ABSTRACT

Title of Document: GATEWAY TO THE SANDIAS
BUILDING WITH SITE AND CLIMATE

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Cities in the American Southwest such as Albuquerque, New Mexico consume large amounts of resources to build buildings and to operate them under extreme desert conditions. Architecture is the opportunity to investigate thresholds between urban and nature additionally inside and outside for solutions to natural resource depletion. In-between spaces often divided between inside and outside with a simplistic and arbitrary line. By viewing architecture as an ecotone, a transition space between two different ecosystems, designers can begin to stratify the threshold allowing for layered adaptability in different weather conditions. The Sandia Mountain Aerial Tram, at the eastern edge of Albuquerque offers opportunity for investigating a desert mountain ecotone to find solutions to the conflict between urban and nature as well as the built and wild. The building program examines the threshold between botany and land art approaches to the disruption of desert ecotone and natural resource depletion. The disciplines of botany and land art span the sciences and arts and offer innovative ways of looking at our natural environment.

GATEWAY TO THE SANDIAS
BUILDING WITH SITE AND CLIMATE

By
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Thesis submitted to the Faculty of the Graduate School of the
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of the requirements for the degree of
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Dedication

To my grandfather, for showing me the pursuit of knowledge is never-ending.

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Chapter 1: Ecological Design

Current Ecological Conditions

Stretch: Mend: Adapt

Biodiversity allows the earth's environment to repair itself and adapt to new factors. The more diverse an ecosystem is, the more likely it will be able to recover from human inflicted shocks. Human progress denies ecosystems opportunities to rebalance themselves by reducing the variety of plant and animal life that once existed in an area through pollution, land disruption and human invasion. Our expansion in economics and society population are stretching natural resources beyond their limits to repair and adaption. Biodiversity is reduced by key factors the building industry can be mindful of: habitat loss and degradation, over-exploitation and unsustainable use, invasive alien species, pollution and climate change.[1]

World Energy Consumption

Energy consumption today can be divided into three main categories: industry, transportation and buildings. The building sector consumes 49% of the energy produced in the United States [Figure 1]. An astonishing 77% of all electricity consumed in the United States goes towards building operations. The building sector affects nearly every industry from resource mining to computer electronics [Figure 1]. This area of resource consumption should be a leader in environmental stewardship. Environmental degradation is a major result of energy and resource consumption in relation to the building sector. Resources such as air, water, and soil become harvested, disrupted or polluted damaging the ecology that relies on these resources.

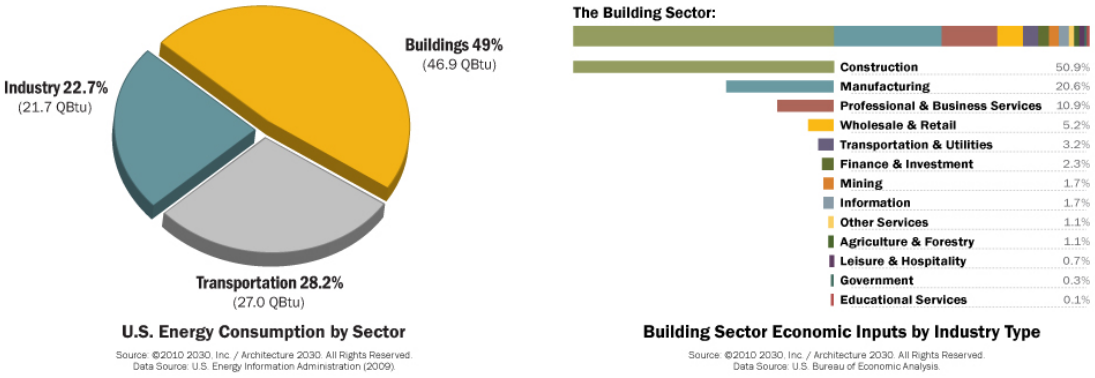

Figure 1 U.S. Energy Consumption by Sector and by Industry Type[2]

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1 "WWF - Science - Biodiversity and Ecoregions." Wildlife Conservation, Endangered Species Conservation. World Wildlife Fund, 2010. Web. 17 May 2011. <http://www.worldwildlife.org/science/ecoregions/item1847.html>.

2 Mazria, Edward. "Problem: The Building Sector: Why?" Architecture 2030. 2010. Web. 17 May 2011. <http://architecture2030.org/the_problem/buildings_problem_why>.

Making Sustainability Work

Economy Society Ecology Integration

Eco-conscious practices in our construction methods and building operations are often times idealized yet remain unrealized due to economic concerns. Implementation of sustainable techniques relies on balancing three main factors: economic, social and environmental aspects of modern man's lifestyles[3]. Integration requires ecological, social and economic sustainability to balance each other and rely upon each other for stability.

By identifying opportunities instead of assessing the value of something researchers and designers will have a different perspective on implementing sustainable strategies. For examples, the United States National Park Service is one of America's greatest assets. Our National Parks include a diverse population animals and plants that would be unprotected if our society did not protect the land. Assessing a singular value to our National Parks becomes less relevant over a period of time as habitats change, and urban living grows closer to its boundaries.. If the value for our National Parks did not grow as the need or cost for maintenance increased, these Parks would deteriorate. Instead, by looking at the size of the opportunity, the importance of National Park conservation becomes more evident. Maintaining biodiversity in the National Parks would also enhance the economic and ecological value of the habitat. From an economic standpoint, consumption of National Park land without replacement would result in a one time value assigned and deny future opportunity for benefit from the otherwise undeveloped space.. From a social standpoint, human societies need to be adaptable to stress and shocks by maintaining a variety of options in social living from urban to rural community types with adequate proximity and preservation of natural habitats.

Relationship between Built and Natural Environments

Ecotone

"A transitional area between two adjacent but different ecological communities. From the origins: oeco, from Latin meaning household, and tonos, from Greek meaning tension."[4]

Plants in competition extend themselves as far as they are able to survive. Beyond this point, competing plant life takes over. The overlapping area, an ecotone, where both plants survive yet dominance from one plant type to another shifts. Therefore, an ecotone represents a shift in dominance [Figure 2]. Ecotones become important because they contain species from two neighboring ecosystems and those species have become highly

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3 Munasinghe Institute for Sustainable Develo, Mohan Munasinghe. "Economic, Social, and Environmental Elements of Development." Encyclopedia of Earth. 23 Sept. 2008. Web. 17 May 2011. <http://www.eoearth.org/article/Economic,_social,_and_environmental_elements_of_development>.

4 Merriam-Webster's Collegiate Dictionary. Springfield (Mass.): Merriam-Webster, 2005. Print.

adaptive[5]. Architecture can integrate “ecotone” like transition spaces with climate changes occurring in smaller increments.

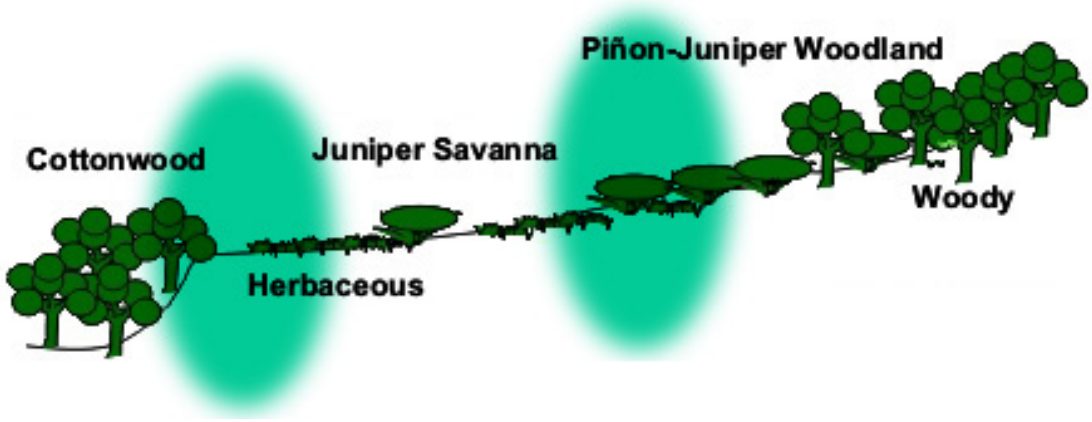

Figure 2 Ecotone Diagram with plant life transitions highlighted in blue

Limits: Sources and Sinks

Building construction and operations can take concepts from ecology other than the ecotone. The concept of Source-Sink dynamics, first described by Pulliam, explains a cyclical dynamic of energy and waste[6]. A source-sink dynamic is demonstrated clearly by the cycle of carbon. CO2 is released by aspiration from living organisms and off-gases from the earth’s interior. Then it is transferred into energy by plant life which in turn releases oxygen into the atmosphere which is then consumed by animal life. The cycle is repeated. In buildings, exhaust from mechanical systems, water runoff from the site, and consumption waste can be recaptured and reused. At an elementary level, air exhaust may be reused in greenhouses to keep warm and provide CO2. Consumption waste can be reduced by reusing items, composting organic waste and recycling plastics, glass, paper and metals. Water can be repurposed as well. This would allow buildings to have less impact on the immediate surrounding s and waste disposal methods at the city level.

5 World Wildlife Fund. "Ecoregion-Based Conservation in the Chihuahuan Desert." (2009): Chapter-4. Print.

6 Pulliam, H. R. 1988. Sources, sinks, and population regulation. American Naturalist 132:652-661.

Chapter 2: Site Context and Background

Desert Biome

Des·ert

"a : arid land with sually sparse vegetation; especially : such land having a very warm climate and receiving less than 25 centimeters (10 inches) of sporadic rainfall annually b : an area of water apparently devoid of life."[7]

Deserts cover one fifth of earth's land surface. World Wildlife Fund defines this particular biome as "Desert and Xeric Shrubland" where annual potential loss of moisture through evaporation exceeds moisture received through rainfall[8]. A desert biome is defined as an arid climate receiving less than ten inches of rain per year sporadically. Semi-arid climates that receive between ten and twenty inches of rain per year are often considered desert or desert like biomes. This project is located at the northern most tip of the Chihuahuan desert highlighted in Figure 3. It is located in a Desert biome with less than ten inches of rain per year.

Plants in hot arid climates tend to be ground hugging shrubs and short woody trees. All these plants have adapted to this climate by developing the ability to store water and nutrients for extended periods of time and by developing the ability to withstand high temperatures and twenty to thirty degree temperature swings. Many plants remain dormant until a rare downpour of rain. Then, short wiry grasses and delicate flowers sprig up, growing and flowering quickly before the desert dries up again.

The Sandia Mountains transition between the arid and semi-arid climates. The foothills average less than ten inches of rain per year while the top peaks receive fifteen to twenty inches and are cold enough for snow to remain five months per year.

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7 Merriam-Webster's Collegiate Dictionary. Springfield (Mass.): Merriam-Webster, 2005. Print.

8 World Wildlife Fund. "Ecoregion-Based Conservation in the Chihuahuan Desert." (2009): Chapter-4. Print.

Figure 3 Regional Map, Arid climate in light brown, Semi-Arid climate in dark brown

Urban Environment: Albuquerque, New Mexico

Historical Cultural Identity

Native Americans began building pueblo villages around 900 a.d. in the Rio Grande Valley.[9] The Rio Grande offered lush soils and a reliable water source for farming within the Chihuahuan desert [Figure 3]. Nomadic tribes began to settle into an agrarian lifestyle which resulted in the construction of permanent mud brick structures stacked in a tight composition began to spring up. Land was used for hunting, material gathering and farming based carefully on the amount needed to sustain the community. The urban footprint of these small villages was forced to stay small to reduce the amount of energy spent on maintaining them and consumption of precious materials such as wood and water.

Figure 4 Taos Pueblo[10]

Figure 5 Adobe Materiality[11]

Residential pueblos were constructed from adobe, a mixture of native grasses, clay rich mud, and water. The adobe mixture was then formed into a common rectangular modular and laid out to dry in the sun [Figure 5].
Some of these pueblos still remain in use today [Figure 4]. Archeologists speculate that around 45 multistory pueblo Indian villages resided in this part of the Rio Grande Valley before Spanish settlers[12].

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[9] Rosner, Hy, Joan Rosner, and Kathleen Norris. Peak. Albuquerque's Environmental Story: toward a Sustainable Community. Albuquerque, NM: H. and J. Rosner, 1996. Print.

10 Fields, Scott. "Taos Pueblo Photo Album." Taos Pueblo: A Thousand Years of Tradition. Taos Pueblo, 2004. Web. 17 May 2011. <http://www.taospueblo.com/photoalbum/fields.php>.

[11] Photograph taken by Amber M Straquadine January 2010

12 Rosner, Hy, Joan Rosner, and Kathleen Norris. Peak. Albuquerque's Environmental Story: toward a Sustainable Community. Albuquerque, NM: H. and J. Rosner, 1996. Print.

Spanish explorers first arrived in this lush Rio Grande River Valley in 1540. Spaniards settled at the banks of the Rio Grande where the river made a wide curve and flattens, providing good irrigation. In addition to quality crop land ample wood could be harvested from the Bosque tree groves along the river banks. The location they chose is at the foothills of a small mountain range just north of the flat lands of the Chihuahuan desert highlighted in Figure 3 in red. These mountains were lovingly named Las Sandias for the red hues that the desert sunsets project onto them. The original town has characteristics of the Law of the Indies although such rules were not established until 1680. The settlers designed a plaza or town square and arranged their cathedral and commercial buildings around it [Figure 6] but the proportion of the open space and the lack of civic buildings on the square deny the Law of the Indies. Expanding between the plaza and the river were farm land which utilized asequias for irrigation. To the east, smaller residences were established. Albuquerque grew during this time due to the strong trade route, El Camino Real, that connected the small villa to Mexico City.

Figure 6 Albuquerque Plaza[13]

Figure 7 Old Town Drawing, circa 1952[14]

The United States acquired the New Mexico- Arizona territory in 1848 and Anglo settlers began transplanting their way of life to the area. The Atchson, Topeka, Santa Fe railroad was brought through Albuquerque in 1880. The introduction of the railroad began infusing American culture to the desert landscape. The establishment of the railroad two miles east of the plaza spawned new city growth. Similar new growth occurred with the paving of Route 66 in 1926 down Albuquerque's main street, Central Avenue. The intersection of Central Avenue (Route 66) and Fourth Street (El Camino Real) was historically a monumental intersection in the region. Vincent Price, a journalist for the Albuquerque Tribune describes Albuquerque as "At the crossroads of ancient and up to date"[15] This idea resonates throughout the identity of the city.

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13 Rosner, Hy, Joan Rosner, and Kathleen Norris. Peak. Albuquerque's Environmental Story: toward a Sustainable Community. Albuquerque, NM: H. and J. Rosner, 1996. Print.

14 http://www.cabq.gov/library/postcards/p10.html

15 Price, V. B. *Albuquerque: a City at the End of the World*. Albuquerque: University of New Mexico, 2003. Print.

Figure 8 City of Albuquerque Neighborhoods Map

Increase in Land Area

The city of Albuquerque celebrated its Tricentennial in 2006 and has grown into multi-cultural metropolis of 800,000 residences over the last 300 years[16]. The metropolitan area covers 181 square miles. As the population of Albuquerque grows so does the city's land use. Many neighborhoods in the city have resisted changes such as increased residential density and buildings that become differ from the land hugging ranch and pueblo style. Many neighborhoods, especially those in the eastside neighborhoods, limit heights of buildings to preserve views of nature encouraging horizontal expansion.

Albuquerque: City of Open Space

Albuquerque's Open Space Program, a part of the municipal government, works to acquire and protect open space with unique natural characteristics [Figure 9]. The program, including 28,000 acres, aims to conserve natural and archeological resources while providing space for recreation and educational activities [Figure 10][17]. Land acquired by the program is designated as places for "low impact" recreation such as hiking, biking and horseback riding. Hunting activities are not allowed. Organized team sports are also prohibited to eliminated grass and paving elements from encroaching into the natural open spaces. These open spaces define the urban boundary. To the east, Ellena Gallegos, Simms, Bear Canyon and Juan Tabo open spaces define the boundary at the base of the Sandia Mountains. To the west, the Petroglyph park space once defined the city limits although current residential developments have begun to wrap around the open space and sprawl. Open spaces are defined as Major Public Open Space, Major Open Space Links (arroyos and storm water drainage). The Sandia Tramway site is surrounded by Major Public Open Space but also has Major Open Space Links to the north and south.

[16] Rosner, Hy, Joan Rosner, and Kathleen Norris. Peak. *Albuquerque's Environmental Story: toward a Sustainable Community*. Albuquerque, NM: H. and J. Rosner, 1996. Print.

17 "Open Space - City of Albuquerque." *Open Space Division: About the Open Space Program*. Albuquerque - Official City Website, 2000. Web. 17 May 2011. <http://www.cabq.gov/openspace/>.

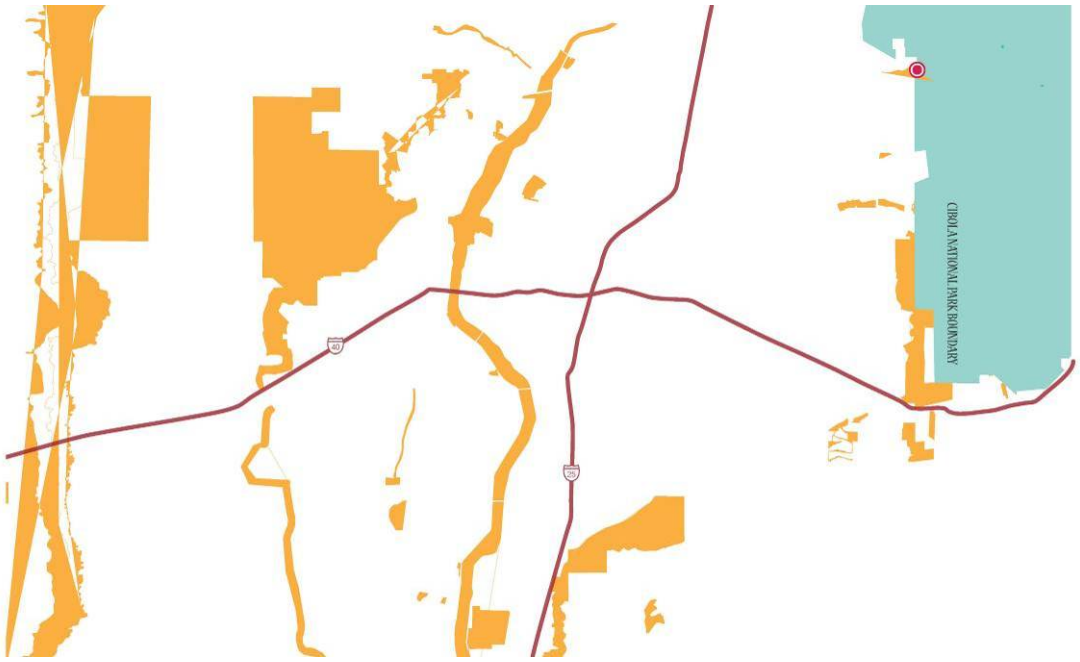


Figure 9 Albuquerque Open Space Map

Figure 10 "Whitewash" near the Ellena Gallegos Open Space.[18]

18 Photo taken by Ira Straquadine July 2009.

Architecture Identity

Vincent Price describes Albuquerque's architectural identity as "Conceptually modern, pueblo-esque residential with shed style commercial architecture."[19] The city includes two basic architectural trends: the infusion of European styles and the regional pueblo styles.

