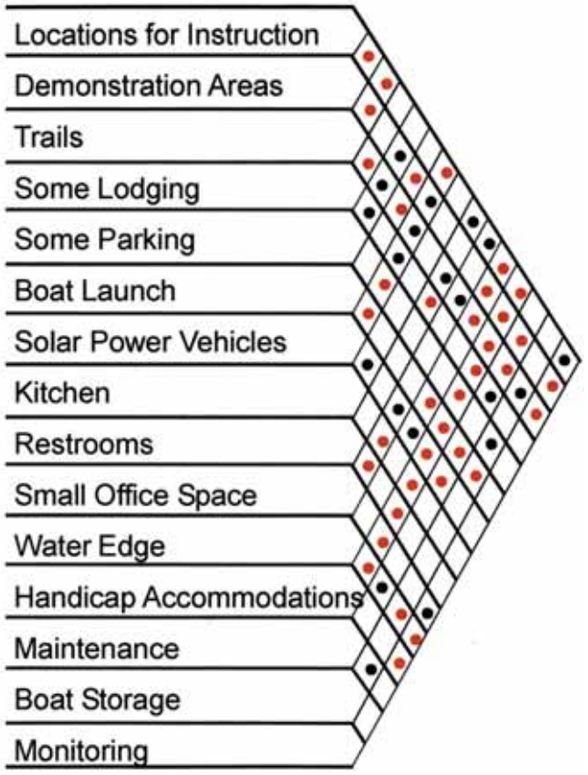


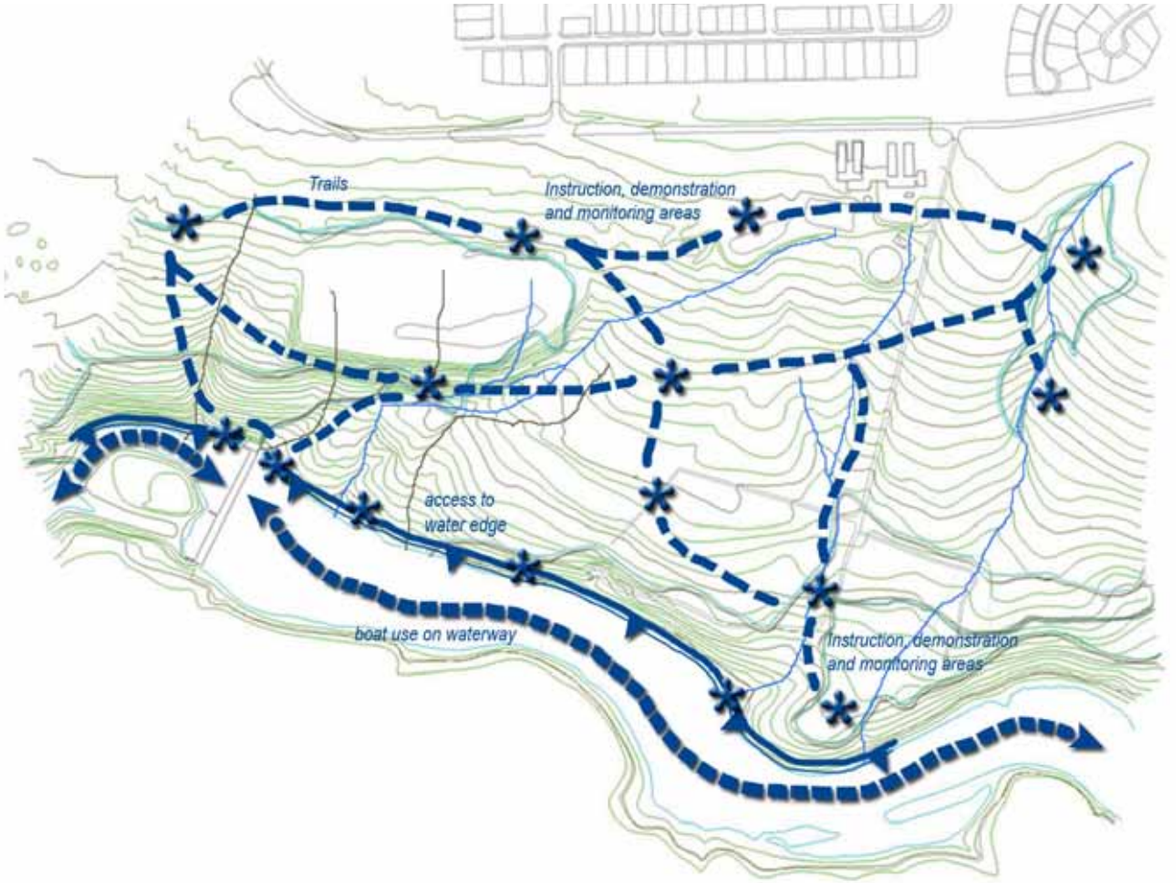
General Public Interests



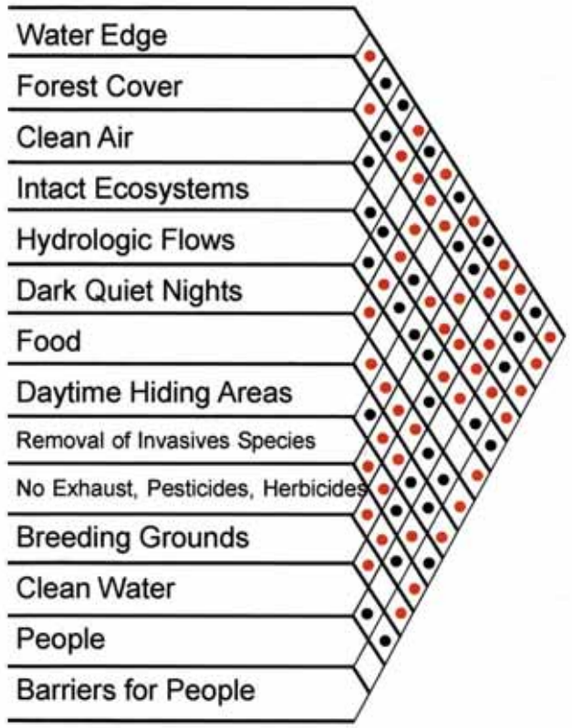


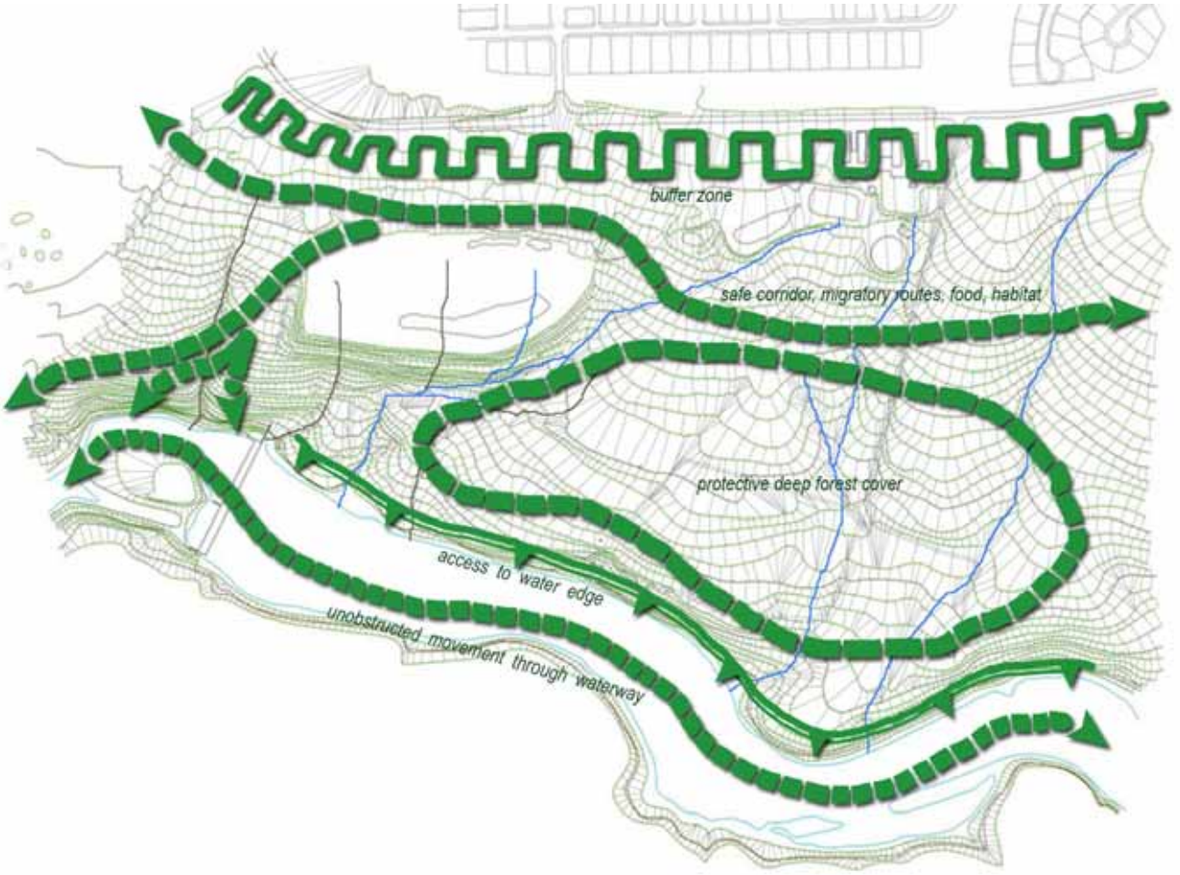
Education & Research Institute Interests





Native Wildlife and Natural Process Interests



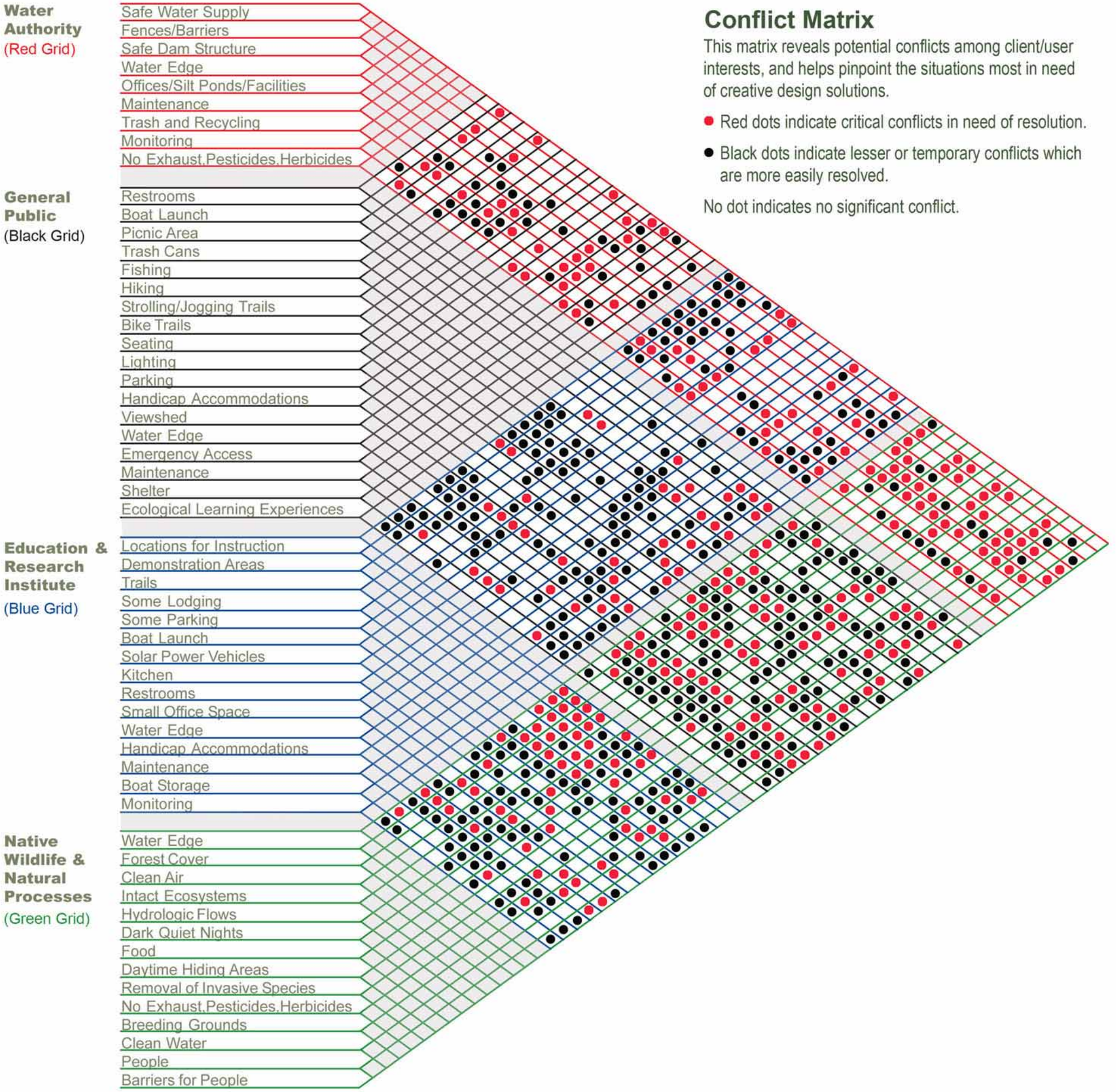


Conflict Matrix

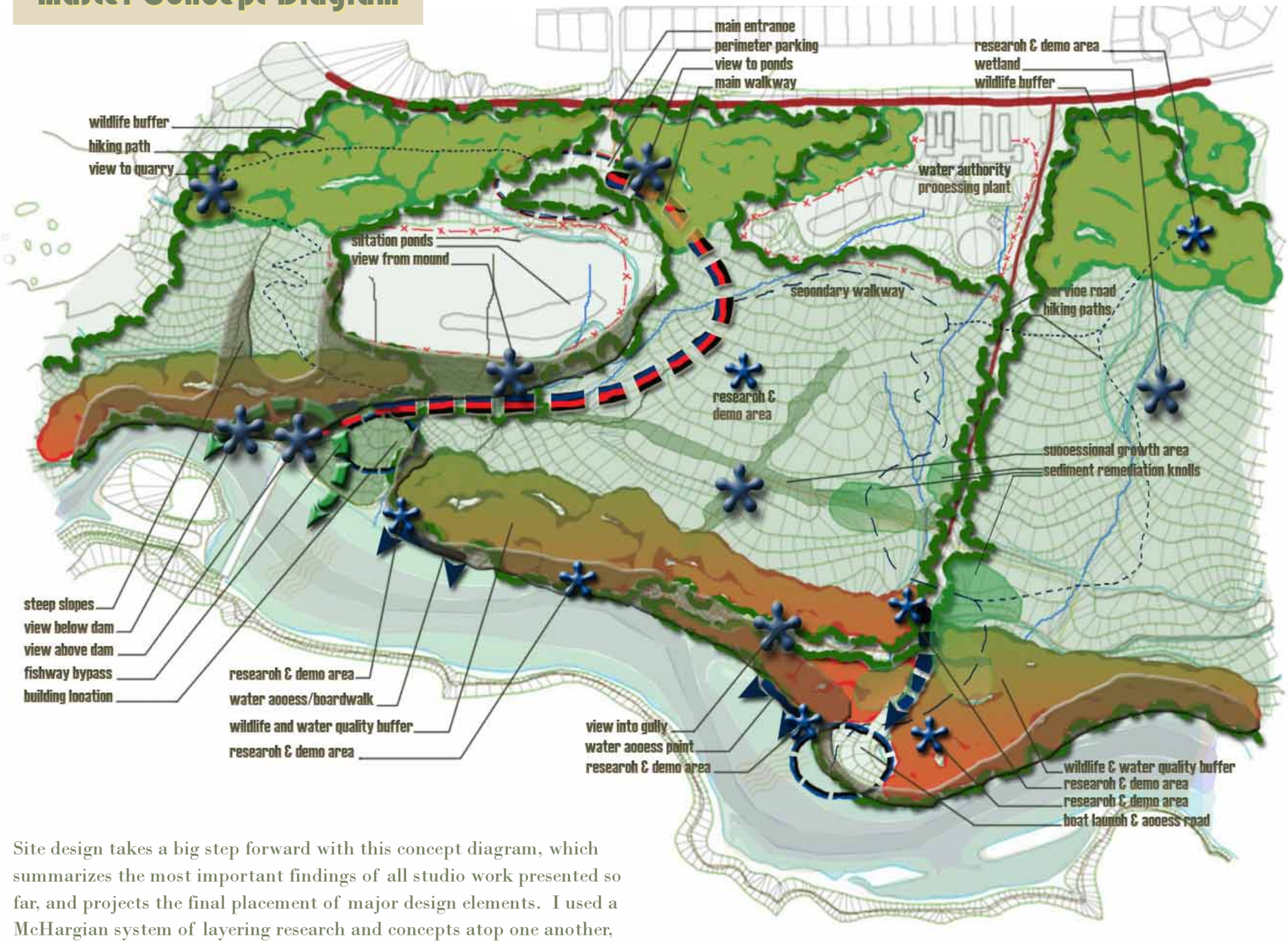
This matrix reveals potential conflicts among client/user interests, and helps pinpoint the situations most in need of creative design solutions.

- Red dots indicate critical conflicts in need of resolution.
- Black dots indicate lesser or temporary conflicts which are more easily resolved.

No dot indicates no significant conflict.



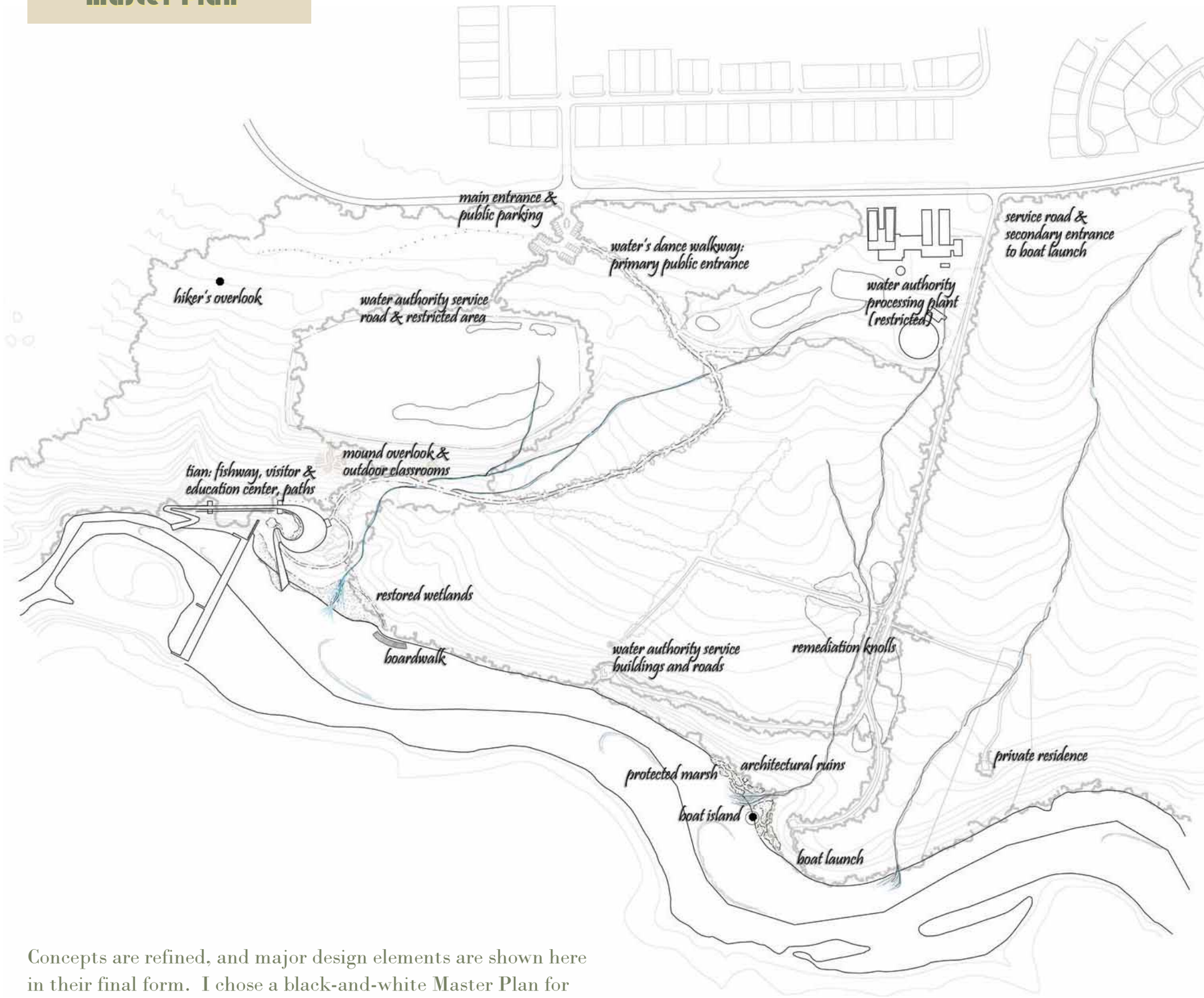
Master Concept Diagram



Site design takes a big step forward with this concept diagram, which summarizes the most important findings of all studio work presented so far, and projects the final placement of major design elements. I used a McHargian system of layering research and concepts atop one another, and considered findings from the matrices to reveal hidden opportunities for design and to determine the ideal locations for elements. In this diagram, biocentric intentions become more evident – such as the addition of a bypass fishway – and a unified whole that responds to and respects all users begins to take shape – as in the ratio of water access open to wildlife versus the amount allotted to the general public.

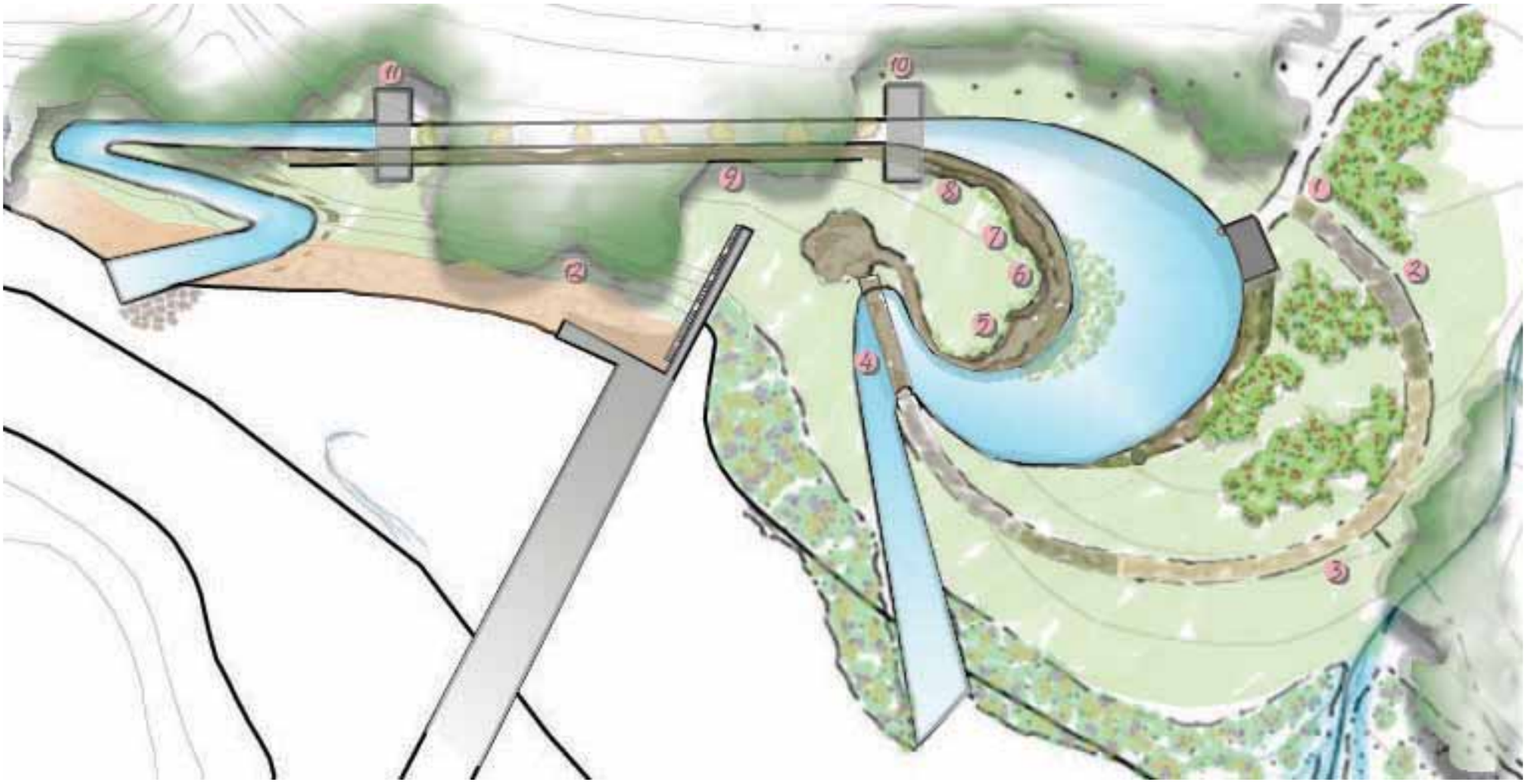
Notice the amount of forest cover and wildlife buffer have actually increased over existing conditions, and most paths and hiking trails create minimal land disturbance. Routes were selected to lead visitors to significant points on the site (important viewsheds or specific landscape typologies), as indicated by large dark blue asterisks. Smaller asterisks show demonstration and monitoring stations for research and education functions. Areas with the steepest slopes remain undeveloped and a small few are accessible by boat only.

To assist in reading the diagram, keep in mind that colors were selected and combined based on user interests for a given area or element. Consult the color schemes used for Need Assessment diagrams and matrices, as they correspond to user interests here.



Concepts are refined, and major design elements are shown here in their final form. I chose a black-and-white Master Plan for its cleanness and legibility. Rendered versions of focused areas and design elements follow.

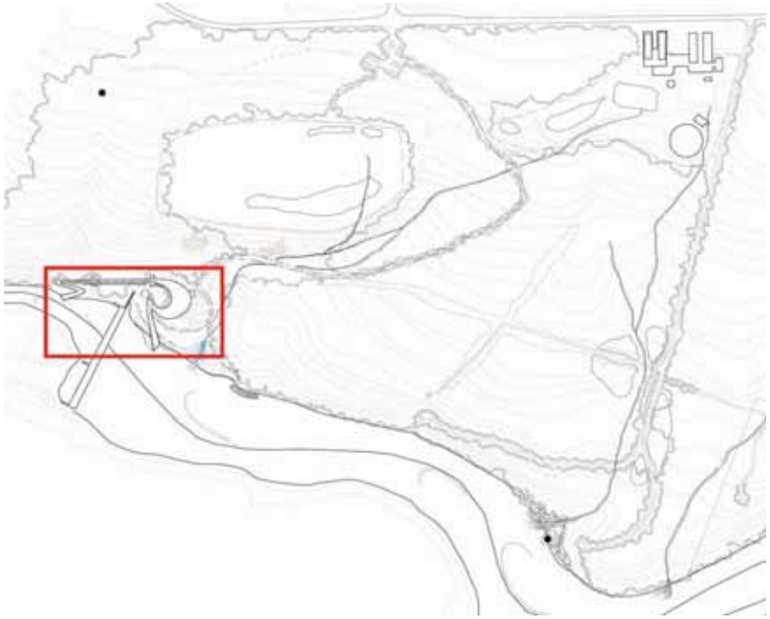
Tian: Nature With Authority



"*Tian*" is a Taoist word roughly translated as *sky, heaven*, or *nature with authority*, whereby sky represents the constant nature (as the motions of the heavens) (Toropov and Hansen 2002, pp 68,131).

Here, Tian is the heart of the site. Located in the low-successive growth area of the former boat launch, Tian distinctly embraces sky, water and earth.

Part fishway (bypass-type fish ladder), part path system, and part visitor and research center, Tian accentuates the dam and literally draws the creek into and through the land. Although an intriguing eco-revelatory experience for visitors, Tian's importance lies in its service to wildlife and nature where aquatic species overcome the dam, geomorphic processes prevail through improved sediment and nutrient flows, and forest habitat is restored with native plant species.



Tian: Fishway

The beauty and awe of water's flow over earth and into earth has the power to make one pause and reflect about time, and nature, and purpose. As water follows itself down the path we call Goose Creek, and cascades over the dam or spills into the Fishway, visitors bear witness to stories about the creatures that inhabit these waters, the society that impacts them, and the flux of nature and her processes.

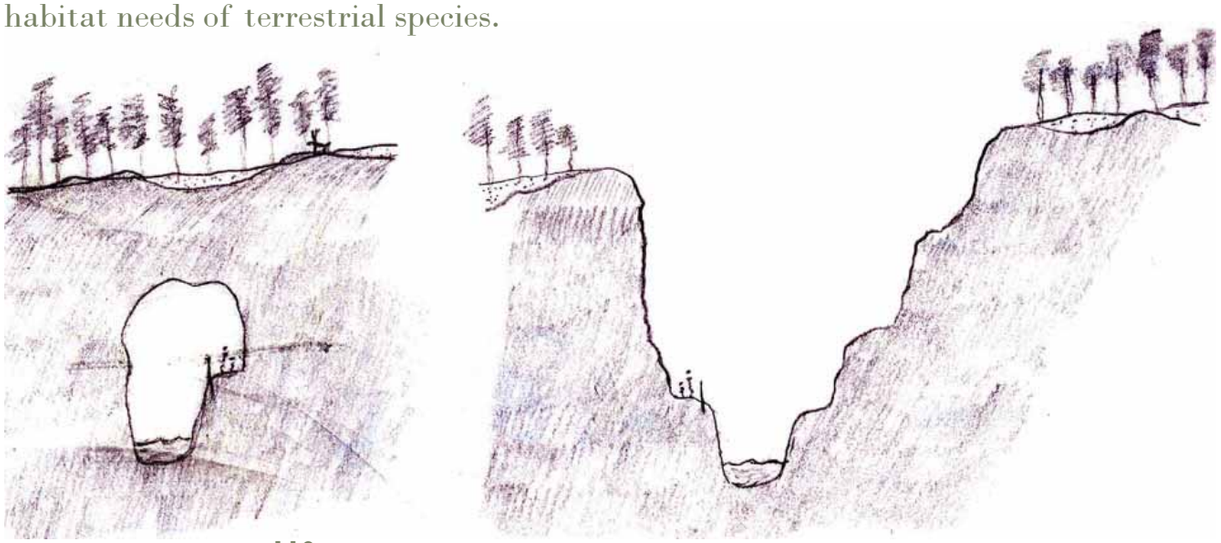
Goose Creek dam is an important element to the anthropocentric community, but an impenetrable barrier to aquatic species, such as shad (*Alosa* and *Dorosoma* sp.), eel (*Anguilla* sp.), bass (*Micropterus* and *Ambloplites* sp.), and a Federal Species of Concern, the darter (*Percina* sp.). The dam is particularly damaging to populations of anadromous aquatic species known to exist in Goose Creek and the Potomac River, which rely on unimpeded waterways for spawning.