Pueblo Indian styles are commonly one and two story structures made of adobe and include flat roofs. Vegas or joists run exposed on the ceiling and protrude out the sides of the buildings exterior. Adobe walls allow for deep window sills and door thresholds. This style has evolved as the craft of adobe becomes time consuming and requires skilled craftsmen. Modernist Pueblo styles have become more common in recent decades. These styles retain the flat roofs and massing look to the buildings but are framed structures covered in stucco. The buildings take on plutonic forms but the thick walls and deeply recessed windows are no longer apparent.

Figure 11 Pueblo Revival building with luminarias atop the parapet walls[20]

Spanish colonial styles are also common in the area. These styles are often plastered or stuccoed framed buildings with low sloped roofs with Spanish tiles or pitched wood roofs [Figure 12]. They will usually include a wrapped porch or arcade like the one found at the Alvarado Train Station [Figure 13]. Colors are often whites and pinks. A derivation on this style is the California Mission style.

19 Price, V. B. *Albuquerque: a City at the End of the World*. Albuquerque: University of New Mexico, 2003. Print.

20 Photograph taken by Amber M Straquadine, August 2003

Figure 12 Santuario de Chimayo, Spanish Mission Style built 1811[21]

21 Photo taken by Amber M. Straquadine January 2010

Figure 13 Railroad Station Postcard, circa 1920[22]

Vincent Price describes a style unique to the state that he calls, New Mexico Regional architecture. He describes this style as a significant contribution to American architecture.[23] He describes the Kimo Theater in this category [Figure 14]. The Kimo is often referred to as Pueblo Deco, a highly ornamented style popular in the 1920's and 1930's. A continuation of this New Mexico Regional style is the work of John Gaw Meem. These buildings refer back to Mayan forms with canted walls in simple geometric building footprints. Meem blends the Mayan forms with pueblo style adobe materiality and deep reseeded windows with canted sills. University of New Meixco's Travelstead Hall is an example of this composition [Figure 15]. Most noted of John Gaw Meem's work is University of New Mexico's Zimmerman Library [Figure 14] that rises up from the central park space on the campus.

22 "Albuquerque Historic Postcards - Albuquerque/Bernalillo County Library System - City of Albuquerque." *Albuquerque - Official City Website*. The Albuquerque/Bernalillo County Public Library System. Web. 17 May 2011. <http://www.cabq.gov/library/postcards/p10.html>.

23 Price, V. B. *Albuquerque: a City at the End of the World*. Albuquerque: University of New Mexico, 2003. Print.

Figure 14 Kimo Theatre front façade (left) and Zimmerman Library original entrance facade (right)[24]

Figure 15 Travelstead Hall, Uninhabitable Tower, University of New Mexico[25]

24 Reference Needed

25 Photograph taken by Amber M Straquadine, July 2004

North Albuquerque Community

This community is defined between Bear Canyon Arroyo to the south, the Sandia Pueblo reservation to the North, Cibola National Forest to the east and Interstate 25 to the west. The land was a part of the Ellena Gallegos Land Grant of 1891. Typical lots were 165 by 264 feet to centerline of road. Public road easements are 60 feet. Typical of the time, platting does not respond to natural topography or drainage patterns. The idea that platting does not respond to natural topography renders some plats as unbuildable as terrain becomes rockier towards the Sandia Mountains. This allowed Albuquerque's Open Space program to develop these lots as a public amenity.

In 1934, Albert Simms, US Representative for New Mexico acquired a large portion of undeveloped land at the foot of the Sandia Mountains currently where the small residential development and the Sandia Tramway facility sits. It was held privately undeveloped until an agreement was made to include it as part of the Ciblola National Forest. 11 acres of this land is now Ellena Gallegos and Simms picnic grounds. These are show pieces of Albuquerque's Open Space program. Another 640 acres was designated as part of Cibola National Forest and more specifically as part of the Sandia Wilderness area and will remain undeveloped land for public enjoyment.

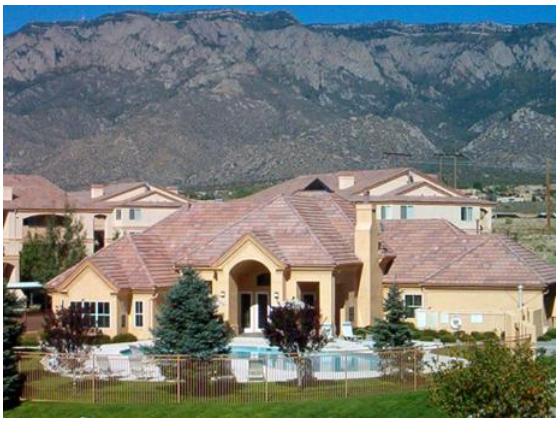


Figure 16 North Albuquerque Neighborhood[26]

Its citizens worship regional traditions yet yearn to be participants in a global society. People want the American lifestyle that includes a home and a yard to call their own yet they strive to respond to regional aesthetics. The Pueblo Revival style residences placed within a sea of emerald green grass demonstrates the values for both regional aesthetics and American lifestyle definitions in conflict. The sprawling lawns and loosely knit residential neighborhoods tax Albuquerque's diminishing water resources. Water restrictions continue to become stricter within the city limits as Albuquerque's aquifer becomes depleted. Property owners are encouraged to convert landscaping to low-water consumption plants.

26 Reference Needed

Sandia Heights Residential Community

Figure 17 Sandia Heights Residential Community[27]

This community was the first subdivision in Albuquerque to include water conservation in its initial plans. Since this community is just beyond the political boundary of the municipality it operates with its own water system deeming water conservation a necessity from the start [Figure 19]. Lots east of Tramway Boulevard average in size around three quarter acres each. Water conservation strategy begins with lot sizing. Larger lots encourage minimal site regarding, allowing builders to utilize natural drainage patterns. Other neighborhoods in Albuquerque leveled lots, channeling water into concrete arroyos.

Early architectural designs blended homes with the natural environment through site positioning, and volume formation in stucco colors to match the natural context. Minimal changes to the landscape allowed individually developed lots to read seamlessly with neighboring lots that may remain vacant for years. This strategy leaves no obvious holes. The community plan for this area requires no more than a ten percent roof slope and building exterior colors and materials to be derived from the muted tones and natural stone landscape.

27 Image provided by Sandia Heights Homeowners Association.

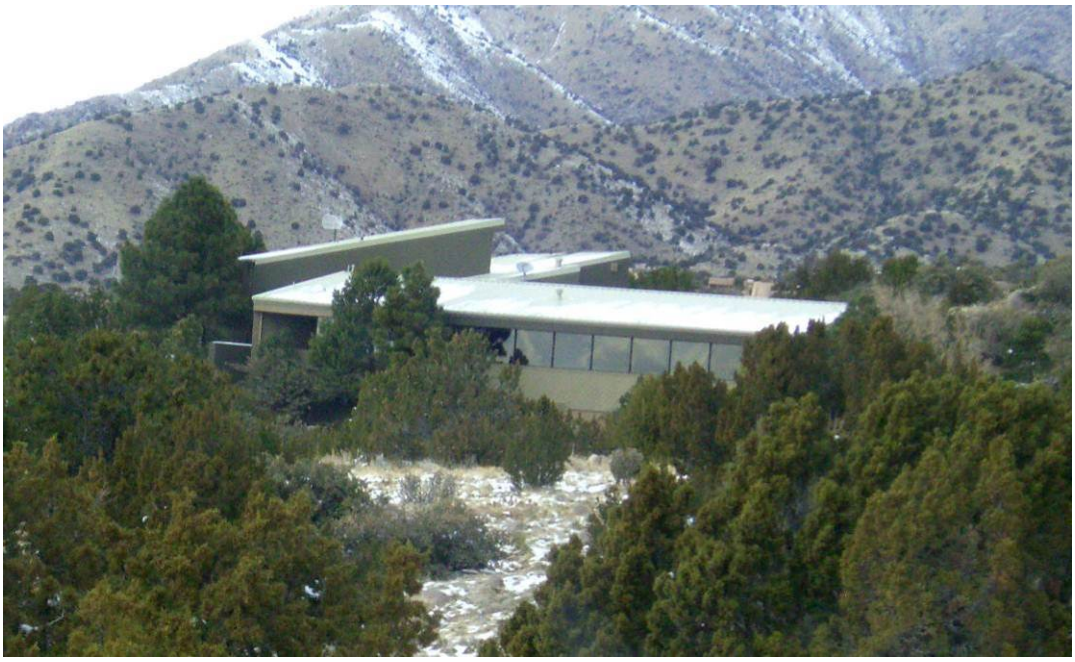


Figure 18 Sandia Heights Home from Base Tram Terminal[28]

28 Photograph taken by Ira Straquadine, March 2011

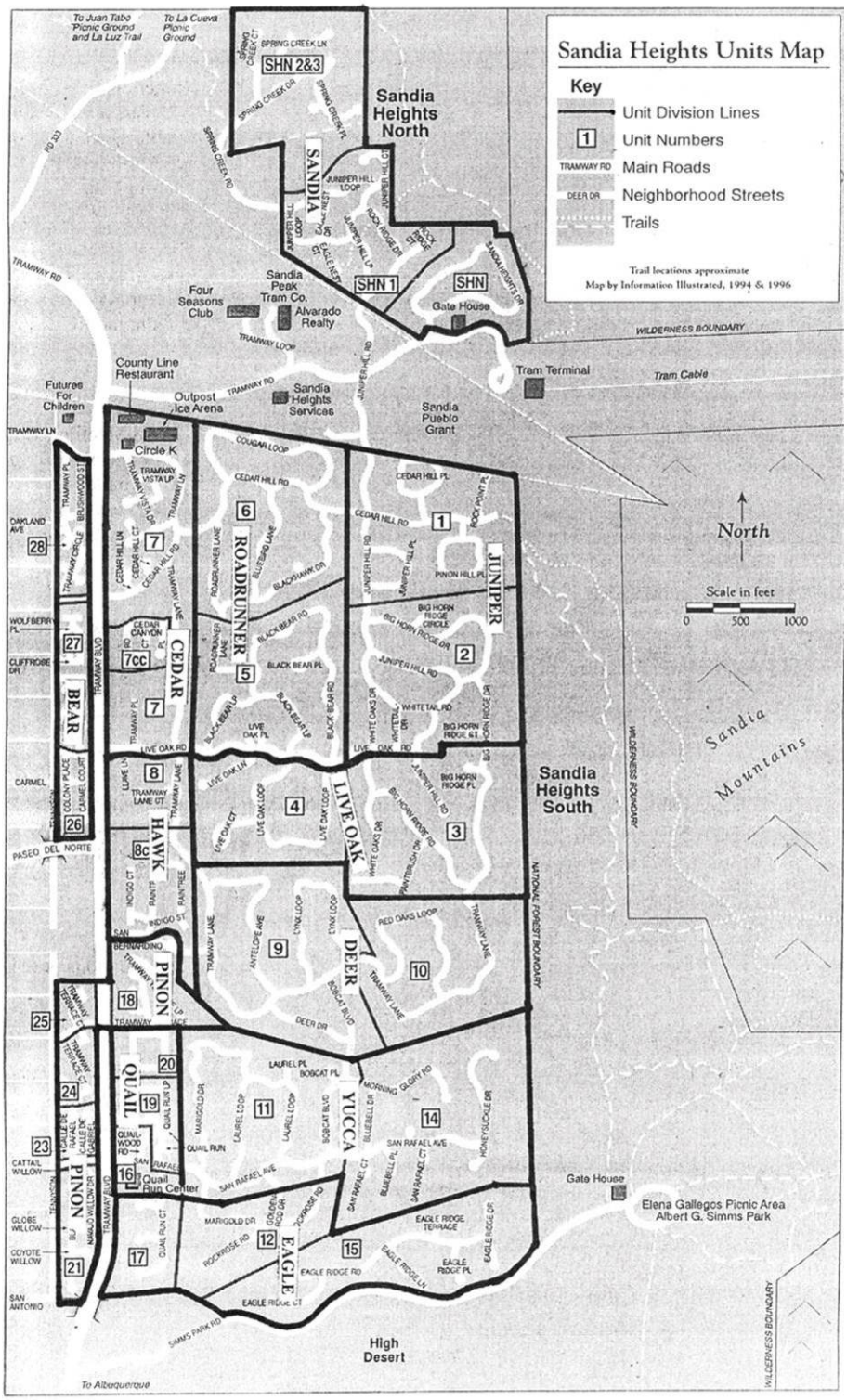


Figure 19 Sandia Heights Neighborhood[29]

29 Map provided by Sandia Heights Housing Association, print.

Natural Environment: Sandia Wilderness

Sandia Mountains

Sandia means watermelon in Spanish. The mountains earned the name due to the reddish color they turn during New Mexico's incredible sunsets as in Figure 20. This mountain range and its neighbor Manzano mountain range were created when the Rio Grand Rift shifted, pushing the mountain range up, exposing the rocky granite west face that Albuquerque residence live beneath.

Figure 20 Sandia Mountain, Winter Sunset[30]

Base versus Summit Ecology

Base Terminal Conditions

The foothills of the Sandia Mountains offer views of the lush Rio Grande River Valley. This area's land is dotted with large boulders and sandy arroyos that allow only small low to the ground plant life to survive. The vegetation in this area includes grasses and pinon trees. The developed and natural characteristics of this site are diagramed in Figure 21.

Foothills Vegetation[31]

Yucca- Part of the Agave family found at elevations 4,000 to 6,000 feet. Leaves are long and fibrous and grow in a clump spiking out from a central clump. Banana Yucca and

30 Reference Needed

[31] Julyan, Robert Hixson., and Mary Stuever. *Field Guide to the Sandia Mountains*. Albuquerque: University of New Mexico, 2005. Print.

Soapweed Yucca spot the landscape in the foothills with ivory white flowers that grow in a bunch at the top of a long stem.

Tree Cholla- Part of the Cactus family found at elevations up to 6,500 feet. Sometimes it is planted as a fence. Blooms are reddish purple. When segments dry they become woody and hollow with elongated holes.

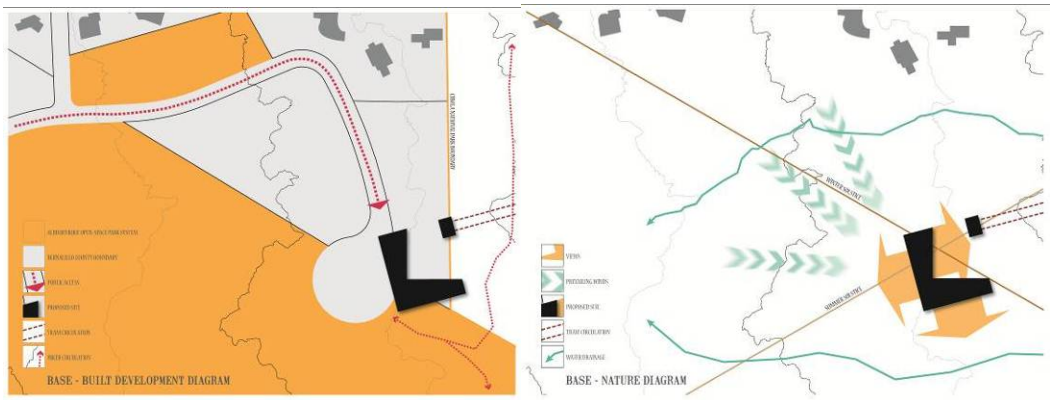


Figure 21 Base Terminal Development and Natural Conditions

Summit Terminal Conditions

The top ridge of the Sandia Mountains, often referred to as The Crest, offers escape from the heat of the city below. Temperatures often tend to be ten to fifteen degrees cooler than Albuquerque International Sunport. Visitors travel to the Crest to enjoy views of 11,000 square miles of the Land of Enchantment[32]. To the west lies the Rio Grande River in the foreground, then the volcano field and 100 miles in the distance Mount Taylor. To the east the mountains heavily forested terrain that gradually descends to flatlands. The developed and natural characteristics of this site are diagramed in Figure 22.

Peak Vegetation[33]

Pinon Pine- An evergreen pine found at elevations between 6,000 and 8,000 feet. These trees are known for the nuts produced and harvested. It is also sought after firewood for its dense wood and distinctive smell when burned.

White Fir- Found only at the highest altitudes above 8,000 feet of the Sandia Mountains, An evergreen tree distinctive for its white and blue hue. The seeds from these trees are sought after for Christmas tree production.

32 "History & Technology." *Sandia Peak Tramway*. Web. 17 May 2011. <http://www.sandiapeak.com/index.php?page=history-technology>.

33 Julyan, Robert Hixson., and Mary Stuever. *Field Guide to the Sandia Mountains*. Albuquerque: University of New Mexico, 2005. Print.

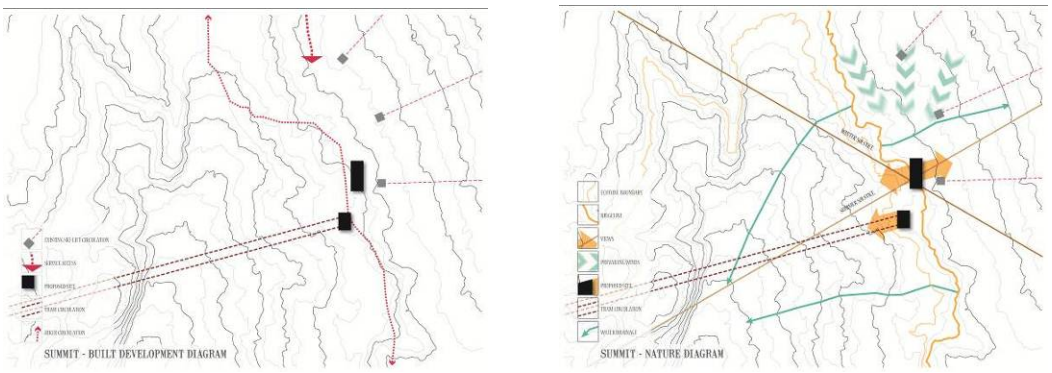


Figure 22 Summit Terminal Development and Natural Conditions

Figure 23 View of foothills from Tram Access Road[34]

34 Photograph taken by Ira Straquadine, March 2011

Figure 24 Trailhead and Tram Cables from Base Terminal Parking[35]

35 Photograph taken by Ira Straquadine, March 2011

Figure 25 Baca Canyon from Sandia Ridgeline, Autumn[36]

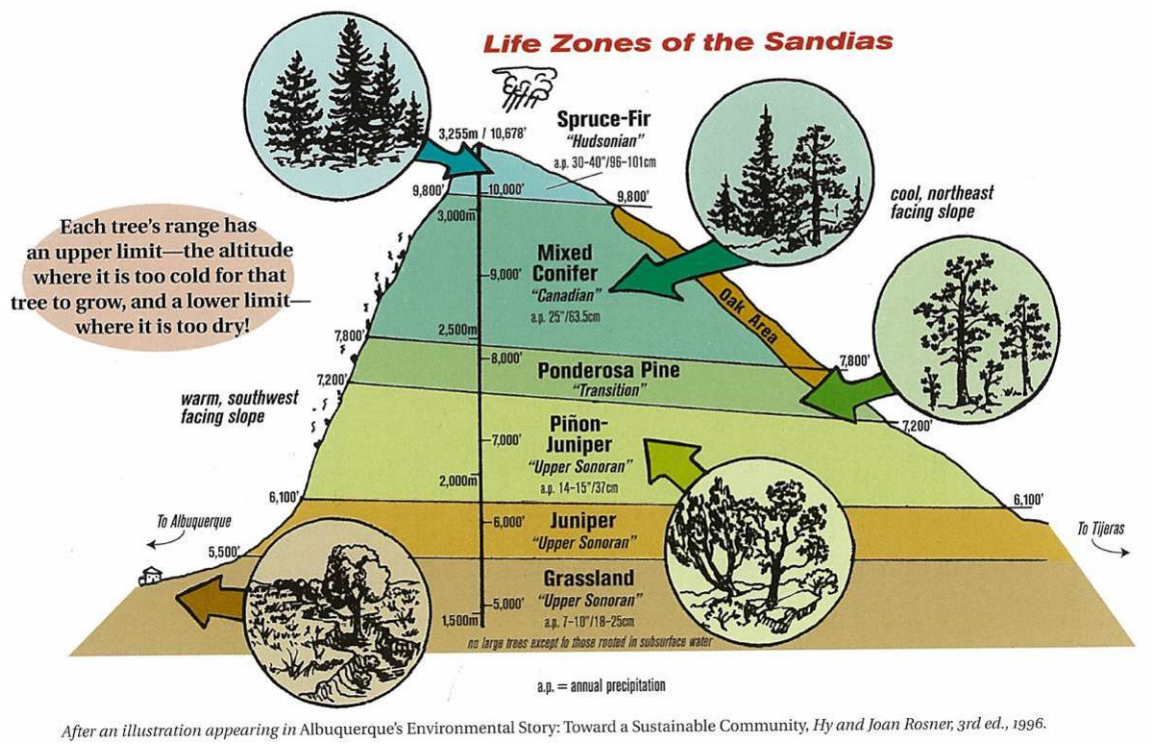
East Face versus West Face Conditions

The mountain's east face has a gradual rolling slope covered heavily in pines and aspens as well as lush grassy meadows filled with high desert wildflowers. The terrain lends itself to navigation by car, bike, ski or on foot. The mountain provides recreation options for the surrounding villages, suburbs and city of Albuquerque in the manner of hiking, biking, picnicking, horseback riding, and nature watching. Hunting, camping and off-road automobile activities are prohibited due to the variety of private ranches that dot the National Forest edges.

The mountains west face is rocky and jagged exposing much of the granite bedrock that comprises the mountain and Albuquerque metro area. Vegetation is limited and reduced to low scale shrubs and small woody trees. Cactus such as yucca, century plants, and prickly pear thrive at the warmest and lowest elevations. The upper rocky areas support groves of pines.

36 "History & Technology." *Sandia Peak Tramway*. Web. 17 May 2011. <http://www.sandiapeak.com/index.php?page=history-technology>.

Figure 26 Sandia Mountain West Face from La Luz trail



After an illustration appearing in Albuquerque's Environmental Story: Toward a Sustainable Community, *Hy and Joan Rosner, 3rd ed., 1996.*

Figure 27 Life Zones of the Sandia Mountains[37]

37 Julyan, Robert Hixson., and Mary Stuever. *Field Guide to the Sandia Mountains*. Albuquerque: University of New Mexico, 2005. Print.

Sandia Peak Ski Area and Tramway

The Sandia Peak Ski Area opened in 1937. Construction on the aerial tramway began in 1964 and was completed by 1966[38]. The double hitch back tramway springs from the Sandia Heights residential community up the western face of the Sandia Wilderness area to the highest ridgeline of the mountain range. The development of the Sandia Heights community and Tram was begun at the same time by the same land owners. The addition of the tram facility allowed greater public access to the ski area by eliminating an hour long drive up the sometimes treacherous icy mountain roads around the East face of the mountain. Bell Engineering from Lucern, Swizerland was contracted to install the four sets of tram cables, two cable towers and base and summit terminal machinery[39]. Two towers were installed along the mountain face by helicopter and anchored by thirty foot steel rods into the granite bedrock. A double hitch back cable system allows two tram cars to travel up and down their respective cable paths independently. Double cable systems means that two tram cars at either location at the same time allowing for evacuation of summit facilities easily (weather permitting). This system differs from ski lift type trams which have only a single set of cables meaning that if one car is at the top, a matching car must be at the bottom.

Each tram car holds a maximum of 50 people with trips lasting fifteen minutes each, the facility is capable of moving 200 people per hour. Passengers ascend about 5,000 feet from 5,300 to 10, 300 feet above sea level along the journey[40].

Tramcars run at the mercy of the weather. High winds, gusts, lighting, snow and ice accumulation are major issues for safe operations of the tram. It is not uncommon for ski patrol and tram operators to be stranded at the summit terminal after the mountain is cleared of visitors. Snow mobiles may transfer stranded individuals down the east face of the mountain to the main Sandia Peak Ski Lodge for safety overnight. Facilities are provided at the summit terminal and ski lodge for such incidences. Additional statistics included in Figure 29.

38 "History & Technology." *Sandia Peak Tramway*. Web. 17 May 2011. <http://www.sandiapeak.com/index.php?page=history-technology>.

39 "History & Technology." *Sandia Peak Tramway*. Web. 17 May 2011. <http://www.sandiapeak.com/index.php?page=history-technology>.

40 "History & Technology." *Sandia Peak Tramway*. Web. 17 May 2011. <http://www.sandiapeak.com/index.php?page=history-technology>.

Figure 28 Base Terminal Mechanics[41]

Total Horizontal Length:	2.7 miles
Total Vertical Rise:	3,819 feet
Elevation of Lower Terminal:	6,559 feet
Elevation of Tower One:	7,010 feet
Elevation of Tower Two:	8,750 feet
Elevation of Top Terminal:	10,378 feet
Height of Tower One:	232 feet - leans at an 18 deg angle
Height of Tower Two:	80 feet
Hourly Capacity:	220 passengers at 4 trips per hour
Average Number of Passengers Per Year:	275,000
Normal Speed:	12 mph or 20 feet per second
Maximum Clear Span Between Tower Two and Top Terminal:	7,720 feet or 1 1/2 miles This is the 3rd longest clear span in the world.
Number of Tramcars:	Two
Capacity of each:	55/50 with watertank
Weight of each tramcar empty:	8,000 pounds
Maximum Payload of each tramcar:	10,000 pounds
Water Tank Capacity:	1,000 gallons
New Tramcars Installed:	May 17, 1986 for 20th Anniversary
New Track Cables Installed:	April, 1997

The tramway was manufactured by Bell Engineering, Lucerne, Switzerland in 1964-66 at a cost of 2 million dollars. It is a Double Reversible Jigback Aerial Tramway. Five thousand helicopter trips were made during construction of Tower 2 and cable installation.

Track Ropes:	4 each with a diameter of 40mm or 1 5/8 inches
Weight of Each:	52 tons
4 Track Cable Counterweights:	47 tons each (located at lower terminal)
Depth of counterweight pit:	70 feet
Haul Ropes:	1 haul rope and counter rope
Diameter of Haul Ropes:	32mm or 1 1/4 inches each weighing 17 tons
Main Power Unit:	600 HP DC Electric Winch Motor
Auxiliary Drive:	250 HP Ford Gasoline Engine

Figure 29 Sandia Tram Fact Sheet[42]

41 Photographs taken by Ira Straquadine, March 2011

42 Courtesy of Sandia Peak Tramway Information Center, print.

Threshold Condition

Roadless New Mexico:

The state of New Mexico is developing a program in conjunction with the U.S. Forest System to reduce the impact of roadways cutting through wildlife areas. The rule was issued in 2001 to protect roughly one third of undeveloped U.S. Forest Service lands. By eliminating roads through more rugged areas the State Park Service can protect areas from damaging effect of automotive traffic including litter and pollution. Known damage due to increased automotive traffic include stream sedimentation, reduced water quality, introduction of non-native and invasive species, habitat fragmentation and man-caused wildfires. New Mexico inventoried 1.6 million acres of what they call "Roadless Areas" in 6 national forests.[43]

"People can have fun and show their support for saving these treasured places," said Nathan Newcomer, Associate Director of the New Mexico Wilderness Alliance. "Roadless forests are some of the best outdoor recreation areas we have in the state, and New Mexicans are enjoying their roadless areas even more today than they did when the roadless rule was enacted in 2001."[44]

Water:

Water is shed from the mountain into canyons from which the city captures into arroyo systems that move the water through the city before releasing it into the Rio Grande River.

Water rights in New Mexico are governed by two separate agencies. The Office of the State Engineer designates retention of visible runoff for only up to 96 hours without an associated water right. The EPA is demanding in their new New Mexico storm water permits on-site retention of any storm water flows in excess of pre-development flow conditions. These two rules do not always lend themselves to the same resolution of water run off.

Climate Data

D.H. Lawrence, British author, lived in Northern New Mexico for a stint in the early 1920's and wrote about its unique atmosphere in his book *Mornings in Mexico*. He is able to capture the unique feel of the place that charts and weather data cannot.

"In a cold like this, the stars snap like distant coyotes, beyond the moon, and you'll see the shadows of actual coyotes, going across the alfalfa field. And the pine-trees make little noises, sudden and stealthy, as if they were walking about. And the place heaves with ghosts. But when one has got used to one's own home-ghosts, be they never so

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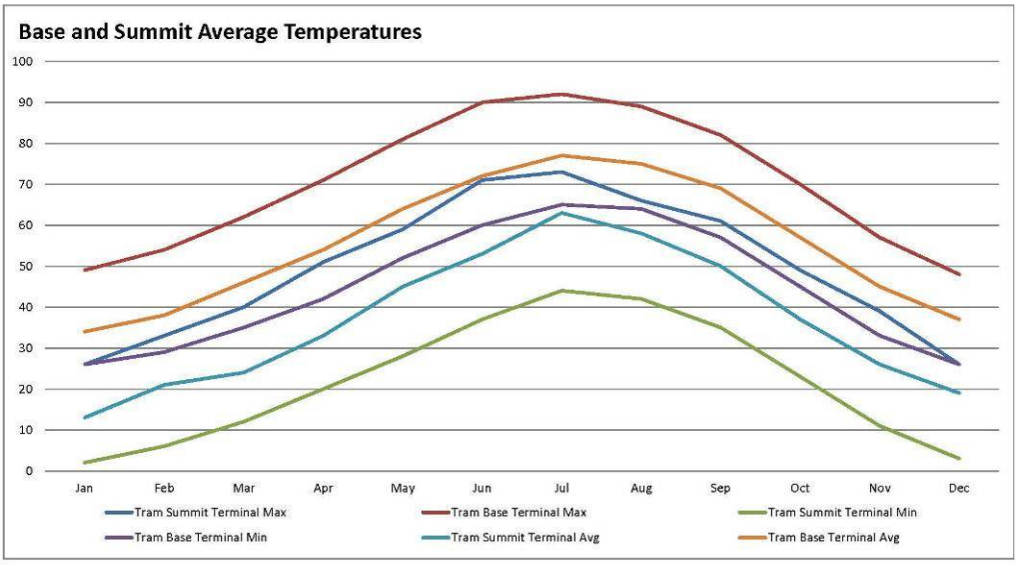
43 *Wildlife, Habitat, and Hunting: New Mexico's Roadless Areas.* Publication. Santa Fe, New Mexico: New Mexico Department of Game and Fish, 2006. Print.

44 Newcomber, Nathan. "Governor Proclaims Roadless Recreation Week in New Mexico | New Mexico Wilderness Alliance." *NM Wild!* New Mexico Wilderness Alliance, Aug. 2010. Web. 17 May 2011. <http://www.nmwild.org/press-releases/governor-proclaims-roadless-recreation-week-in-new-mexico/>.

many, they are like one's own family, but nearer than the blood. It is the ghosts one misses most, the ghosts there, of the Rocky Mountains. ...because it is cold, I should have moonshine ..." Expert from *Mornings in Mexico* by D.H. Lawrence 1934[45]

D.H. Lawrence summed up the Southwest's effect on him in 1928: "In the magnificent fierce morning of New Mexico, one sprang awake, a new part of the soul woke up suddenly and the old world gave way to the new."

All weather numerical values were attained from NOAA's National Weather Service[46]. Charts were designed by Amber M Straquadine. Figure 30 and 31 are comparative charts describing high and low temperatures, precipitation and snow fall.



[45] Lawrence, D. H. *Mornings in Mexico*. London: Tauris Parke Paperbacks, 2009. Print.

[46] "NWS Albuquerque." *NOAA's National Weather Service*. National Weather Service. Web. 17 May 2011. <http://www.weather.gov/climate/index.php?wfo=abq>.

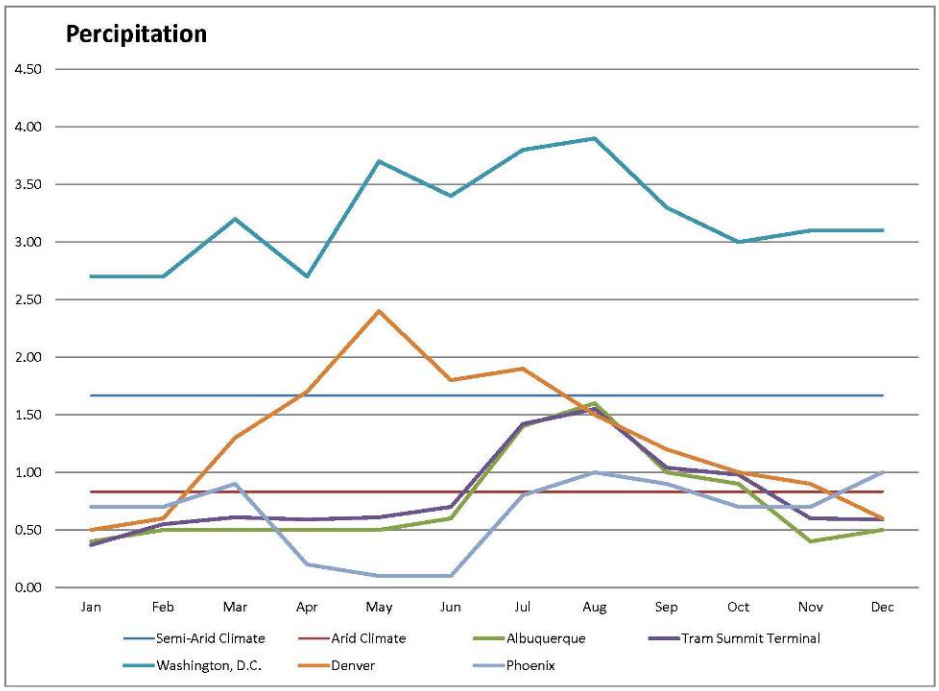
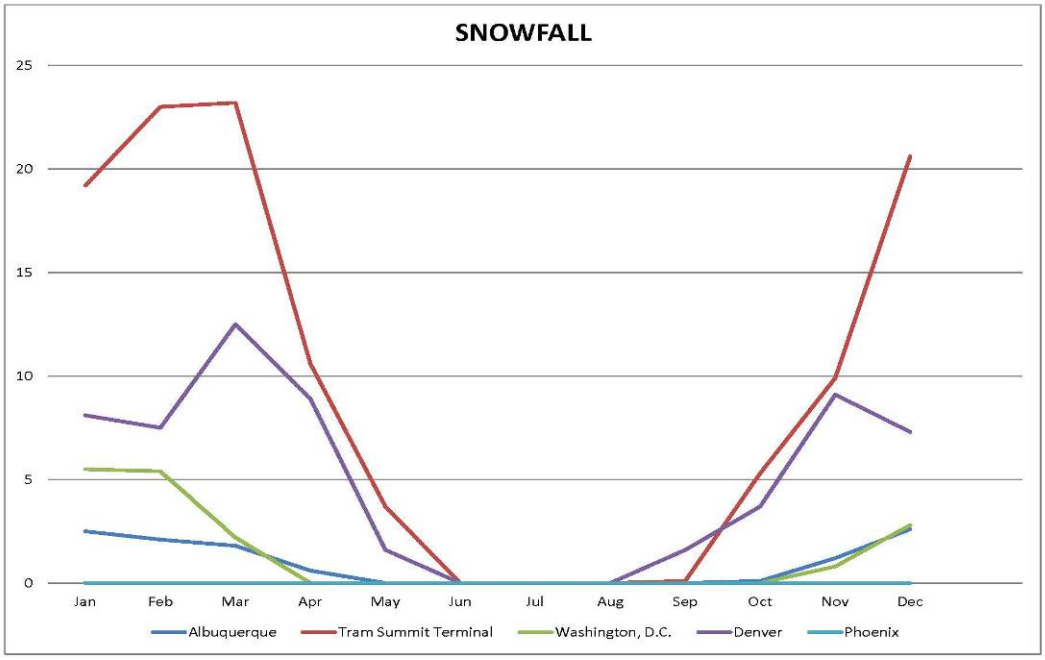


Figure 30 Temperature and Percipitation Trends



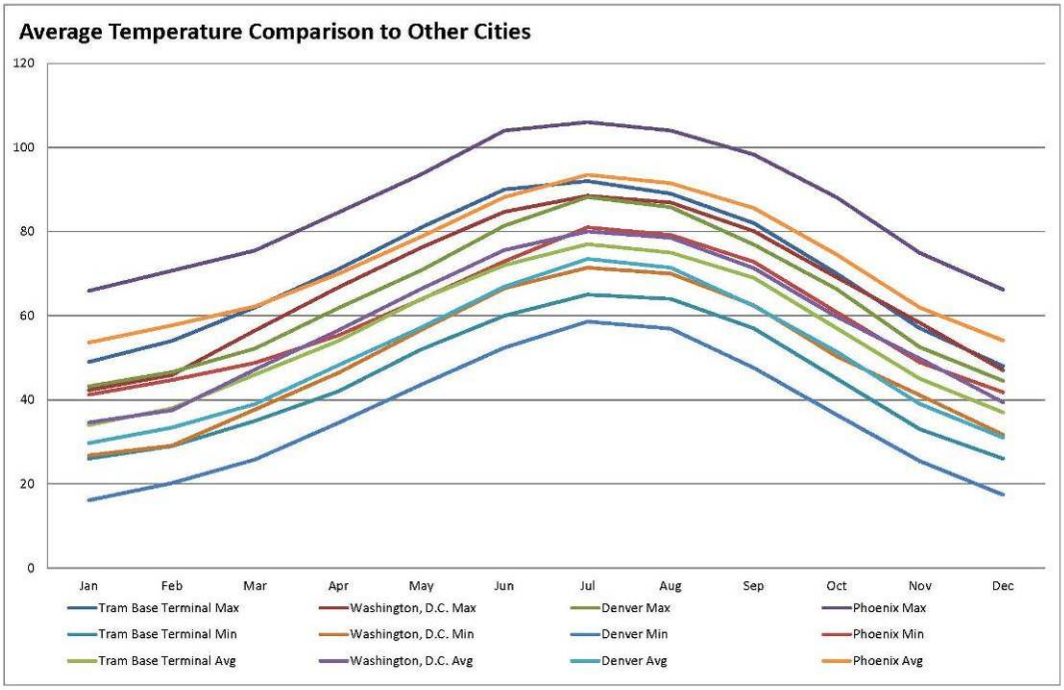


Figure 31 Snowfall and Temperature Trends

Chapter 3: Program Development

Science and Art

"The greater one's science, the deeper the sense of mystery."[47] *-- Vladimir Nabokov*

Science and art disciplines overlap; both are a means of testing old traditions and new ideas. Throughout history many different civilizations recognized the link between the sciences and the arts. Ancient Greek word for art is "techne", the root for our modern words "technique" and "technology." One of the best know scientist and artists from the Renaissance, Leonardo da Vinci allowed his scientific experiments to influence his art and his art explorations to influence his new inventions. Da Vinci executed master paintings of the human form that were directly influenced by his anatomy investigations. Evidence of the hybrid of art and science in his work can be found in his drawing of the Vitruvian Man. Da Vinci also studied plants but did not record his findings in diagrammatic form but rather, as an artist observing the precise appearance of plants, the phases of growth and the variation of a single plant varied from instance to instance. Modern breakthroughs in physics have also been linked to the cubist art movement. Niels Bohr, a physicist in the 1920s was investigating the structure of matter. Previous physicists had thought the nucleus of an atom was a reflection of the inner solar system with the atomic nucleus as the sun and the electrons as planets in orbit. This was the classical model but Bohr he realized that science needed a new metaphor after observing unusual properties of the electrons. Bohr had long been fascinated by cubist paintings. "For Bohr, the allure of cubism was that it shattered the certainty of the object. The art revealed the fissures in everything, turning the solidity of matter into a surreal blur."[48] Bohr explained that the form the electrons took was a consequence of the observer's standpoint. The influence of the new art movement inspired Bohr's explanation of the electron. Instances of arts influencing science influencing art exist throughout history. At a certain point, the defined line between Arts and Sciences blurs. Some scientific studies may require an artistic finesse while some artistic explorations may require some technical research.