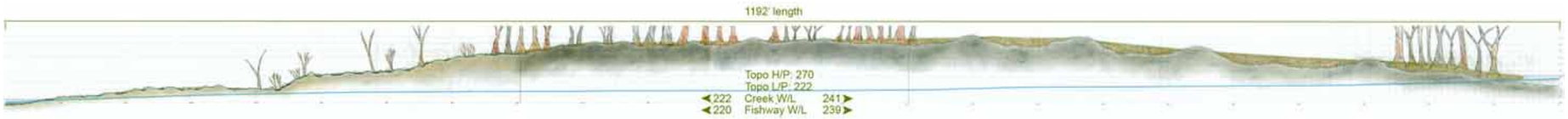
The Fishway is designed to help aquatic life overcome the dam and flourish upstream. Its first order of business is to serve the biotic community; its high-interest design attracts humans as well, and offers them an accessible-grade path system to experience the Fishway without direct contact with water.

A simple and sustainable system, the Fishway draws from Goose Creek's natural flow without pumps or other high-maintenance mechanisms.

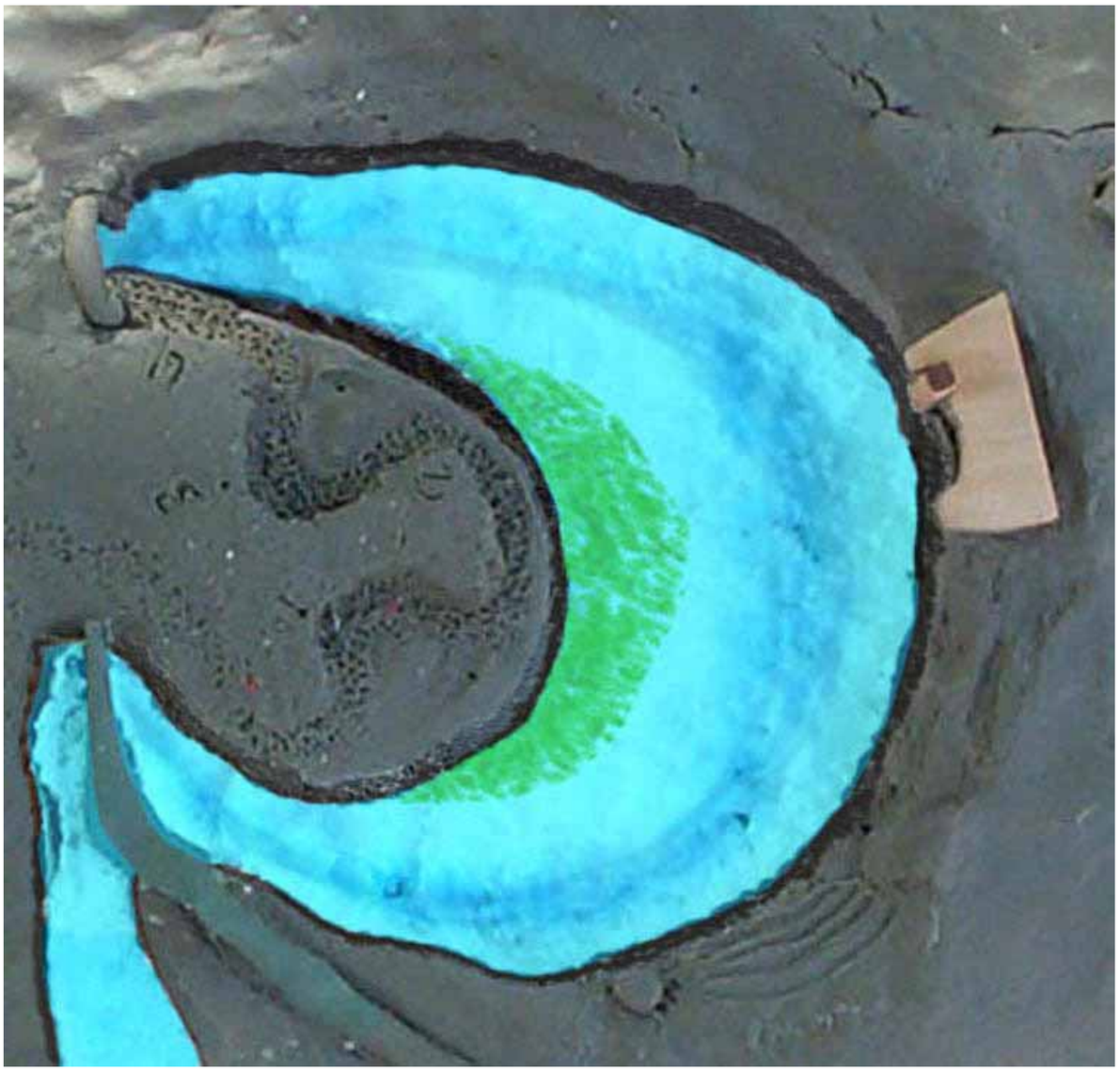
Concept. I wanted to protect and preserve the wildlife buffer along Goose Creek, but as a water lover myself, I was drawn to the water and wanted to allow some sort of human interaction with it. The original thought was to add a water feature that would interpret Goose Creek, but initial ideas failed my self-imposed standard of multiplicity, and served more as land features than ecological functions. After several miscues, the idea of pulling water off the creek and up into the site began to grow. Soon I realized the ecosystem could be served while giving humans a unique and memorable eco-revelatory experience. Though I allow only visual interaction at the Fishway, the desire for physical interaction with water is satisfied elsewhere on site with a modest boat landing and boardwalk, and at the area below the dam.

Below. Study of a tunneled Fishway versus an all open-chasm design. The tunnel proved more biocentric in design as it more fully considered migratory routes and habitat needs of terrestrial species.





As shown in this longitudinal section (approx. 1,200 feet), the Fishway moves through three types of soils and subsurface geological layers – some with vegetative covering, some with abundant rock outcrop. The trough line (shown in blue along the bottom) begins and ends two feet below the Goose Creek shoreline, and plunges as much as 39 feet below topographical elevation. A hard diabase-like substrata in the center provides ideal conditions for the tunnel, assuring its stability and durability, and holds maintenance requirements to a minimum.



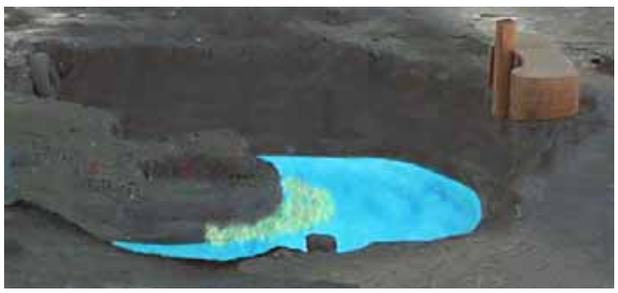
* Aquatic life reads Fishway as a naturalistic tributary with riffles, pools, vegetation, food sources, sediments.

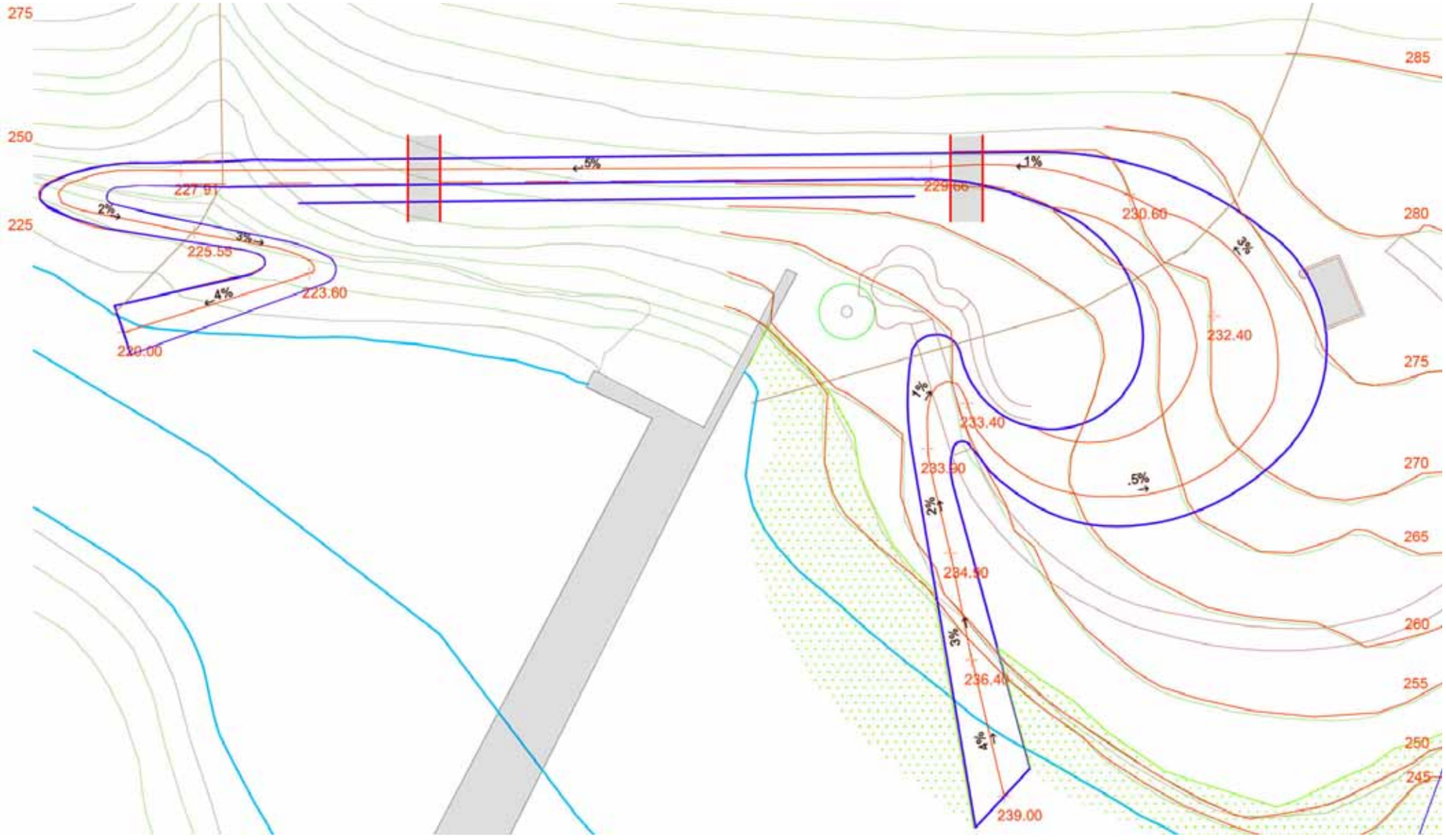
* Trough line (dark blue) follows the current's natural shifting patterns.

* Earth-cut provides wildlife a safe passage around dam, as it uniquely reveals to humans the deeper structure of land.

* Excavated stone and soil, and a small amout of timber become on-site construction materials.

* Visitor & Research Center (on right), amphitheather (bottom), paths (bottom and left), and tunnel (upper left) enhance the human understanding and experience of this place without allowing direct access to the ecosystem below.





Center Line

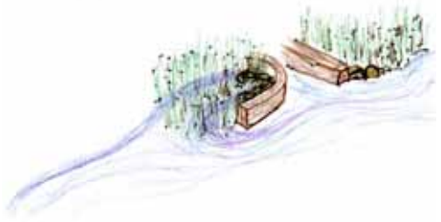
Trough Line

Water revolves around the axis of the Fishway floor. Linear portions of the Fishway have a true center line along the bottom (top, in section), which produces symmetrical revolving water currents. Bends in the Fishway create asymmetrical troughs, and produce primary and secondary revolving currents.

Existing topography, spot elevations of the trough line, and slopes along the bottom of the Fishway show the system's depth, and explain the gravitational pull which draws water from the creek, feeds it into and through the Fishway, and returns it to the creek below dam.

Right. The mouth of the Fishway, located above the dam, is reinforced with stone and wetlands. Construction materials and form work with water's tendency to wrap around obstacles, and not direct water in unnatural patterns. Below the dam, where water is shallow, stones and modest grass growth protect the Fishway terminus.

Left. Water flows in shifting currents as it follows its course, be it a creek, Fishway, ocean, or even air.

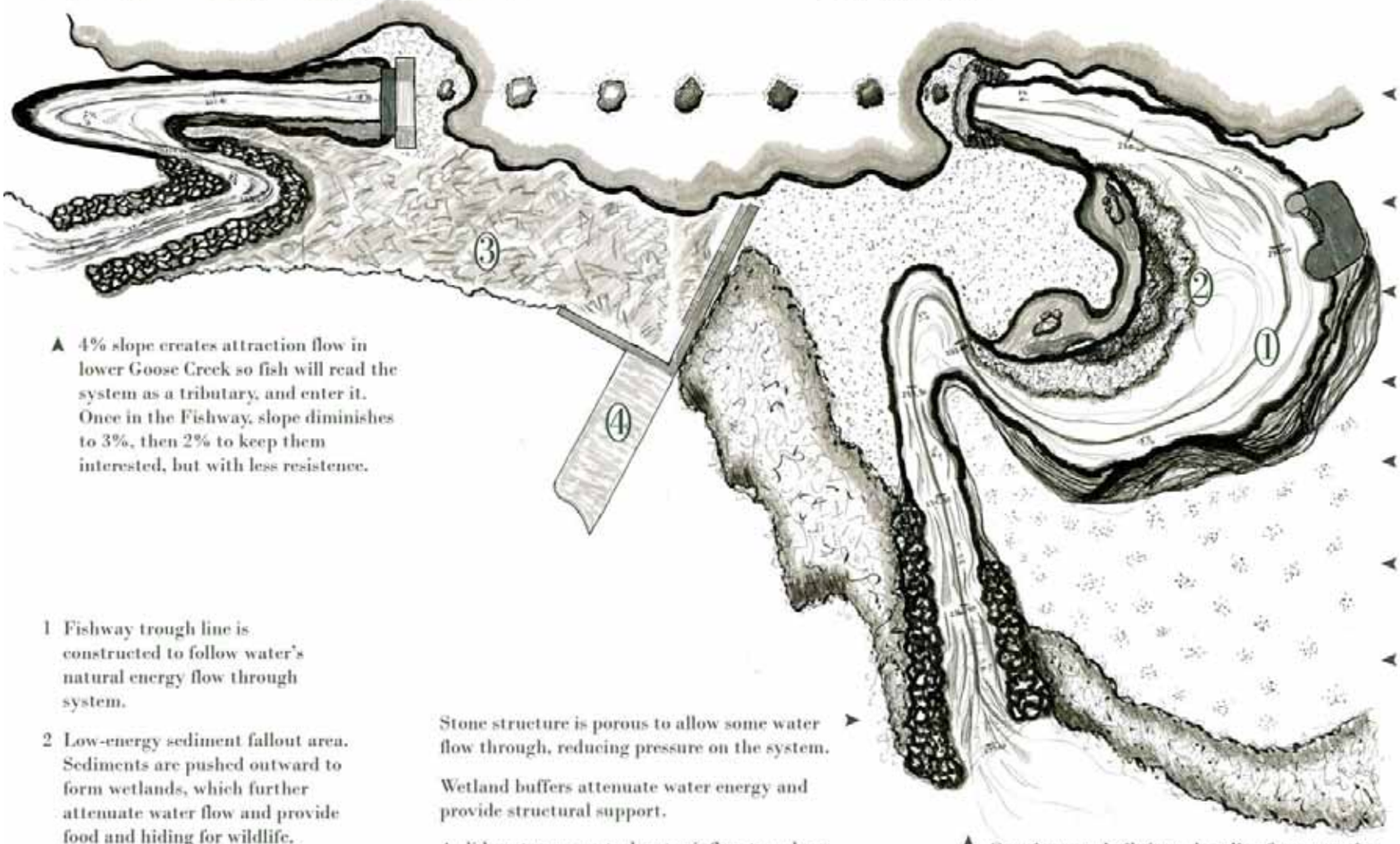


How It Works

Despite the term "fishway," this system does not suffer speciesism. Because of its open design and the fact that it is not built to the specific needs of a few chosen types of fish, many aquatic, marginal and winged species will gain ecological benefit from it.

▼ .5% slope slows water through constricted tunnel, providing low resistence for long swim.

Tunnel with light wells and fiber optics for attraction lighting.



◀ 1% slope sustains riffles and gives fish a bit more resistence after long stretch of calm.

◀ 3% slope creates active riffle segment and rejuvenates water's movement.

◀ .5% slope creates low resistence flow for rest, and reduces erosion of bedrock.

◀ 1% slope calms water as it enters the first turn.

◀ 2% slope slows water further as it feeds the flow up the Fishway.

◀ 3% slope maintains a strong water volume, but slows flow a bit.

◀ 4% slope draws water into system, and directs fish out to Goose Creek.

▲ 4% slope creates attraction flow in lower Goose Creek so fish will read the system as a tributary, and enter it. Once in the Fishway, slope diminishes to 3%, then 2% to keep them interested, but with less resistence.

1 Fishway trough line is constructed to follow water's natural energy flow through system.

2 Low-energy sediment fallout area. Sediments are pushed outward to form wetlands, which further attenuate water flow and provide food and hiding for wildlife.

3 Sensitive overspill area with steep rock outcrops is a study in structure and ecological impact, and is a unique destination.

4 Goose Creek dam.

Stone structure is porous to allow some water flow through, reducing pressure on the system. ▶

Wetland buffers attenuate water energy and provide structural support.

A slide gate can control water inflow to reduce flood impact.

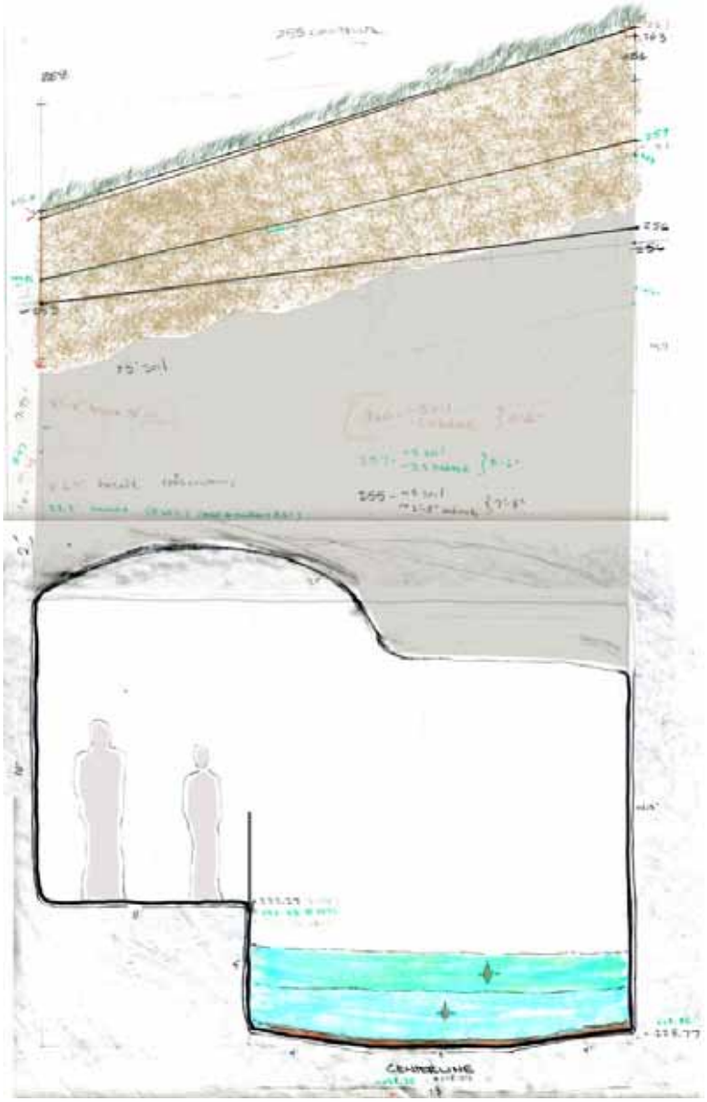
Stronger currents favor Goose Creek's west bank along this reach, so Fishway is protected in a low- energy area.

▲ Openings are built into shoreline for protection and support.

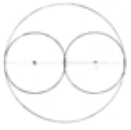
Opening is set 2' below shoreline and typical water level to help ensure water flow in low-water periods, and to aid in the transport of sediments to lower reaches of Goose Creek.

This illustrative diagram indicates my intentions and reflects my research and consultations behind the design. At this point, the biocentric landscape architect would collaborate further with others in the same field and in complementary fields, such as geologists, biologists, hydrologists, wetlands specialists, and structural engineers, to fine-tune the system for optimum performance and sustainability. As stated earlier, reaching beyond one's own scope of expertise to collaborate with others is a key element to successful biocentric design.

Existing conditions at Fishway location.



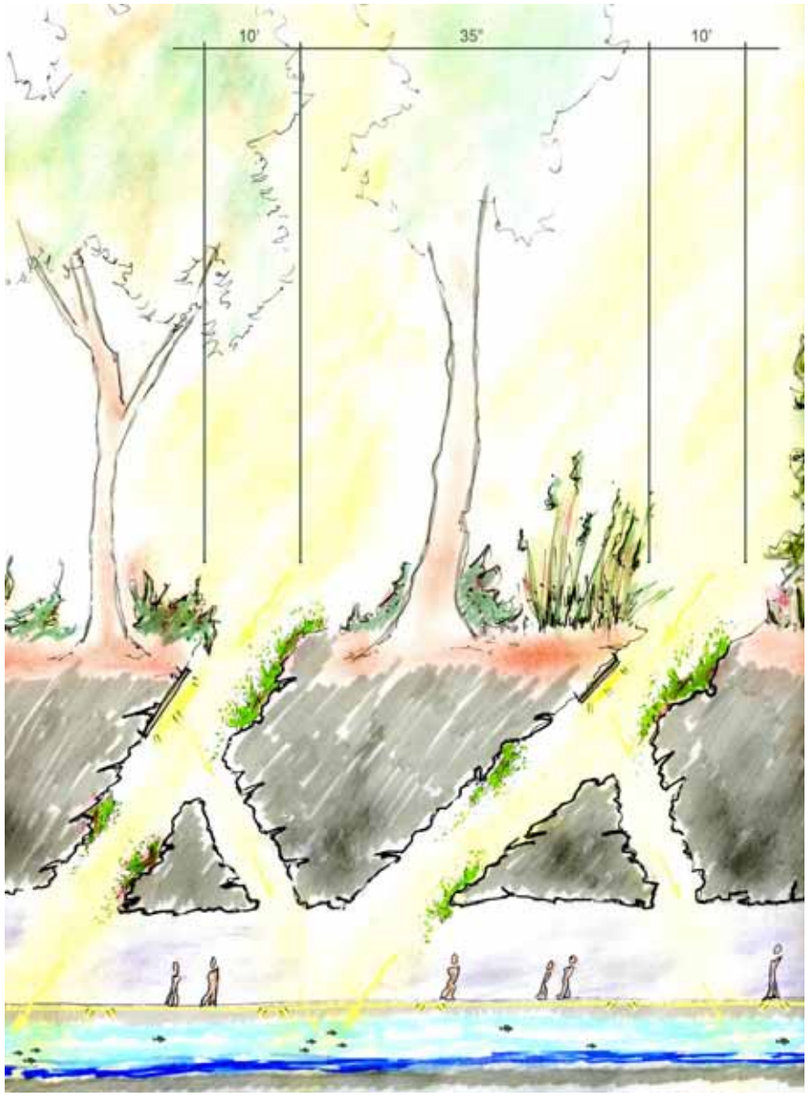
Cross-section of tunnel shows geological layers, dimensions, and the separation of humans and aquatic life in the Fishway.



Layout for the Fishway was inspired by my reading on sacred geometry and the Unity arrangement of circles. This arrangement produces the familiar yin-yang design.

Imposing perfect geometrical forms onto the land was not the appropriate ecological response. The basic arrangement evolved to respond to Fishway function, existing landforms and underlying geology.

Tangents and curves continue to guide the shape of the Fishway, and are useful for layout and excavation.



Because fish will not swim through a long dark tunnel, daylighting options were explored:

* Light wells, akin to skylights in a home, allow natural light into the Fishway. Strategically placed reflective surfacing directs light into side wells: one small opening above ground lights an area more than twice its size.

* Small vegetation will likely establish inside the light wells, and attract insects. Seeds, spores and bugs are welcome nourishment to the aquatic life below.

* Solar-powered fiber optic lighting, placed along the walkway, provides supplemental light for the Fishway. It would be lit only during daytime (to ensure dark nights for wildlife).

Tian: Birdsong Path

Concept. In the forest surrounding the area that I call Tian is a small creek hidden within a white oak grove. The trill of birdsong from deep inside the grove caught me by surprise, as though a celebration had erupted that announced my arrival to this sunny spot along the water.

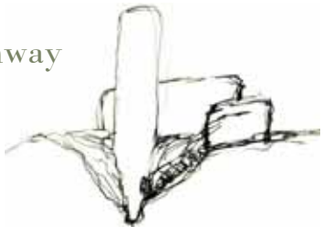
I wanted to capture this aural experience, and did so by preserving this environment and enhancing it with additional native vegetation. A Visitor & Research Center and modest pathway, which doubles as a continued access route for emergency and maintenance vehicles, guide visitors through this wildbird sanctuary.

Named Birdsong Path to honor the plentiful wildlife, this segment of Tian pays homage to earth, sky and the cycles of life.

1

At-grade conditions. This refers to segments of the path in which the imposed universal grade runs concurrently with existing grade, shown in green above. Here, path features are modest. Low-growing herbaceous plants stabilize the soil cement path edges. Soil cement was chosen because it reuses soil from on-site excavation, reveals information about the land's materiality, requires a fraction of the Portland cement required for concrete, and aesthetically blends in with this environment.

A Visitor and Research Center is built into the Fishway cliff wall to provide visitor amenities, interpretive materials, and classroom, office and overnight accommodations for the Research Institute.



2

Below-grade conditions. Shown above in gray, these areas fall below existing grade. The 10' wide soil cement path surface protects against erosion, and indicates to visitors the appropriate route to follow through this area.

Sidewalls vary from 12-inch curb to 4.5-foot retaining wall, and use stone excavated on-site. Where appropriate, stone outcrops serve as path edges. Native perennials, shrubs and trees further stabilize side slopes, provide wildlife habitat, and act as guiding barriers to humans.

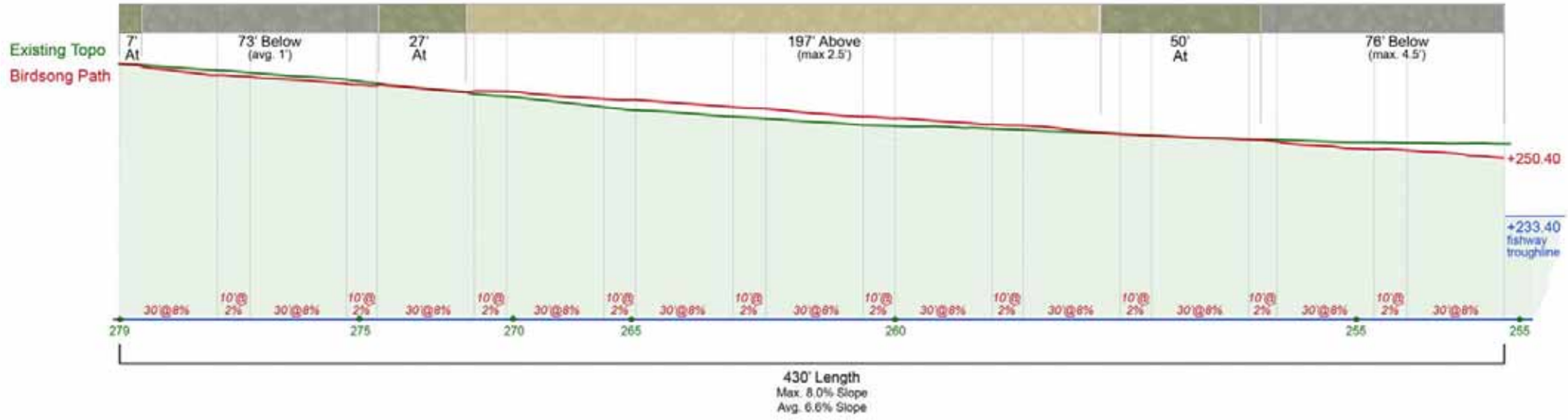
3

Above-grade conditions. Indicated on the map in tan, this portion of Birdsong Path is a raised boardwalk. Excavated soil is used here in a stronger form for pilings, as rammed earth. The three soil types excavated from the Fishway vary in color, to include yellow-brown, olive-brown, yellowish-red, and gray. Striations of the rammed earth forms will beautifully display the diversity of earth's underlying structure, a vital part of the ecosystem to which most people give little thought.