The Sciences aim to explain the origins and inner workings of nature. The Arts aim to capture the emotion and energy of nature. This project aims to create a place where people from both the science and art disciplines can work together and collaborate. The building program and the architecture should be designed to influence each other. Not only should the architecture provide space for technical and creative production but the products i.e. plants and art should become a seamless part of the architecture and the site.

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47 Lehrer, Johan. "The Future of Science…Is Art? § SEEDMAGAZINE.COM."*SEEDMAGAZINE.COM*. 16 Jan. 2008. Web. 17 May 2011. <http://seedmagazine.com/content/article/the_future_of_science_is_art/>.

48 Shlain, Leonard. *Art & Physics: Parallel Visions in Space, Time, and Light*. New York: Harper Perennial, 2007. Print.

Arts: Land Art Studio

Mission Statement:

Explore relationships between land, art and community

Provide studio space for a visiting artist

Provide community workshops

Exhibit works that address man's relationship with nature

Advocate awareness for responsible land use and appreciation for public open space within and around the city.

Studio

Base: offering approximately five local members of the Land/Art New Mexico studio experimentation space both indoors and outdoors. The Land/Art NM aims to depict the unique nature of the New Mexican landscape and engage communities in a discussion about the importance of the environment[49].

Summit: offering limited space for studio experimentation both indoors and outdoors focusing on two visiting artists.

Art Program Precedence

The Lightning Field: Installed on the planes of Western New Mexico by Walter de Maria in 1977, the Lighting Field was created to capture the magnificent effect of late summer thunderstorms on the desert. It is an arrangement of 400 polish stainless steel poles into a perfect grid spaced 220 feet apart. Together they define a horizontal plane as well as a vertical reflective connection to the sky. Visitors arrange a guided overnight stay to the property in hopes of a glimpse at lightning striking one of these poles.

49 Lippard, Lucy R., William L. Fox, Nancy Marie. Mithlo, and MaLin Wilson-Powell. *LAND/ART New Mexico*. Santa Fe: Radius in Collaboration with 516 Arts, the Albuquerque Museum of Art and History, the University of New Mexico College of Fine Arts, the Fund at Albuquerque Community Foundation, 2009. Print.

Figure 32 Lighting Field, New Mexico, Walter de Maria

Arcosanti Bells: Paolo Soleri's village of Arcosanti provides foundries and ceramic studios for the production of bells. The profit from these bells provides financing for Arcosanti projects.[50] "The bells are more than a dash of fashion with which to accent our surroundings. They are a call to arms against the compound problems of an exploding world population, worsening pollution, shrinking resources, and poor public policy. The alarm over our global environmental situation has only recently been raised, but Soleri has been sounding his warning bells for nearly fifty years.[51]" Writes Ray Wyman, Jr.

50 Lima, Antonietta Iolanda. *Soleri: Architecture as Human Ecology*. New York, NY: Monacelli, 2003. Print.

51 Wyman, Ray. "The Sound of Distant Bells - Arcosanti Bells - By Ray Wyman, Jr." *Heavypen – Freelance Writer, Editor, and Publisher in California*. Web. 17 May 2011. <http://www.heavypen.com/articles/arcosanti.html>.

Figure 33 Arcosanti Studio, Paolo Soleri

Sciences: Desert Greenhouse

Mission Statement:

To grow and research native plant life of the Sandia Mountains.

To offer options and solutions to residences of the city for individual properties.

To work in conjunction with the New Mexico Forestry Division to provide habitat restoration research for the Sandia Wilderness area.

To raise awareness for the natural ecology as a community asset by working with the ski resort to provide an exhibition pavilion at the summit terminal.

Provide interactive educational activities for the community by providing public workshop space and exhibition spaces.

Greenhouse

Base: growing and distributing desert plants for residences of the Albuquerque metropolitan area. Profits from this production would be spent for operation of Summit greenhouse production.

Summit: Ecotone Habitat Restoration Research. The greenhouses will provide indoor and outdoor cultivation space for New Mexico State Forestry Division Programs including the Conservation Seedling Program. This program supports the growth of seedlings for forestry rehabilitation.

Botany Program Precedence

Eden Project: The renovation of disused clay mines into a string of bio-domes with varying ecologies inside attract visitors interested in learning about the varying ecologies and experiencing the magical bubbles nestled into the hillside. Grimshaw Architects designed the form of the buildings by investigating soap bubble structures. By doing so, they were able to translate a natural occurrence to a structurally efficient enclosure.[52]

Figure 34 Eden Project, Grimshaw Architects

Rio Grande Nature Center and Preserve: The primary building for this project as well as the master plan for the preserve was designed by Antoine Predock. There is an element of 'river-edge vernacular' to the building; an 8-foot diameter, corrugated drainage culvert forms and frames the tunnel entry into the center. The building is primarily of concrete formed into jagged organic shapes to match the landscapes of the arroyos that divert water into the Rio Grande.

52 Grimshaw Architects. "Eden Project, Cornwall." *GRIMSHAW ARCHITECTS*. Web. 17 May 2011. <http://www.grimshaw-architects.com/base.php?in_projectid>.

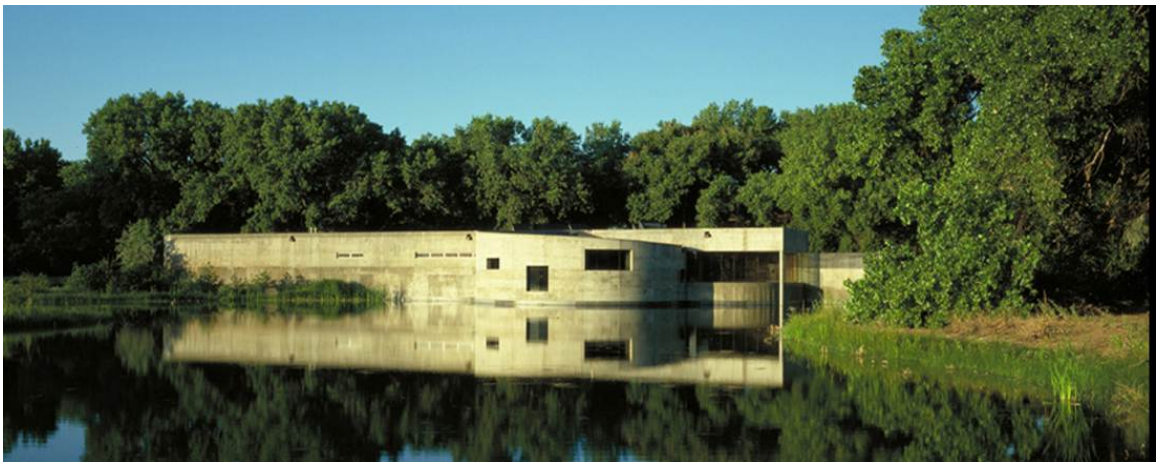

Figure 35 Rio Grande Nature Preserve, Antoine Predock[53]

Threshold

The program size should reflect an attention to ecological sensitivity by consuming and disturbing the smallest amount of land necessary. The base building(s) should provide spaces for gatherings of 10 to 40 people. The bulk of the program functions will be located at the bottom of the mountain.

The summit building provides space for small gatherings of 8 or less. The upper exhibition should provide for quiet reflection allowing visitors to absorb the views, atmosphere, nature and art. Summit research and studio labs will provide workspace for one or two individuals and will include some overlap spaces as well as shared service spaces.

Tram Terminal

An open air facility is provided for loading and off loading of visitors to aerial trams at both base or summit ecotones. The tram will service visitors to the mountain, and New Mexico Forestry Division employees as well as greenhouse researchers and land artists.

Exhibition

Summit Exhibition Pavilion: depicting man's impact on habitats in the area as well as educating visitors about the steps they can take to make a positive change in the community. The exhibition space will also display works of art and science advocating ecotone awareness and symbiosis.

Public Workshops

These workshops offering a hybrid space serving 10 members of the community and allowing for interaction with both the artists and botanists. The space would be used for

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53 Predock, Antoine, and Brad Collins. *Antoine Predock, Architect 4*. New York, NY: Rizzoli International Publications, 2006. Print.

production of seedlings for the Re-Leaf program. This program is organized in conjunction with the New Mexico Forestry division and supports community tree planting projects.[54]

Threshold Precedents

California Academy of Sciences and the de Young Museum: The Academy of Sciences building by Renzo Piano and the de Young Museum by Herzog and de Muron flank a garden space themed for music. The music concourse has existed at Golden Gate Park for many years but its new renovation and placement between the two buildings creates a visual and theoretical connection between the two buildings and their functions.

Figure 36 California Academy of Sciences and the de Young Museum

Salk Institute: Louis Khan's design for the new science research institute in California focused on collaboration of individuals. Khan created collaboration spaces in stair wells as well as visual connections between wings. Khan created a monumental outdoor plaza between the two buildings in anticipation of researchers gathering outside for meetings and discussions.

54 "ReLeaf." *EMNRD*. Web. 17 May 2011. <http://www.emnrd.state.nm.us/FD/ReLeaf/Releaf.htm>.

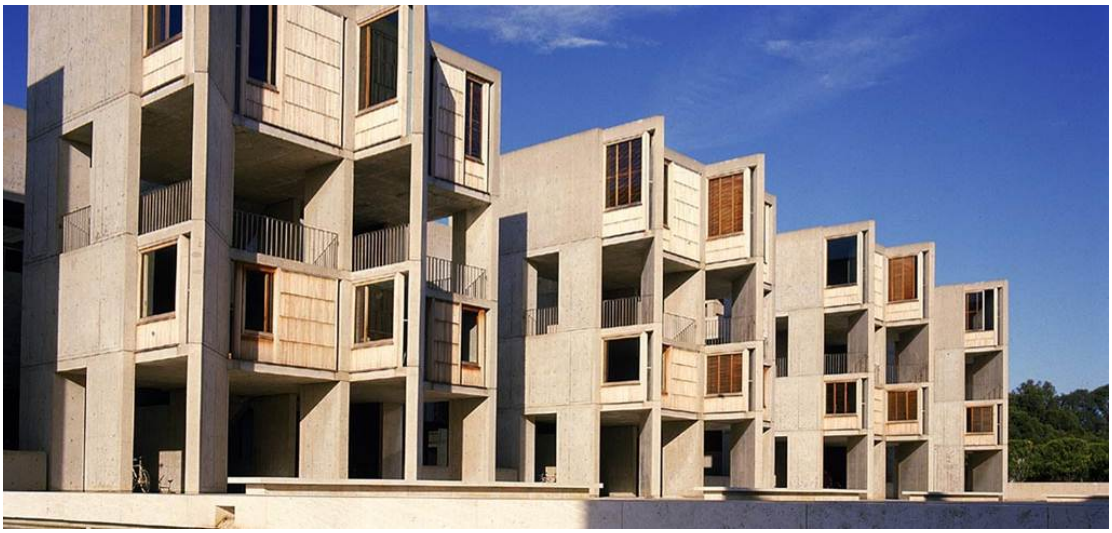
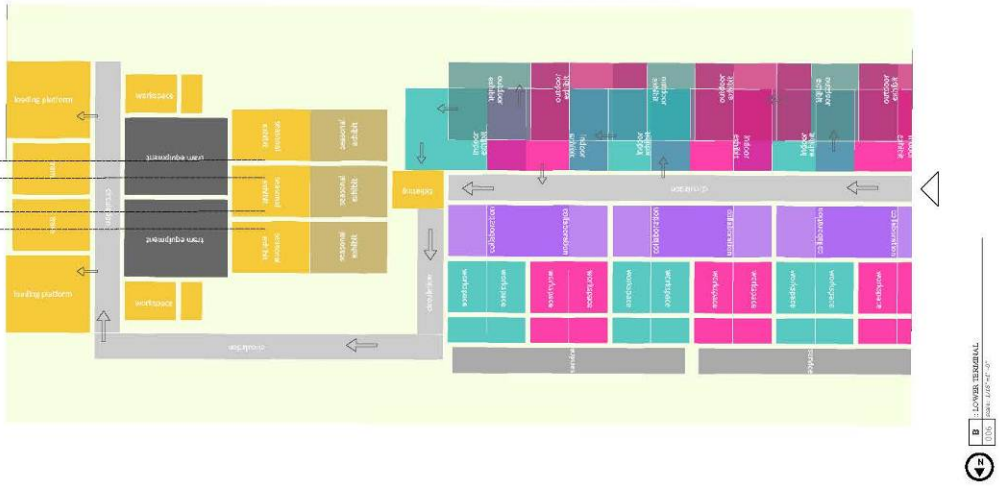


Figure 37 Salk Institute, Louis Khan

	Including	Modular	SF	#	Base (sf)	#	Summit (sf)
Arts					1,536		384
Workspace	Indiv. Tabletops	8 x 12	96	8	768	2	192
Collaboration	Shared Facilities	12 x 16	192	4	768	1	192
Storage		4 x 8	32	8	256	2	64
Sciences					1,536		384
Workspace	Indiv. Tabletops	8 x 12	96	8	768	2	192
Collaboration	Shared Facilities	12 x 16	192	4	768	1	192
Storage		4 x 8	32	8	256	2	64
Exhibition					4,608		2,304
Science Exhibit	Greenhouse	32 x 16	512	1	512	1	256
Arts Exhibit	Gallery	32 x 16	512	1	512	1	256
Seasonal Exhibit	Temp. Installation	32 x 16	512	1	512	1	256
Outdoor Science Exhibit	Greenhouse	32 x 16	512	2	1,024	1	512
Outdoor Arts Exhibit	Gallery	32 x 16	512	2	1,024	1	512
Outdoor Seasonal Exhibit	Temp. Installation	32 x 16	512	2	1,024	1	512
Tram Terminal					2,208		1,344
Tram		12 x 16	192	2	384		
Loading Platform	Waiting area	16 x 24	384	2	768	2	768
Ticketing		8 x 12	96	2	192	1	96
Workspace	Control Panel	8 x 12	96	1	96	1	96
Mechanical	Engine & Gears	16 x 24	384	2	768	1	384
Subtotal					9,888		4,416
Service Space			0		989		442
Total Area					12,854		5,741
Site Area					261,360		87,120

Program Analysis



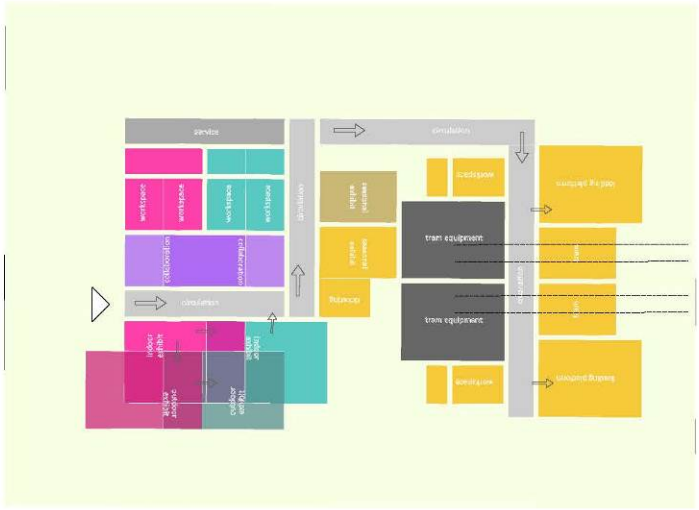
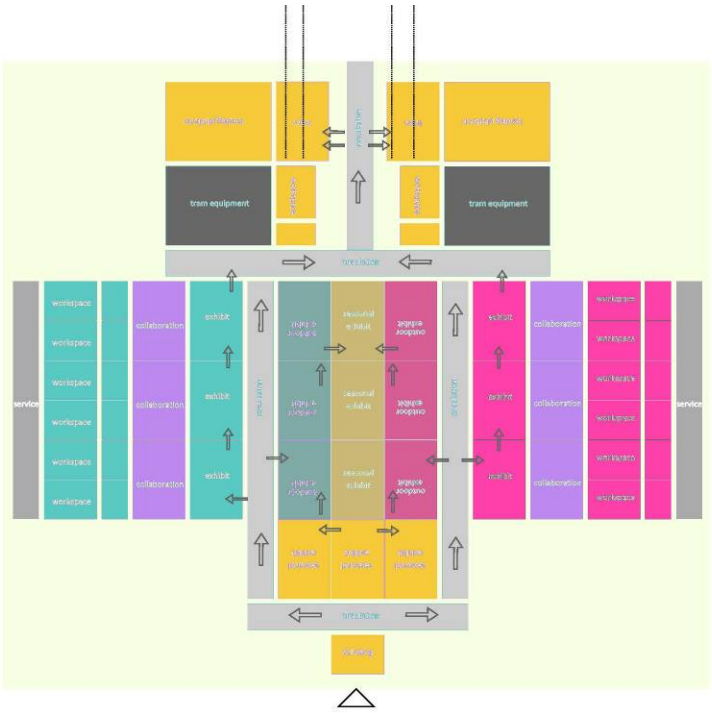


Figure 38 Scheme One



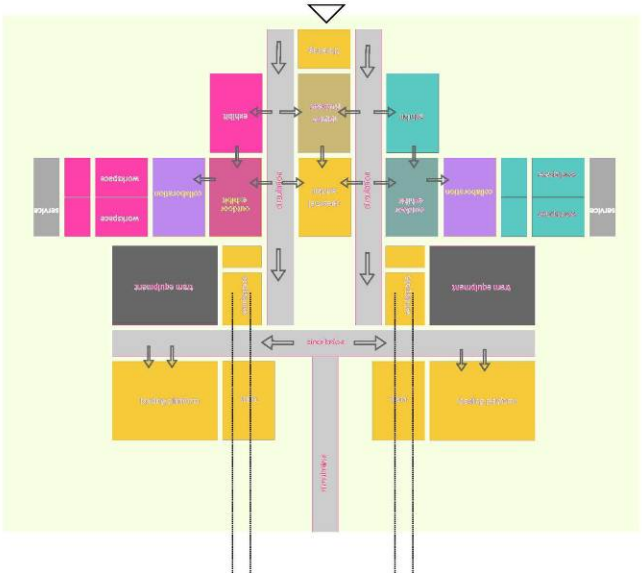


Figure 39 Scheme Two

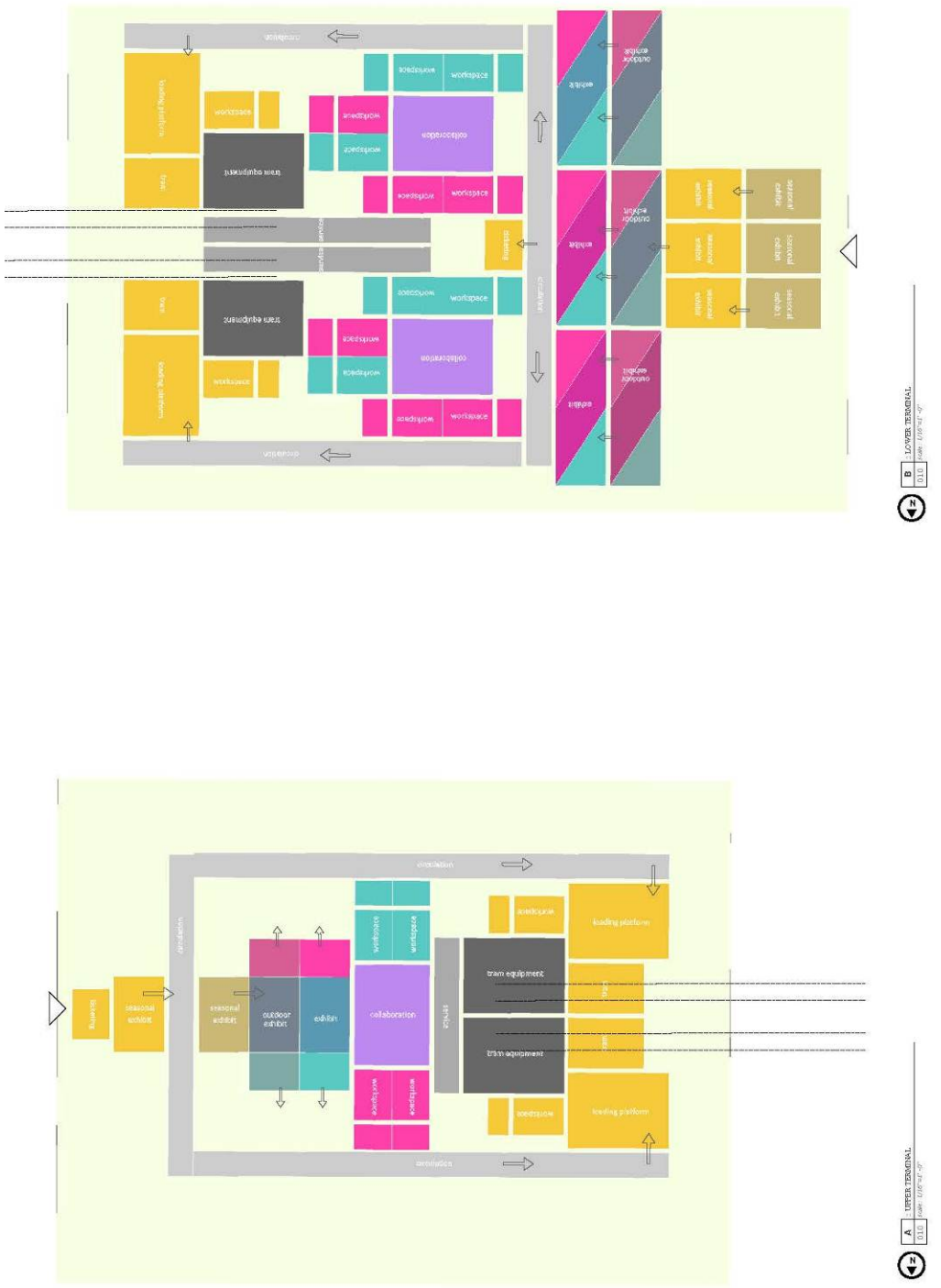


Figure 40 Scheme Three

The final program parti utilized additional outdoor space. The two buildings interior programs are integrated with exterior program.

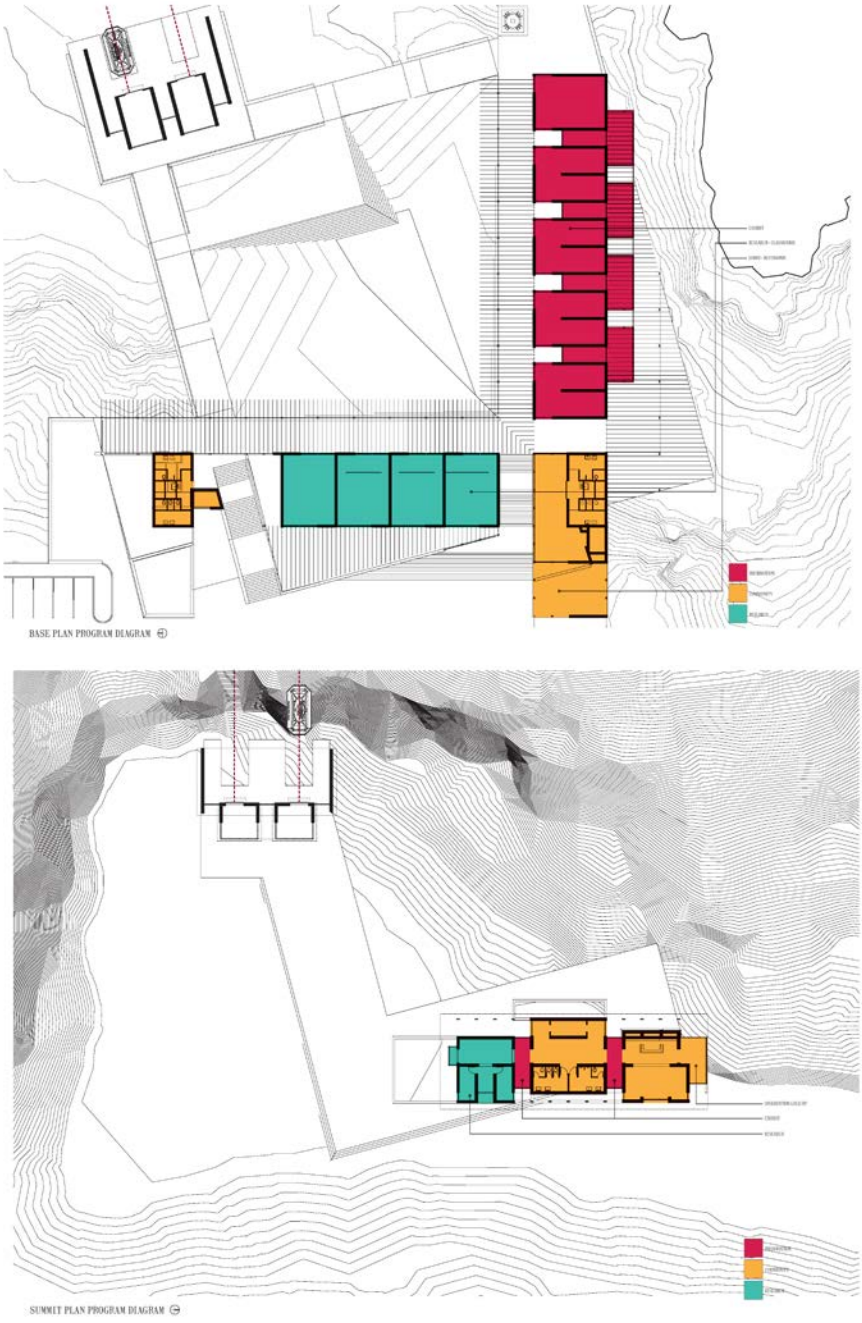


Figure 41 Final Program Diagram

Chapter 4: Ecotone Design Strategies

Learning from Nature

"In nature, as an organism evolves it increases in complexity and it also becomes a more compact or miniaturized system. Similarly a city should function as a living system. Arcology, architecture and ecology as one integral process, is capable of demonstrating positive response to the many problems of urban civilization, population, pollution, energy and natural resource depletion, food scarcity and quality of life. Arcology recognizes the necessity of the radical reorganization of the sprawling urban landscape into dense, integrated, three-dimensional cities in order to support the complex activities that sustain human culture. The city is the necessary instrument for the evolution of humankind." - Paolo Soleri[55]

Landscape Study

The high desert climate of the Sandia Mountains allows for a unique variety of vegetation possibilities for the building and courtyard. Because of the minimal rainfall in this climate, turf would be a high water consuming option. Figure 42 shows the best options for planting beds in relation to area for water collection. The table also describes the volume of water collected to size cisterns.

The number of visitors at this place could be as high in January (skiers) as it is in July (tourists) therefore using rainwater for toilets would mean during dry seasons the toilets would have to be served by potable city water anyway. If the water collection is used for landscape, the landscape planting season already corresponds to the rainy season= Symbiotic relationship between building and nature. I also do not believe this water would have to be treated the same way as it would if it were going into a toilet (I might be wrong though).

[55] Soleri, Paolo. *What If?: Collected Writings 1986-2000*. Berkeley, CA: Berkeley Hills, 2002. Print.

Average Annual Percipitation

	J	F	M	A	M	J	J	A	S	O	N	D	A
Base Terminal	0.4	0.5	0.5	0.5	0.5	0.6	1.4	1.6	1	0.9	0.4	0.5	8.8
Summit Terminal	0.59	0.88	0.98	0.94	0.98	1.12	2.27	2.48	1.66	1.57	0.96	0.94	15.38

Average Yearly Rainfall

inches	Yearly	Chubaso*
Base	9	3
Summit	15	5

Water Comsuption

gallons per square foot	
Turf	79
Xeriscape	17

Collection Area Dimensions

	Width	Length	Area (sf)
Exhibit Wing	32	240	7,680
Classroom Wing	32	168	5,376
Plaza	168	144	24,192
Parking			50,000
Summit	40	104	4,160

Projected Water Collection

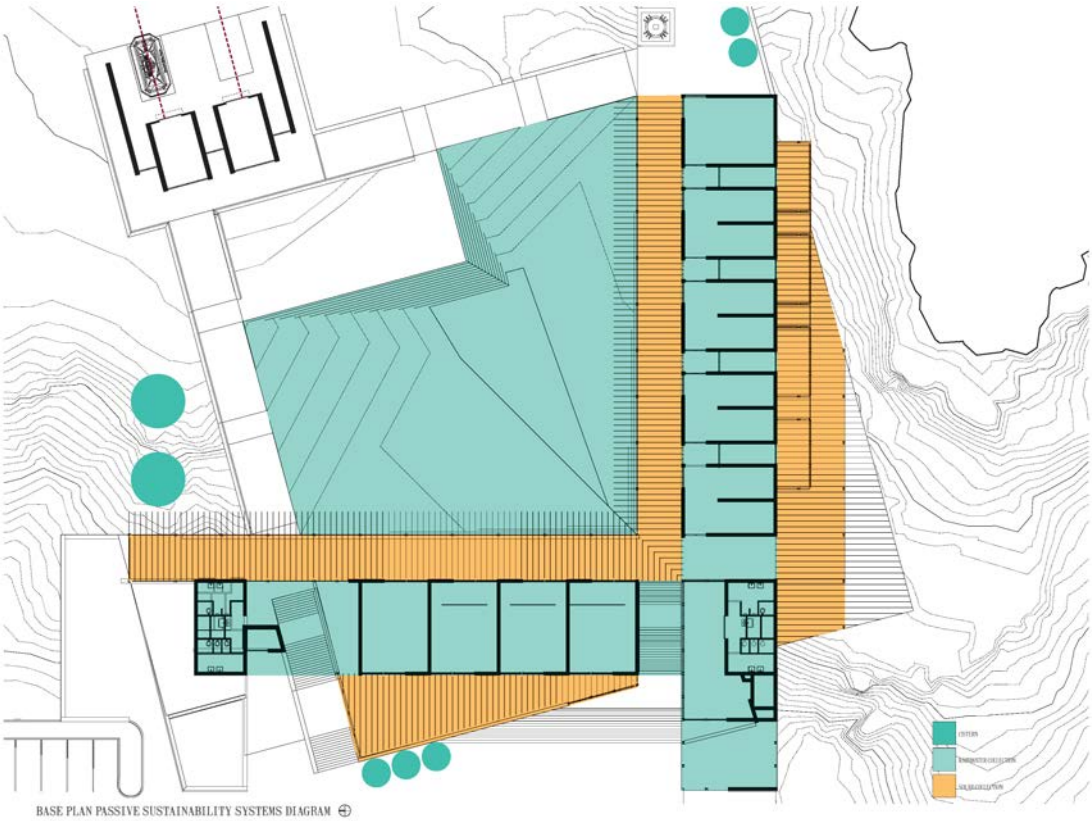
Cubic Feet	Yearly	Chubaso*	Gallons	Yearly	Chubaso*
Exhibit Wing	5,632	3,041		42,240	22,810
Classroom Wing	3,942	2,129		29,568	15,967
Plaza	17,741	9,580		133,056	71,850
Parking	36,667	19,800		275,000	148,500
Summit	3,051	1,647		22,880	12,355

Outdoor Planting Bed Size According to Water Collection

Turf (sf)	Yearly	Chubaso*	Xeriscape (sf)	Yearly	Chubaso*
Exhibit Wing	535	289	Exhibit Wing	2,485	1,342
Classroom Wing	374	202	Classroom Wing	1,739	939
Plaza	1,684	909	Plaza	7,827	4,226
Parking	3,481	1,880	Parking	16,176	8,735
Summit	290	156	Summit	1,346	727

*Chubaso = Rainy Season that occurs in July and August

Figure 42 Xeriscaping Versus Turf Landscape Study



Concept Image

The base and summit terminals are located in terrain that is distinctly different from each other as shown in Figure 43.

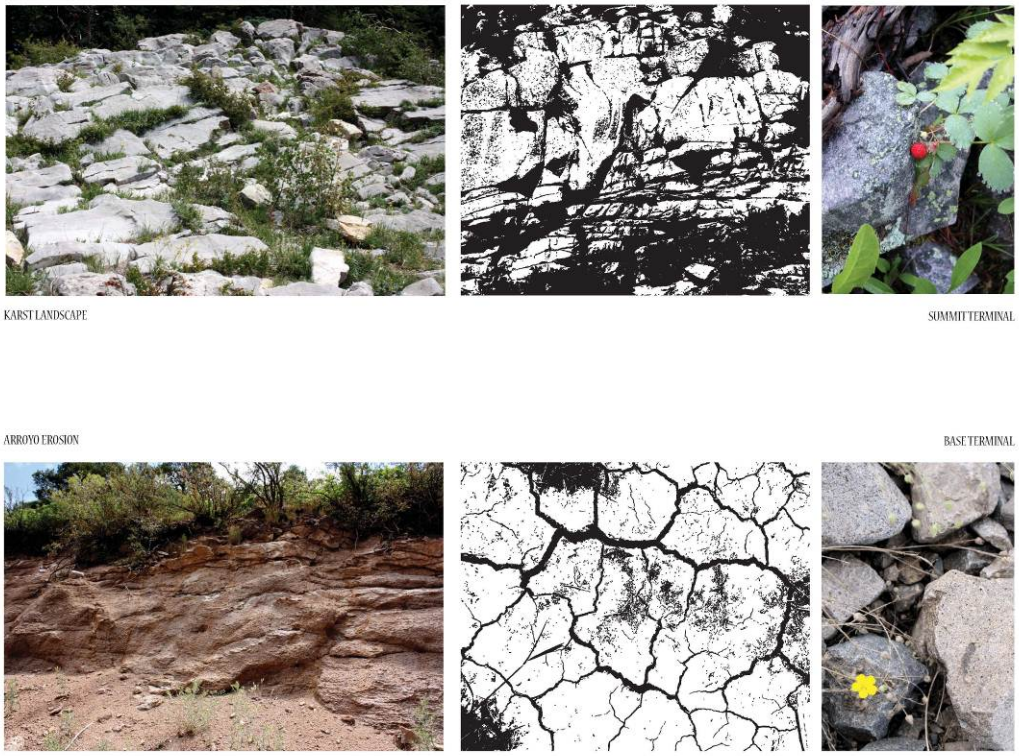


Figure 43 Terrain Study for Base and Summit Terminals.[56]

Building Ecotone

The ecotone concept can apply to human developments on many scales.

Urban Scale:

Urban environments and architecture offer similar ecotone characteristics. At the urban scale, neighborhood edge boundaries often offer a mixture of people and lifestyles. These edges sometimes offer conflict over dominance but can offer a comingling of cultures which then in turn become a hybrid borrowing characteristics from each unique culture.

Site Scale:

At the site scale, ecotones concepts help delineate plant life and arrangement. Identifying appropriate functions for outdoor spaces should be delineated by ecotone conditions. Patio spaces, for example, can be identified by edge conditions. Sites with discernable fronts and backs offer a gradient of functions as one passes through the space. Public functions can occur logically at the front of the site while private functions can occur at the back.

[56] Photographs taken by Amber M Straquadine.