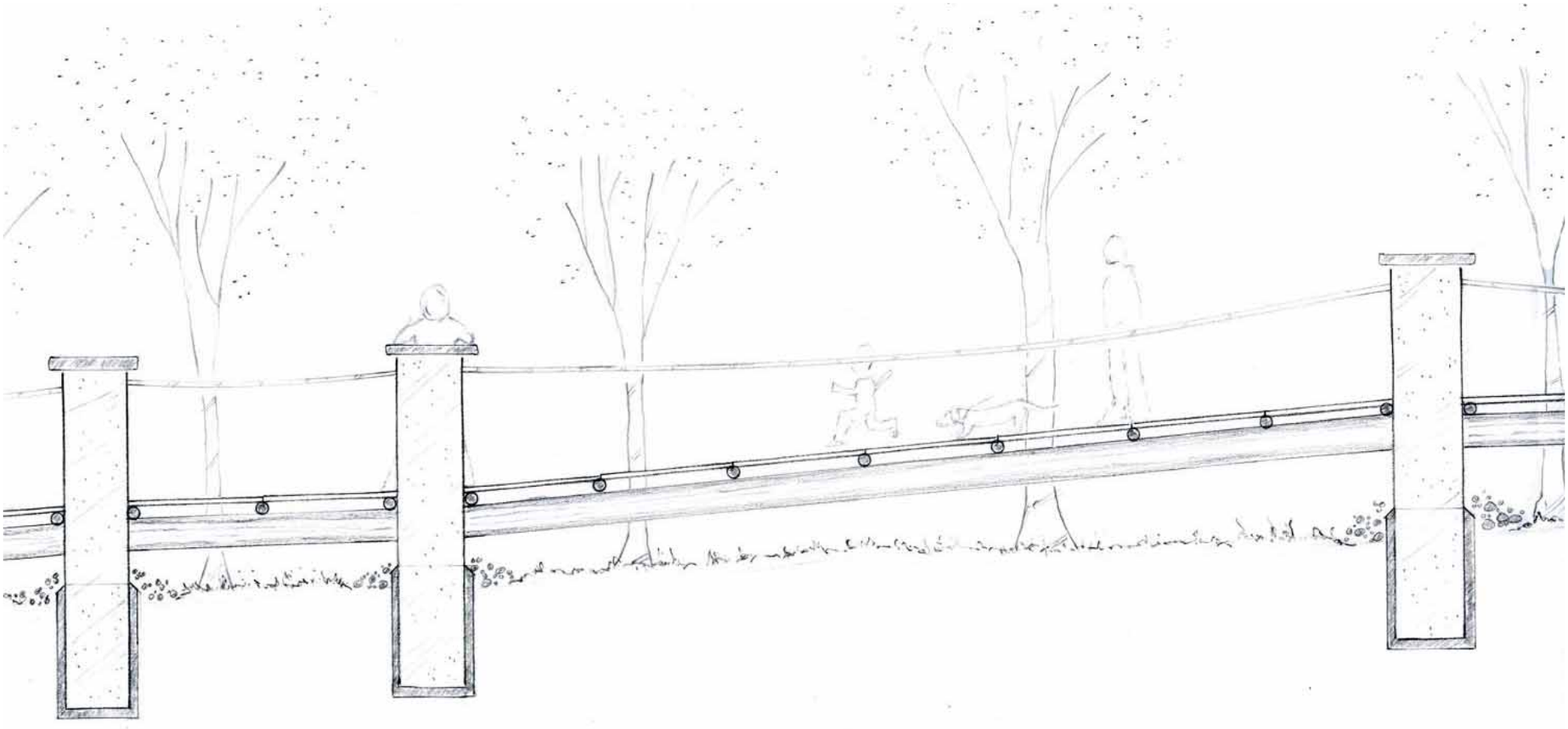
4

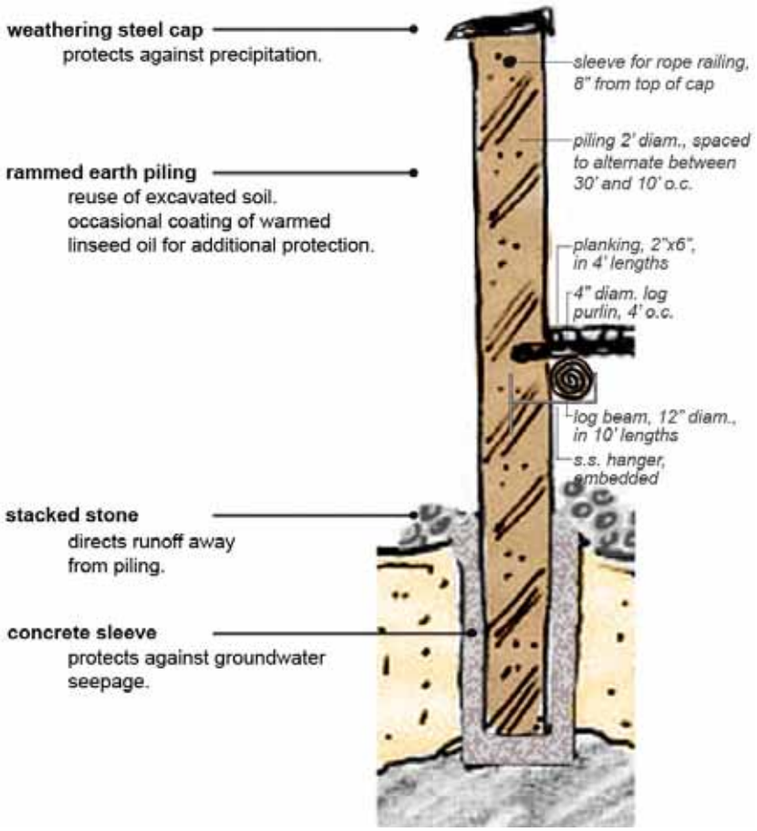
Suspended bridge. This is the sole point of crossing for the Fishway. Consideration must be given to supporting emergency and dam maintenance vehicles in bridge design and construction.

The bridge provides welcome shade to aquatic life below; an open-design, colorful overhead suncatcher provides comfort and added interest to pedestrians above.



Birdsong Path in longitudinal profile. The 430-foot path maintains an accessible grade, with 10-foot landings every 30-feet. An elevation change of about 29-feet is comfortably achieved, and terminates 17-feet above the Fishway.



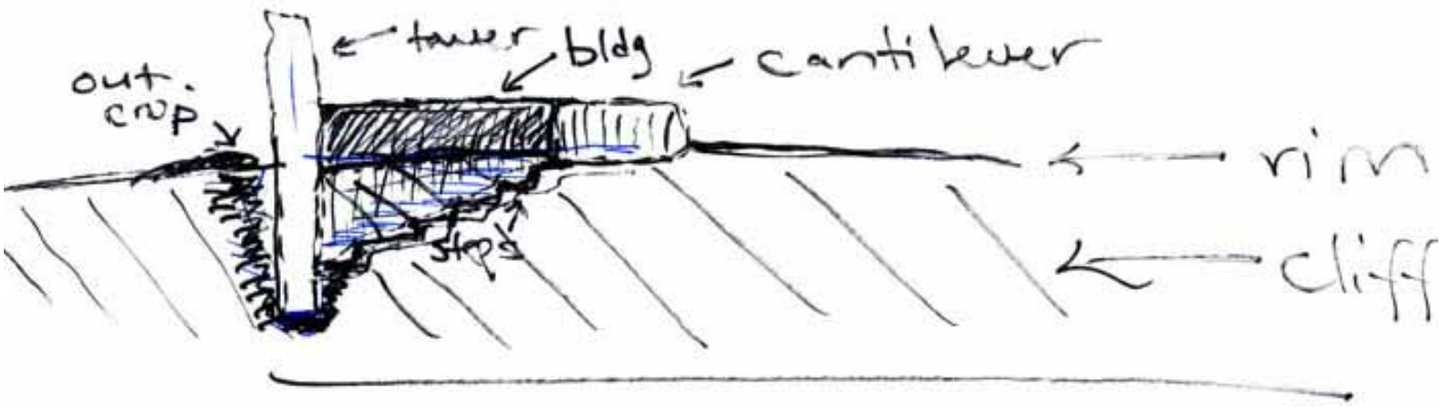


* Because Tian is located in the clear-cut area of the former boat launch, very few trees were sacrificed during construction. Some hardwood timber can be used in certain aspects of Birdsong Path, such as structural support for the raised boardwalk.

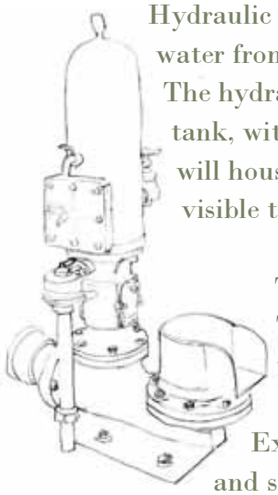
* Materials and construction techniques, though somewhat experimental, were chosen for their stability, durability, expressive qualities, and low-maintenance requirements.

* The harmonious balance between modest, multiuse path, increased wildlife habitat, aesthetic appeal, and an enhanced spirit of learning renders Birdsong Path a successful example of sensitive, biocentric design.

Right. Weathering steel, a material repeated throughout the site, directs rain water away from rammed earth pilings, and provides necessary protection against moisture.

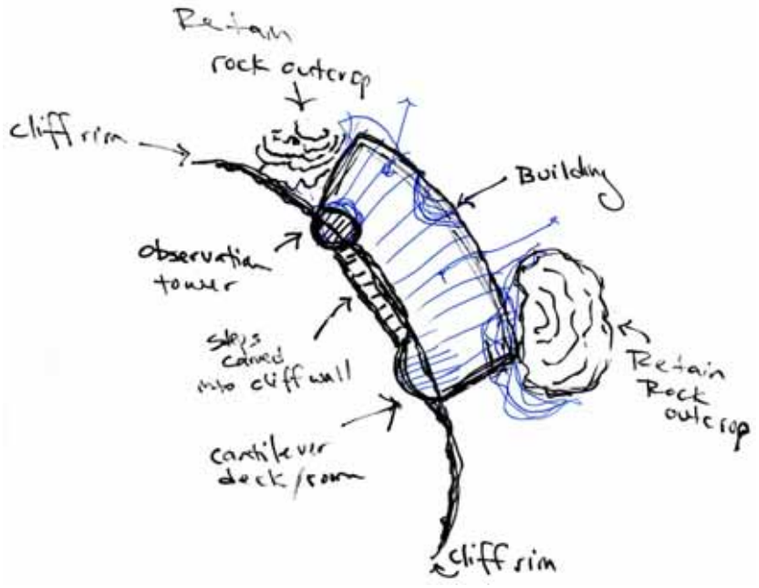


Ink sketches (*left*, in section; *below* in plan view) show the relationship of building and earth. Situated on a north-facing cliff, the tower resembles icicles in winter – water, like *li*, that defies entropy as a frozen moment in time.



Hydraulic ram pump. A simple, quiet pump can be installed to lift water from the creek or Fishway up to the Visitor & Research Center. The hydraulic ram uses gravity and pressure to lift water to an uphill tank, without the use of electricity or fossil fuels. The building's tower will house the pump and storage tank so that all components are visible to visitors.

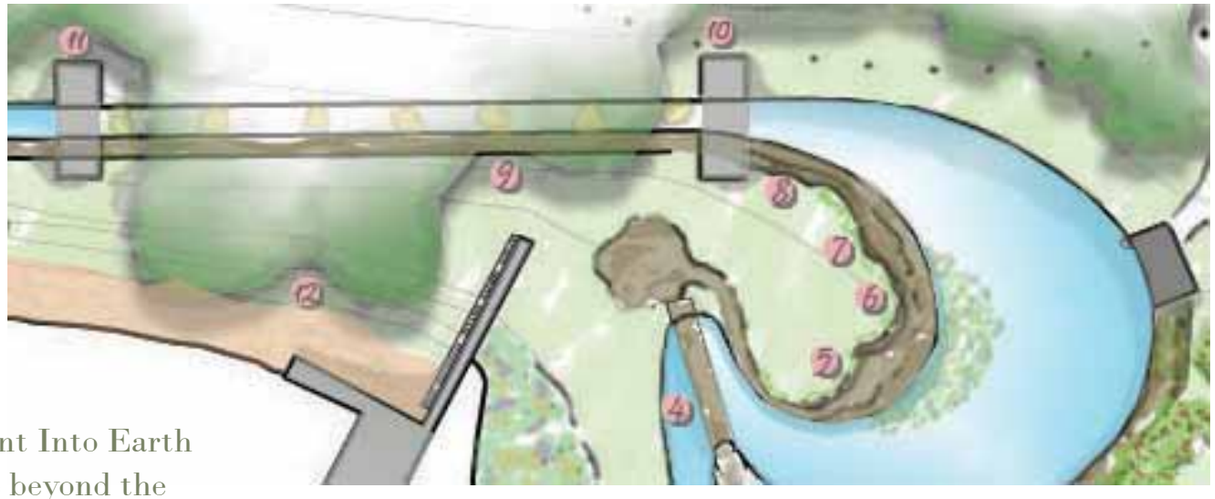
The non-potable water is used as waste water and air coolant. The possibility that the kinetic energy of water overspill within the tower could generate the building's electricity (supplemented by photovoltaics) should be explored. Exposed water and electrical systems raise visitor awareness of and sensitivity toward energy and resource consumption, and significantly enhance the cultural and eco-revelatory experience of the place. Sustainability and alternative systems, materials and techniques will be better understood and discussed.



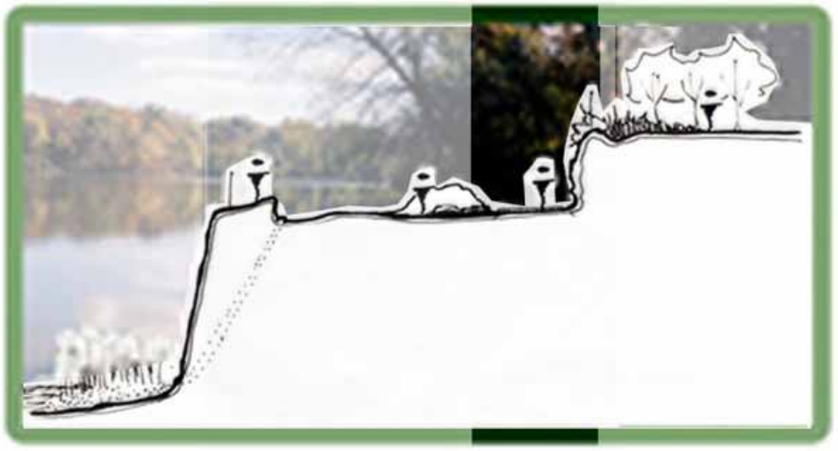
Models. *(left)* The unique perspective from the Visitor & Research Center is also called "Tian." Birdsong Path swings wide around the building. The tunnel allows one to peer into earth. People, in red, indicate scale. *(below)* Surrounding rock outcrops and excavation carvings are highlighted.

Tian: Descent Into Earth

After hiking the Grand Canyon's Angel Bright Trail, the idea of safely scaling the Fishway's cliff walls became important. The act of moving deeper into rock is the act of moving backward in time, and that is medicine powerful and inspirational.



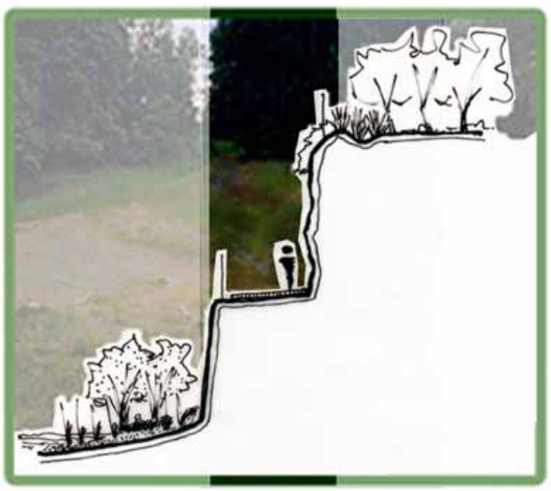
A peripheral function of the Fishway, Descent Into Earth Path allows humans to experience landscape beyond the superficial, by seeing and moving among earth's deeper layers. The descent imparts wisdom in equally visceral and cerebral ways.



5

Creekview. Referring to numbers on the map above, this point is named for its orientation toward and views of Goose Creek. As one follows the path's twists and turns, the scenery unfolds to reveal views of different surrounding features.

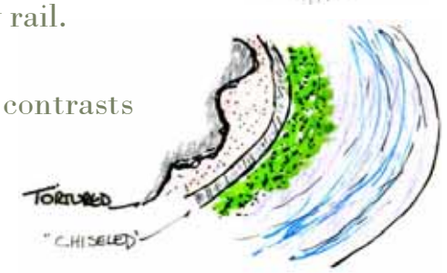
Descent Into Earth Path starts at-grade, and about 23' above the Fishway, as one crosses the bridge (station point #4). Upon reaching Creekview, an 8' high wall has gradually emerged along the path. This wall grows taller as the path continues its downward slope. The wetlands, which colonize at the sediment dropout point, are roughly 19' below.

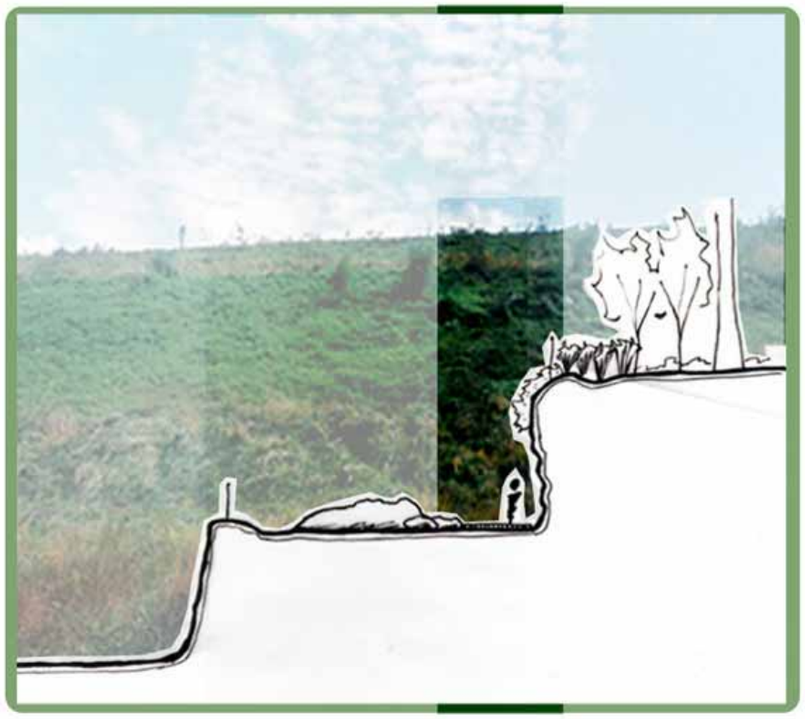


6

Tian way. This narrow point along the path offers views across the Fishway to the Visitor and Research Center, "Tian." While the 8' wide soil cement paved walking surface has remained the same, the open space around it has narrowed from 35' wide at Creekview to 10' wide at Tian Way – just enough space to add a safety rail.

The cliff wall along the Fishway contrasts from a rough, tortured surface above (along the path), to a smoother chiseled surface below.





7

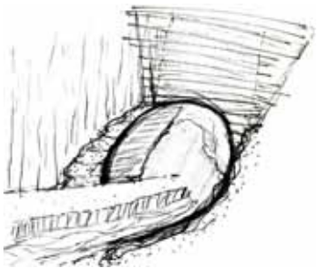
Moundview. The sensation here is that of being enveloped by the earth. With views facing toward the high mound, the path wall at a height of more than 16' to the side, and stone formations rising up from the path floor, a visitor could not mistake earth's display of strength and longevity. It is this special appeal to all of the senses that makes Descent Into Earth Path eco-revelatory.

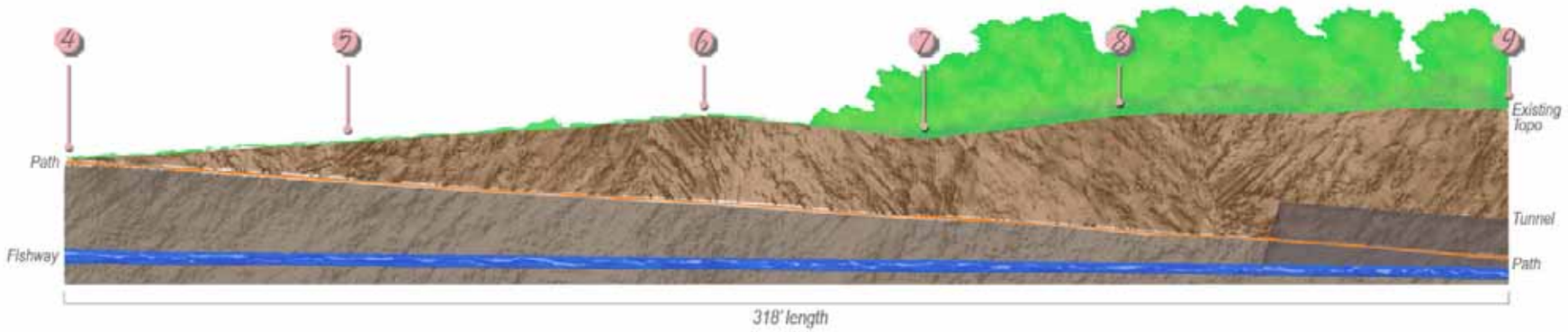
8

Descent into earth. Here is a most dramatic point along the path: the tortured stone wall is at its tallest, towering 24' overhead, vegetative growth from existing grade looms heavy from above, the path has narrowed again to a 10' width, and the Fishway is 10' below – close enough to hear and smell, but far enough to be an imposing drop. The setting is intended to mimic stream bank erosion, leaving the visitor likely to feel just as unstable and vulnerable as eroded earth.

9

Tunnel walk. After entering the tunnel via the Earth Portal *(below)*, visitors follow the path 5' above the protected Fishway to the area below the dam. Lit only by solar-powered fiber optics along the path's base and daylight from light wells, Tunnel Walk provides safe, if perhaps ominous, passage through the earth, defying even the biggest skeptic who questions nature's authority.





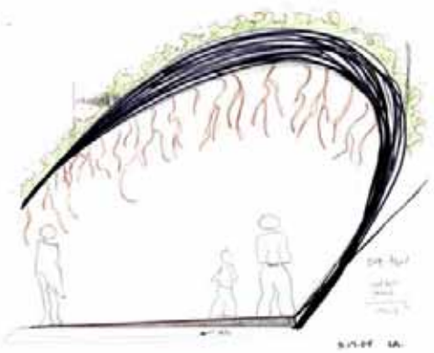
Bridge		Creekview		Tian Way		Moundview		Descent Into Earth		Tunnel Walk	
Existing Topo:	256.50	Existing Topo:	260.00	Existing Topo:	265.00	Existing Topo:	260.00	Existing Topo:	265.00	Existing Topo:	266.50
Path Topo:	256.50	Path Topo:	251.94	Path Topo:	246.82	Path Topo:	243.80	Path Topo:	240.90	Path Topo:	235.00
To Fishway:	23.10'	To Fishway:	18.75'	To Fishway:	14.50'	To Fishway:	12.50'	To Fishway:	10.00'	To Fishway:	5.00'

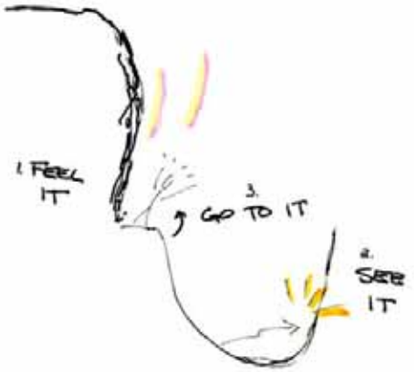
Descent Into Earth Path in longitudinal profile. The path follows a universally accessible grade of no more than 8%, with 2% landings spaced no more than 30 feet apart, allowing comfortable footing along the rugged terrain of the cliff wall. The path follows an elevation change of 21.5 feet spread over 318 feet. The chiseled wall below the path reflects the excavation techniques required to construct the Fishway to proper specifications; the tortured path wall required less rigor and precision.

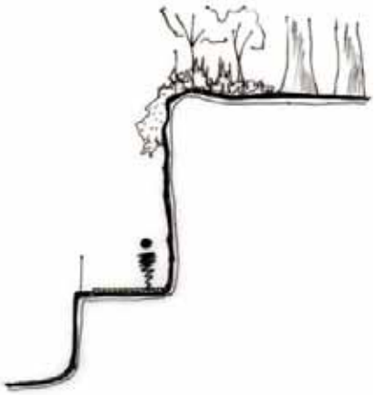
Model. The twists, turns, and varying widths of Descent Into Earth Path are best understood from plan view. As visitors walk along, the path wall acts as a baffle, hiding and revealing aspects of the surrounding landscape, and directing the gaze in intentional directions.

Rock formations near Creekview (#5) and Moundview (#7) provide naturalistic sitting and play areas.

Visitors and emergency and maintenance staff who prefer faster access below dam would take the added stairs behind the dam (see numbered map).







Inspiration Concept Opportunity Design

Concept. Drawing on what I know about entropy, energy, and Land + Water Interactivity, I was intrigued by the land's response to the dam structure, as shown along the creek bank as erosion and scour. Exposed and dangling roots of gravity-challenged trees, and weathering jagged rock outcrops reveal a process and tell a story that inspired me. I wanted to share the story with visitors, to communicate the otherwise silent process to those who do not know how to read the signs.

The concept became communication through sensory experience. What better way to express the instability and significance of an eroded stream bank than to make another feel that instability? Early ideas focused on landscape features, such as statuary, that conveyed the emotions, but a better opportunity came to me while designing Descent Into Earth Path. A functional path with tall tortured walls and dangling overhead vegetation would tell the story in a more meaningful, unexpected way, and would far more successfully express the land's vulnerability and strength. This path reveals the dynamic processes of nature, as it guides visitors from *seeing* the water interact with land and stone, to *feeling* that interaction, to *going to* the place where it is carried out every day so dramatically below the dam *(as shown above left and below)*.

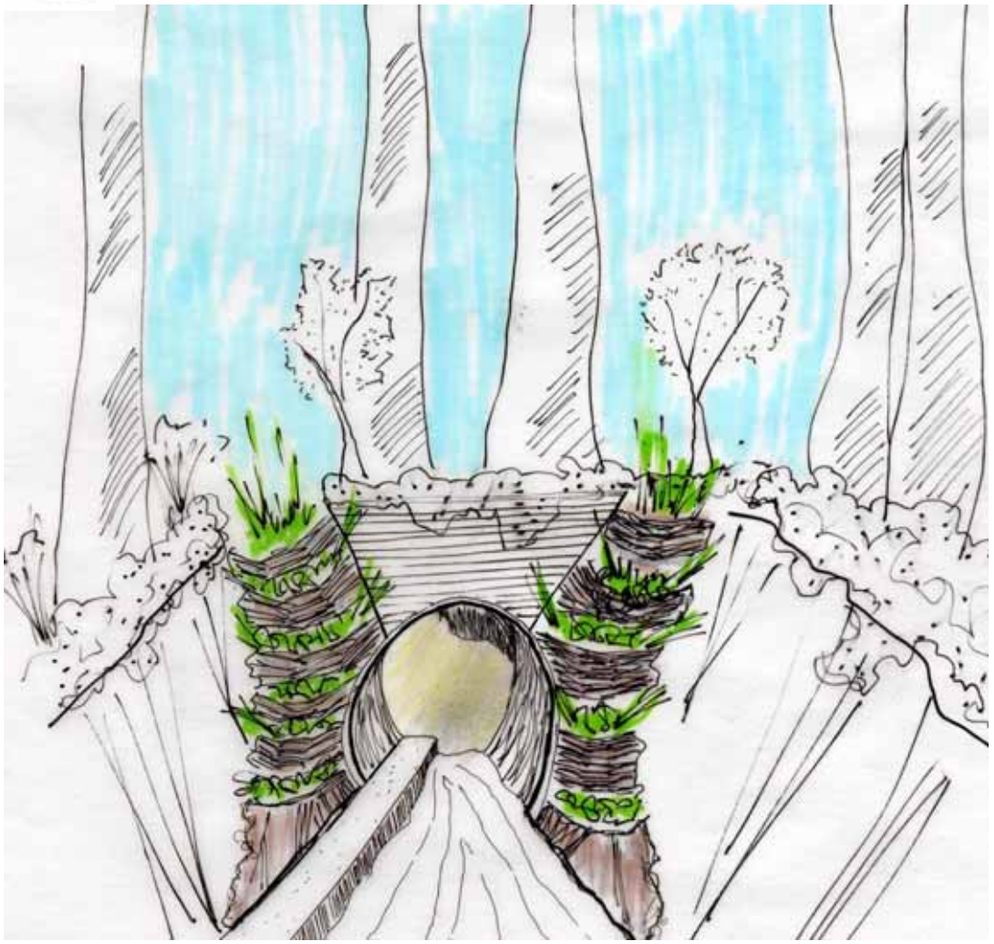
12 Process and Scour: A Telling Stone

* During a flood event, creek water exceeds normal levels and encroaches on more vulnerable slopes and soils. As soils wash away, underlying stone is exposed, which begins to weather from wind, sun and moisture. While this is a natural geomorphic process, human input increases the occurrence and severity of stream bank scour.

* Structures and impervious surfaces we build within a watershed have direct impacts on flood events and these geomorphic processes.

* After witnessing this ecological response to our decisions and actions affecting the landscape, visitors will notice other small- and large-scale consequences throughout their communities.

10 Earth Portal



* Embraces water's downward flow into earth.

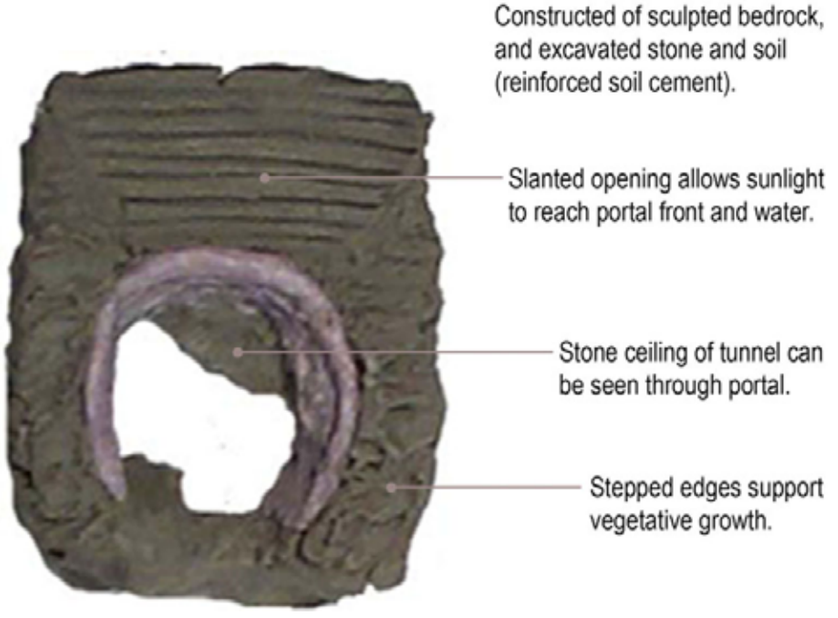
* Celebrates fish's upstream calling, and awaits their eventual return.

* Rejoices the near end of fish's journey to overcome the dam.

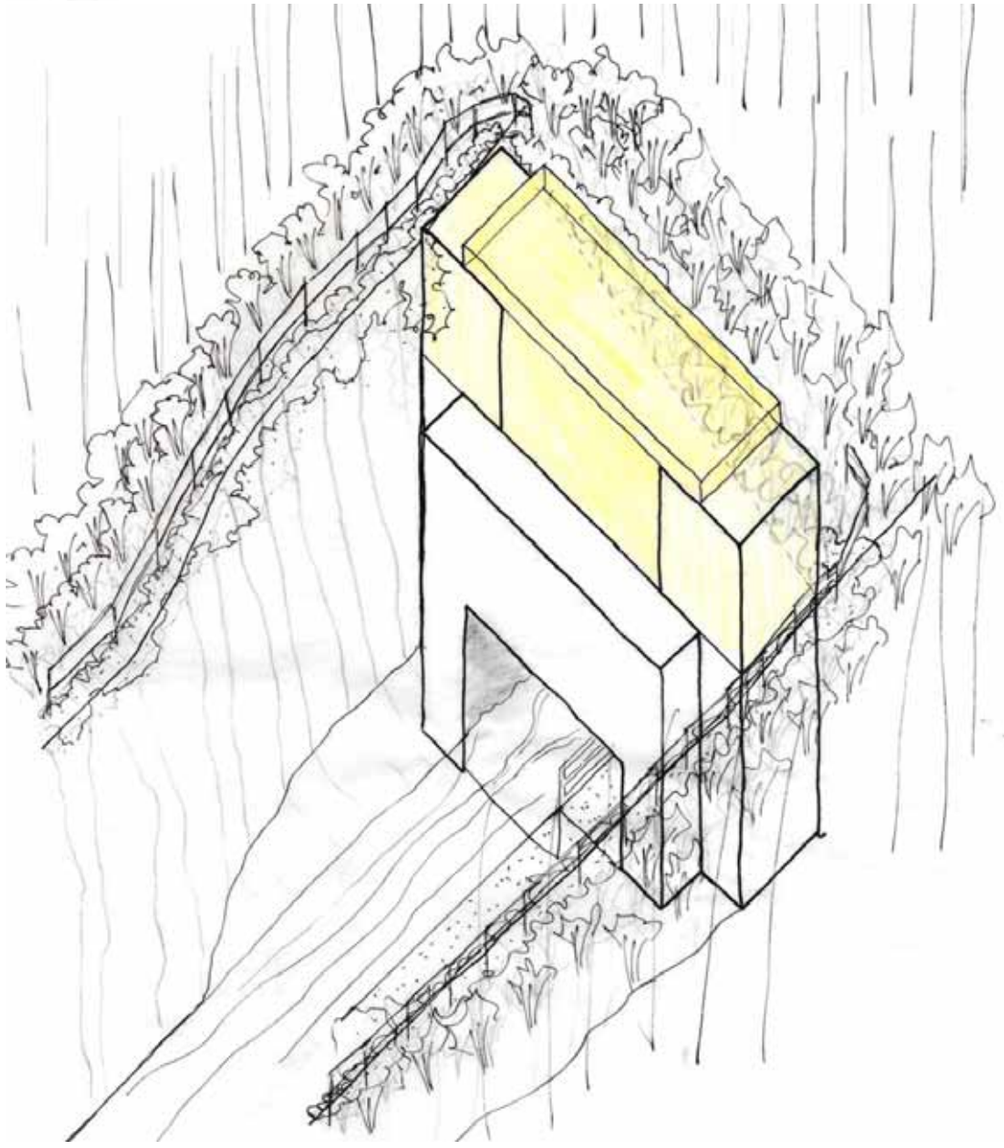
* Connects symbolically to surface land and deep earth.