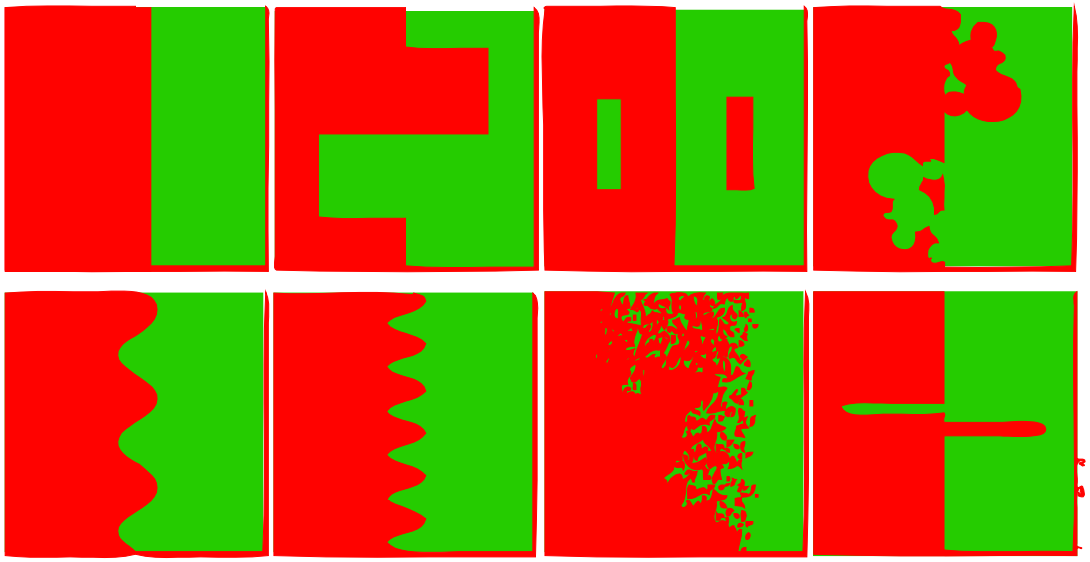
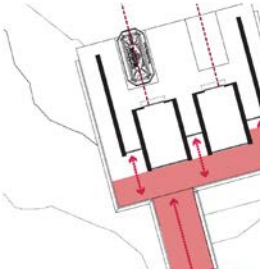


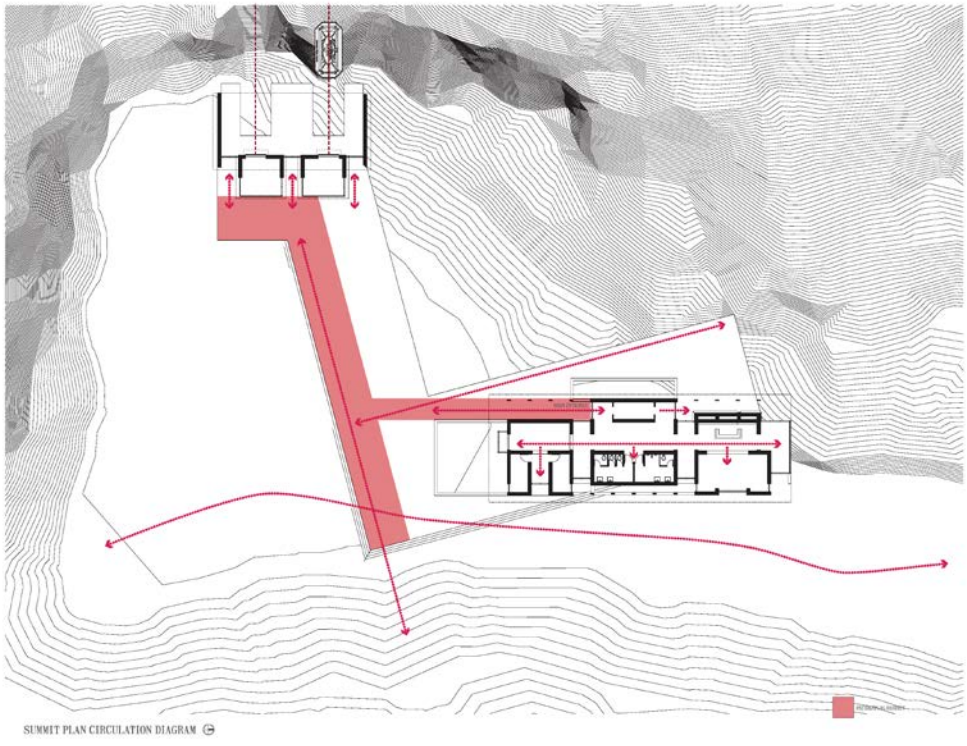
Figure 44 Urban and Nature Ecotone Diagram

Building Scale:

Similarly, buildings offer a variation of habitats from the sunny side of a building to the cool side, from the outdoor space to a transitional space to the interior. Utilizing the concept of ecotone in architecture allows designer to think about those transitions. The transition from wild to tamed, nature to courtyard to patio to sunroom to interior atrium becomes important elements of design integration.

Building and Site Circulation





SUMMIT PLAN CIRCULATION DIAGRAM

Detail Scale:

At the detail scale, the building envelope construction, degrees of openness and types of openings should be derived from edge conditions.

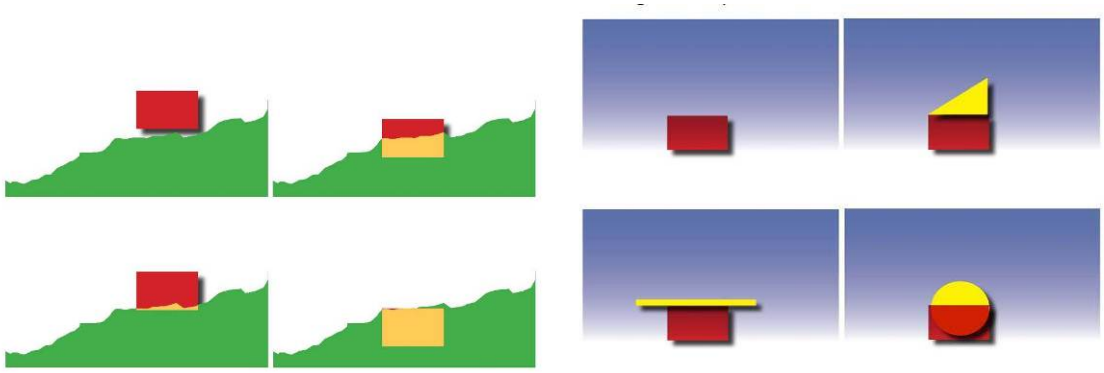


Figure 45 Building Meets Ground Diagram and Building Meets the Sky Diagram

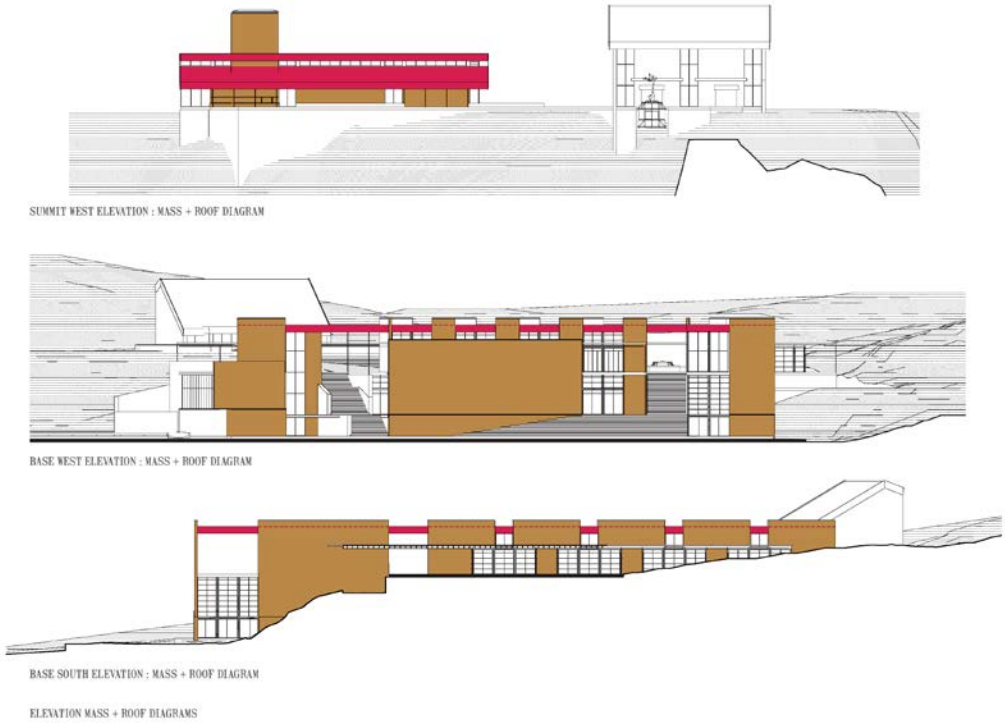


Figure 46 Roof Diagram

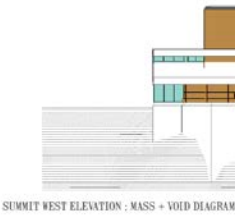


Figure 47 Mass to Void Elevation Diagram

Regional Materials

The Rio Grande Valley is rich in local building materials as shown in Figure 48. The base terminal will be comprised of adobe because of the local craftsmen and availability of clay and mud. The summit terminal will be comprised of rough cut limestone excavated from the site. This would allow for less transportation of material. Both buildings will utilize wood roof structures.

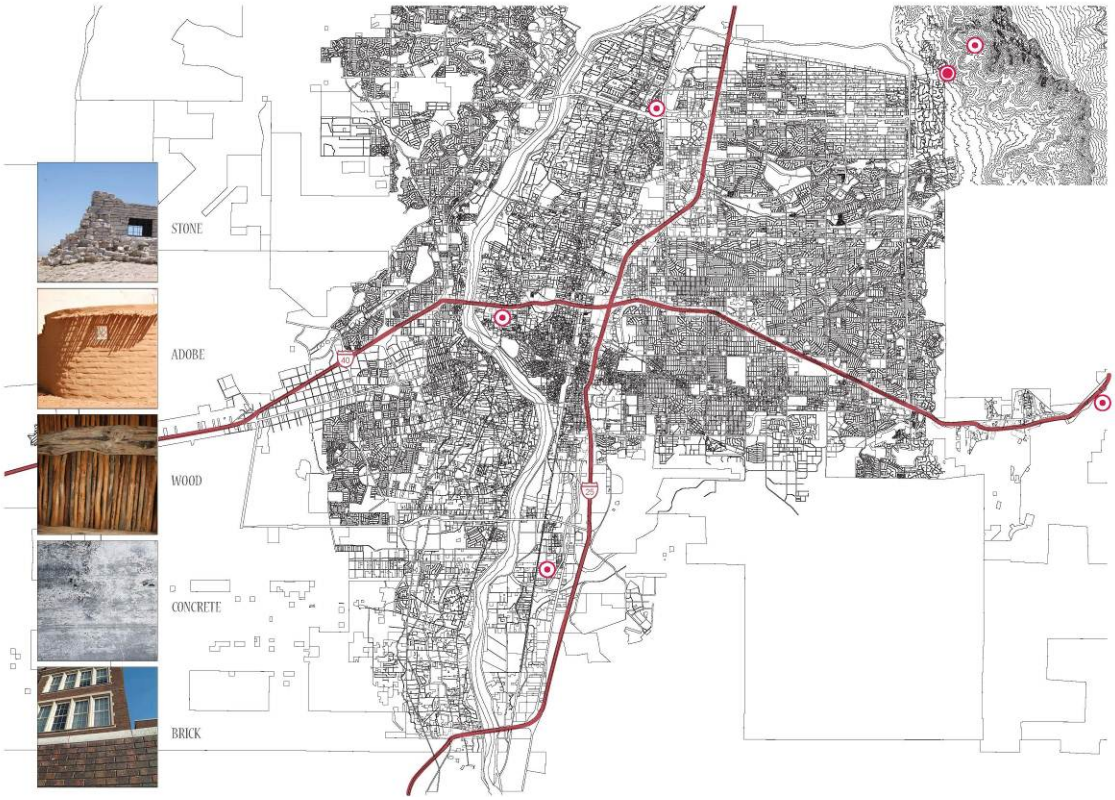


Figure 48 Regional Materials

Active and Passive Sustainability Systems

Passive sustainable systems unitized on this project include organizing program function in relation to solar exposure. In the base terminal, sunny warm plant grow rooms line the sounth side of the gallery wing capturing sun and light for use by plants growing inside. Both buildings utilize operable windows in both high and low places allowing for air to circulate in through low openings and hot air to be expelled from high windows.

Active sustainable systems include the rain water harvesting from both the roof and hardscapes for use in botanical garden exhibits on site. Photovoltaic panels cover outdoor open space allowing some shading from the sun but also a visual connection to the sky.

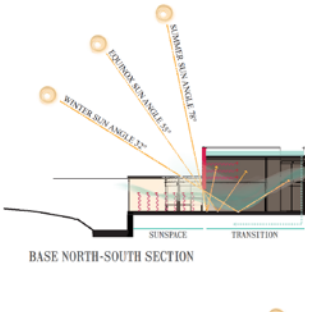


Figure 49 Solar Exposure and Cross Ventilation Diagrams

Applicable Codes and Guidelines

Homeowners Association Aesthetic Guidelines

The Sandia Heights Homeowners Association defines architectural aesthetics as well as placement on site to retain a naturalistic character to the neighborhood. These aesthetic requirements include reduced or minimized roof pitch, local natural colors and building materials, and prohibited view blocking.

New Mexico Construction Code

New Mexico abides by the International Building Codes (IBC). The IBC outlines adobe construction under Section 2108 Strength Design of Masonry. The criteria outlines wall height and width restrictions. New Mexico also supplements the IBC code with additional building guidelines since adobe construction is predominate in the area.

ASLA Sustainable Sites Initiative Guidelines

Because of the extensive integration into the landscape, this project lends itself to the application of the Sustainable Sites Initiative Guidelines developed by the American Society of Landscape Architects. ASLA is working in association with the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden. The U.S. Green Building Council (USGBC), a stakeholder in the Initiative, anticipates incorporating these guidelines and performance benchmarks into future iterations of the LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™. The guidelines defined in the SITES document can be easily attained in conjunction with the LEED rating system. Its detailed criteria dealing with site issues make it a rating system well suited for projects with a larger emphasis on site design. The most unique quality of this rating system is its applicability on projects that do not include a permanent built structure. Large landscape projects such as botanical gardens, municipal parks, and public squares would benefit from applying these strategies.

The guidelines are broken down in a similar manner to LEED. They are outlined into 9 primary categories under which prerequisites and credits are defined. Stars are awarded based on levels of compliance with the guidelines. The ASLA have comprised only one set of guidelines under the Sustainable Sites Initiative that are applicable to all types of projects. This allows users to only a single set of regulations, simplifying its applicability. The guidelines are specifically tailored to site issues and can be easily applied in conjunction to any other sustainability guidelines or codes.

The Sustainable Sites Initiative (SITES™) was created to promote sustainable land development and management practices that can apply to sites with and without buildings such as open spaces in local, state and national parks, conservation easements and buffer zones.

There are several major guiding principles that make the SITES guidelines appropriate to apply at these two building locations. The guidelines encourage developments to make no changes that degrade surrounding environments. Also the guidelines encourage designing with nature and culture as well as fostering environmental stewardship.

Topic	Criteria Achieved by this Design	Points
1. Site Selection		**21**
Select locations to preserve existing resources and repair damaged systems		
Prerequisite 1.1: Limit development of soils designated as prime farmland, unique farmland, and farmland of statewide importance	Not Farm Land	required
Prerequisite 1.2: Protect floodplain functions	Arroyo Protection	required
Prerequisite 1.3: Preserve wetlands		required
Prerequisite 1.4: Preserve threatened or endangered species and their habitats	Ecotone Awareness Program	required
Credit 1.5: Select brownfields or greyfields for redevelopment		5-10
Credit 1.6: Select sites within existing communities	North ABQ Acres Community	6
Credit 1.7: Select sites that encourage non-motorized transportation and use of public transit	Utilization of Existing Tram	5

Topic		Points
2. Pre-Design Assessment and Planning		**4**
Plan for sustainability from the onset of the project		
Prerequisite 2.1: Conduct a pre-design site assessment and explore opportunities for site sustainability	Included in this Document	required
Prerequisite 2.2: Use an integrated site development process		required
Credit 2.3: Engage users and other stakeholders in site design		4

Topic		Points
3. Site Design—Water	**34**	**44**
Protect and restore processes and systems associated with a site's hydrology		
Prerequisite 3.1: Reduce potable water use for landscape irrigation by 50 percent from established baseline	Xeriscaping versus Turf Study included in this document	required
Credit 3.2: Reduce potable water use for landscape irrigation by 75 percent or more from established baseline	Xeriscaping versus Turf Study included in this document	2-5
Credit 3.3: Protect and restore riparian, wetland, and shoreline buffers		3-8
Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines		2-5
Credit 3.5: Manage stormwater on site	Stormwater collection from all hardscape and roof	5-10
Credit 3.6: Protect and enhance on-site water resources and receiving water quality	Stormwater collection from all hardscape and roof	3-9
Credit 3.7: Design rainwater/stormwater features to provide a landscape amenity	Stormwater collection from all hardscape and roof	1-3
Credit 3.8: Maintain water features to conserve water and other resources	Stormwater collection from all hardscape and roof	1-4

Topic		Points
4. Site Design—Soil and Vegetation		**51**
Protect and restore processes and systems associated with a site's soil and vegetation		
Prerequisite 4.1: Control and manage known invasive plants found on site	Plantings according to Ecotone included	required
Prerequisite 4.2: Use appropriate, non-invasive plants	Plantings according to Ecotone included	required
Prerequisite 4.3: Create a soil management plan	Reuse of onsite rocks and	required
Credit 4.4: Minimize soil disturbance in design and construction	Reuse of existing parking lot grading	6
Credit 4.5: Preserve all vegetation designated as special status	Plantings according to Ecotone included	5
Credit 4.6: Preserve or restore appropriate plant biomass on site	Plantings according to Ecotone included	3-8
Credit 4.7: Use native plants	Plantings according to Ecotone included	1-4
Credit 4.8: Preserve plant communities native to the ecoregion	Plantings according to Ecotone included	2-6
Credit 4.9: Restore plant communities native to the ecoregion	Plantings according to Ecotone included	1-5
Credit 4.10: Use vegetation to minimize building heating requirements	Plant Galleries	2-4
Credit 4.11: Use vegetation to minimize building cooling requirements	Plant Galleries and Cross Ventilation	2-5
Credit 4.12: Reduce urban heat island effects		3-5
Credit 4.13: Reduce the risk of catastrophic wildfire		3

Topic		Points
5. Site Design—Materials Selection		**36**
Reuse/recycle existing materials and support sustainable production practices		
Prerequisite 5.1: Eliminate the use of wood from threatened tree species	Use of wood reduced to exposed ceiling joists	required
Credit 5.2: Maintain on-site structures, hardscape, and landscape amenities		1-4
Credit 5.3: Design for deconstruction and disassembly		1-3
Credit 5.4: Reuse salvaged materials and plants	Reuse of existing onsite boulders	2-4
Credit 5.5: Use recycled content materials		2-4
Credit 5.6: Use certified wood		1-4
Credit 5.7: Use regional materials	Adobe and cut stone from region	2-6
Credit 5.8: Use adhesives, sealants, paints, and coatings with reduced VOC emissions		2
Credit 5.9: Support sustainable practices in plant production	Native Plant research labs and exhibits	3
Credit 5.10: Support sustainable practices in materials manufacturing	Adobe crafted locally	3-6

Topic		Points
6. Site Design—Human Health and Well-Being 32 possible points		**32**
Build strong communities and a sense of stewardship		
Credit 6.1: Promote equitable site development		1-3
Credit 6.2: Promote equitable site use		1-4
Credit 6.3: Promote sustainability awareness and education	Ecotone Galleries, Classrooms and Research labs	2-4
Credit 6.4: Protect and maintain unique cultural and historical places		2-4
Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding		3
Credit 6.6: Provide opportunities for outdoor physical activity	Access to Hiking Trails, Ski lift, and Mountain Biking Activities	4-5
Credit 6.7: Provide views of vegetation and quiet outdoor spaces for mental restoration	Courtyard and Observation Decks included	3-4
Credit 6.8: Provide outdoor spaces for social interaction	Activity Patio, Observation Decks, and Sunset Lounge	3
Credit 6.9: Reduce light pollution		2

Topic	x	Points
7. Construction 21 possible points		**21**
Minimize effects of construction-related activities		
Prerequisite 7.1: Control and retain construction pollutants		required
Prerequisite 7.2: Restore soils disturbed during construction		required
Credit 7.3: Restore soils disturbed by previous development	Reuse of existing site grading for buildings and parking	2-8
Credit 7.4: Divert construction and demolition materials from disposal		3-5
Credit 7.5: Reuse or recycle vegetation, rocks, and soil generated during construction	Reuse of existing site boulders	3-5
Credit 7.6: Minimize generation of greenhouse gas emissions and exposure to localized air pollutants during construction		1-3

Topic		Points
8. Operations and Maintenance 23 possible points		**23**
Maintain the site for long-term sustainability		
Prerequisite 8.1: Plan for sustainable site maintenance	Xeriscaping	required
Prerequisite 8.2: Provide for storage and collection of recyclables	Community Recycle Containers Included in Parking area	required
Credit 8.3: Recycle organic matter generated during site operations and maintenance	Xeriscaping	2-6
Credit 8.4: Reduce outdoor energy consumption for all landscape and exterior operations	Landscape maintained by hand due to terrain	1-4
Credit 8.5: Use renewable sources for landscape electricity needs	Landscape maintained by hand due to terrain	2-3
Credit 8.6: Minimize exposure to environmental tobacco smoke	Smoking Prohibited in Wildlife Reserve	1-2
Credit 8.7: Minimize generation of greenhouse gases and exposure to localized air pollutants during landscape maintenance activities	Landscape maintained by hand due to terrain	1-4
Credit 8.8: Reduce emissions and promote the use of fuel-efficient vehicles		4
9. Monitoring and Innovation		**18**
Reward exceptional performance and improve the body of knowledge on long-term sustainability		
Credit 9.1: Monitor performance of sustainable design practices	Monitoring Performance as apart of Gallery Exhibits	10
Credit 9.2: Innovation in site design	Threshold Design and development of site	8

Chapter 5: Design Conclusions

Final Drawings

Site Plans

Final rendered site plans are designed to show the integration of many elements. A strong factor in composing the site plan was to integrate access to the building as well as the outdoor activity space. [Figure 50, Figure 51]

Site Access

The base terminal site plan includes visitor parking, as well as designed trail heads to allow access to the site and through the site by visitors via automobile, mountain bike, horse, or on foot. The summit terminal site plan includes trail access to existing ski lifts, the small dirt service road, and ridge trail hikers and bikers.