* Is mysterious, yet warm and welcoming.

Emotive, embracing, and evocative. Earth Portal wraps visitors in a sense of serenity as they enter the stone-clad depths of earth inside the tunnel *(below)*. Mindful of wildlife's needs, the path can be gated at the portal, as well as the bridge, during spawning season, at night, and during bad weather.



11 Sea Portal



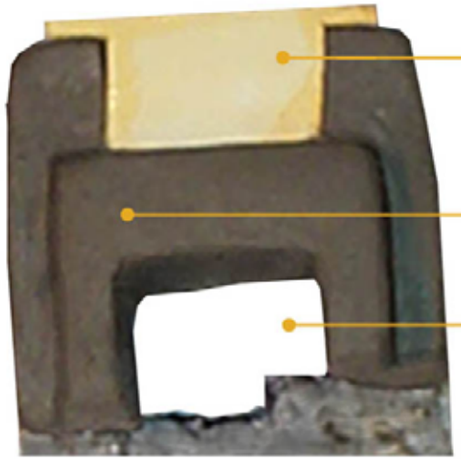
* Releases water from the tunnel to open sky.

* Dutifully sees water off to its seaward journey.

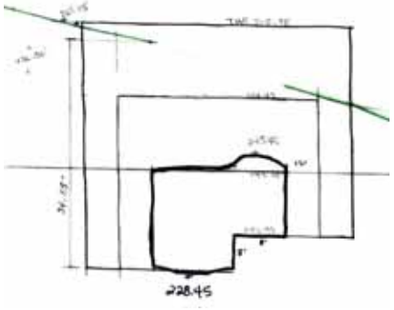
* Acknowledges the importance of and proudly stands to assist the fish's voyage.

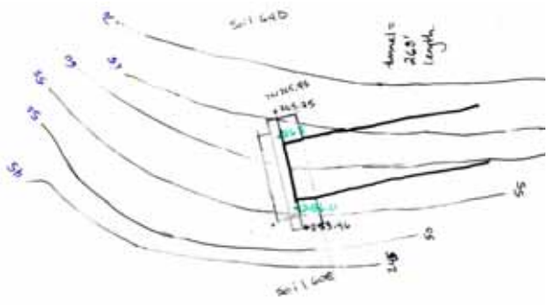
* Shelters and protects all of those it serves.

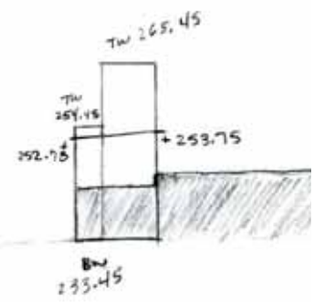
* Is symbolically nautical and connected to the sea.

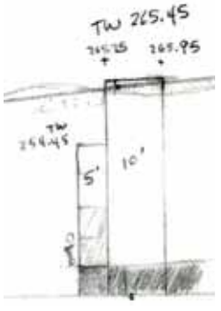


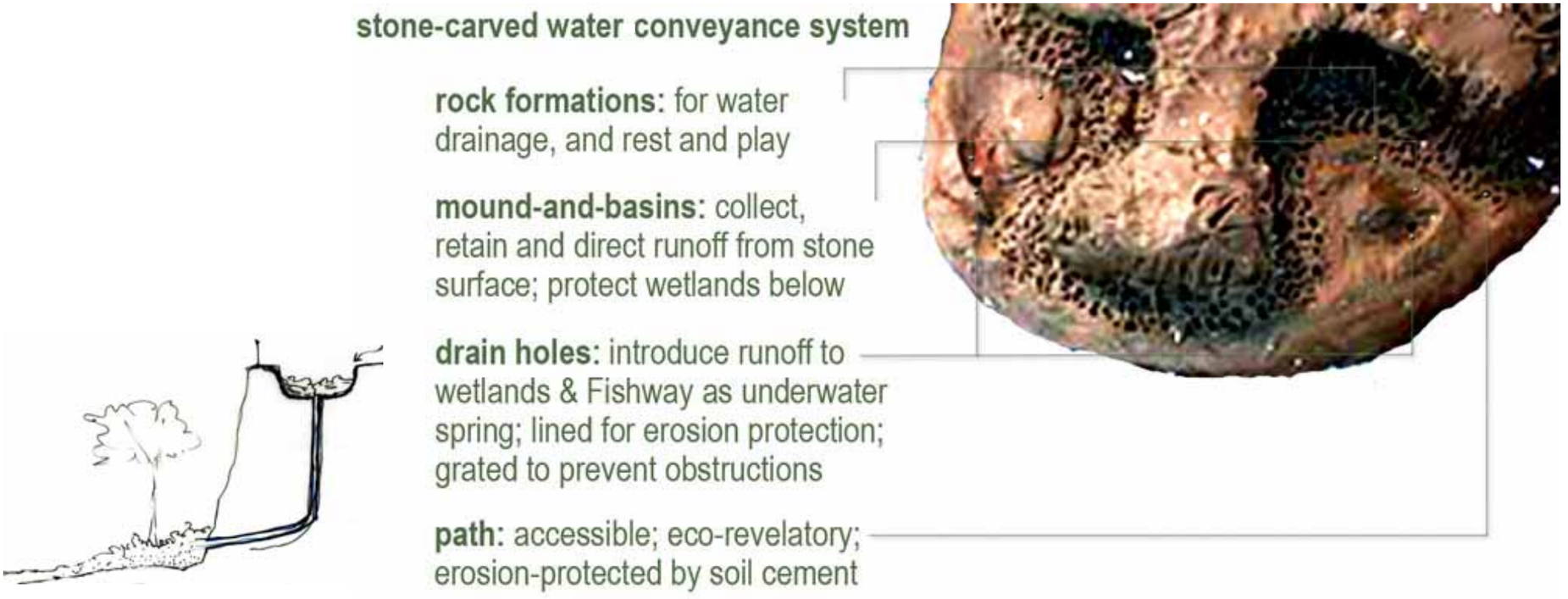
Stoic, stalwart, and strong. Sea Portal valiantly protects the Fishway and path from the elements and harsh winter winds from the north. Sturdy and unyielding, it gives visitors a sense of security as they, too, overcome the dam.











Directing Stormwater Runoff

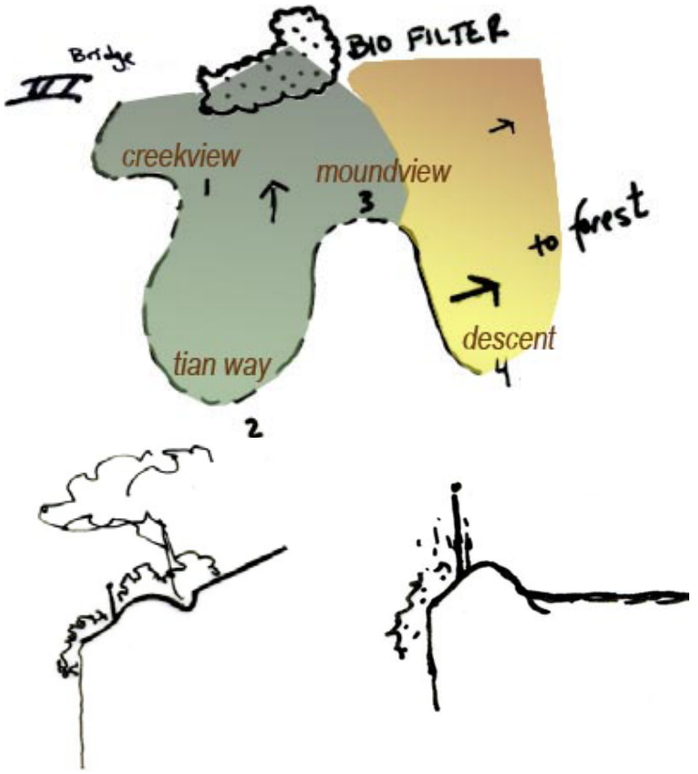
Along the path. *(Above)* As an impervious surface, the path's exposed bedrock creates runoff, which could be disruptive to the aquatic life in the Fishway below if allowed to free-fall over the edge. A drainage system of rock formations, mound-and-basins, drain holes, and borings drilled through stone convey water into the Fishway as underground springs rather than overhead deluge. Canopy cover of sturdy shrubs in the wetlands help intercept the small amount of water that runs over the edge.

At existing grade. *(Right)* The vegetated land above the path creates far less runoff than does exposed stone. Stormwater is directed into swales and transported to a biofilter near the bridge, or it simply follows a natural course into the forested area.

(Right, top) Diagram of drainage divide. The area in green drains to a biofilter, the area in yellow drains into the forest.

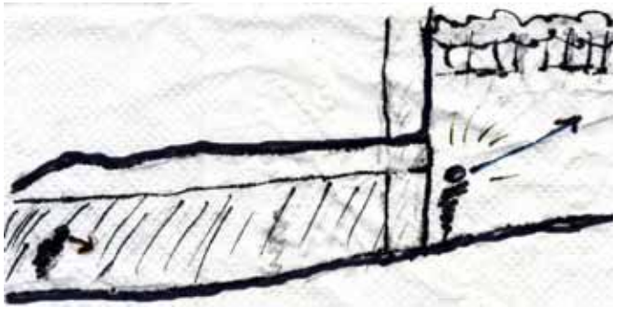
(Near right, bottom) Edge conditions for drainage to biofilter, with swale.

(Far right, bottom) Edge conditions for drainage to forest, without swale.



Upward

There is a moment along Descent Into Earth Path when the eye is drawn outward and upward. It occurs on the return walk from the dam, before emerging from the tunnel through Earth Portal. This moment is most significant to those who have walked the narrow path with deep walls and have felt land's vulnerability, those who understand earth's response to actions we have taken upon it. This moment has an almost magical way of lifting the spirit and promising solutions, because it is a moment of hope.



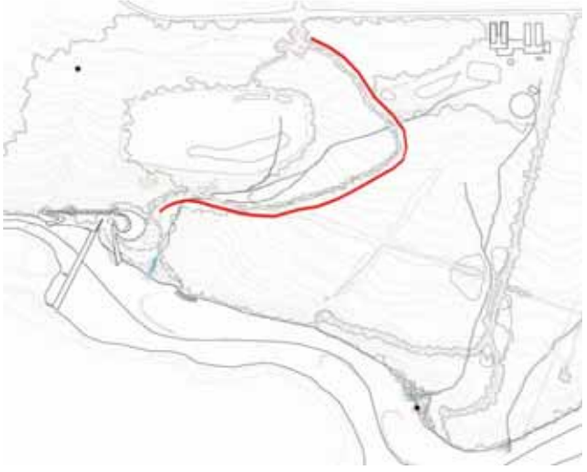
The path in the tunnel follows the one-half of 1% grade of the Fishway, except the first 50 feet past Earth Portal, which follows an 8% grade (with appropriate 2% landing). Inside the tunnel, the eye is drawn downward toward water and light. To emerge from the tunnel through Earth Portal is to be physically lifted by the increased incline, and visually lifted as the eye moves upward, first up the cliff wall, then up Tian's icicle tower, then skyward. Like an epiphany, Tian comes into full view, containing resolution we have been seeking.

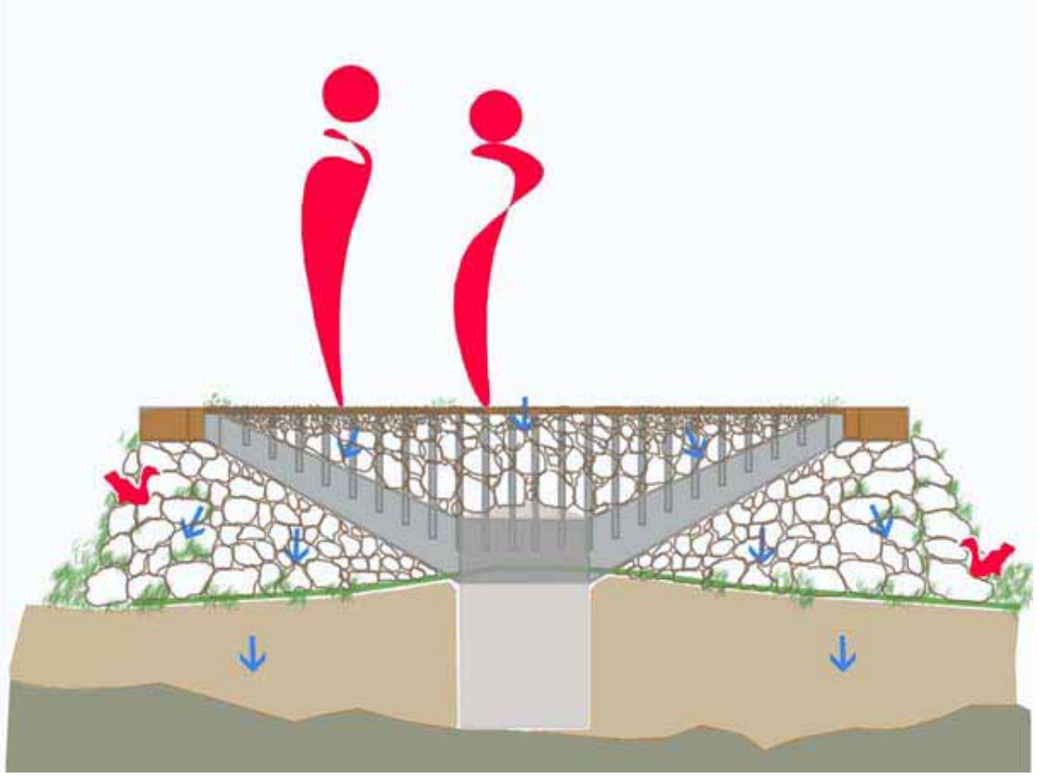
Tian is nature with authority. The moment we accept this principle is the moment we find hope.

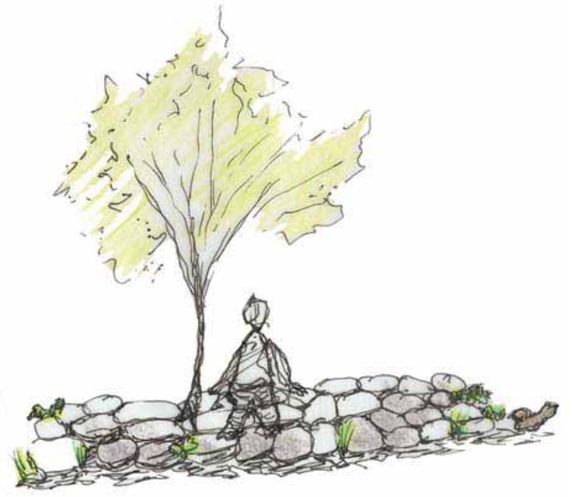
Water's Dance Path

Reminiscent of old stone farm walls that once prevalently crisscrossed Loudoun County's countryside, Water's Dance Path gracefully traces a curving line across the land as it guides pedestrians through the site from the main entrance and parking to Tian. Just as a drop of water is directed along the sloping terrain, pedestrians "flow" through the site atop a low, sturdy stone walkway that follows the existing topography.

Moments of pause are created along the path to take advantage of key site elements, such as views of siltation ponds and the mound, sounds of babbling brooks, and the nuances between landscape typologies featuring different hydrologic energies and Land + Water Interactivity. By arousing the senses and heightening awareness of the natural and man-made surrounds, Water's Dance Path turns a casual stroll through the woods into a stimulating, engaging experience.







Concept. Much of Water's Dance Path runs through a water "storage" area, so I gave serious consideration as to where a drop of rain would go once it hit land. Rather than increase the amount of runoff with impervious surfaces, drains and swales, I determined the better solution was to allow that raindrop to flow through the forest as it would naturally, as if there were no walkway in place. These images express my aesthetic intent for biocentric design that provides habitat to terrestrial species and allows rainwater to permeate the walkway and soil, and reach the water table very close to where it does under existing conditions.

* Water's Dance Path provides access through the site while supporting the green corridor and open migratory routes.

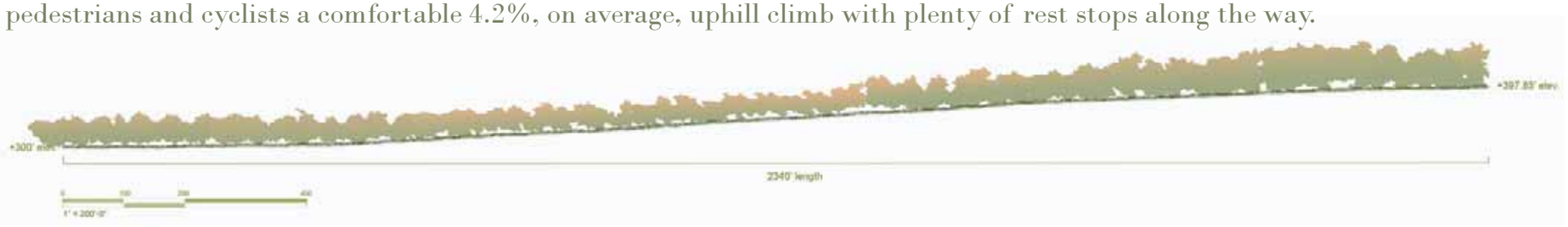
* Path construction reuses stone excavated for the Fishway.

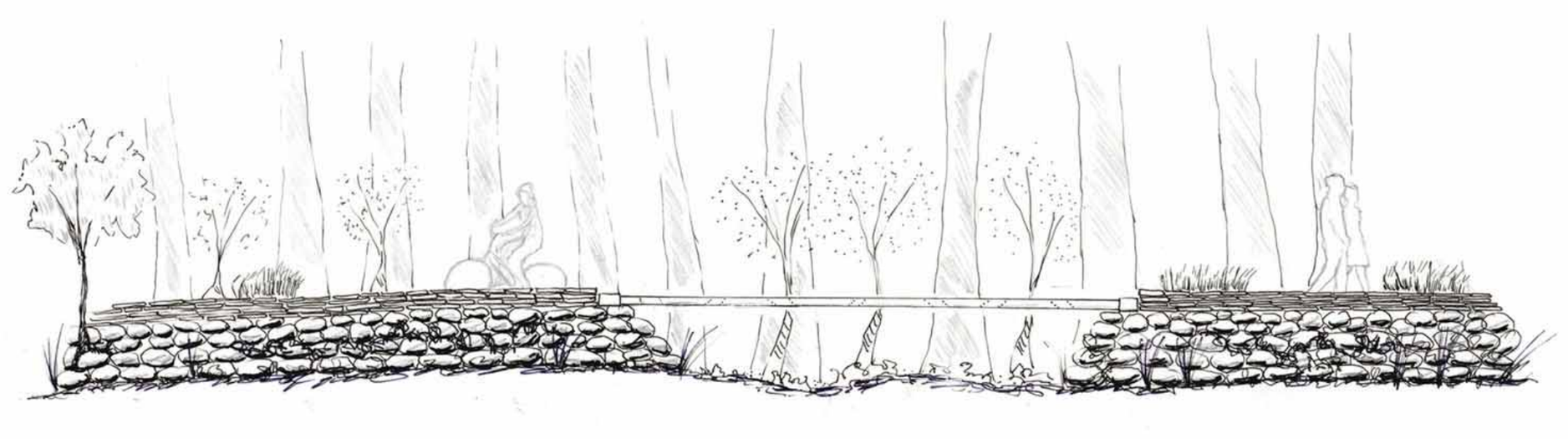
* Sturdy path becomes a visual backdrop for entropy and other natural processes, against which visitors mark the amounts and rates of change occuring around them.

* Porous perimeter parking limits on-site automobile traffic to occasional emergency and alternative-fuel service vehicles.

* Durable, low-maintenance materials – concrete, weathering and stainless steels and stone – require no energy for upkeep and embrace the evolution of successive plant growth around, and even on, the walkway.

Water's Dance Path follows a gradual incline that never exceeds an 8% accessible grade, ensuring universal access to the site (actual path slope ranges from 2.7–7.8%). A change of nearly 100 feet in elevation spread over 2,340 longitudinal feet offers pedestrians and cyclists a comfortable 4.2%, on average, uphill climb with plenty of rest stops along the way.





Borrowing Frank Lloyd Wright's technique of using "rifts" to diversify the built wall (Hoffman 1993, pp22-33), I incorporate wall breaks in Water's Dance Path to complete its biocentricity. The stone structure is interrupted with perforated weathering steel slabs, exposing the bare forest floor to air and light. Rifts maintain migratory routes for small forest fauna, ensure streams remain daylit, and provide pedestrians points of rest.

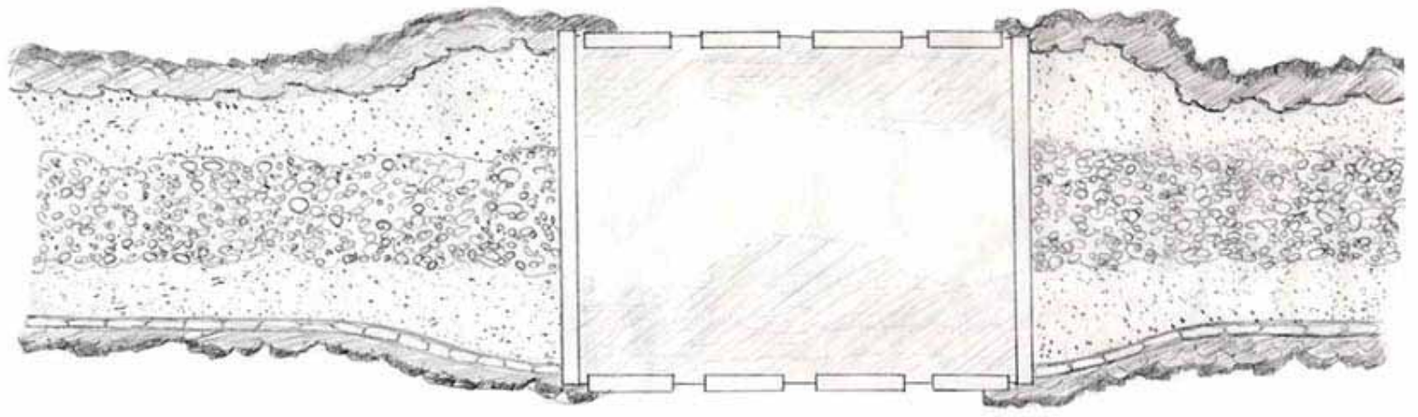
* Sturdy and visually pleasing among the forest, weathering steel rifts support pedestrian and emergency vehicle access through the softer soils of the "storage" area.

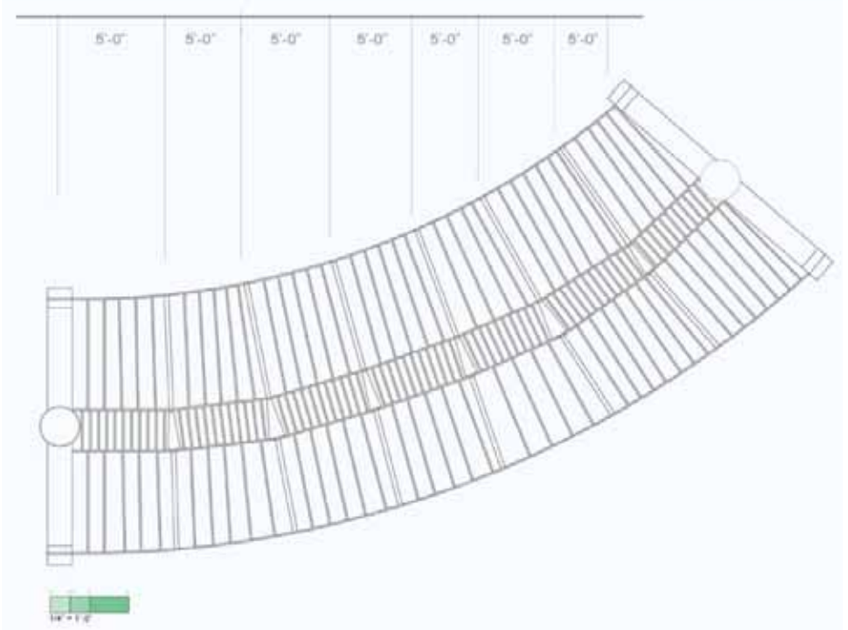
* Strategically placed rifts allow pedestrians moments of pause at the most interesting points along the path.

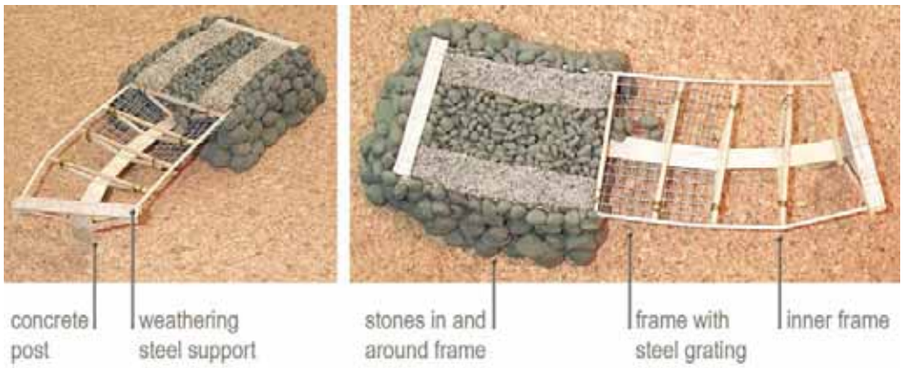
* Rifts are wider than the stone walk to accommodate the slower movement of lingering pedestrians.

* Mounted I-beam seats are comfortable and modest.

* Perforations in the steel deck allow light through and add visual interest.

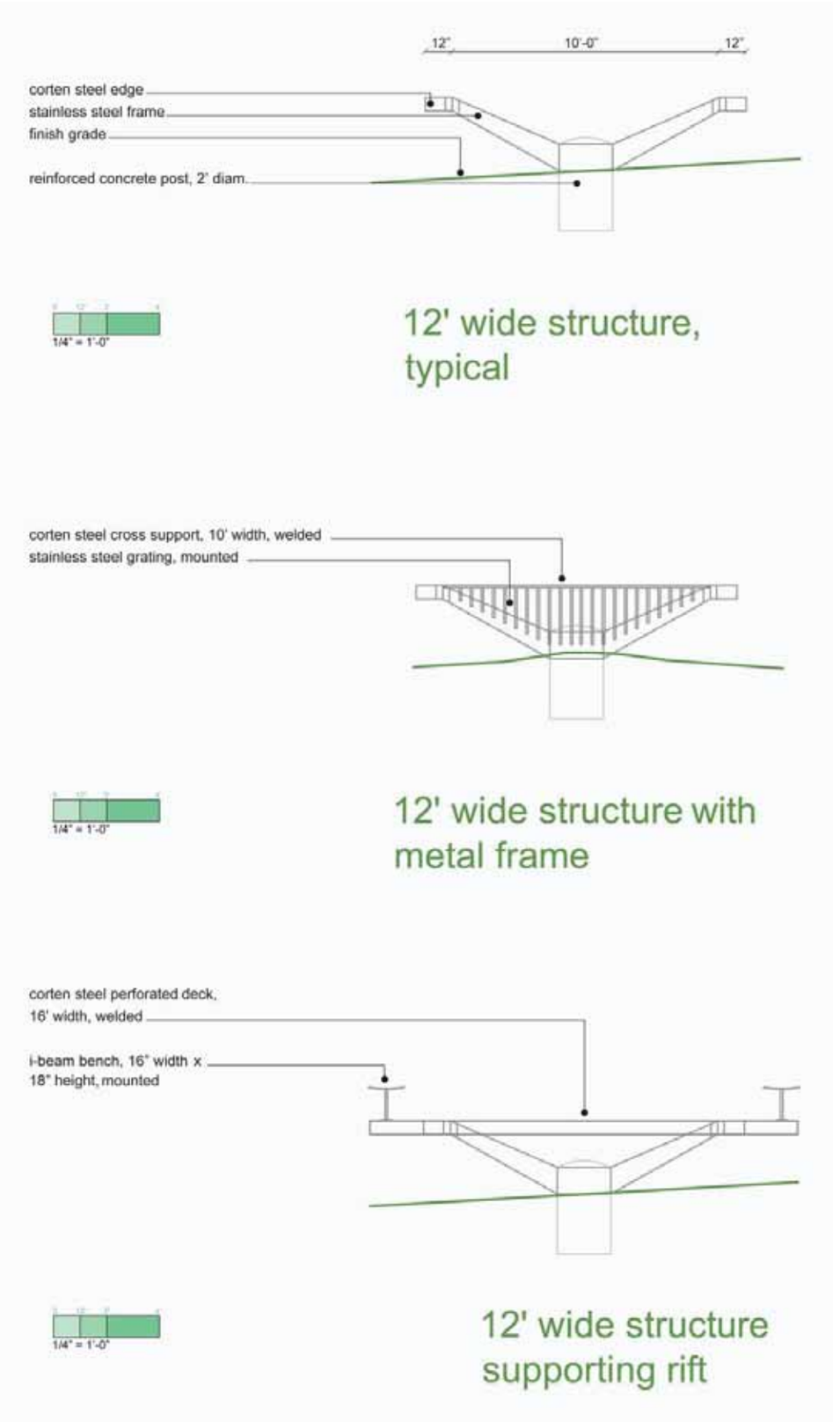






Above (in plan view and model). The structure inside: The idea for the path structure came from gabions – stone-filled wire cages or baskets – and how they could be more ecologically sound and aesthetically pleasing. My solution takes advantage of gabions' best benefits, and improves on their shortcomings. I call my concept the "inside-out gabion": an inner metal frame provides support for the stone, setting it free from the cage, and allowing exposure to wind, water and sun. Concrete posts provide added strength and stability.

Right (in section). The basic structure (*top*), the addition of steel bars that hold the stone path in place (*middle*), and the weathering steel deck with mounted I-beam benches, as rift (*below*).



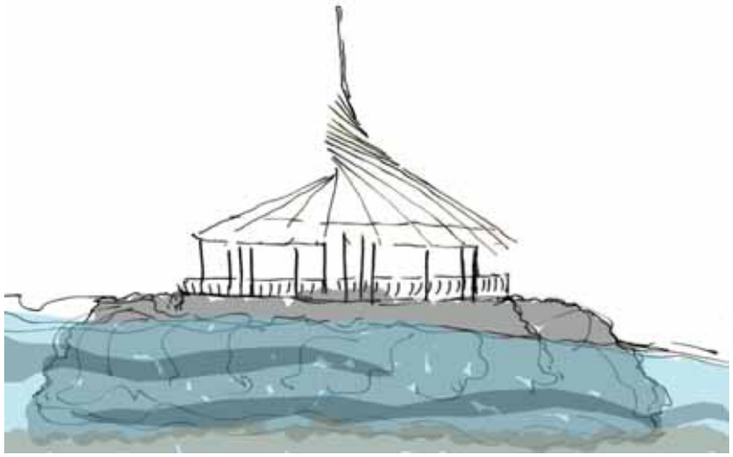
Boat Island

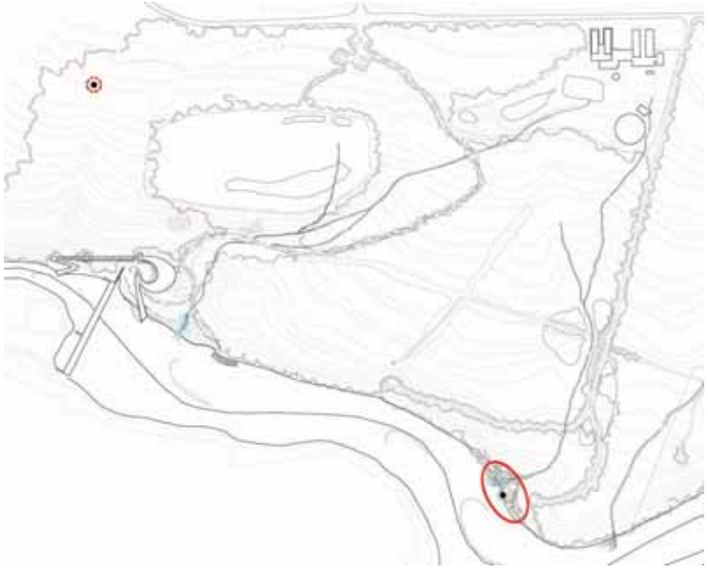
Tucked into a calm-water depositional eddy, Boat Island provides boaters a quiet respite along Goose Creek. Surrounded by the marsh's rich and diverse flora and fauna, and in proximity to architectural ruins, Boat Island offers unique perspectives of the creek and stands as an example of harmonious biocentric design. Shoreline morphology, the interplay between water, sediments and landform, is revealed in this deltaic landscape through fluctuating water levels and the convergence and commingling of a low-energy current and an incoming higher-energy stream.

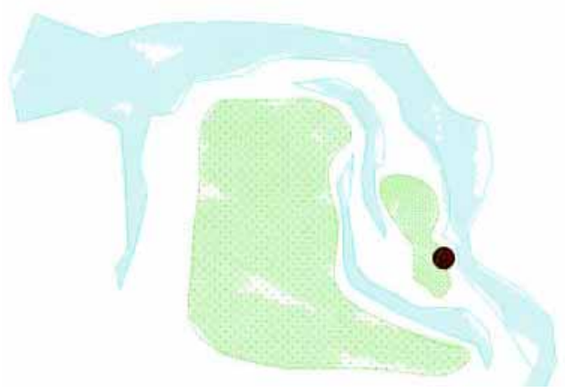
* The rock island provides safe habitat to maturing aquatic and marginal species, and serves as the structure's protective buffer against storm surge.

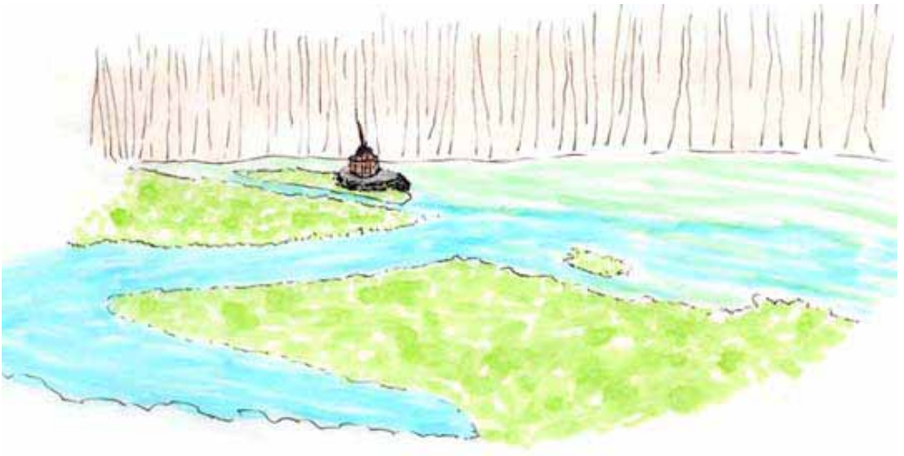
* Boat Island is located and constructed to minimize ecological disturbance of the sensitive marsh-buffered shoreline.

* Boat Island passes the test of multiplicity: it benefits native wildlife while providing research, recreation, education and reflective opportunities for humans.









Concept. I was once asked, *"Where would Ishmael hang out on this site?"* My answer is Boat Island. Here he can contemplate the water's power and persuasion over the land, can witness the life cycle in the maturing species, and of course, can relax and fish from boat or island. Boat Island was created as a place one can experience the fluctuating morphology of the shoreline: as more rock is exposed or buried by water, and more or less marsh revealed as dry land, access and opportunity to the visitor varies.

A good place to stretch one's legs and retreat from the sun and water, Boat Island is the place where canoers, kayakers and fishers congregate and share their experiences on the creek. Or, it can be a place of seclusion where one can steal a quiet moment with his or her thoughts.

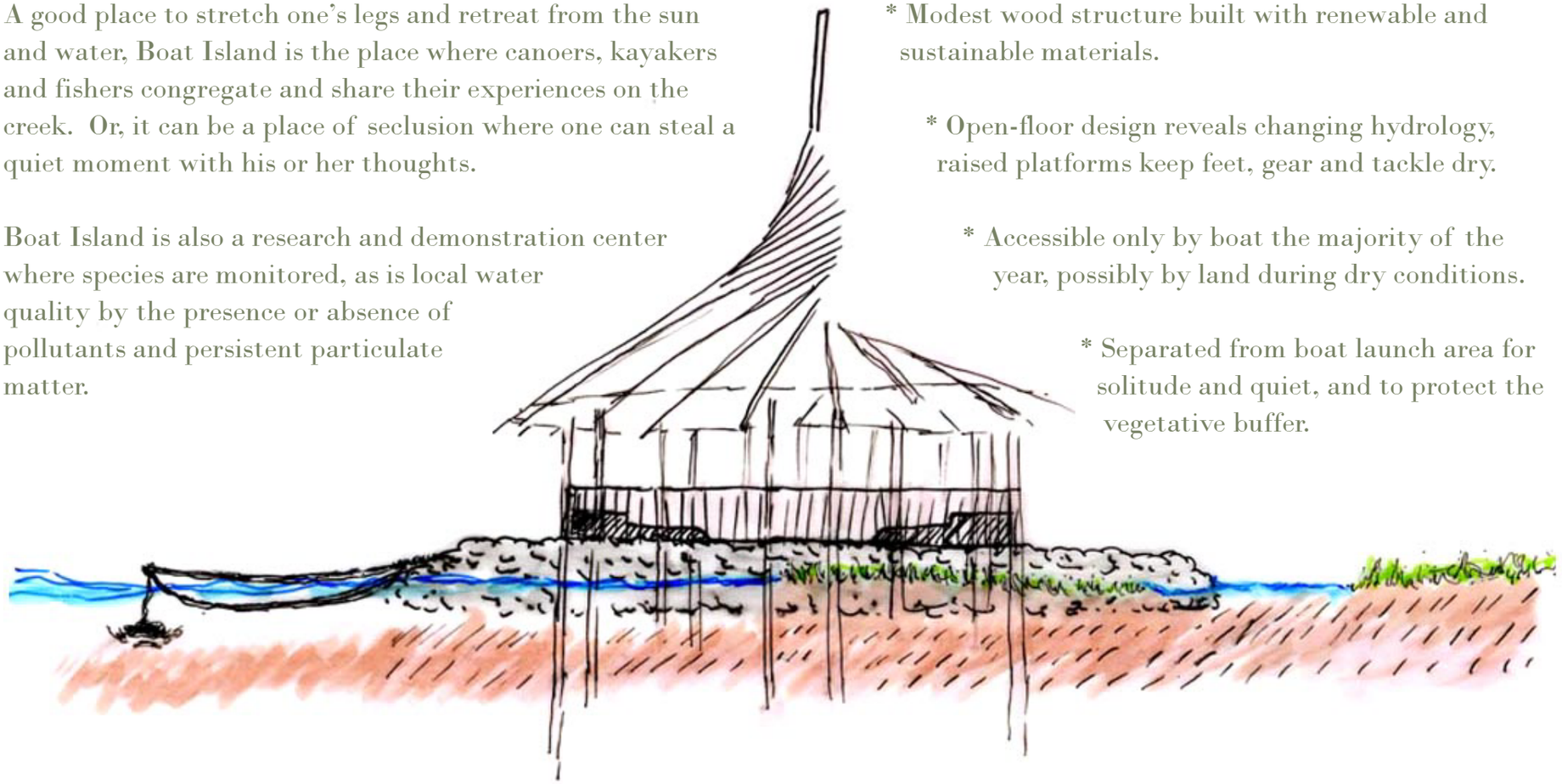
Boat Island is also a research and demonstration center where species are monitored, as is local water quality by the presence or absence of pollutants and persistent particulate matter.

* Modest wood structure built with renewable and sustainable materials.

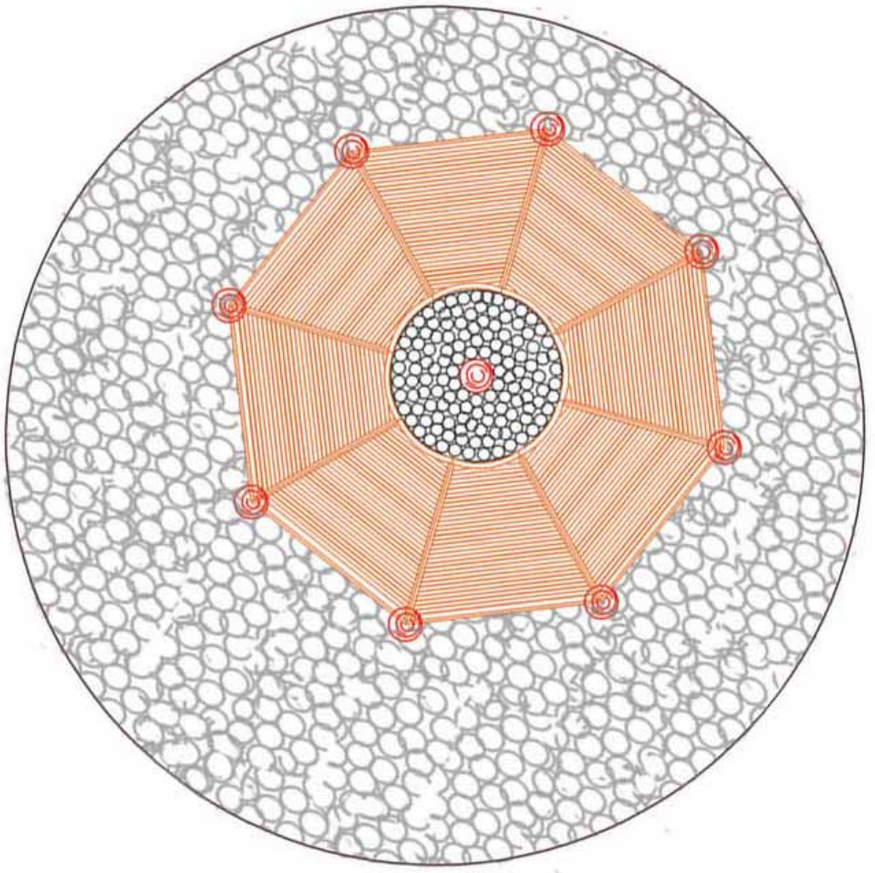
* Open-floor design reveals changing hydrology, raised platforms keep feet, gear and tackle dry.

* Accessible only by boat the majority of the year, possibly by land during dry conditions.

* Separated from boat launch area for solitude and quiet, and to protect the vegetative buffer.



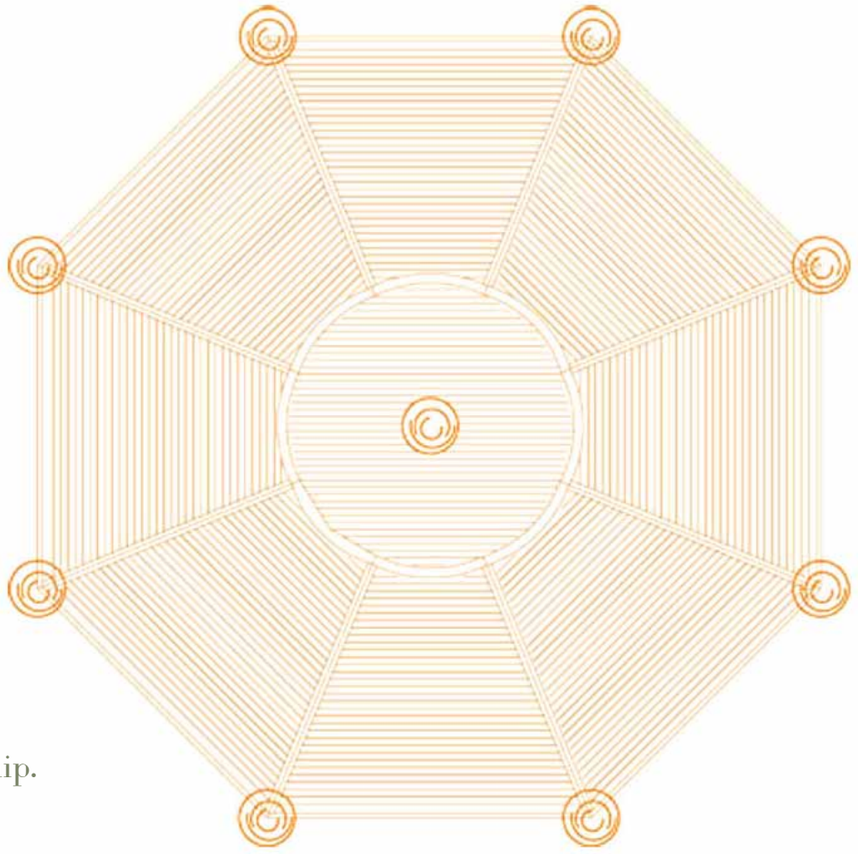
Nearby architectural ruins include a house circa 1930 and separate chimney and foundation built in the creek's floodplain. These ruins are likely associated with locks and a navigation system that once operated on Goose Creek.



Boat Island, plan view of floor. The open-floor design:
* Allows water and marginal-zone species freely into the structure.

* Features a center "well" filled with stone and ringed with durable bamboo slat flooring.

* Is supported and protected by pylons embedded in the creek bottom and an underlying island of large stone.



Modified Hiking Hut. Similar in its simple design except with a closed all-bamboo floor, the Hiking Hut is located along a hiking trail in the northeast corner of the site. Like Boat Island, the Hiking Hut provides comfortable access to a key vista, in this case one that overlooks an adjacent active quarry. The revelatory experience from this position changes with the seasons as more of the landscape is revealed during the forest's dormancy and concealed when trees and other vegetation are in-leaf.

With an open design, wildlife is certainly welcome in the Hiking Hut, but the most significant benefits to native flora and fauna are indirect. As a learning, research and demonstration area, and as a pleasing pause for self-reflection, the Hiking Hut exploits the unique juxtaposition of protected forest and adjacent extreme land disturbance to inspire contemplation of the human-nature relationship.

Final Studio Considerations

This last segment on studio work features two remaining ideas for biocentric landscape design, as well as closing thoughts on the overall design process and the studio work I have presented. This brings Part 3 of the book to a close, with only a reflection on the findings and design criteria of the thesis as a whole remaining.

Concepts

Throughout design work, two issues resurfaced time and again: Are there outdoor classrooms?, and What should be done with sediments dredged from the reservoir? Satisfied with my explanation and demonstration of biocentric design, my committee encouraged me to be brief by addressing these issues in concept only. My solution for both involves earthworks (shaped earthen forms) – Outdoor Classrooms carved into the base of the large mound, and "Remediation Knolls" near Boat Island, which are formed of dredged sediments.

Earthwork Concept: Outdoor Classrooms

There simply had to be classrooms outdoors on this site – where better to learn and discuss ecology, land stewardship and sustainability? I located them at the foot of the mound for several reasons:

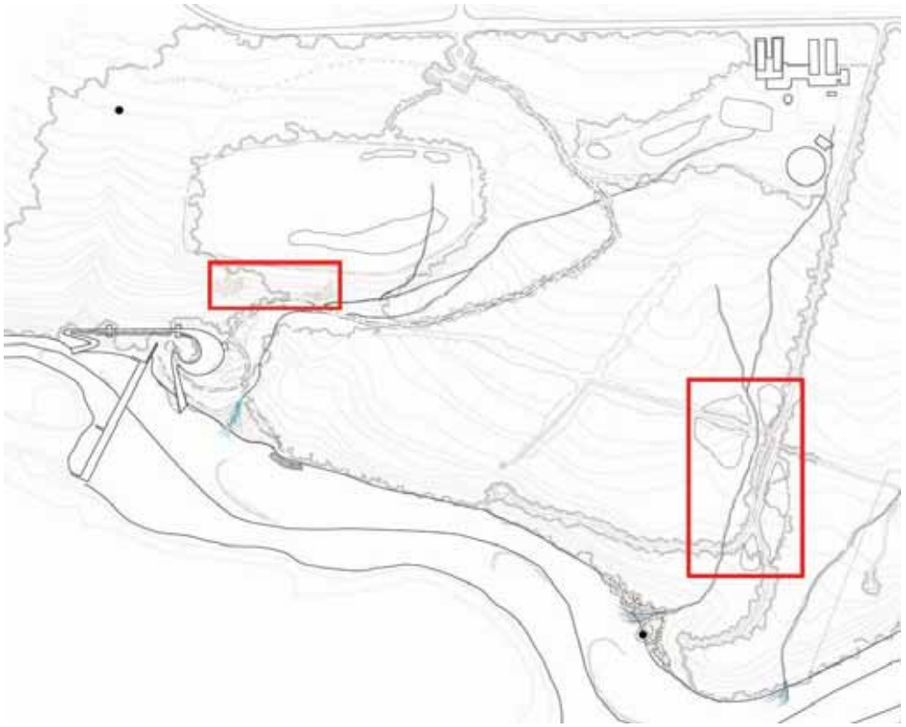
* Topography: stadium-style seating is more easily achieved.

* Views: seeing loose, swaying treetops of lower elevations is a rare treat after walking among staid trunks.

* Backdrop: the mound and surrounding environment provide lively inspiration for learning.

* Multiplicity: adding new use to the existing mound leaves other areas unspoiled.

View of treetops from the Mound. One Outdoor Classroom would be located on the left along the base of the Mound. Vegetation in the foreground grows along linear depressions, or swales, where rainwater gathers and runs downhill. It is important to wildlife that swales and vegetation remain intact, therefore seating is situated around them. Views are directed toward Goose Creek, and into swaying billowy treetops.



Concept. As a child, I remember cherishing those warm spring days and willing teachers who would move class outside. There is something undeniably special, and effective, about learning outdoors, and experiencing the outdoors in a new light.

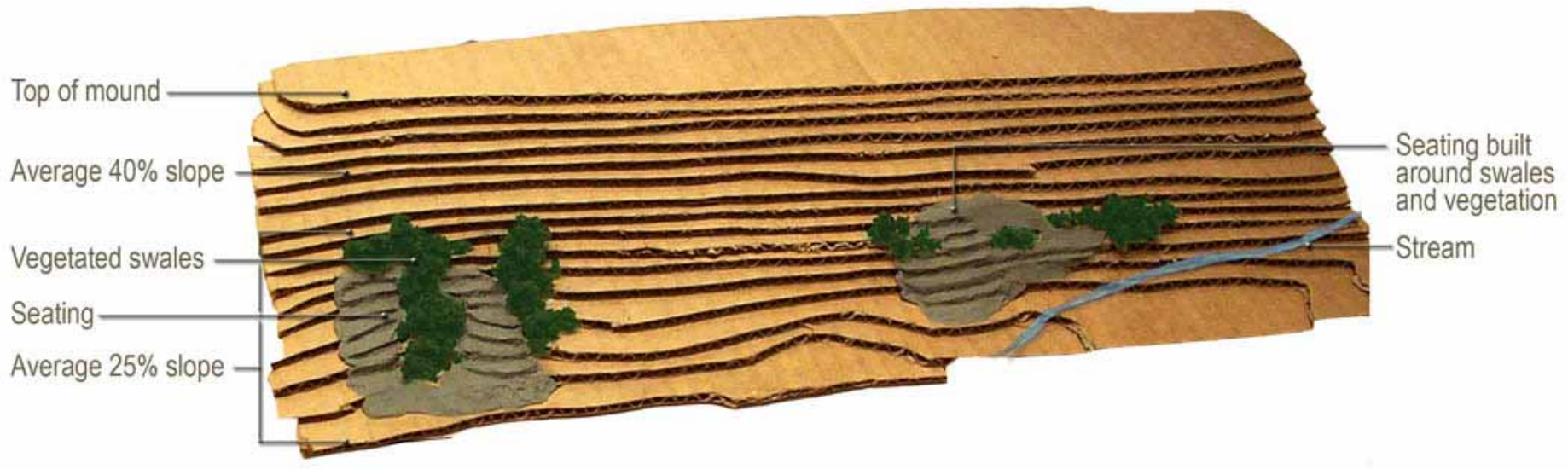
Outdoor theaters, so popular in warmer climates and seasons, stand as testimony to that. Inspiration for the Outdoor Classrooms came from two of my favorites: the Filene Center at Wolf Trap in Virginia, and the Colly Soleri Music Center at Arcosanti, Paolo Soleri's Urban Laboratory in Arizona. Many times while hunched over my drawing board I was soothed by a music CD, *The Bells of Arcosanti* – haunting acoustic music recorded at Arcosanti made particularly special by background calls of wildlife from the surrounding landscape.

Here, education, public discussion, and meeting presentations are given similar added aural dimension from the surrounding landscape. The babbling brook at the foot of the mound, wind wisping through trees and grasses, and calls of birds and animals engage those who gather here in a way unrivaled by traditional indoor classrooms.

Above. Outdoor Classrooms use a combination of seating types as determined by the slope, the goal being to work with existing topography as much as possible. Seating on the left responds to slopes of lower grades, and relies on "benches" that begin at grade and reach a height of 15" to 18".

Seating on the right responds to slopes of higher grades, and relies on terracing. Retaining walls start at grade, and run diagonally downhill (semi-parallel to the contours), and hold slightly sloping vegetated terraces. Walls and benches reuse stone excavated on-site.

Existing swales are protected by simple, nonobstructive bridges. Stage structures also accommodate swales, rather than diverting them or otherwise impeding upon them. Open stage design allows for a dynamic, vegetative backdrop.



* Exhilarating landform under open sky, with wintertime views of Goose Creek.

* Two Outdoor Classrooms constructed along the lower grades of the mound. Front-row seating and stage meet accessible-grade requirements.

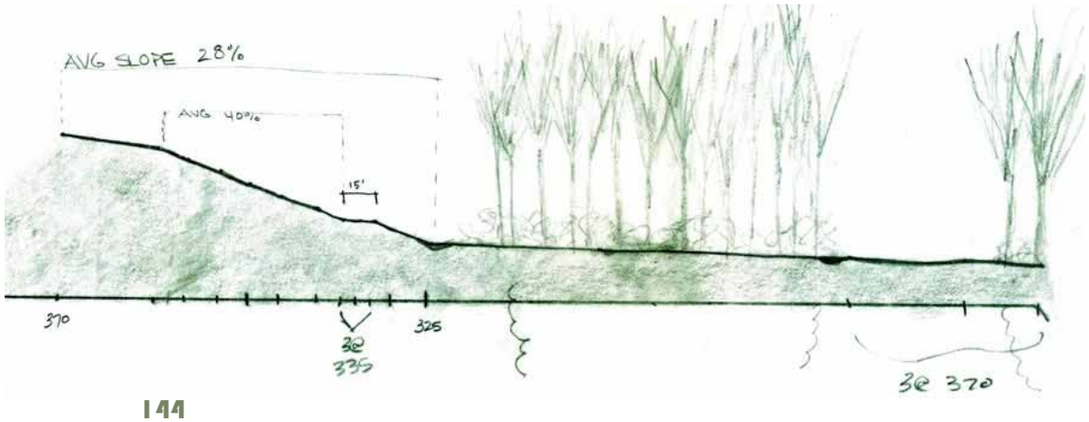
* Steep upper slopes and restrictive fencing maintain safety and separation from Water Authority siltation ponds.

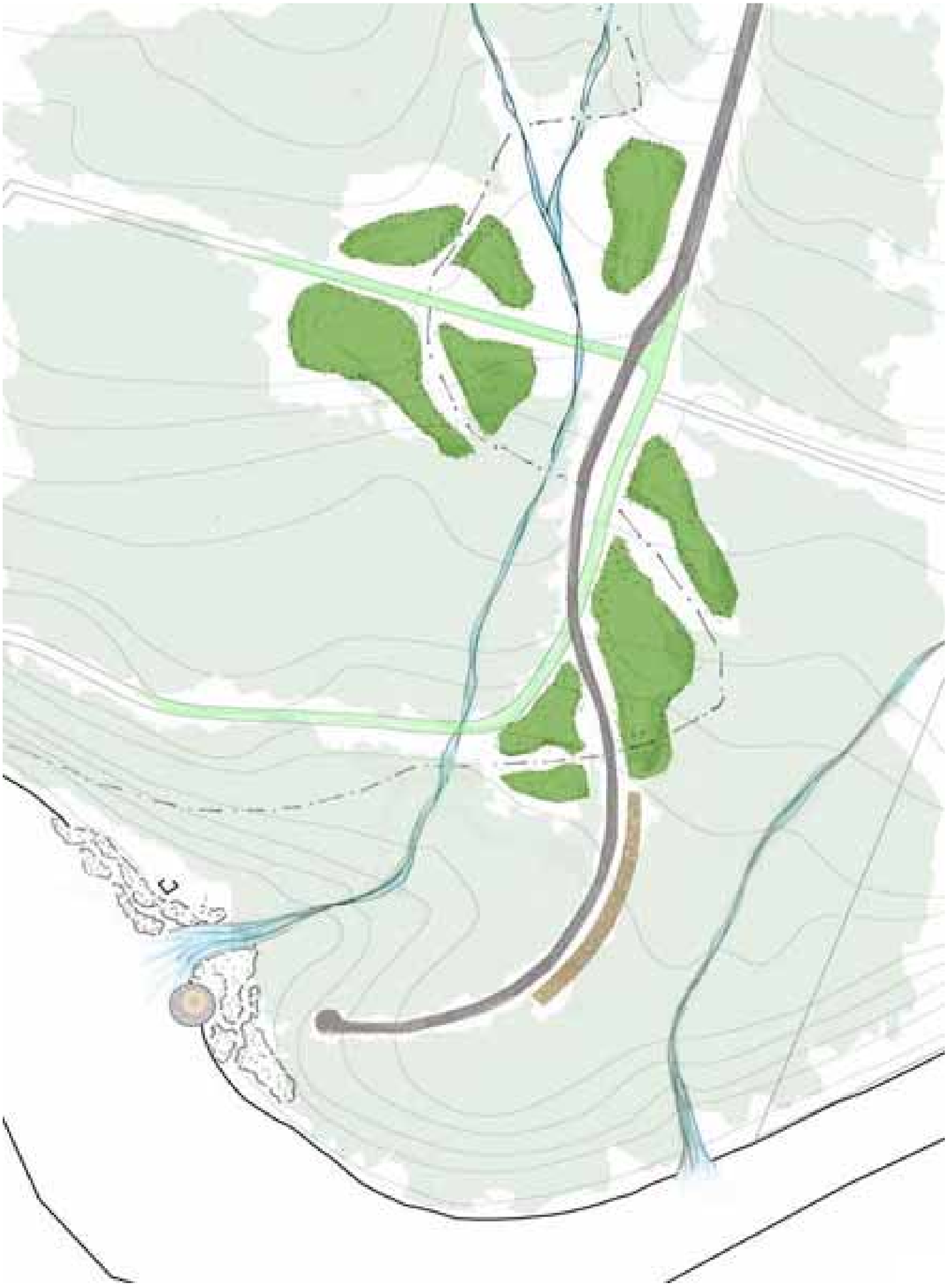
* Talking Water Classroom is located near a brook for aural effect, Hawk Nest Classroom is tucked behind a forest buffer.

* Easily accessed from Water's Dance Path.

* Can be used in the evening with virtually no intrusion on wildlife's dark nights, and no access to the Fishway or tunnel.

* Located in close proximity to amenities at Tian Visitor & Research Center.





Earthwork Concept: Remediation Knolls

Questions about the sediments dredged from the reservoir included:

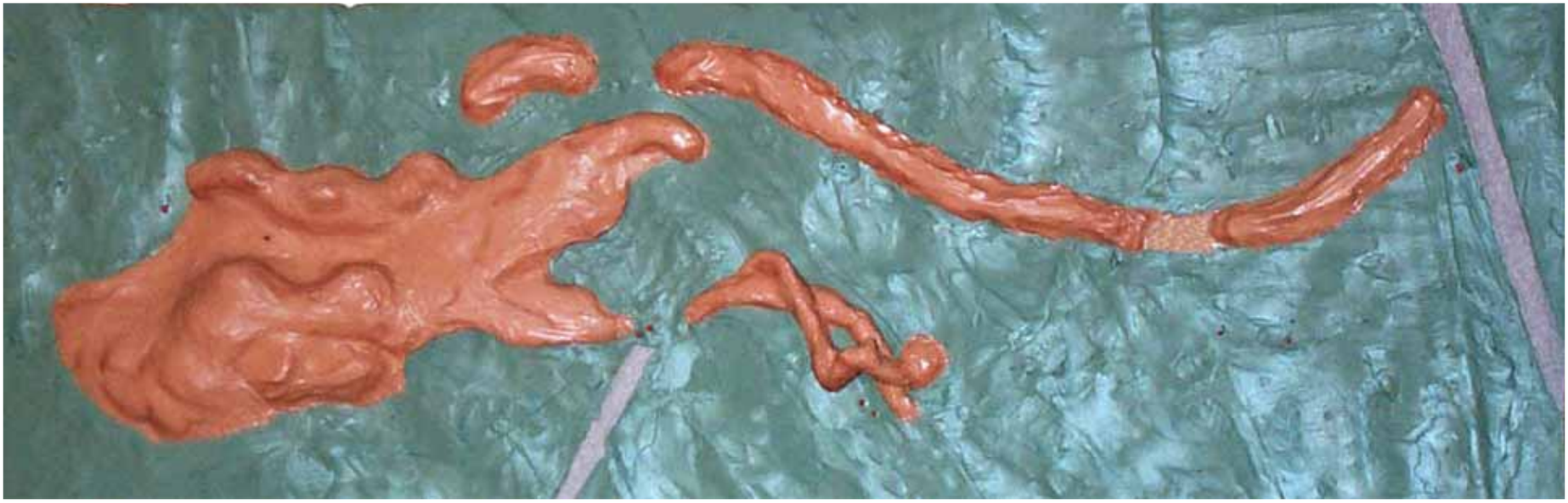
* Should they remain on-site?