Hardscape

The site landscape in both locations is designed to utilize water collection on site and existing boulders. Both site plans convey the hard and softscape materiality. The asphault for the parking in the bottom plan is a large aggregate crushed gravel from on site to allow rainfall to seep below it. The courtyard in the base terminal is made of flagstone that also allows water to seep between the stones to be collected for use in planting beds. The summit terminal hardscape is primarily composed of plank wood deck that allows for rainfall to seep between the planks and run away from the building or into planting beds.

Softscape

Both sites include native vegetation planting beds that require little additional water and are low maintenance. The base terminal includes a rain garden utilizing water run off from the site and includes plantings normally found in arroyos of the area. Natural grasses and cactus are predominating. The base terminal also includes a rooftop garden exhibiting ways of using native plants and rocks in place of a grass covered vegetative roof. There is also a rock garden that incorporates boulders found on site during construction. This garden allow for native plantings to infiltrate naturally.

The summit terminal includes small planting beds near the building that will capture rainwater directly from the roof without being stored in cisterns. Plantings in these areas would include rare wildflowers and natural grasses that may be scarce and delicate in the area but are native. Small saplings may be grown in these areas until they are ready for transplant.

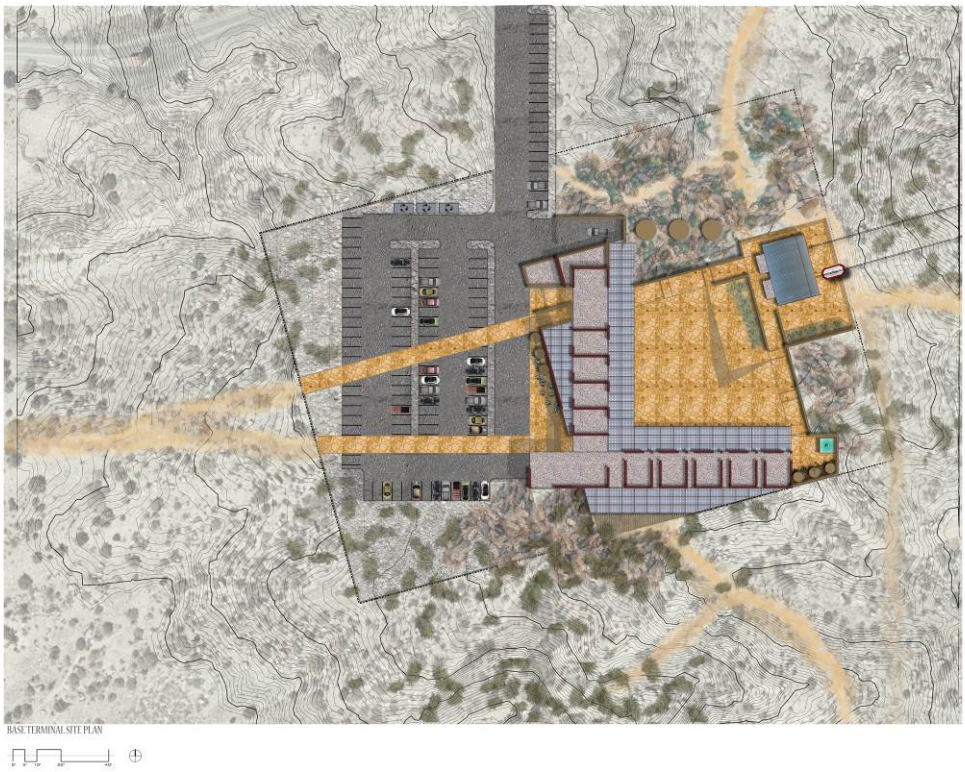


Figure 50 Base Terminal Site Plan

Figure 51 Summit Terminal Site Plan

Site Sections

Site sections of both terminals highlight the distinct differences in terrain as well as city and natural context. Both site plans show the relation between the interior space, the outdoor activity space, and the transition between the two. The site section also helps to highlight the variation in size of the two buildings. [Figure 52, Figure 53]

Figure 52 Base Terminal Site Section

Figure 53 Summit Terminal Site Section

Plans

The building plans for both buildings highlight the relationship between building functions as well as their relationship to the exterior. [Figure 54, Figure 55] The base terminal plans include a grand lobby accessed from the parking. This functions to welcome guests that may not be familiar with the variety of functions. The bottom building is arranged with two wings.

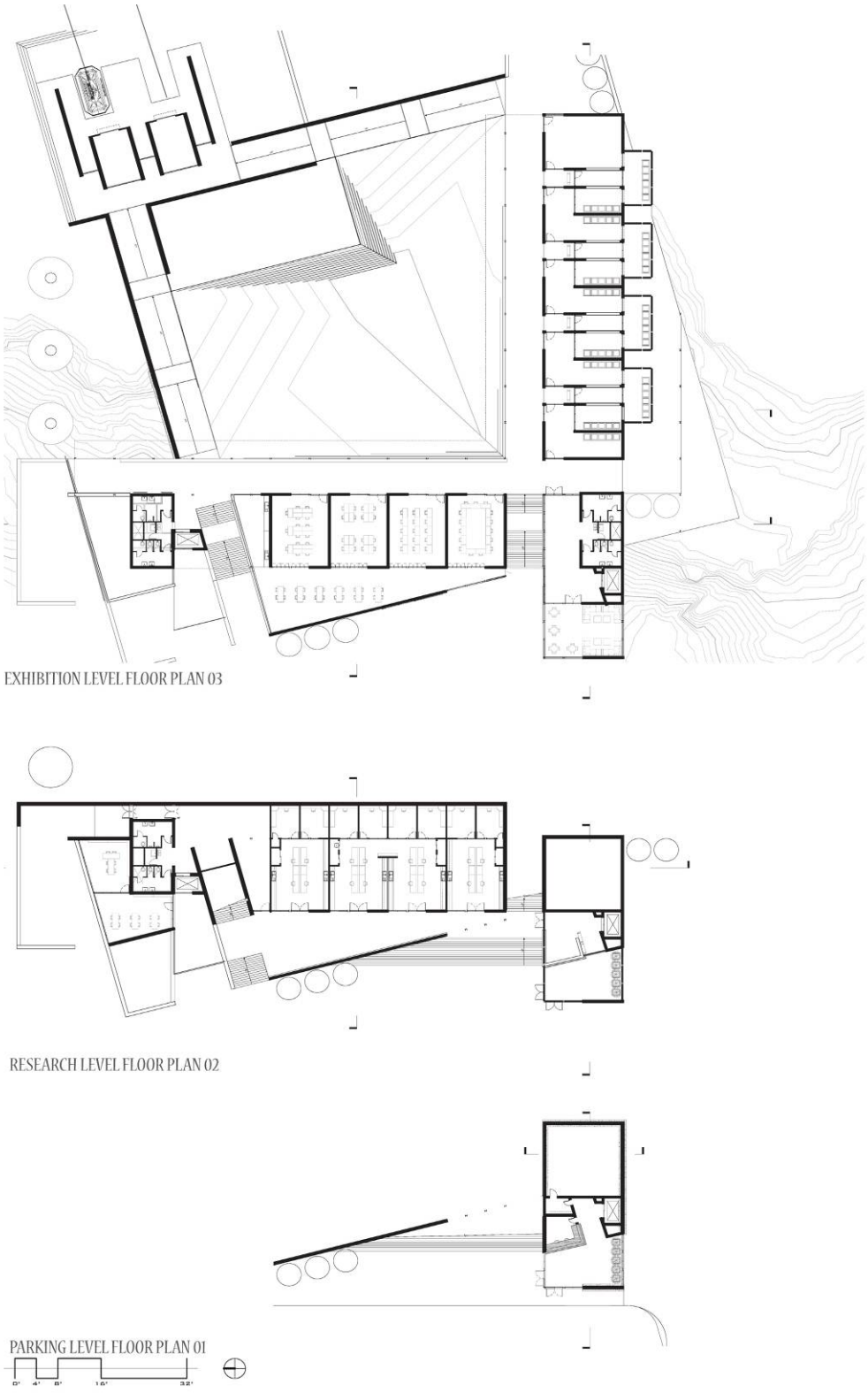


Figure 54 Base Terminal Plans

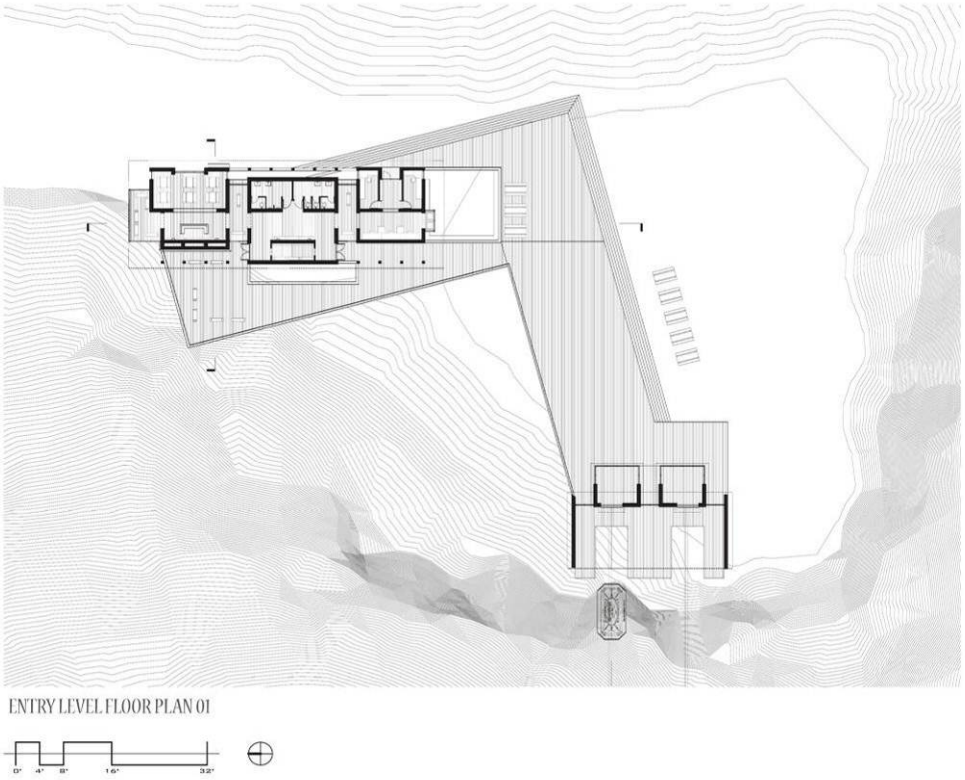


Figure 55 Summit Terminal Plan

One wing serves as utilitarian functions including biological research and classroom functions while the other wing serves as gallery function.

Because of the outdoor function of both buildings as well as the mild climate, the primary circulation is located outdoors. This allows for less square footage to temperature control. The summit terminal is arranged in 3 small volumes with the main entry in the middle one. One side volume houses field research functions while the other side volume houses an indoor lounge and activity area as well as an enclosed observation gallery. The three primary functions are connected by small reflecting galleries.

Elevations

The elevations for the two buildings reflect the materials local to each location as well as appropriate wall openings and roof structures to respond to climate needs. The base terminal uses adobe massing walls and strategically placed window openings that respond to summer afternoon sun. The summit terminal uses rough cut limestone found on site and minimal window openings to ensure heat detainment. The base terminal has a a flat roof to allow for rainwater collection while the summit terminal has a pitched roof to shed snow into planting beds.

Figure 56 Bse Terminal North and West Elevations

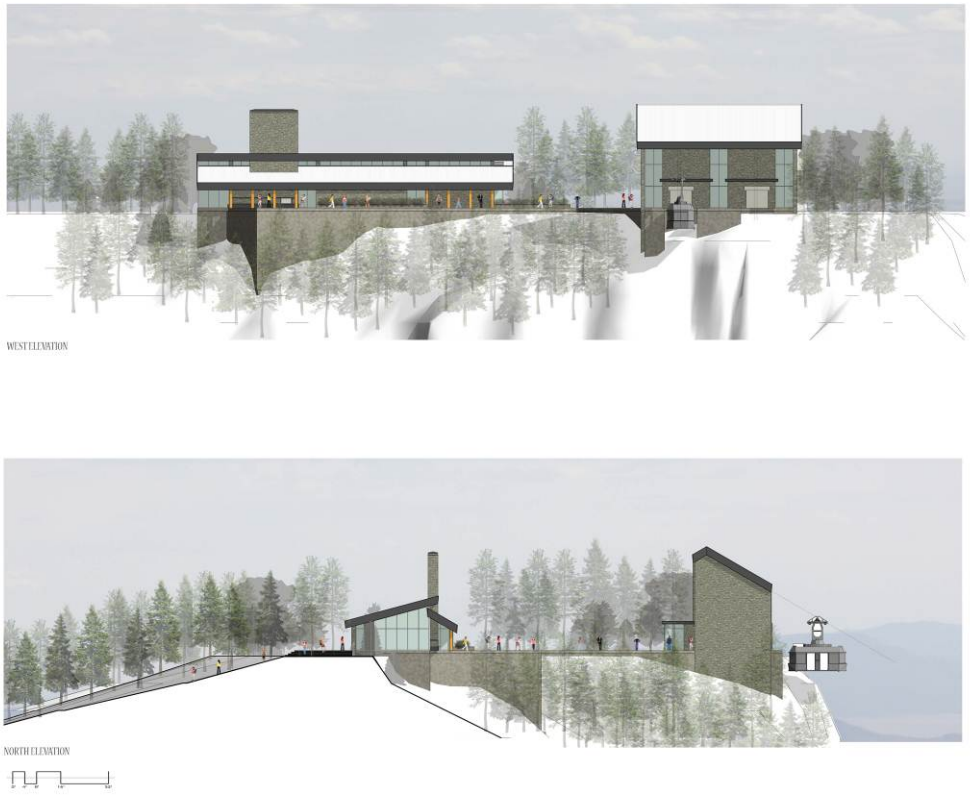


Figure 57 Summit Terminal North and West Elevations

Sections and Wall Sections

Building sections show the relationship between galleries in both buildings as well as the rhythms of small and larger volumes. [Figure 58, Figure 59] The wall sections in Figure 60 reflect the construction of the varying material and the detail scale response to climate including insulations, moisture barriers, and vapor barriers.