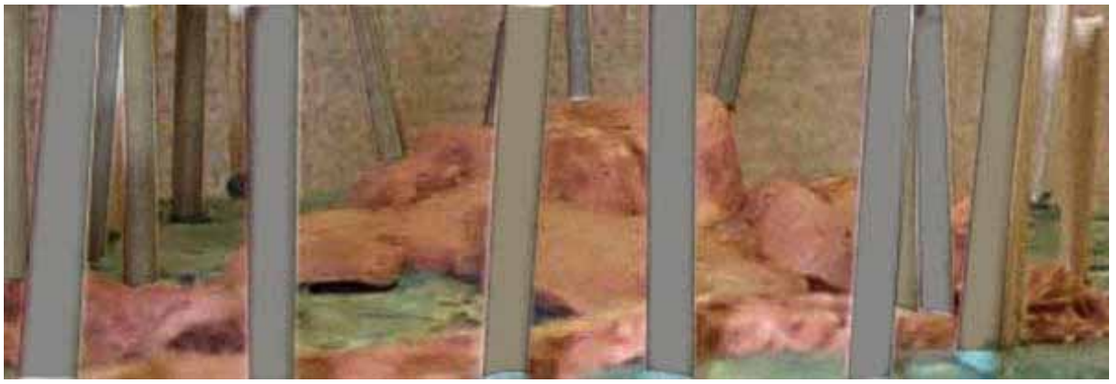
* Should they be transported elsewhere in the watershed, from which they came?

* How can they be multiplistic without creating environmental degradation or hazard?

My decision to keep the majority of the sediments on-site was based on eco-revelatory opportunity. Exposing the problem of siltation and the costs of maintaining the water supply is crucial to understanding how the ecosystem functions, and to publicly discussing solutions and alternatives. Sediment loads could exceed viable space on-site, in which case a portion of the load would be transported back to areas within the Goose Creek Watershed.

Remediation Knolls would be capped with vegetation so they pose no environmental threat to wildlife or humans. As such, they make safe and attractive amenities, such as areas for wildlife sanctuary, children's play, picnicking, biking, and relaxation.





Above. Concept model in plan view showing possible sculpted abstract forms and juxtaposition of Knolls.

Middle. Concept model in elevation with trees showing height and interaction with the ground.

Below. Photographic image showing how Knolls might fit among trees and rock.

* Contaminants and pollutants are removed from reservoir dredge spoils as sediments filter into and through underlying soils.

* Phytoremediation techniques utilize top-cover plants and trees to extract, contain, and/or degrade toxins.

* Knolls are strategically placed along areas of all types of hydrologic energies (storage, filtration, distribution) so that changes can be witnessed over time as Knolls settle and weather at different rates.

* Knolls should contain some structural or other fixed elements for stability and functionality, and to track their morphology.

Closing Thoughts

Working on this would-be recreational and educational nature reserve along Goose Creek Reservoir has been as much a journey for me as a design project – a journey that has made me a more thorough, contemplative designer. As an inaugural attempt toward my ideal of biocentric landscape architecture, I found the process challenging, the work mentally demanding, and the overall experience gratifying because of the professional growth and maturity it has given me.

Every thesis student I have known says the same: there is so much more design work they could do on their projects, and the same holds true for me. That is because for us, these places and structures and plans become so real, so vivid in our minds, they take on a depth of meaning and a certain life of their own that we wish was more than word and image on paper and screen. We wish people and animals could occupy the spaces we create, and experience the moments we intend for them.

But my task was not to design every aspect of the 175 acre site, nor to fully detail every concept indicated on the Master Plan and Diagram. Some of my intentions never made it past the idea stage, including a green roof and cisterns for the Tian Visitor & Research Center, the use of eco-pavers on service roads, the simplicity of the trodden hiking paths, or possible volunteer and educational opportunities that could enrich the experience of the place, simply because that would have meant losing sight of the big picture. No, the point of studio work was to put my goals for biocentric design to the test, and *that* I have done. I believe my studio work is a successful demonstration of a design process and solutions that created a public space which truly benefits the natural world.

Goals and Objectives

Early in this section I set forth design goals and objectives that would shape this project, and now, measure its success. The question at this point becomes, were those goals and objectives met, and how so?

> Goal: Determine criteria and methods of land planning and design that will produce a public landscape in harmony with and attentive to natural processes.

Criteria for land planning were based on a standard of multiplicity, and favored the ideals of environmental justice. I pursued these standards with sustainable methods of design that demonstrated a balance of resource use with resource regeneration.

> Goal: Explore the restoration, protection and/or maintenance of a healthy, functioning ecosystem while creating a dynamic place which teaches ecological systems.

I decided the ecosystem had to benefit from design solutions, and that design work could not be predominantly anthropocentric. Improving and maintaining the health and functionality of this landscape was a primary concern, so I incorporated methods of restoration (via wetlands, native forest), protection (habitat, waterways), and maintenance (limited access, educational programs, volunteer opportunities). I give credence to Lyle's opinion that the human mind is nature's consciousness, so creating a dynamic setting for learning became a major driving force and justification for my design. Therefore, eco-revelatory experiences, research and demonstration areas, spaces for classes, lectures and public discussion, and opportunities for individual discovery are included to foster learning and the exchange of ideas.

> Goal: Delineate the decision-making process of a biocentric landscape architect.

The process I followed was not necessarily unique, but the information I gathered and absorbed did, indeed, steer the project toward biocentric solutions. Specific personal interests in built structures and associated ecological response, as well as in dichotomies in the landscape determined **Site Selection**. A strong desire to test multiplicity among clients and how they occupy physical space led to **The Program**. Through **Research and Analysis**, particularly by focusing on the geomorphology, the interaction of water, energy and entropy, the greater watershed, the affected species, the native riparian forest and wildlife corridor, the circulation and views, and the societal issues surrounding the site, I gained a deeper understanding of how this landscape "works" as a unified whole. **Reflective Equilibrium Theory** and **Eco-revelatory Design** became guiding lights to addressing and responding to mainstream attitudes and assumptions about the human – nature relationship. An **Exploration of Ideas** revealed to me the story I wanted to tell on the site and the natural processes I wanted visitors to better understand. Through **Need Assessment**, I realized ways I could meet the needs of clients and users while creating less land fragmentation, minimizing footprints and the number of new structures, concentrating and optimizing user benefits, and maximizing utility *and* conservation of natural resources. The **Master Concept Diagram** helped me find hidden opportunities for design, and determine the ideal locations for the elements of my design. Creating the **Master Plan** and focused **Areas of Site Design** allowed me to explore how biocentric landscape design responds to real landscape conditions and considerations.

Furthermore, I consulted the design objectives frequently, asking myself if the developing design was abiding by them. If the answer was no, I tried again until solutions fell within their framework. Some examples of how objectives were met include:

Minimize further land fragmentation: combined visitor and research institute facilities under one roof, modest path systems, Fishway tunnel rather than chasm, maintained migratory routes

Provide habitat: the Fishway and its created wetlands, use of native plants to expand riparian forest, structures (Boat Island, Water's Dance Path, Hiking Hut) support wildlife

Reduce on-site pollutants and avoid introduction of contaminants: perimeter parking, Remediation Knolls, use of soil cement, use of hydraulic ram pump

Promote a spirit of learning: Outdoor Classrooms, eco-revelatory experiences along paths and Remediation Knolls, Tian Visitor and Research Center

Preserve the naturalized waterfront: limited human access to waterfront, protected and restored wetland buffers, structures (Boat Launch, Boat Island, Boardwalk) built in low-energy areas along creek

Accomplish multiple functions with fewer resources (standard of multiplicity): shared pedestrian and vehicular paths are eco-revelatory and considerate of wildlife, shared use of structures among multiple clients, Remediation Knolls improve water quality and quantity, provide site amenities and are eco-revelatory, reuse of excavated materials

Eco-revelatory Pursuits

I called eco-revelatory design one of my guiding lights. When considering all the eco-revelatory moments I envision for this site, I feel the Fishway is the most poignant, followed by the exposed view from the Hiking Hut into the adjacent quarry, the Remediation Knolls, and the rammed earth pilings of Birdsong Path.

In addition to its service to the biotic and abiotic community, the Fishway powerfully opens the earth and reveals to us so much of its deeper being. In architecture, this form of "un-building" has been called "Matta-Clarking," named after artist Gordon Matta-Clark who removed parts of buildings to expose their inner structures and rearranged their properties to create new space; for landscape architecture Matta-Clarking holds potential for revealing landscape's internal structure and material, while offering occupiable space that shares a love for what is past and a belief that we can make a place better (Betsky, Levy and MacCannell 2001). The Fishway reaches this potential of un-building, opens us to new information about the land in a way no poured-in-place concrete fish ladder ever could, and most important, reestablishes essential life cycles and geomorphic processes to the aquatic ecosystem.

Because of this project, I believe that when eco-revelatory design functions for the well-being of the landscape, it makes strong contributions to the notion of the human mind as the mind within nature. It may be said this type of design could require more time, more research and analysis, and more complexity in planning, but I believe the ecological potentials it offers are worth it.

The First Attempt

With goals and objectives met, and eco-revelatory design demonstrated, the last word on studio work goes toward the design's biocentric nature. For my first attempt at biocentric landscape architecture, I am pleased with the work I have produced. I opened this presentation of studio work with a review of design implications (normative ethics) that I wanted to apply to the program and design. Three basic tenets guided my work as I conducted research and analysis that helped me understand the ways of earth, I applied design and decision-making methods to promote sustainable patterns, I consulted reflective equilibrium and eco-revelatory design to challenge anthropocentric assumptions and provide mental stimulation to engage the mind, heart and spirit. (Please see the first page of Part 3 for a review of the tenets and normative ethics.)

I believe I have successfully executed this work according to my ethic and have, indeed, presented a landscape plan that is ecologically benign, holistically functional, and culturally significant – the true vision of biocentric landscape architecture.

	Biocentric	Eco-revelatory	Minimize fragmentation	Provide habitat	Reduce pollutants, avoid contaminants	Promote spirit of learning	Preserve waterfront	Standard of multiplicity
Tian								
Fishway	✓	✓	✓	✓		✓		✓
Birdsong Path	✓	✓	✓	✓	✓	✓	✓	✓
Descent Into Earth Path	✓	✓				✓		✓
Water's Dance Path	✓	✓	✓	✓	✓	✓		✓
Boat Island	✓	✓	✓	✓		✓	✓	✓
Outdoor Classrooms	✓	✓	✓	✓		✓		✓
Remediation Knolls	✓	✓		✓	✓	✓		✓

For further demonstration on how these design criteria were met, please see Appendix Six: Evaluating Studio Work Success.

Part 4: Thesis Findings and Design Criteria

Through this thesis I sought, because I believed there exists, a more harmonious human-nature relationship than is typical of many of our built environments. I explored a "trifecta of origin" to explain how we have become fragmented from nature, from our communities and from one another, much in the same way our landscapes and ecosystems have suffered fragmentation. Early cultural influences, the rapid rise of technology, and economics largely continue to determine the ways in which we shape and make utilization of our environment, much as they have since this country was founded. A person can become vulnerable to attack should he or she challenge any one of these revered American traditions.

Because of a longstanding resistance to rethinking our relationship with nature, we have committed devastation to our environment, and continue to do so at alarming rates. "Water. Air. Climate. Soil. Vegetation. Wildlife. Humans have affected all aspects of nature," I said on the opening page of "The Disconnect" segment of this book. That is why John Tillman Lyle considers human thought as a regenerative function, as the mind within nature, as nature's consciousness. It is why environmental scientists measure anthropogenic rates of ecological change in terms of temporal and spatial scales and patch and landscape dynamics. And it is why more and more concerned citizens question, "How long can such rates of consumption be sustained?" (Roger Hooke), and call for change, for "an earthquake into the future" (Robert Mugerauer), "a rethinking and refeeling of our nature and destiny" (Lynn White), "science and technology that do not come with fragmentation or separation" (György Doczi), "an awareness of the implications and a compassionate sense of responsibility" (Albert Schweitzer).

Through this thesis I explored how landscape architecture, as a profession, is involved in such change: how it can redefine "land stewardship," how it can contribute to paradigm shifts that change actions and attitudes, and how it can take a place at the forefront of new solutions. Because there is great variety and discrepancy among the design work we recognize as "sustainable," I developed an ethic and methodology by which I felt I could shape the built environment as ecologically more benign, holistically more functional, and culturally more significant than is conventional, especially during times of rapid development.

Believing ours is the mind within nature, my system highly values landscapes that educate and communicate in socially and environmentally just manners, and considers the abilities to inspire and motivate as high ideals. And because we are nature's consciousness, the truth in the sentiment that humankind's ultimate demise would be greeted by earth's surviving community with a resounding "good riddance" (Paul Taylor) suggested to me that we are failing nature. With an ethic and methodology in hand, I set out to test through design work how I could do better.

I explained the ways I believe my design did do better by nature in the closing thoughts of Part 3: Biocentric Design Studio; no need to repeat that here. The design resulting from having started with a well-defined biocentric ethic has more mettle and substance than any of my prior design work. I felt my work became more meaningful, and I felt empowered knowing where I wanted to go and having a sturdy framework to guide me there. I found I worked with more purpose, more conviction, more interest in every aspect of design.

Design Criteria: Methodology

After conducting Research and Analysis, I realized the dynamic energies of the place should be allowed to play out on their own with little interference from me as designer. The decision to take a light hand and a non-anthropocentric approach, however, made determining and applying a design methodology difficult, as numerous false starts would indicate.

From Part 1, I developed a list of "implications for design," or my personal design ethic, a guiding list of preferences and wishes for how I can contribute meaningfully and responsibly to landscape architecture and to the ecosystems in which I work. My ethic, however, lacked that magic step that would bridge it with site design – i.e., a methodology. I needed a strategy for action, which came to me as three basic tenets that one could commit to in order to work toward landscapes that are ecologically more benign, holistically more functional, and culturally more significant than is the current convention during rapid development. Together, Ethic + The Three Tenets became my biocentric method of design, the methodology which propelled and structured every aspect of design work.

Along the way, sub-methodologies emerged to further shape design:
Standard of Multiplicity – a test of biocentricity that maximizes benefit and minimizes ecological impact.

Eco-Revelatory Design + Reflective Equilibrium – means of communicating about ecology and aligning beliefs, attitudes and actions.

Considering The Ecosystem and/or Its Components As Prime Client – a practice of weighing human *wants* against nature's *needs*. Biocentrist Paul Taylor calls this the Principle of Proportionality: differentiating

between nonbasic human interests from the basic interests of nonhumans.

This methodology can rightly be accused of idealism, because it is based on a commitment to doing the right thing as far as our ecological understanding guides us, and an optimism for just and sensible treatment of the land by our societies. At times while working on this thesis, it has been hard for me to distinguish between methodology and worldview because the biocentric landscape architecture methodology grew organically from my personal design ethic, designer goals, and a nonanthropocentric worldview. But I submit that it is also a practical methodology which can be applied at any scale, large or small, with results that strengthen ecosystems and build informed communities.

Arriving at this methodology was time consuming, and equal parts frustration and utter reward. Happily, I conclude that here is the system I have sought, one by which I can proudly and responsibly practice landscape architecture, one I will continue to explore, apply and challenge as it grows and evolves in the future.

Design Criteria: Successes and Shortcomings

On the concluding pages of Part 3, I stated what I believe works about this project. I feel it only fair to now mention a few of the struggles I had with things that I feel did not work.

Many of my difficulties fall under one umbrella statement: Doing green/sustainable/biocentric design single-handedly did not work. The required time, energy and level of expertise needed in some areas is too great for one person to take on alone. This hard-learned fact manifested itself and riddled my thesis work with problems in a number of ways.

• *The amount of research is overwhelming.* Research, in the forms of site analysis with added emphasis on ecological processes and responses, historical accounts, societal data, literature reviews, case studies, and numerous other forms, can easily consume large amounts of the designer's time and energy. Often more data is collected than is used as ideas evolve or are dismissed.

• *Assessing the land's ecological responses to my design solutions.* In large part, my studio work focused on the land's ecological responses to a dam and reservoir; naturally I wanted to compare the conditions and reactions pre- and post-construction of my design. The time involved and the level of expertise I would need to predict such outcomes far exceed the bounds of this thesis. I cannot help but wish I could scientifically prove my design's fit with nature's flux and evolution, or assess how my rates and extents of change affect/improve ecological function and land's capacity for self-renewal.

• *Working in isolation is no way to work.* Despite the significant contributions of my thesis committee, and additional input from those with whom I collaborated, my pursuits into sustainability and green design were conducted very much alone. I envision that, in the future and with strong leadership, a team approach will expedite the project, energize it with divergent thoughts and experience, result in a product of higher quality, and create an enthusiasm that is difficult for one person to sustain alone.

• *It is difficult to abide by a time management strategy.* I often found it impossible to accurately predict the amount of time required to complete a task, perhaps because this is my first attempt at design of this nature and scope. Given the learning curve, false starts, additional work created, synthesis of new input, and correction of mistakes, while working on other projects, time management was a frustrating, elusive element that at times I could not master. Sharing the workload, collaborating with others on a professional level, and gaining more experience should improve the ability to accurately allocate and budget time.

• *I would have liked to take design even further.* While I am satisfied with the design aspect of my thesis work, there are elements of the design I would have liked to develop further and tested more. Perhaps this is the student-feeling-unfinished phenomenon I mentioned in the closing thoughts of Part 3, but I recognize that one person's knowledge and experience are unlikely to carry a sustainable project through to completion, especially not a novice. The specialized skills of a team of consultants would be needed to truly complete the project, and while as a student I do not have those resources, as a collaborative team leader, I will be comfortable coordinating the expertise needed to bring ideas to fruition.

In addition to the limitations of working alone, a lack of compromise did not work. Early in thesis work, constructive challenges were made to my burgeoning ideas for a personal design ethic. I think that because I had not fully understood my ethic or its applicability I was protective of its nascent condition. I often met the challenges with a certain stubborn steadfastness, and the result was unsuccessful studio work that tested little of my position, and was boring and off the mark. When my ethic became more clear to me, I became open to the sound advice I had been receiving and was able to design with purpose and vision. Lesson learned, a personal ethic should not become rigid dogma or an obstacle that blinds the designer and prevents him or her from achieving the true intentions of the project.

Finally, a word of caution. Although I consider the test of my standard of multiplicity an overall success, there were instances when I

questioned if the layering of functions and forms was producing real value or if value was forced and contrived. Critical to making this work are determining upfront how "ecological value" is defined and understood, and being willing to check and challenge ideas against those parameters. If the outcome is an artificial or trivial multiplicity, it is not working, it does not pass the standard, and the idea must be rethought.

Findings: Related to Other Portions of the Book

Design work not only presented the opportunity to test my thesis position against real landscape conditions, it also gave me insight on the mutually informing relationship between theory and practice. I find it beneficial to reflect on lessons I learned through design work that relate to earlier parts of this book.

Time constraints are another factor in the "Disconnect" (i.e., how the conventional became what it is). Rarely designers have the luxury of time to be inventive and often need solutions quickly, therefore we often look to what has been done before, or are encouraged to rely on "the ways we've always done it;" the tried and true, not so much the experimental. This is particularly true in areas undergoing rapid development: taking risks with new and unproven techniques, and the costs associated with research & development (such as time, and the locating and hiring of specialists with experience in a new technique) can be prohibitive to finding alternatives.

My "green" may not be your green. I have stressed all along that this idea of biocentric landscape architecture is a system that works for me, just as I have encouraged readers to develop their own personal design ethic. My "shade of green" may not be the answer to the elusive *ecological design* another may wish to pursue. Mine may quaver or stall under the scrutiny of another's standards as they judge my designs against my intentions and goals. While I strive for positive working solutions and not just a list of good intentions, my ideas for biocentric design, or my overall personal design ethic in general, will likely evolve as I continue its pursuit and refine its expression and functionality.

Collaborative efforts among diverse fields strengthen sustainable design. I decisively built my thesis committee to test the importance I place on collaboration with others in landscape architecture and complementary fields. My committee included two landscape architects, one practicing, one in academia, a conservation biologist, and an architect. Additionally, I consulted a geologist, two City of Fairfax employees (the former director of transit and utilities, and the assistant director of public works), and a fish and wildlife specialist, who represent some of the stakeholders and consultants I would collaborate with on a project of similar scope and objective. I learned that drawing on the insight, experience and perspective of many diverse professionals rigorously tested the applicability of my design solutions and checked my interventions against my intentions. The collaborative effort produced a successfully rich, complex, deeply examined project that achieved my thesis goals.

It was not always easy synthesizing the sometimes opposing viewpoints and direction I received, and compromises had to be made, such as how much boardwalk along the waterfront I could design without committing environmental violence, or how I could justify determining and cutting new circulation paths when existing paths are currently intact, or how I could weigh short-term environmental responses against long-term ecological gains. The abilities to negotiate with others and to prioritize ideas and outcomes will help the designer consider alternative solutions without sacrificing the vision.

Beside the art of compromise and synthesis, I learned the value of decision-making. In order to lead a collaborative effort, one must be comfortable making decisions not only about project strategy, site design, and construction documentation and supervision, but also decisions affecting the team of collaborators and differentiating what is needed from whom. Clearly communicating whether you seek general design guidance versus specific information that helps define limitations or refine details will determine the quality and the relevance of their counsel. It is the varied knowledge and perspective of responsible professionals that make collaboration an essential and welcome element of design that sustains itself, the landscape and the ecosystem.

Realigning one's beliefs and actions can be a rewarding experience. Prior to design work, I thought producing "ecologically benign designs" meant strictly taking a light hand on the land, making only modest disturbances and erasing all evidence of human intervention. Then I met my highly engineered Fishway, and experienced a certain realignment of my beliefs and actions that would make deep ecologists and reflective equilibrium theorists proud.

While I still hold fast to the idea that big gestures and major alterations should be critically examined and weighed against environmental impact and ecological response, should be multiplistic, and should provide improved functionality to the ecosystem (along the lines of John Tillman Lyle's "mind within nature"), I concede that innovative and sustainable anthropogenic acts of design can bring about positive, long-term, harmonious, reconnective, responsible solutions with true ecological benefits.

Responsible designs come from informed designers. Designers must be willing and able to stay abreast of research and findings in ecology, conservation biology and other environmental sciences. Learning from those they work with, conducting their own research, and seeking opportunities to continue their education are ways they can stay informed. Achieving sustainability in design will mean working within this knowledge.

A harmonious human–nature relationship can result from contemplative people. Human-generated changes to the landscape affect the land's ability to recover from natural and anthropogenic disturbances. But it is how humans perceive and understand natural processes that determine how we respond in the aftermath of a land disturbance. Do we replace, and build the same as quickly as possible? Do we reflect, and contemplate nature's patterns and processes, considering them as boundaries to which we modify our behaviors? Do we reinvent, and expand our repertoire of design, methods of construction, and technology to turn those limits into sustainable opportunities that can help define a harmonious human-nature relationship?

Findings: Current and Future Challenges to My Theory

As I developed my personal design ethic and tested it with design, a number of challenges arose. While they helped shaped the outcome of this thesis, I realize that some will persist as I carry my work forward. Here are some of the challenges along with strategies for how I can overcome them.

Cost-benefit analysis. The value of a healthy, balanced environment is becoming better understood than it has been in the recent past, but the debate between environmental protection versus property value and land utility will wage on for the foreseeable future. As long as a forested buffer, for example, will be more highly valued as a developable revenue source than as a source for habitat, air purification and wildlife corridor, then justification for biocentric design will be an uphill battle. A serious challenge to my theory, particularly among those who do not consider themselves necessarily anthropocentric, will be arguing against economics as the absolute bottom line. Creatively educating those who understand *economics* over ecology about issues such as landscape heterogeneity, patch and landscape dynamics, our unnatural rates of resource consumption, and the long-term *values* of sustainability and a balanced ecology is a hopeful strategy toward finding acceptance of my theory/approach.

Ecological in perpetuity. My case study on Frank Lloyd Wright's Taliesin West raised, for me, the question of maintaining environmental protection in perpetuity. How can concerned stakeholders, and particularly landscape architects, ensure ecological designs, or protected lands in general, will remain holistically functional and ecologically benign? The challenge becomes does my theory merely delay the progress to which the land inevitably will fall after it has become an even more highly prized piece of real estate and development pressures are even greater?

Beyond sustainable designs, materials and construction, which introduce a certain built-in resiliency from the beginning, zoning and policy regulations must be part of the solution. Another strategy is to define appropriate usage and prevent excesses by creating some form of longstanding protection, such as bylaws, maintenance guidelines, usage agreements, usage restrictions, or other formal, binding documentation. The responsibility for creating explicit forms of protection and the authority to enforce them would be delegated among stakeholders and/or multiple clients.

Criticisms of sustainable design. Frequent criticisms of sustainable design projects are their complexity, and the increases in upfront costs, time and energy (i.e., human input). When extrapolated over time, often sustainable design interventions cost less, mostly because of reductions in long-term maintenance and energy use. Through studio design work, I found it true that significantly more time and energy was required to attempt biocentric design solutions than when I have designed using more conventional methods and techniques. I found myself questioning if the extra input was worth the experiment; staying dedicated to the task was, at times, a challenge and a strain. The ongoing challenge, then, becomes a matter of efficiency:

- reducing time and human energy input spent on design projects;
- reducing costs of research and development, and of construction techniques;
- developing a network of experts with which to collaborate on specialized matters; and
- finding or cultivating a client base that recognizes the urgent need for, and the rewards of, *responsible* design, all while maintaining the long-term cost-saving advantages of sustainability.

Results

As a personal result of having done this project, I have gained a more holistic sense of the landscape and have considered deeply a number of the connections within ecosystems. I consider how aspects of design affect wildlife, water sources, existing vegetation, human culture; how construction techniques affect climate, and air and water quality; how there is more to the environment and stewardship than what we see on earth's surface, such as soils, rock substructure, underground water

sources and aquifers; how unnatural rates and intensities of change and homogeneity can degrade environmental systems to the point of collapse; and how natural processes, which are often given little thought, can and should carry more weight in our design decision-making processes and solutions.

Another result of this project concerns landscape architecture in general. It seems the most outspoken of those who pursue *sustainable* design, those whose authority is most widely recognized as leaders in the field, tend to be from disciplines other than landscape architecture. After doing this project, I firmly believe that landscape architects are uniquely trained and poised to assume an even stronger position on the forefront of the green movement.

While I absolutely view collaboration among disciplines as an essential part of sustainable design, I believe landscape architecture possesses a certain unique authority and leadership in coalescing societal desires, design features, human interactions with the land, and ecological functions. Because landscape architecture is an inherently diverse field, there exists an advantageous ability to "speak many languages of the land," which requires comprehending, coordinating, combining and communicating a range of facts, ideas, opinions and interests among those involved in the design process. These fortes can position landscape architects as recognized leaders of this exciting design revolution.

Therefore, I submit that the potential for responsible design resides in a commitment to ideals and activities which bring about true ecological value. Those who practice responsible design must discover ways in which they can abide by that commitment, perhaps by arriving at some set of guiding principles or rules – some ethic – that responds to their individual understanding of the world and the place they wish to hold in it. Such discovery has the power to imbue the designer's work with unprecedented veracity and character, to reveal one's unique essence of design. It is my belief and vision that this is an auspicious path to producing work that carries promise into the future.

Appendices

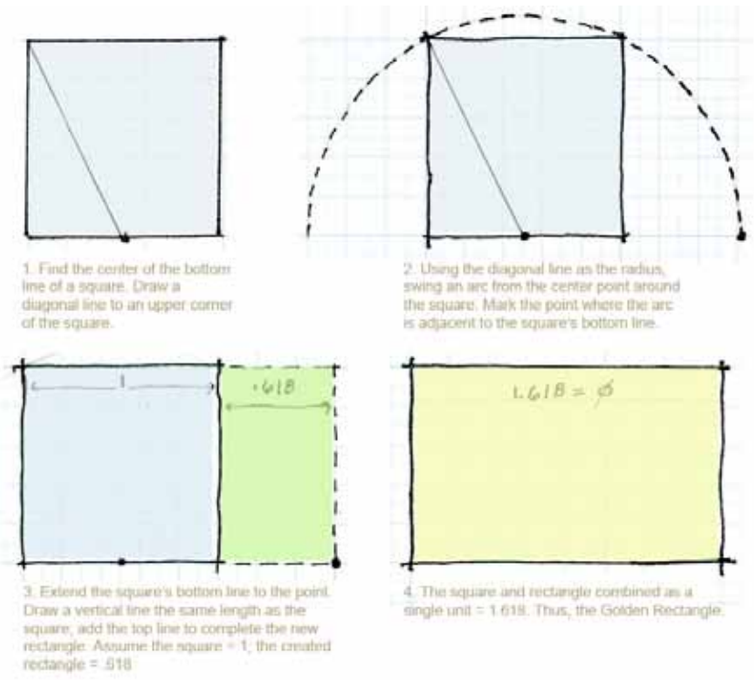
Gregory Nobles' work reveals commonalities among some American Indian creation stories. Differing noticeably from Judeo-Christian creation beliefs, Indian stories emphasize and remind people of their deep connection to, and a oneness with, all living things on earth.

> Among the Pueblo people of the Southwest, the origin of human life began when two women were born in the underworld. There, Thought Woman (Tsichtinako) nursed the sisters, taught them language, and gave them each a basket containing the seeds and fetishes of all the plants and animals that were to exist in the world. One of the pine seeds they planted grew into a tall tree that broke through the earth's surface, and the sisters emerged into the sunlight. Once on earth, Thought Woman taught them how to give life to the animal fetishes, so that the animals would give them life in return. The sisters scattered the pebbles that would grow into mountains and seeds that would grow into plants.
>
> Similar stories existed among the Creek people of the Southeast, who told of people first coming out of the earth, and among the Iroquois people of the Northeast, who told of a woman falling from the sky and planting seeds in the mud on the back of a sea turtle. In these and other creation stories, the emphasis on seed-bearing women as first beings underscores the connection between human life and plant life. As a result, Indian religion taught a spiritual relationship between all living things and human beings.
>
> Thus deer hunters, both in the Southwest and the Northeast, prayed to the animals before the hunt and gave them thanks afterward for providing for their needs. As Calvin Martin explains, both human beings and animals were assumed to understand their respective roles in the hunt, and Indians had a 'sense of cautious reverence for a conscious fellow-member of the same ecosystem who, in the view of the Indian, allowed itself to be taken for food and clothing.' (Nobles 1997, pp28-29)

Continued here is more of the research I accumulated on the compelling and dynamic number, ratio and phenomenon, phi, which has inspired works in the arts, sciences, theologies, literature, and other fields.

Geometric Proportions

Geometry gives form to phi, allowing one to see the number as exquisite ratio. For example, the so-called Golden Rectangle is, to many, the archetypal geometric form of perfect proportion for rectangles. Phi, of course, plays a role.

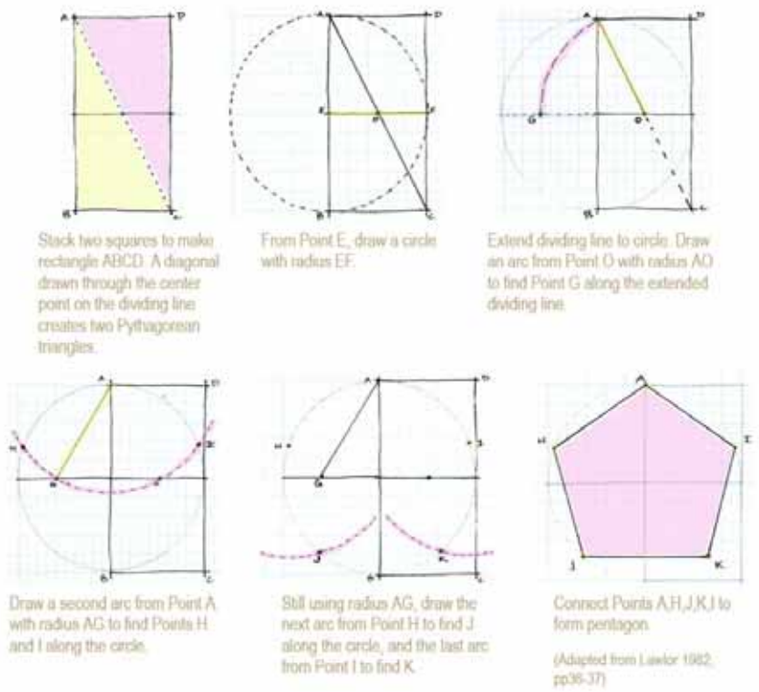


Drawing a golden rectangle.

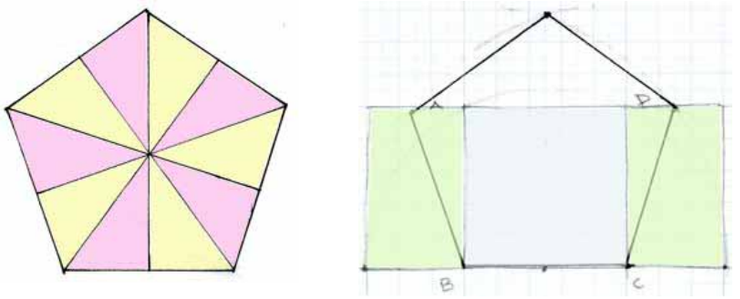
Ever since humans have contemplated the geometries of the world, there has been "grand philosophical, natural and aesthetic considerations" regarding the Golden Rectangle (Lawlor 1982, p53). It shows up again and again in ancient Egyptian and Greek architecture, in art of the Renaissance, and even in modern-day culture via these and many other forms.

It has been said that phi possesses an attractive unity, order, balance and beauty, and where there is an intensification of function or a particular beauty and harmony of form, there the Golden Mean will be found (Lawlor 1982, p53). Adherence to this ratio determines structure, limitations and patterns, whether designed by man or nature. Doczi credits the "complete reciprocity of this proportion which strikes us as particularly harmonious and pleasing" (1981, p2).

Phi is evident in other key geometric forms, such as the Pythagorean triangle, pentagon and spiral. As is true of

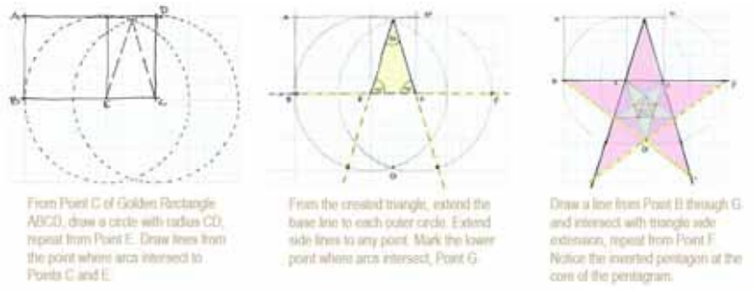


Drawing a pentagon.



Left: Pentagon divided into 10 Pythagorean triangles.
Right: Pentagon drawn from Golden Rectangle + a reciprocal (.618) rectangle.

Fibonacci numbers and phi, these geometric forms and proportions recur throughout nature and natural phenomena, *including human anatomy*.

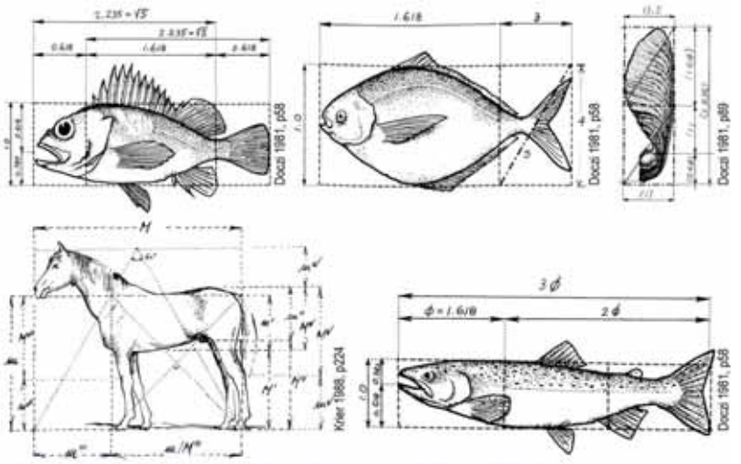


From Point C of Golden Rectangle ABCD, draw a circle with radius CD; repeat from Point E. Draw lines from the point where arcs intersect to Points C and E.

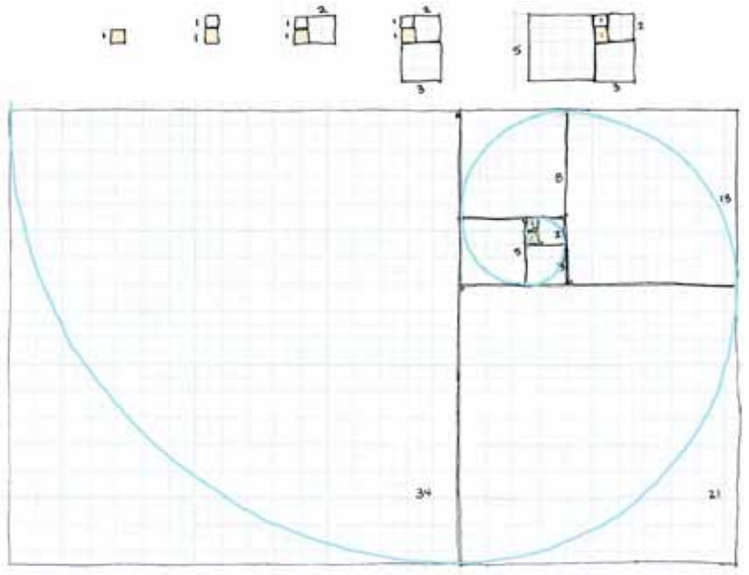
From the created triangle, extend the base line to each outer circle. Extend side lines to any point. Mark the lower point where arcs intersect, Point G.

Draw a line from Point B through G and intersect with triangle side extension; repeat from Point F. Notice the inverted pentagon at the core of the pentagram.

Drawing a pentagram.

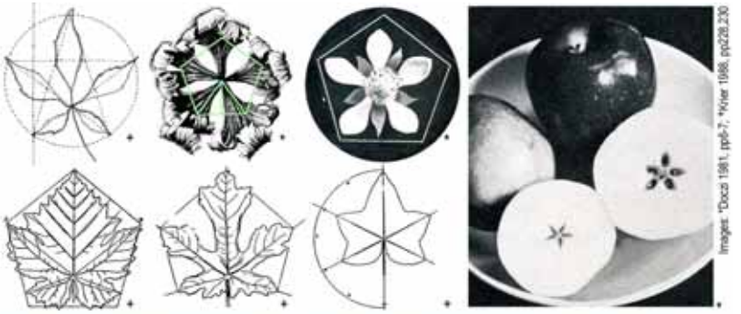


Golden rectangle proportions in rockfish, pompano, maple, horse and salmon.

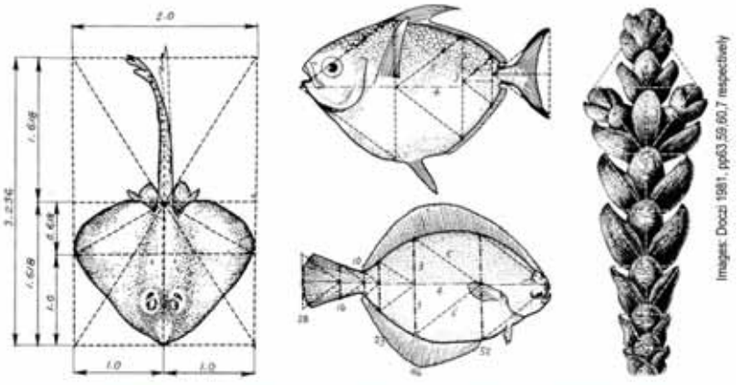


The Fibonacci numbers (and phi) also manifest in logarithmic spirals. Here 1,1,2,3,5,8,13,21 and 34 are used to construct a spiral. Draw a square, then an identical one on top of that. To the right, draw a third square with a side length equal to the two stacked squares. Moving clockwise around the original square, continue adding the length of the previous squares to draw the next square; the length of each square will always be a Fibonacci number. Once the grid of squares is complete, sweep an arc in each square with radius equal to the side length of that square. Sweep the first arc from the upper right corner of the original square; continue from the lower right corner of the second, the lower left of the third, upper left of the fourth, upper right of next, and so on (arc center points are indicated in green above).

Drawing a logarithmic spiral.



Because of its appearance in the pentagon, the Golden Section can be found in all flowers having five petals or any multiple of five, such as the flowers of edible fruit-bearing plants (Lawlor 1982, p58).



Proportional analyses on skate, opah, sole and deerhorn cedar reveal Pythagorean triangles, evidence of the Golden Section, and by association, phi.

Spirals in nature: peacock (Doczi 1981,p77), barrel cactus, conch shell (Knier 1988,p227), nautilus (Doczi 1981,p85), multiple seashells, the galaxy (Doczi 1981,p81).

Human Harmonies

Reminiscent to Jan Hartke's sentiments is this by György Doczi, "Nature's own golden proportions are built into our own nature, into our bodies and minds which are, after all, part of nature. The basic pattern-forming processes of nature have shaped the human hand and mind" (1981, p141).

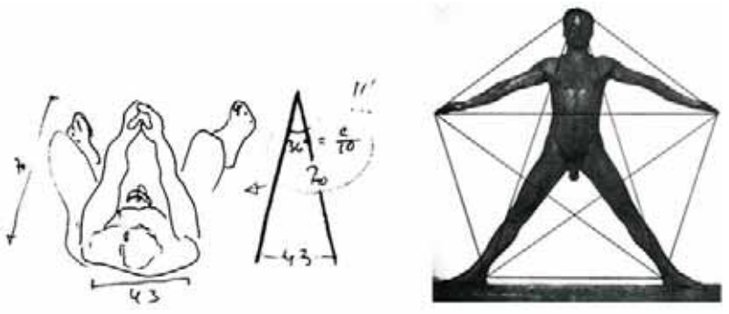
The Greeks of antiquity recognized the dominating role the Golden Section played in the proportions of the human body, and believing both humanity and the shrines housing their deities should belong to a higher universal order, they utilized these same proportions in their temple structures (Ching 1996, p286). However, the person most credited for analyzing and documenting the existence of phi in the human body is Albrecht Dürer. For 30 years Dürer studied and analyzed the proportions of the human body, which he documented in four books (circa 1528). His illustrations of the mathematics of the human form are still recognized as valid, and are commonly referred to today. (Krier 1988, pp193-99)

Robert Lawlor summarizes:

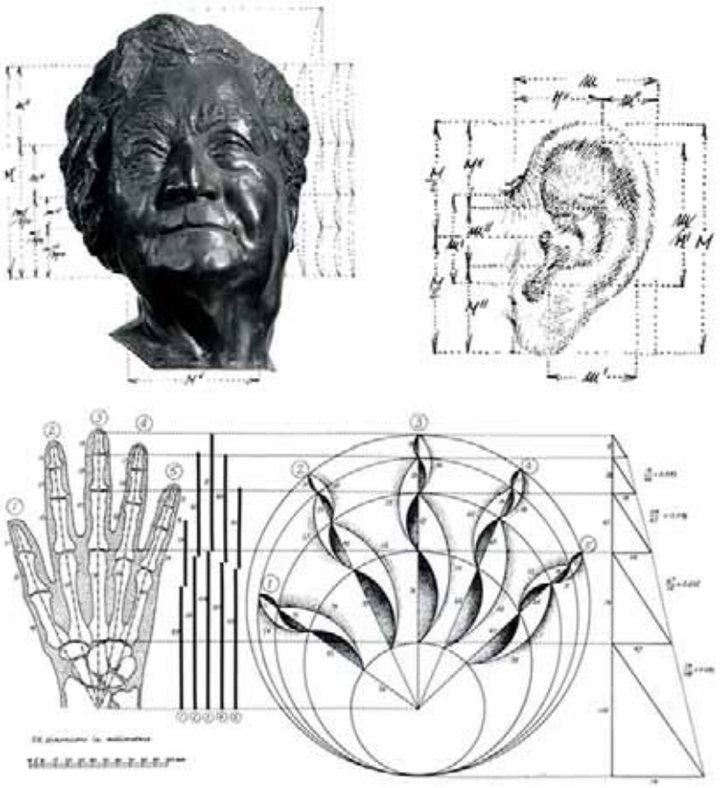
> In the human body, the navel divides the body approximately according to the Golden Section; in females the navel is slightly above the exact cut of the Golden Section, and in males it is a little below. There are numerous phi relationships which occur in the human body; for example, the relationships between the bone-lengths of finger, hand and arm. (1982, p59)

Adjacent parts of the body share proportions which fall within the range of the Golden Section and the Pythagorean triangle – the entire human bone structure fits neatly into three golden rectangles (plus a reciprocal for the head) (Doczi 1981, pp93-94,99). In fact, a well-proportioned hand, from middle finger to wrist and side-to-side, will fit into a Golden Rectangle (Burger and Starbird 2003). Furthermore, there exists an astonishing unity between the proportional harmonies of the whole body and its diverse parts (Doczi 1981, p101).

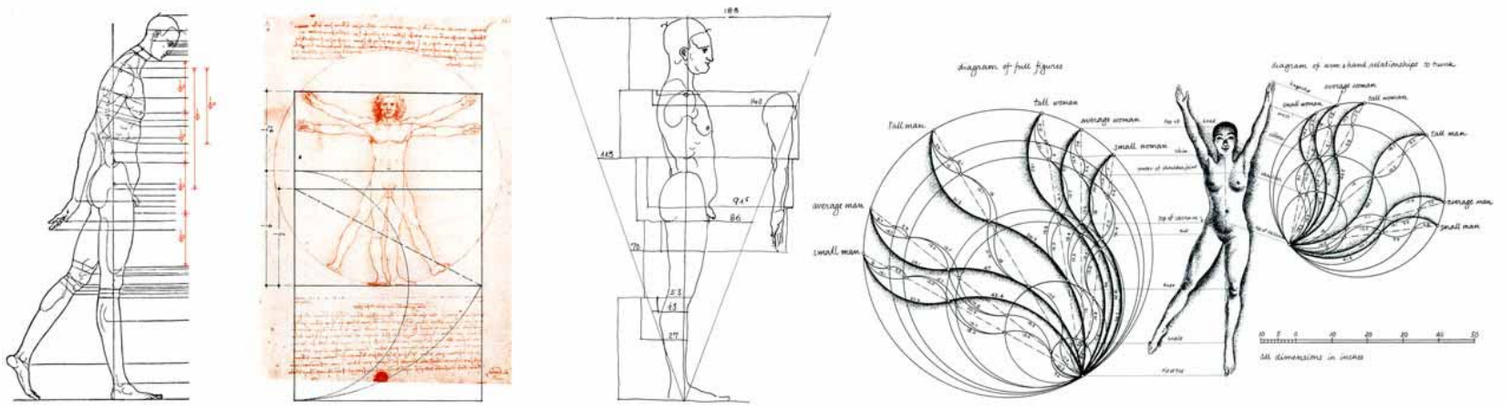
In *Architectural Composition*, Rob Krier illustrates the existence of the Golden Section in the human head, face, skull, ear, hand, foot, the entire skeleton, the full female body, and the full male body. Additional drawings and dimensional analyses of Leonardo da Vinci, Albrecht Dürer, Cesare Cesariano and Le Corbusier serve to further the point that phi is repeated within the structure of the human body. (1988, pp192-201)



Man as isosceles triangle (Krier 1988, p204); as pentagon (Lawlor 1982, p58);



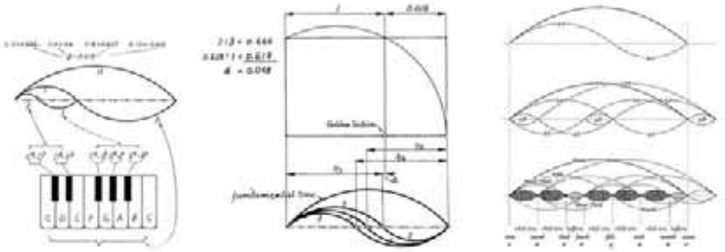
Proportions of the face, ear (Krier 1988, pp212,215) and hand (Doczi 1981, p101).



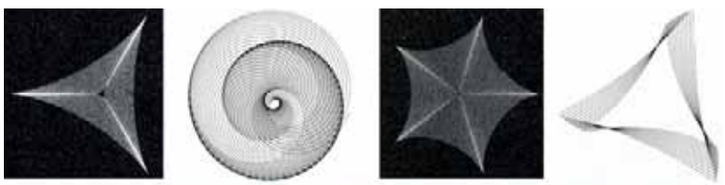
These analyses reveal golden proportions in the human form. *From left:* phi in an Albrecht Durer drawing and in da Vinci's Vitruvian Man (Lawlor 1982, p86,59); Durer drawing superimposed with Le Corbusier's modulor (Krier 1988, p199); unity of proportion in diverse body sizes (Doczi 1981, p100).

Beyond Structure

Phi is also found in the ***operational systems*** of the human body. Phi, and related root harmonies of music, share certain rhythmic patterns found in calendric changes, such as the changing of the seasons, the waxings and waxings of the moon, the rhythmic ebbs and flows of tides, the movement of heavenly bodies, and other important cycles of time (Doczi 1981, pp38-52). The universe is composed of vibrations and is perceived by humans as wave phenomena of pure temporal pattern that can be defined and understood only through number. "Thus our whole universe is reducible to Number." (Lawlor 1982, p12).

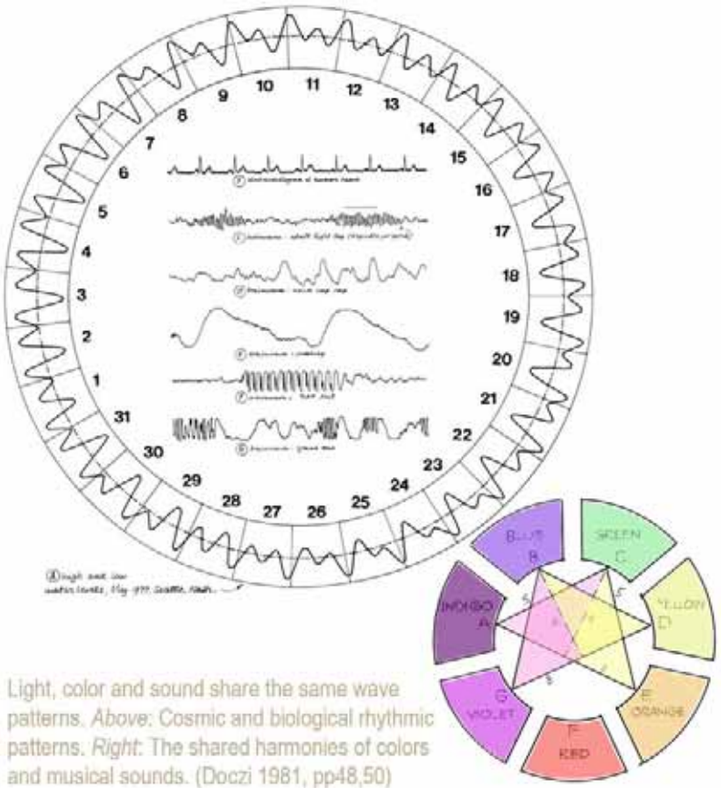


Golden proportions of the keyboard (Doczi 1981, p10). Golden section and harmonic overtones of a vibrating string (Doczi 1981, p10). Manifestation of the musical scale (Ashton 2003, p11).



Seeing sound. Harmonographs draw vibrations to form diverse designs, some with familiar geometric shapes. (Ashton 2003, pp29,38)

The same numbers and wave patterns of cosmic rhythms are shared by humans in the heartbeat, brainwaves, menstrual cycle, breathing, biorhythms (fluctuations of physical and mental cycles), and circadian rhythms (personal patterns of time). As an aside, light, color and sound likewise share these same wave patterns and vibration rates. (Doczi 1981, pp48-51)



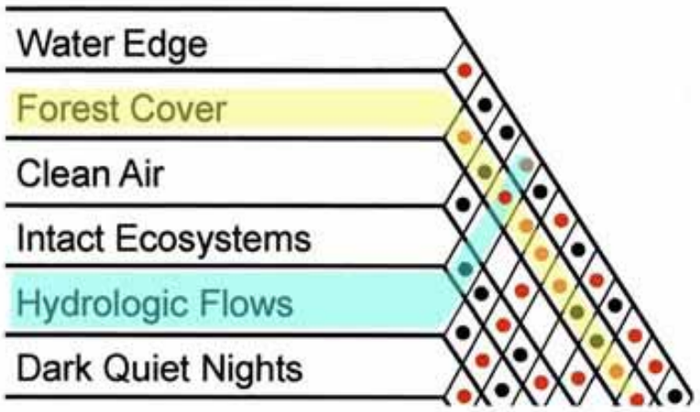
Light, color and sound share the same wave patterns. *Above*: Cosmic and biological rhythmic patterns. *Right*: The shared harmonies of colors and musical sounds. (Doczi 1981, pp48,50)

I love the image of two friends and colleagues, Arne Naess and George Sessions, camping in Death Valley, California, celebrating John Muir's birthday and the advent of the 1984 spring, and succinctly summarizing 15 years of philosophical contemplation in hope that "they would be understood and accepted by persons coming from different philosophical and religious positions." The outcome was eight basic principles of Deep Ecology:

1. The well-being and flourishing of human and nonhuman life on earth have value in themselves. These values are independent of the usefulness of the nonhuman world for human purposes.
2. Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.
3. Humans have no rights to reduce this richness and diversity except to satisfy *vital* needs. [A description of the distinctions between interests, wants and needs can be found in Des Jardins 2001, p224.]
4. The flourishing of human life and cultures is compatible with a substantial decrease of the human population. The flourishing of nonhuman life requires such a decrease.
5. Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening.
6. Policies must therefore be changed. These policies affect basic economic, technological, and ideological structures. The resulting state of affairs will be deeply different from the present.
7. The ideological change is mainly that of appreciating life quality rather than adhering to an increasingly higher standard of living. There will be profound awareness of the difference between big and great.
8. Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes.

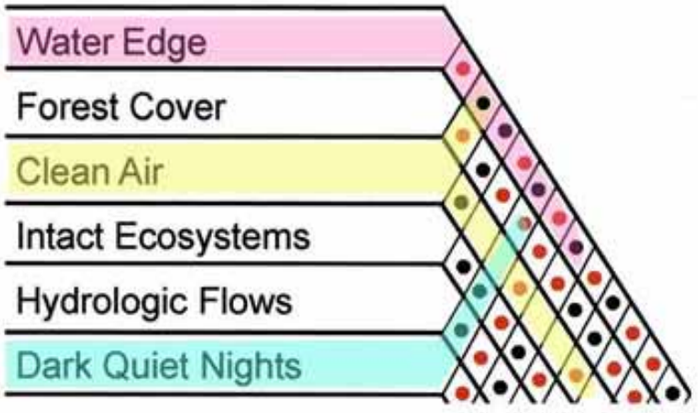
Devall & Sessions 2002, p266

Using Matrices to Track Connections



Making a matrix can reveal important and unexpected relationships and creative opportunities that help the designer check him or herself against the realities of the project. Start by listing design criteria and client or user interests. Use the grid to note potential connections between the criteria. Shown here is a connection between Forest Cover and Hydrologic Flows. The designer identified this as a significant or immediate relationship, as indicated by the red dot. A black dot would indicate a secondary relationship.

Here, Clean Air and Dark Quiet Nights share no immediate connection. Moving up the grid from Clean Air, a black dot indicates a secondary relationship with Water Edge. The designer concluded that food and habitat along the water's edge benefit from clean air.



Quotations from some of my research:

On the Laws of Thermodynamics
All systems move toward a maximum disorder – retaining order requires a constant input of energy. (Chiras, Reganold and Owen 2002, p49)

Heat flows spontaneously from hot to cold. The rate of the flow of heat depends on the temperature difference between two objects. (Hazen 2001)

Today's science shows us a continual fluctuation and alternation between matter and energy, confirming that in the natural world there is no zero. (Lawlor 1982, p20)

We will understand that thermodynamics is *chance generating order* in fragments of the process, while it is *necessity generating disorder* in the process as a whole. (Fernández-Galiano 2000, p118)

Energy laws (the Laws of Thermodynamics) control the activities of all organisms, and of all ecosystems, on Earth. Energy laws affect a series of environmental problems and provide a key to understanding the urgency of our environmental problems, and how they can be solved. (Chiras, Reganold and Owen 2002, p49)

The coherence of the logical construction of classical thermodynamics has been said to be as harmonious and complete as Euclidean geometry. (Fernández-Galiano 2000, p42)

What Cesare Maffioli has called the "culture of energy," with its obsession with the increase of production and consumption of material and energetic goods, still occupies first place in our times. Still embryonic, the "culture of entropy," with its qualitative preferences and concern for the conservation of resources, can be discerned in the background. Coming decades will witness the development of a struggle between them which today, a century and a half after Carnot, has just begun, and on whose outcome might depend very much on our survival. (Fernández-Galiano 2000, p55)

On Energy – The First Principle
Energy cannot be created or destroyed, it can be converted from one form to another. (Chiras, Reganold and Owen 2002, p48)

Energy is the ability to do work or cause change. (Chiras, Reganold and Owen 2002, p48)

Energy can be highly concentrated (as in food or fuel) and can perform a great deal of useful work. Energy can also be in a more dispersed or disorganized state (as in heat, i.e., 'thermal energy') and cannot perform as much work. Both forms are essential to life on Earth. (Chiras, Reganold and Owen 2002, p48)

Whenever energy is converted from one form to another, a certain amount is given off as heat – no conversion is 100% efficient. (Chiras, Reganold and Owen 2002, p49)

The sun is the source of virtually all energy in the biosphere. Solar energy flow and heat loss can be altered by human activities, such as loss of vegetative cover, pollutants in the atmosphere, the burning of fossil fuels. Humans may be profoundly influencing solar energy flow and the climate of the entire planet. (Chiras, Reganold and Owen 2002, pp50,51)

Energy also flows through ecosystems via photosynthesis and respiration, food chains and food webs, and nutrient/ biogeochemical cycles (nitrogen, carbon and phosphorus). (Chiras, Reganold and Owen 2002, pp 51-62)

"Thermodynamics of the first principle" is kept within the conceptual framework of mechanicism. The rupture came with the second principle. (Fernández-Galiano 2000, p48)

On Entropy – The Second Principle

Whenever energy is converted from one form to another, a certain amount is lost in the form of heat. (Chiras, Reganold and Owen 2002, p49)

Entropy is the degree of disorder in a system. (Chiras, Reganold and Owen 2002, p49)

The Second Law of Thermodynamics addresses restrictions on how the form of energy can change, i.e., the flow or motion of energy. (Hazen 2001)

There are differences between thermodynamic behaviors expected in a closed system, where entropy does tend to increase, and in an open system, which is able to reduce its entropy if it benefits from a relationship that allows the environment to absorb the surplus entropy of the system. (Fernández-Galiano 2000, p61)

In a closed system, entropy will not decrease without the input of energy. (Hazen 2001)

Every physical substance has a quantity of entropy, just as it has a quantity of heat energy. (Hazen 2001)

In nature, a random sequence is more probable than a highly ordered arrangement. Entropy is a macroscopic manifestation of nature's slot machine. (Hazen 2001)

There are many more ways to achieve a disordered state than ordered. Looking at nature's trillions of arrangements, there is an infinitesimal chance for a highly ordered arrangement. (Hazen 2001)

One can assign a mathematical value to entropy using the probability theory. Entropy is the logarithm of the number of configurations of atoms or molecules. Statistically, entropy is the measure of the possible configurations of its components. (Hazen 2001)

Only the Entropy Law adequately explains the nature of change, its direction and the interconnectedness of all things within the change process. (Fernández-Galiano 2000, p53)

The philosophical and scientific importance of the second principle can hardly be overestimated. Through the inevitable increase of entropy associated with any interaction of matter and energy, irreversible changes and the direction of the movement of time are introduced. (Fernández-Galiano 2000, p49)

On Transformation

Entropy = Transformation (Hazen 2001)

Energy injects life, processes, and transformation into the inanimate world of matter. (Fernández-Galiano 2000, p4)

Everything is in a state of digestion, assimilation, transmutation. This transformation goes on in every passing moment, as well as in the long aeons of evolutionary cycles. (Lawlor 1982, pp30-31)

The moment of transformation is everywhere before us, in the roots of plants transforming mineral into vegetal, in the leaves transforming sunlight into live supporting tissue, in rock and stone being weathered and worn down, light into heat, heat into mechanical movement, the assimilation of food supports the creation of mental and spiritual experience. (Lawlor 1982, p30)

There is periodicity, rhythm, oscillation, pattern, frequency in the ubiquitous condition of transformation – all measurable in time and space. (Lawlor 1982, p31)

The moment itself of transformation, from one state to another, one quality of being to another, from one form or level of consciousness to another, is always a leap, a jump, an incomprehensible velocity outside of time, as when one cell divides into two. This transformative moment is all that really exists. (Lawlor 1982, p31)

Transformation occurs by three general processes:

Square root of 2	Generative transformation
Square root of 3	Formative transformation
Square root of 5	Regenerative transformation

(Lawlor 1982, p31)