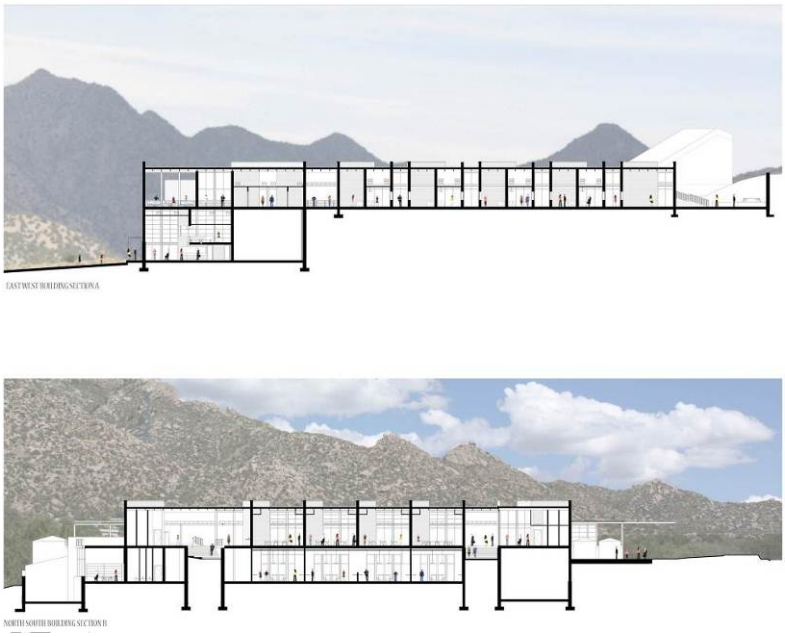


Figure 58 Base Terminal Sections

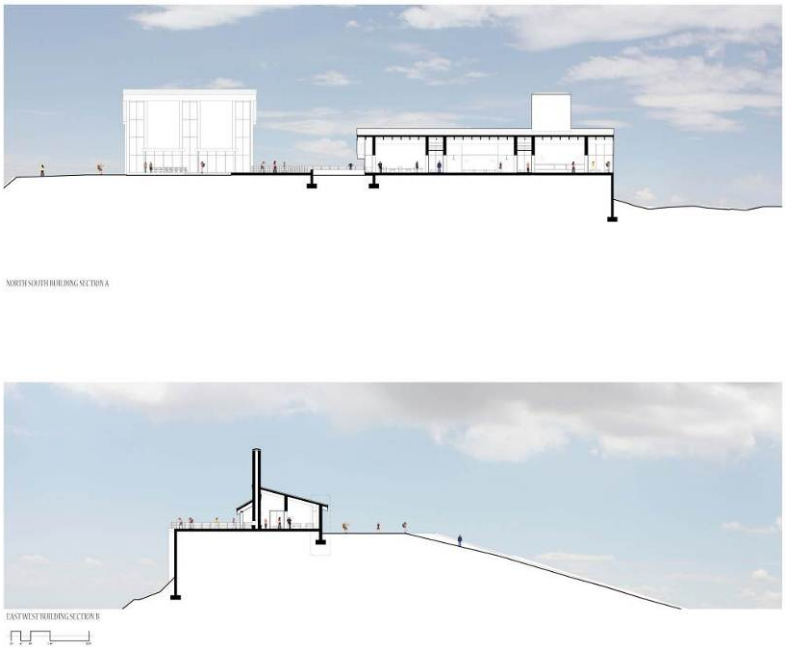


Figure 59 Summit Terminal Sections

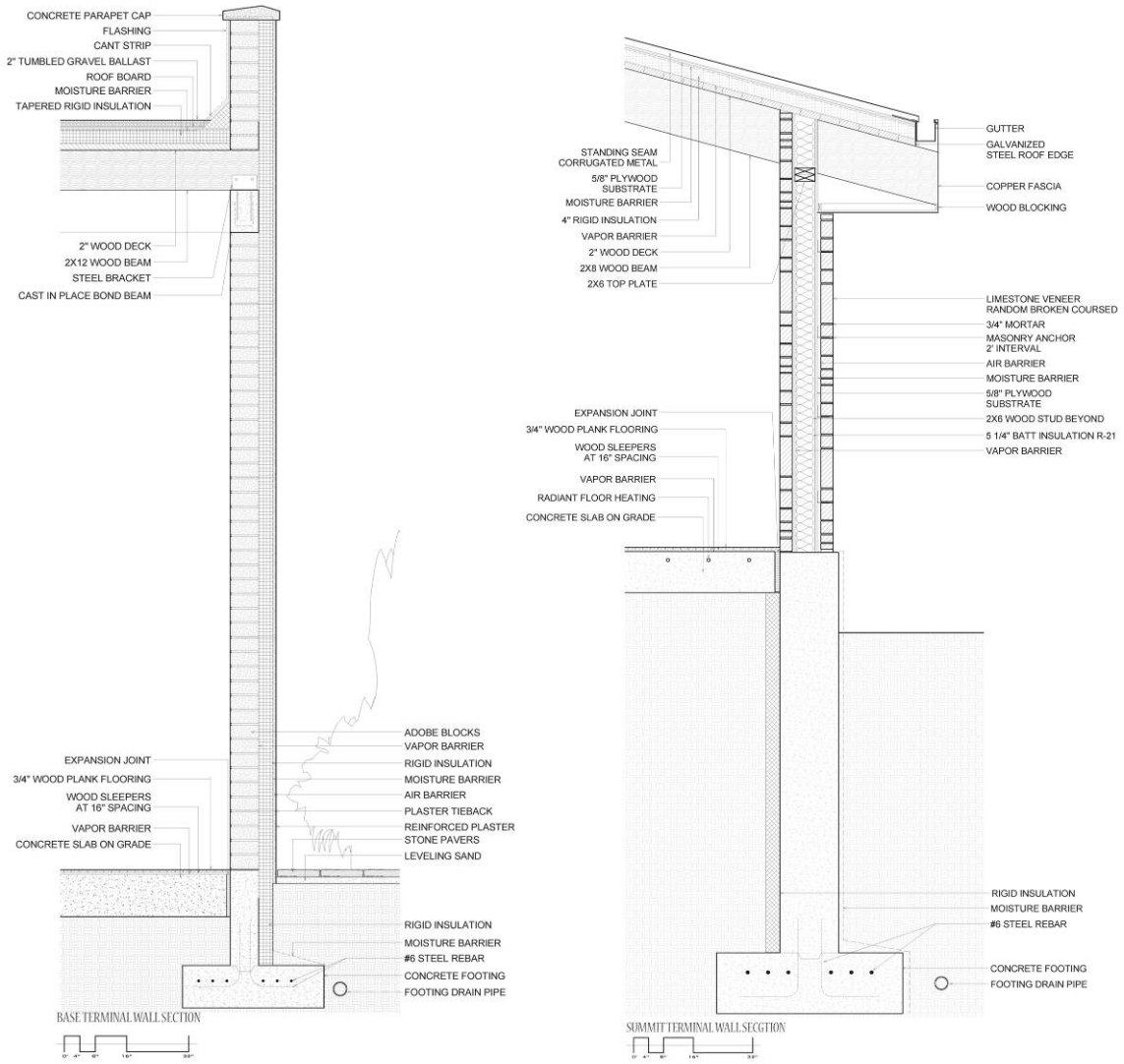


Figure 60 Wall Sections

The Pathway as a Journey

Through the design process, it became apparent that the holistic experience outlined as a story or a journey was an important way to communicate the message of the project. This project became an investigation between the built and natural environments. The best way to depict and describe this reconciliation between opposites was to allow each to coexist along the journey. The project became about the experience along the journey as much as it was about the sustainable features of the building. By allowing the journey to take place, the project becomes more personal. The journey allows people to relate more readily to the idea of adapting sustainability into each person's lives. The beginning of the research process presents many facts and figures to describe the importance of sustainable living but does not present the information in a manner that allows people to

relate to on a humanistic level. By describing this idea in terms of a story or a journey, the idea can be conveyed in small doses that visitors might be able to incorporate into their daily living.

Weekend adventure seekers, young and old, that live at live below the Sandias have a brazen sense of exploration that draws them to these mountains. Afterall, this mountain looms over their daily. 1,700,000 visitors make the treck to National Parks in the state of New Mexcio each year to drink in this enchanting landscape.

Early in earch morning, 600,000 Albuquerque metropolitain area dwellers peer out their winslows at this particular mountain to see what the day will hold, and how they should prepare. In winter, if the ridge is covered in snow, and the sky is clear, the day will undoubtebly be bright and crisp. In late summer, storm clouds might cloak the entire mountain in a mystic fog by afternoon bringing rain to quench the thirsty sands. The people who live near will watch and wait in anticipation of how this mountain will portray each day.

Evenings are marked by the vivid hues of reds and purples that the mountain turns as the sun sinks beyond the western horizon. This incredible array of colors is how this mountain earned its name, Sandias. These ridges hold the moods of the high desert and reflects them as if communicating with the people who live at its feet.

Water is a driving force in this landscape. It's initial existence as ocean helped form the stripped ridges of the mountain, and deposited tiny crustatians to be fossilized in the stone. These fossils used to dot the rocks of the ridges, many of the exposed loose stones have been collected by visitors for what they deem to be safe keeping.

Today, water's absence drives the ecology of this region. While the elevation is more than 5,000 feet above sea level spanning to close to 11,000 feet and the temperatures may not reach sweltering highs, rainfall is less than 10 inches yearly, predominatly falling during the Chubasco, or short rainy season in July and August. The gush of water in summer carves natural arroyos out of the sand and dictates what specific plant life will grow.

On the weekends, cars filled with weekend adventurers make their way through the city streets. Typical urban grid of boulevards flanked on either side by parking lots. Box stores beyond. Side streets hold neighborhoods, schools, and libraries.

The car turns onto Tramway Blvd. This road is unique in comparison to all the other streets traveled in the city. As the car rides along this road, passengers, unknowingly trace the boundary line of the city limits. Traffic lightens and speeds up, freed from the barriers of the city. There are no buses and few stoplights. To the east, the Sandias. To the west, Albuquerque. Neighborhoods of custom homes are set back unusually far to incorporate a strip of nature. A walking path is fully inset within the bushes and shrubs between the homes and the speeding cars. Bikers and hikers sprinkle the sides of the roads at sunrise and sunset.

As the car heads north, as if to cruise completely beyond the city, a small unassuming stop sign marks the turn off. The turn off seems to lead visitors into an exclusive neighborhood nestled into the foothills. The road bends away from the neighborhood and gives way to a quaint sign and guardhouse marking the sacred entrance.

One dollar. The cost of admission per vehicle. For one dollar, a car full of people will be granted access to 100555 acres of nationally protected wilderness here in the Sandia Wilderness, a part of the Cibola National Park. A small price, and largely a ceremonial act as the volume of visitors probably could not cover the salary of the park ranger collecting fees.

Visitors deposit their car in the parking lot at the base of the hill, just beyond the guardhouse. The last remnants of urban life begin to fall away. Visitors tumble out of their cars, stretch big, breath deep, and look out over the organized little city from which they emerged. Many note the thick blanket of smog below, some grumble but all of them drove.

Ascension into wilderness areas changes visitors. Those who might litter on the highway, now save their trash. Those who might throw burning cigarette butts out in a bush, now carefully extinguish them on their shoe and save them. People breathe deeper, notice the colors. Most people are enchanted. There is a reverence for the land that most do not hold for their own front yards.

Visitors now filter through the parking area and into the lobby. They investigate their options. Most ramble through the in door and outdoor corresponding exhibits on their way up the hillside. These exhibits depict a story of the interaction between man and nature. Some stories of man succumbing to nature's forces, other stories of man taming its wild, and still others stories of man harnessing nature's offerings. Some stories with happy endings, other tragic but all stories end justly.

The temperate climate in the high desert allows people to linger out doors. As visitor's progress from exhibit hall to exhibit hall, they encounter an out door plaza. The plaza is defined on two sides by building. The other two sides are defined by the hillside. The plaza is filled with activities. A family gathers for picnic. A volunteer group huddles in a circle for instructions before heading up the mountain to gather photographs. A Boy Scout troop laces up their boots for their first of many hikes. Some neighborhood residences linger on the steps awaiting their meeting in one of the community rooms.

As visitors walk down the colonnade they discover that the pathway continues. The end of the colonnade marks the beginning of the hiking trails. It is the end of the protection of the city and the beginning of nature's exuberance. The vast network of hiking trails on the western face of the Sandia Mountains link neighborhood to neighborhood. These trails also climb the mountain side and loop around the mountain's ridge. The trails lace through the natural history and ecology of the mountains. Hikers ascend 5000 feet in elevation change by passing through 4 distinct ecotones on their way to the Crest.

Visitors may choose to ascend the mountain via aerial tram. The tram grants city dwellers an express journey into nature. In 15 minutes, riders experience the 4 distinct ecotones and one mile elevation change. People file on to the little cable car, pointing upwards, wondering where will this journey end. The cable cars seem to disappear over a small sandy hill in the near distance.

As the tram car climbs the cables to the first of two towers, the announcer points out rock formations on either side of tram. That sandy hill that visitors could see from the terminal platform is in actuality comprised of many car size granite boulders deposited at the foothills while the mountain was being formed. They have weathered as the rest of the mountain has weathered when the seas receded exposing this incredible landscape. The vegetation begins to dense and green as the car creeps up the mountain.

The tram now reaches the second tower; it seems that the car will not make it over the ridge but rather slam directly into the rock face. Anticipation mounts.

At the last second, the car sweeps upward, past the tower and suddenly gives way to a vast canyon below. As visitors trace the cable upwards with their eye, the destination point is finally revealed. This marks the halfway point in the tram journey and also the highest point in which the tram car is dangled above the canyon floor.

The announcer begins to tell a tragic story of a plane crash in this remote canyon in the 1970's. He points out that debris can still be found along the hiking trails as it was too treacherous to remove. As minds wander, it might occur to visitors that these canyons hold many stories, some of which are only partially recounted, some of which were never told. Some of tragedy, such as the hang glider who slammed into the cliff face as a result of an unexpected gust of wind that swept up the mountain side. Some of triumph, such as the war veteran who returned home to hike his beloved mountain with prosthetic legs.

Though these stories may not be memorialized, they whispered in the wind and they sparkle in the sand. As the car creeps close to the top of the ridge, the tram riders can see hikers sprinkle the ridge like little ants climbing on grains of sand. The air is thin now and clouds wisp by, brushing the tree tops with incredible speed.

The tram car slips into its docking station and rocks to a hault. Riders file out of the car with politeness in their movement and yet an excitement in their voices at the Summit terminal where a new environment awaits exploration.

A singular deck extends north and juts over the ridge framing views of the little city to the west and the mystic ridge to the north. The small stone lodge seems to be carved out of the rock and anchors the deck. The deck is filled with activities.

Some hikers sit on the steps allowing their dogs a chance to lap up some water before their trek back down the mountain side. A few mountain bikes have been deposited against a railing, unchained, left on blind faith. In the wilderness there is a certain respect people have for others and for the sacred place they share. It is an unwritten value that everyone here holds in common. It is civilization where these people become skeptical of others. Perhaps it is the enchanting place that evokes such reverence for nature and for fellow man.

The Boy Scouts have paused at one of the picnic tables, sprawled out a few trail maps and discuss a final plan of action before marching down the steps and onto the dirt trail heading north. Their destination, the Kiwanis Hut, 15 miles down ridge. They treck on with purpose thin their eyes and excitement in their step.

To the East, the blue painted ski lifts rise unusually far above the ground as it is spring time and the usual 42 inches of snow has melted away allowing a green meadow to grow. The little chairs dangle on the cables, carrying mountain bikers and visitors from the east side of the mountain. People from all over the area escape to these higher elevations for relief from the heat and sometimes the dust.

The ridge trail is busy with hikers. It is mostly flat and easy to navigate, making it accessible to a large variety of hikers with varying skill levels. There is a little girl, who wants to climb right up to the edge and dangle her toes, allowing rocks to bounce like rubber balls down the cliff. Her dad holds tightly to her arm, ensuring that any sudden squirm would not result in her bouncing down the side of the cliff like those rocks beneath her feet.

The tram allows all types of visitors the chance to look back on the city in which they live. Some ride the tram for the sheer excitement of the journey, gulp in the views from the decks, and return without stepping off the built path. Others catch the early ride, 8am, with the intent of spending the entire day basking in the mountains offerings. Everyone jumps at the chance to linger on the mountain top during sunset. The entire landscape turns every color of red, orange, purple, and pink imaginable in the short time the sun takes to sink beyond the horizon.

The journey back down the mountain side is equally as exciting as the ride upwards. The views of the city beneth the mountain, and the lush river valley that slices it in half are dominating. As one's eye looks further beyond the tiny organized urban grid, the blackend chared mesa beyond flattens out and disappears on the horizon.

The tram car slips down the mountain gently setting visitors back on the ground. People pour out of the tram car, down the ramp, past past the plaza and building with satisfaction. Time well spent, and a journey to retell.

Summary

Objective One: Building with Climate in the High Desert.

	Purpose:	Grassland Ecotone Elevation- 5280ft	Spruce-Fir Ecotone Elevation- 10560ft
		Site	
Design Configuration	Minimize Solar and Wind Exposure	15 degree shift from cardinal direction to reduce solar exposure from south and west	Long bar rotated to minimize wind exposure from North. Deck to minimize wind gust up mountain face
Vernacular Consideration	Seasonal Planting Beds in proportion to water available	Rock Garden, Rain Garden, Cactus Garden	Reduction of impact based on remoteness of location
Modern Technology	Rainwater Harvesting	From Hardscapes, Parking	From Deck?
		Building	
Design Configuration	Cross Ventilation	Narrow bar buildings with operable high windows to expel hot air	Narrow bar buildings with operable high windows to expel hot air
Design Configuration	Roof Slope and Type adapted to climate	Flat roof with parapets for rainwater harvesting	Sloped roof with long overhangs allow for shedding of snow
Vernacular Consideration	Maximizing outdoor spaces	Plaza and Exterior Building Circulation	Deck and Exterior Building Circulation
Modern Technology	Harnessing Energy Opportunities	Outdoor patios covered with photovoltaics allowing visual connection to the sky while gathering energy from the sun	
		Program	
Design Configuration	Flexibility	Reconfiguration of community rooms for varying functions	Reconfiguration of community room for varying functions
Vernacular Consideration	Indoor program and outdoor communal space relationship	Options for community and research functions to be moved outdoors	Options for community and research functions to be moved outdoors

		seasonally	seasonally
Modern Technology		Research Labs	Field Research Station
Tectonics			
Design Configuration	Reconciling Interior Program and Climate Exposure	Balanced Glazing openings and Massing Walls according to function and climate exposure	Reduction of Glazing openings to massing walls according climate exposure
Design Configuration	Thermal Massing	West Adobe wall protects interior spaces from overheating in the late afternoon. Eastern Glazing is shaded by the mountain in the early morning.	East and West Stone wall to collect heat from the sun in the early morning and late afternoon
Vernacular Consideration	Local Materials and Traditional Craft	Earthen Wall Construction with timber vigas	Stone Wall Construction with timber vigas
Modern Technology	New Materials	Some Steed Frame to reduce use of wood and Added Insulation	Steed Frame to reduce use of wood and Added Insulation

Objective Two: Highlight dialectic relationship between Site and Building

			Bottom	Top
Site				
Site - Place		Undisturbed Land	Arroyo Protection	Minimal site disturbance
Building		Outdoor Rooms	Courtyard and Patios	Decks and exterior fireplace
Connection	Evolving Process	Pathway as Journey	Ramps as Nature Walk and defining boundry between built and natural environments	Integration of Ridge trail
Building				
Site - Place		Response to site conditions	City Grid bisected by natural topography geometry	City Grid bisected by natural topography geometry
Building		Boundary	Grand Stair slices through building connecting city to National Park	Deck juts outward from the ridge connecting the ridge to the city
Connection	Evolving Process	Transition Spaces	Colonnade	Sun Deck
Program				
Site - Place		Research	Laboratories	Field Station
Building		Community	Workshops	Lounge
Connection	Evolving Process	Information	Exhibit	Exhibit
Tectonics				
Site - Place		Local Building Material	Earthen Walls from site Wood roof construction from mountain	Stone Walls from site Wood roof construction from mountain

Building		Local Building Craft	Adobe and Plaster, Vigas	Stone work Vigas
Connection	Evolving Process	Dialogue Between Site and Building	Smooth and organize surface contrasting against rocky terrain of same material	Smooth and organize surface contrasting against rocky terrain of same material
Connection	Evolving Process	Detail connections between the two	Roof sits within natural ruins	Roof sits above natural ruins

Glossary of Terms Native to New Mexico

Plaza	A communal gathering place originating from the central squares of Spanish settlements
Bosque	Small grove of trees near a river
Asequia	Man-made canals used for flood irrigation of farm land
Arroyo	Storm water diversion channels within a city or natural drainage land formations outside of a city
Adobe	A building modular comprised of desert grasses, a clay-mud mixture and water, hand formed and sun baked
Vegas	Timber used as wood joists to hold up roofs or second floors originating in Pueblo architecture
Pueblo	Tightly compact housing communities ranging from one to three floors high and made of adobe
Kiva	Pithouse used for storage and community events
Luminarias	Candles set inside paper lanterns, commonly brown bags, filled with sand. Usually set along streets to light the pathways at Christmas.
El Camino Real	The Royal Road, trade route between Northern Mexico and Mexico City during Spanish rule.
Sandias	Literal translation, Watermelons
Rio Grande	Great River

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