On Time

Why does time seem to have a direction? Why are some actions irreversible? The tendency of the system's entropy to increase defines the direction of time. (Hazen 2001)

Entropy alters our conception of time in two ways, introducing direction in its course while marking its tempo. (Fernández-Galiano 2000, p55)

Entropy marks the rhythm of time through events. The time we associate with biological or cultural becoming flows with the rhythm of processes and the speed of events, in the same way that it stops if these come to a halt. (Fernández-Galiano 2000, pp56-57)

Every isolated system becomes more disordered with time. It takes time and energy to recover original state of order. (Hazen 2001)

Time is associated with the "creative evolution" of the organized being, but also, necessarily, with the corresponding degradation of order in the environment. (Fernández-Galiano 2000, p61)

On Landscape Architecture and Architecture

It could be said architecture is concerned solely with material forms, cold and intangible, situated beyond time. Partly responsible for this vision of architecture … is the scandalous absence of energy considerations in architectural analysis and criticism. (Fernández-Galiano 2000, p4)

Architecture can be thought of as a transformation of the material environment by changing living beings, an artifact continuously altered by use and circumstance, in constant degradation and repair before the aggression of time, permanently perishing and renewing itself. (Fernández-Galiano 2000, p4)

There are two types of Architectures of the Second Principle:
1. *Entropic optimism* = artificial organism. Ex: passive solar architecture that is concerned with controlling the capture of natural energy, nourished by fluctuating energy flows, self-regulated by processes similar to metabolic ones. (Fernández-Galiano 2000, p119)

2. *Entropic pessimism* = architecture of rehabilitation. It is attentive to the process of entropic degradation of matter as to that which affects energy. Is dedicated to the recuperation and recycling of the existing material support and the information it contains. Is concerned first and foremost with rehabilitating what is built and degraded, recycling what is fabricated and used, recuperating what has been learned and forgotten. (Fernández-Galiano 2000, p119)

Recalling the close relationship between time and entropy one is probably accurate in affirming that only rehabilitative architecture fully deserves to be considered "architecture of the second principle." (Fernández-Galiano 2000, p125)

Rehabilitative architecture is focused on physical and symbolic rehabilitation, in a clash with the degradation that entropy – or irreversible time – brings about in both matter and information. (Fernández-Galiano 2000, p126)

The architecture of rehabilitation translates the adaptation of preexisting formal codes into a contemporary language, whether those of great stylistic crystallization or those of neovernacular anonymity, integration with history is the essential concept here. (Fernández-Galiano 2000, p122)

This type (the second type) comes with what could be considered – using the same metaphor – an extraordinary respect for the typological genetic pool, the product of a very long process that appeals more to memory than to genetic creativity and only accepts conservative forms of typological hybridization. (Fernández-Galiano 2000, pp122,124)

On Humanity

Since man is the only creature that uses exosomatic tools requiring much more energy than the living parts of the system, sociocultural systems obey the laws of biological life only partially. Technology represents a world of equilibrium structures whose growth is not self-limiting. (Fernández-Galiano 2000, p259)

This lack of self-limitation in sociocultural systems is probably the strongest reason why we should not assume that entropy – in the energy/entropy dilemma – would necessarily be favored by our culture in the particular historic crossroads it is fast approaching. (Fernández-Galiano 2000, p259)

"Human beings tend to use and waste as quickly as the availability of resources allows. Only the pressure of necessity, competition, motivates them to use resources more cautiously and efficiently. The regime of unpredictive exploitation reappears as soon as a new resource or external energy source is discovered." –Ramón Margalef (Fernández-Galiano 2000, p259)

One hundred and fifty years after Carnot, the thermodynamic dilemma of power versus efficiency remains the touchstone of our at once natural and contrived culture, which debates between physical limits and the tendency to break them, between efficiency and power, conservation and waste, entropy and energy, necessity and desire. If ever the entropic paradigm were to tinge the fabric of our culture, we would have to look for the cause in the gradual encroachment of a desire to persist through self-limitation. (Fernández-Galiano 2000, p260)

"The moderation shown by nature ought to be followed; and here, as elsewhere, we should not so much praise sobriety as condemn unruly passion … only in the end is pleasure provided for, while pleasure itself never fails to shun every excess." –Leon Battista Alberti (Fernández-Galiano 2000, p260)

Newton said, "Nature delights in simplicity." It is doubtful that this statement can be applied to human nature. Alberti's loathing of "excess" results from a voluntary and difficult choice, in which "simplicity" is the fruit of a long process of moral and intellectual decantation that is far from being consubstantial with the nature of the human mind. (Fernández-Galiano 2000, p260)

On Other Phenomena

The Second Law reaches far beyond heat. It has deep and far reaching consequences. (Hazen 2001)

The consistency of form is thus guaranteed by the dynamic interaction of both kinds of processes, catabolic (irremediable degradation) and anabolic (indispensable constructive action that restores), which relate to one another through a retroactive curl of a generative and organizing character. In the words of Edgar Morin, this curl "carries out the passage from the thermodynamics of disorder to the dynamics of organization." (Fernández-Galiano 2000, p94)

Consistency of form, we must repeat, is in every way dependent on the energy flow that feeds the process. "…Rather than destroying the system, the [energy] flow feds it, contributing to its very existence and organization. What is more, stoppage of the flow leads to the degradation and ruin of the system." –Edgar Morin (Fernández-Galiano 2000, p97)

The sun adds energy to a local system – from it, order can arise spontaneously from disorder. Consider salt water that becomes a perfect, highly, precisely ordered salt crystal. We see local order from chaos everywhere we look in nature. (Hazen 2001)

The Second Law also has consequences on trophic levels and world food management. (Hazen 2001)

R.L. Lindeman and G.E. Hutchinson described the degradation of energy as it circulates through the food chains, losing its capacity to do work and continuously descending toward the heat drain. The great chain of life now appeared as a direct consequence of the second thermodynamic law. (Fernández-Galiano 2000, p207)

Tian

Low successive growth area = no added fragmentation
Eco-revelatory experience
Service to wildlife & nature: species overcome dam, geomorphic processes prevail, reforestation with native plants

Tian: The Fishway

Biocentric:

• The Fishway is designed to help aquatic life overcome the dam and flourish upstream. Its first order of business is to serve the biotic community.
• Humans experience the Fishway without direct contact with water.
• Designed to consider migratory routes and habitat needs of aquatic, marginal and terrestrial species (ex: tunnel instead of chasm, waterway as tributary with riffles, pools, vegetation, food sources, sediments, nutrients, daytime lighting only means dark nights).
• Requires collaboration with others in same field and complementary fields.

Multiplistic:

• Serves ecosystem and gives humans eco-revelatory experience, while not undermining dam.
• Improves aquatic life flow-through as well as sediment and nutrient flow-through, helping restore life cycles and geomorphology cycles.

Eco-revelatory:

• See, walk along, but do not touch. That denial/limitation can be powerful.

Design Objectives Met:

• Minimize further land fragmentation.
• Provide habitat.
• Promote a spirit of learning.
• Accomplish a standard of multiplicity.

Tian: Birdsong Path

Biocentric:

• Increased forestation/habitat.

• Harmonious balance between modest, multiuse path, increased wildlife habitat, aesthetic appeal, and an enhanced spirit of learning.

• Energy produced with photovoltaics, and perhaps hydraulic ram pump and kinetic energy. Water for waste and air coolant drawn off creek/Fishway without use of electricity or fossil fuels.

• Excavated materials used on-site, not hauled away.

• Soil cement reduces use of Portland cement, resulting in less leachates and chemicals.

Multiplistic:

• Human path and limited auto route with borders of native perennials, shrubs, trees (providing side slope stability, habitat, guiding barriers)

• Shows alternative materials and construction techniques.

• Tian, the building, houses visitor amenities, interpretive/educational materials, and research institute classrooms, office and overnight accommodations, and is an eco-revelatory experience of itself.

Eco-revelatory:

• Aural experience of birdsong captured.

• Reuse of soil for path and rammed earth post construction reveals info about land's materiality and the diversity of underlying structure, is a vital part of the ecosystem most give little thought to, and demonstrates alternative materials and construction techniques.

• Exposed water and electrical systems at Tian's icicle tower raise visitor awareness of and sensitivity toward energy and resource consumption.

• Sustainability and alternative materials & techniques are better understood and able to be discussed.

Design Objectives Met:

• Minimize further land fragmentation.

• Provide habitat.

• Reduce on-site pollutants and avoid introduction of contaminants.

• Promote a spirit of learning.

• Preserve the naturalized waterfront.

• Accomplish a standard of multiplicity.

Tian: Descent Into Earth Path

Biocentric:

• Path can be gated to restrict usage during spawning season, at night, during bad weather, and other highly sensitive times, ecologically speaking.
• Reuses excavated materials and exposed bedrock.
• Earth portal supports vegetative growth (= food source).
• Sea portal is day lit so natural light will attract aquatic species into the tunnel.
• Walking surface (soil cement) prevents erosion of exposed rock and soil.
• Water conveyance system protects Fishway, wetlands and aquatic life, reduces erosion, and benefits from and maximizes use of overland flow and biofilter.

Multiplistic:

• As a peripheral of the Fishway, it exists only because Fishway was created to serve aquatic wildlife.
• Is eco-revelatory.
• Water conveyance system (mound-and-basin) protects Fishway and provides path amenities.
• Tunnel portals respond to wildlife needs, provide structural support and protection, and use symbology to express their significance.

Eco-revelatory:

• Walking along cliff wall, moving deeper into rock is the act of moving backward through time – medicine powerful and inspirational.
• Earth's strength and longevity are displayed.
• Appeals to all senses. Communication through sensory experience.
• Visitor feels unstable and vulnerable as earth that is eroding.
• Upon exiting Earth Portal, one is lifted physically, visually, spiritually, intellectually, in a stirring moment of hope.

Design Objectives Met:

• Promote a spirit of learning.
• Accomplish a standard of multiplicity.

Water's Dance Path

Biocentric:

• Designed for limited impact to ecologically sensitive area of predominantly soft shrink-swell clay soils of the "storage" area.
• Maintains migratory routes: low wall (2.5' max height) and rifts make overcoming structure easy for wildlife, keeps routes along waterways open.
• Rainwater permeates walkway and soil, and reaches the water table very close to where it does under existing conditions.
• Vegetation is free to establish along and within path structure supporting green corridor.
• Reuses excavated materials.
• Perimeter parking limits on-site auto traffic to occasional emergency and alternative-fuel service vehicles.
• Durable, low-maintenance materials require little energy for upkeep.
• Wall rifts of perforated weathering steel expose bare forest floor to air and light.

Multiplistic:

• Safe passage for wildlife.
• Supports vegetative growth for habitat and food.
• Accessible walkway, bikeway, emergency vehicle route.
• Rifts maintain migratory routes for small forest fauna, ensure streams remain day lit, expose forest floor to air and light, and provide pedestrians points of rest.

Eco-revelatory:

• Reminiscent of old stone farm walls that once prevalently crisscrossed Loudoun's countryside.
• Moments of pause are created along path to arouse senses and heighten awareness of the natural and man-made surrounds.
• Path becomes visual backdrop against which visitors measure entropy and other natural processes, and amounts and rates of change within different hydrologic energy areas.

Design Objectives Met:

• Minimize further land fragmentation.
• Provide habitat.
• Reduce on-site pollutants and avoid introduction of contaminants.
• Promote a spirit of learning.
• Accomplish a standard of multiplicity.

Boat Island

Biocentric:

• Positioned in a low-energy depositional area – sensitive toward geomorphic processes and water currents.
• Positioned so human access is limited to boat arrival only.
• Separated from boat launch area to protect vegetative buffer.
• Constructed to minimize ecological disturbance of marsh-buffered shoreline.
• Provides safe habitat to maturing aquatic and marginal species.
• Modestly built of renewable and sustainable materials.

Multiplistic:

• Rock island provides habitat for wildlife and protection for built structure.
• Quiet respite for boaters.
• Provides research, recreational, educational, and reflective opportunities.

Eco-revelatory:

• Stable, permanent structure reveals changing shoreline morphology (interplay between water, sediments and landforms) through fluctuating water levels and convergence of high and low energy streams.
• As access to land and water changes, visitor opportunities vary.
• A research and demonstration station where species, water quality and water quantity are monitored.
• Open-floor design reveals changing hydrology.

Design Objectives Met:

• Minimize further land fragmentation.
• Provide habitat.
• Promote a spirit of learning.
• Preserve the naturalized waterfront.
• Accomplish a standard of multiplicity.

Outdoor Classrooms

Biocentric:

• Leaves vegetated swales intact.

• Supports the notion of human thought as the mind within nature, and encourages education, discussion and thought that promotes healthy ecosystems.

• Seating is determined by slope, and is built to avoid erosion or intense grading.

• Reuses excavated materials.

• Steep upper slopes of mound are restrictive and protect Water Authority interests.

• Limited use of lighting at night, and incorporates sensitive lighting solutions when night lighting is needed.

• Does not create foot traffic to Fishway or tunnel.

Multiplistic:

• A place that fosters learning and discussion about ecology, land stewardship and sustainability.

• Adds new use that benefits ecology to the existing mound.

• Wildlife habitat, public amenity, Water Authority siltation ponds.

Eco-revelatory:

• Focusing views on the movement of treetops gives a different perspective and experience of and invokes new thoughts about an important landscape element that's easily taken for granted on this site.

• Aural sensations of wildlife sounds and a trickling stream help express the needs and importance of nature.

Design Objectives Met:

• Minimize further land fragmentation.

• Provide habitat.

• Promote a spirit of learning.

• Accomplish a standard of multiplicity.

Remediation Knolls

Biocentric:
- Vegetative caps on knolls make them safe amenities for wildlife and humans.
- Contaminants and pollutants are removed from waterway, and filter naturally through underlying soils.
- Phytoremediation extracts, contains, and/or degrades toxins.
- Placement is concentrated along existing clearings (road cuts) to reduce impact on existing forest.

Multiplistic:
- Improves water quality and quantity.
- Creative and safe reuse of dredged materials.
- Can be used as wildlife sanctuary, and areas for play, picnics, biking and relaxing.

Eco-revelatory:
- Exposes problem of siltation in reservoir, and the costs of maintaining the water supply.
- Stimulates discussion about solutions and alternatives.
- Encourages reflection on water as a resource.
- Strategic placement along areas of all types of hydrologic energy areas.
- Structural/permanent features help measure change as knolls settle and morph.

Design Objectives Met:
- Provide habitat.
- Reduce on-site pollutants and avoid introduction of contaminants.
- Promote a spirit of learning

Bibliography

Publications (Books, Journals, Reports)

Addis, C., 2005. The Whitman massacre: religion and Manifest Destiny on the Columbia Plateau, 1809-1858. Journal of the Early Republic, Society for Historians of the Early American Republic, Summer, 2005, v. 25(2), pp. 221-258.

Betsky, A., Levy, L., and MacCannell, D., 2001. Revelatory Landscapes. Santa Monica, CA: RAM.

Bookchin, M. 2002. Will ecology become "the dismal science"? In: Van de Veer, D. and Pierce, C. (editors), The Environmental Ethics and Policy Book: Philosophy, ecology, economics, 3rd ed. Belmont, CA: Wadsworth.

Boyer, P.S., 2001. The Oxford Companion to United States History. New York: Oxford University Press.

Callicott, J.B., 1998. A critical examination of "Another look at Leopold's Land Ethic". Journal of Forestry, Jan. 1998, v. 96(1), pp. 20-26.

Callicott, J.B., 2002. Conceptual foundations of the Land Ethic. In: Van de Veer, D. and Pierce, C. (editors), The Environmental Ethics and Policy Book: Philosophy, ecology, economics, 3rd ed. Belmont, CA: Wadsworth.

Cerver, F.A., 2000. The Big Book of Environmental Design. Barcelona, Spain: Atrium International.

Ching, F.D.K., 1996. Architecture: Form, space and order, 2nd ed. New York: John Wiley & Sons.

Chiras, D.D., Reganold, J.P., and Owen, O.S., 2002. Natural Resource Conservation: Management for a sustainable future, 8th ed. Upper Saddle River, NJ: Prentice Hall.

Coren, S., 2004. How Dogs Think: What the world looks like to them and why they act the way they do. New York: Free Press.

Czech, B., 2000. Economic growth as the limiting factor for wildlife conservation. Wildlife Society Bulletin, v. 28(1), pp. 4-15.

Des Jardins, J.R., 2001. Environmental Ethics: An introduction to environmental philosophy, 3rd ed. Belmont, CA: Wadsworth.

Devall, B. and Sessions, G., 2002. Deep ecology. In: Van de Veer, D. and Pierce, C. (editors), The Environmental Ethics and Policy Book: Philosophy, ecology, economics, 3rd ed. Belmont, CA: Wadsworth.

Diamond, J.M., 1999. Guns, Germs and Steel: The fates of human societies. New York: W.W. Norton & Company.

Doczi, G., 1981. The Power of Limits: Proportional harmonies in nature, art and architecture. Boston, MA: Shambhala.

Fairfax City Talks About Water Woes, 2 Feb., 1993. Byline unknown. Virginia Journal, Fairfax Edition. Page A3.

Fernández-Galiano, L., 2000. Fire and Memory: On architecture and energy. Cambridge, MA: MIT Press.

Frank Lloyd Wright Foundation, 2003. The private side of Taliesin West. Quarterly, Fall, 2003, v. 14(4), pp. 3-24.

Friedman, S., 2004. Class reading: Shrader-Frechette, K.S. Do we need environmental ethics?: Environmental responsibility and classical ethical theories. Original source unknown, pp 16-25. Ethics for Environmental Professionals, Spring, 2004. Falls Church, VA: Natural Resources Department, Virginia Polytechnic Institute and State University.

Gottlieb, R.S., 1996. Religion in an age of environmental crisis. In: Gottlieb, R.S. (editor), This Sacred Earth: Religion, nature, environment. New York: Routledge.

Hall, C.A.S., Jones, P.W., Donovan, T.M., and Gibbs, J.P., 2000. The implications of mainstream economics for wildlife conservation. Wildlife Society Bulletin, v. 28(1), pp. 16-25.

Helphand, K.I., and Melnick, R.Z., 1998. Eco-Revelatory Design: Nature constructed/nature revealed. Madison, WI: University of Wisconsin Press.

Hemenway, T., 2001. Gaia's Garden: A guide to home-scaled permaculture. White River Junction, VT: Chelsea Green.

Hildebrand, G., 1991. The Wright Space: Pattern and meaning in Frank Lloyd Wright's houses. Seattle, WA: University of Washington Press.

Hoffmnan, D., 1993. Frank Lloyd Wright's Fallingwater: The house and its history, 2nd ed. New York: Dover.

Hooke, R.L., 2000. On the history of humans as geomorphic agents. Geology, Sept. 2000, v. 28(9), pp. 843-846.

Johnson, B.R., Silbernagel, J., Hostetler, M., Mills, A., Ndubisi, F., Fife, E. and Hunter, M.R., 2002. The nature of dialog and the dialog of nature: designers and ecologists in collaboration. In: Johnson B.R. and Hill, K. (editors), Ecology and Design: Frameworks for learning. Washington, DC: Island Press.

Kidder, R.M., 1995. How Good People Make Tough Choices: Resolving the dilemmas of ethical living. New York: Fireside.

Kinsley, D., 1996. Christianity as ecologically harmful and Christianity as ecologically responsible. In: Gottlieb, R.S. (editor), This Sacred Earth: Religion, nature, environment. New York: Routledge.

Krier, R., 1988. Architectural Composition. New York: Rizzoli.

Lawlor, R., 1982. Sacred Geometry: Philosophy and practice. London: Thames & Hudson.

Leopold, A., 1949. A Sand County Almanac. New York: Ballantine Books.

Light, A. and de-Shalit, A., 2003. Introduction: Environmental ethics – Whose philosophy? Which practice? In: Light, A. and de-Shalit, A. (editors), Moral and Political Reasoning in Environmental Practice. Cambridge, MA: MIT Press.

Lindenmayer, D.B., Foster, D.R., Franklin, J.F., Hunter, M.L., Noss, R.F., Schmiegelow, F.A., and Perry, D., 2004. Salvage harvesting policies after natural disturbance. Science, 27 Feb. 2004, v. 303, p. 1303.

Lyle, J.T., 1994. Regenerative Design for Sustainable Development. New York: John Wiley & Sons.

Maclin, E. and Sicchio, M. (editors), 1999. Dam Removal Success Stories: Restoring rivers through selective removal of dams that don't make sense. American Rivers, Friends of the Earth, and Trout Unlimited.

McDonough, W. and Braungart, M., 2002. Cradle to Cradle: Remaking the way we make things. New York: North Point Press.

McGaa, E., 1990. Mother Earth Spirituality: Native American paths to healing ourselves and our world. San Francisco: Harper.

McHarg, I.L., 1992. Design With Nature, 25th anniversary ed. New York: John Wiley & Sons.

Meehan, A., 2003. The Passage of Non-Finfish Through Fishways: A review. Sydney: Water Management Division, New South Wales Department of Infrastructure, Planning and Natural Resources.

Meffe G.K. & Carroll C.R., 1997. Principles of Conservation Biology, 2nd ed. Sunderland, MA: Sinauer.

Mugerauer, R., 1995. Interpreting Environments: Tradition, deconstruction, hermeneutics. Austin, TX: University of Texas Press.

Naess, A., 2002. Self-realization: an ecological approach to being in the world. In: Van de Veer, D. and Pierce, C. (editors), The Environmental Ethics and Policy Book: Philosophy, ecology, economics, 3rd ed. Belmont, CA: Wadsworth.

Nash, R.F., 1989. The Rights of Nature, A History of Environmental Ethics. Madison, WI: University of Wisconsin Press.

Nobles G.H., 1997. American Frontiers: Cultural encounters and continental conquest. New York: Hill and Wang.

Ponting, C., 1991. A Green History of the World: The environment and the collapse of great civilizations. New York: St. Martin's Press.

Regan, T., 2000. The case for animal rights. In: Sterba, J.P. (editor), Earth Ethics: Introductory readings on animal rights and environmental ethics, 2nd ed. Upper Saddle River, NJ: Prentice Hall.

Singer, P., 2000. All animals are equal. In: Sterba, J.P. (editor), Earth Ethics: Introductory readings on animal rights and environmental ethics, 2nd ed. Upper Saddle River, NJ: Prentice Hall.

Simonds, J.O., 1998. Landscape Architecture: A manual of site planning and design, 3rd ed. New York: McGraw-Hill.

Shrader-Frechette, K., 2002. Environmental Justice: Creating equity, reclaiming democracy. New York: Oxford University Press.

Stang, A. and Hawthorne, C., 2005. The Green House: New directions in sustainable architecture. New York: Princeton Architectural Press.

Sterba, J.P., 2000. A biocentrist strikes back. In: Sterba, J.P. (editor), Earth Ethics: Introductory readings on animal rights and environmental ethics, 2nd ed. Upper Saddle River, NJ: Prentice Hall.

Taylor, P.W., 2002. The ethics of respect for nature. In: Van de Veer, D. and Pierce, C. (editors), The Environmental Ethics and Policy Book: Philosophy, ecology, economics, 3rd ed. Belmont, CA: Wadsworth.

Thompson, J.W. and Sorvig, K., 2008. Sustainable Landscape Construction: A guide to green building outdoors, 2nd ed. Washington, DC: Island Press.

Toropov, B. and Hansen, C., 2002. The Complete Idiot's Guide to Taoism. Indianapolis, IN: Alpha Books.

Van der Ryn, S. and Cowan, S., 1996. Ecological Design. Washington, DC: Island Press.

Van der Ryn, S., 2005. Design for Life: The architecture of Sim Van der Ryn. Salt Lake City, UT: Gibbs Smith.

Wade, D., 2003. Li: Dynamic form in nature. New York: Walker & Company.

Watts, A., 2000. What Is Tao? Novato, CA: New World Library.

White, L. Jr., 1967. The historical roots of our ecological crisis. Science, 10 Mar. 1967, v. 155(3767), pp. 1203-1207.

Williams, H., 1938. Legends of Loudoun: An account of the history and homes of a border county of Virginia's Northern Neck. Richmond, VA: Garrett and Massie.

Zeide, B., 1998. Another look at Leopold's Land Ethic. Journal of Forestry, Jan. 1998, v. 96(1), pp. 13-19.

Zeide[2], B., 1998. The legacy of Leopold: forestry and ethics. Journal of Forestry, Apr. 1998, v. 96(4), pp. 25-26.

Websites and Online Publications

American Society of Landscape Architects (ASLA), 2004. Code of Professional Ethics. http://www.asla.org/about/codepro.htm, accessed 4 Feb. 2004.

American Society of Landscape Architects (ASLA), 2004. Code of Environmental Ethics. http://www.asla.org/about/codeenv.htm, accessed 4 Feb. 2004.

American Society of Landscape Architects (ASLA), 2005. Mission and Vision Statements. http://www.asla.org/about/goals.htm, accessed 17 Aug. 2005.

American Society of Landscape Architects (ASLA) PPN, 2005. Sustainable Design and Development Professional Practice Network Listserve, accessed 28 Oct. 2005.

Carlson, P., 2003. Hurricanes Are Good for the Earth. Southern Appalachian Biodiversity Project Wild Mountain Times Nov./Dec., 2003, http://64.233.161.104/search?q=cache:6rwcB_iaoCMJ:www.sabp.net/wmtp14.html++%22benefits+of+hurricanes%22&hl=en&ie=UTF-8, accessed 27 Sept. 2005.

Chesapeake Bay Foundation, 2005. State of the Bay Report, Number 14. http://www.cbf.org/site/PageServer?pagename=sotb_2005.pdf?docID=4564, accessed 27 Aug. 2005.

Committee on the Environment (COTE), 2006. Measures of Sustainable Design and Performance Metrics. American Institute of Architects, http://www.aia.org/cote, accessed 4 May 2006.

Design Workshop, 2006. Firm Profile. http://www.designworkshop.com/design-philosophy, accessed 31 Aug. 2006.

Hartke, J., 2005. Message from the Executive Director. EarthVoice, http://www.earthvoice.org/message.htm, accessed 7 Jul. 2005.

Haynes, S.W., 2005. Manifest Destiny. Public Broadcast System, www.pbs.org/kera/usmexicanwar/dialogues/prelude/manifest/d2heng.html, accessed 31 Aug. 2005.

Hoffman, R.N., 2004. Controlling Hurricanes: Can hurricanes and other severe tropical storms be moderated or deflected? Scientific American, Oct., 2004, http://www.sciam.com/article.cfm?articleID=000593AE-704B-1151-B57F83414B7F0000, accessed 27 Sept. 2005.

Loudoun County Revised Comprehensive Plan, 2001. http://inetdocs.loudoun.gov/planning/docs/compplan_/index.htm, accessed 17 Oct. 2003.

Meisner, G., 2005. Phi (1.618…): The Golden Number, http://www.phi1618.com, accessed 17 Nov. 2004.

Occidental Arts and Ecology Center (OAEC), 2006. http://www.oaec.org, accessed 3 Aug. 2006.

O'Rourke, K.H. and Williamson, J.G., 2001. After Columbus: Explaining the European overseas trade boom 1500-1800. http://www.economics.harvard.edu/faculty/jwilliam/papers/Columbus_7_2001.pdf, accessed 14 Feb. 2006.

Sierra Club, 2005. Sustainable Consumption: Why consumption matters. http://www.sierraclub.org/sustainable_consumption/tilford.asp, accessed 2 Sept 2005.

United States Geological Survey (USGS), 2000. Little Falls Dam Fish Passage Project Wins Coastal America Award. News Release, 3 Aug. 2000, www.usgs.gov/public/press/public_affairs/press_releases/pr1268m.html, accessed 17 Oct. 2003.

Virginia Department of Game and Inland Fisheries, 2003. Virginia Fish and Wildlife Information Service: Species Information. http://www.vafwis.org/wis/asp/default.asp, accessed 17 Oct. 2003.

Yakrider.com, 2005. Unified Field of Behavior. *(*http://www.yakrider.com/Poetry_n_Essays/Essays/unified_field_of_behavior.htm*)*, accessed 29 Jun. 2005.

Lectures

McBride, R. A., 2004. Lecture series. Coastal Morphology and Processes, Spring, 2004. Fairfax, VA: Geology Department, George Mason University.

Stitt, F. A., 2004. Lecture series. Frank Lloyd Wright and Ecological Design Studio Workshop, Summer, 2004. Scottsdale, AZ: San Francisco Institute of Architecture.

Multimedia

Burger, E.B. and Starbird, M., 2003. The Joy of Thinking: The beauty and power of classical mathematical ideas. Recorded lecture. The Teaching Company. Videocassette.

Goldsworthy, A., 2004. Rivers and Tides: Working with time. Produced by Donop, A.V. Directed by Riedelsheimer, T. 90 min. Mediopolis Films. DVD.

Hazen, R.M., 2001. The Joy of Science: The second law of thermodynamics. Recorded lecture. The Teaching Company. Videocassette.

Staloff, D., 1996. The History of the United States, Part I: Patterns of settlement and society. Recorded lecture. The Teaching Company. Cassette.

Images

ADC, 1997. Loudoun County, Virginia Street Map Book, 19th ed. Alexandria, VA: Alexandria Drafting Company.

ADC, 1998. Greater Washington, DC Street Map Book, 4th ed. Alexandria, VA: Alexandria Drafting Company.

Ashton, A., 2003. Harmonograph: A visual guide to the mathematics of music. New York: Walker & Company.

Fuller, D.O., 2002. Monitoring change in impervious surfaces in Loudoun County, Virginia, with Landsat data. Loudoun County, Virginia Indicators of Change, Dec. 2002, v. 4(3), pp1-3. Ashburn, VA: Environmental Indicators Project, The George Washington University.

Gardener's Supply Company, 2003. Holiday 2003 Catalog. Burlington, VT: Innovative Gardening Solutions.

Jellicoe, G. and Jellicoe, S., 1995. The Landscape of Man: Shaping the environment from prehistory to the present day, 3rd ed. New York: Thames & Hudson.

Loudoun County, Virginia Office of Mapping and Geographic Information, Leesburg, Virginia. Permission granted for educational use.

MacLean, A.S. and McKibben, B., 1993. Look at the Land: Aerial reflections on America. New York: Rizzoli.

Murray-Darling Basin Commission, 2003. Upgrading Locks & Weirs 7&8 on the River Murray. http://www.mdbc.gov.au/_data/page/859/brochure_lw7-8.pdf, accessed 23 Apr. 2004.

Netherton, N., Rose, R.P., Meyer, D.L., Wagner, P.T., and DiVincenzo, M.E.C., 1997. Fairfax, Virginia: A city traveling through time. Fairfax, Virginia: History of the City of Fairfax Round Table.

Reshetiloff, K., 2000. Chesapeake Bay: Introduction to an ecosystem. Annapolis, MD: Chesapeake Bay Program.

Rogers, E.B., 2001. Landscape Design: A cultural and architectural history. New York: Harry N. Abrams.

United States Geological Survey, Reston, Virginia. Public domain image library.

Woodrow Wilson Bridge Center Report, 2000. Woodrow Wilson Bridge Project Conceptual Design of Fish Passage Improvements on Rock Creek, Northwest Branch, Little Paint Branch, and Indian Creek. Alexandria, VA.