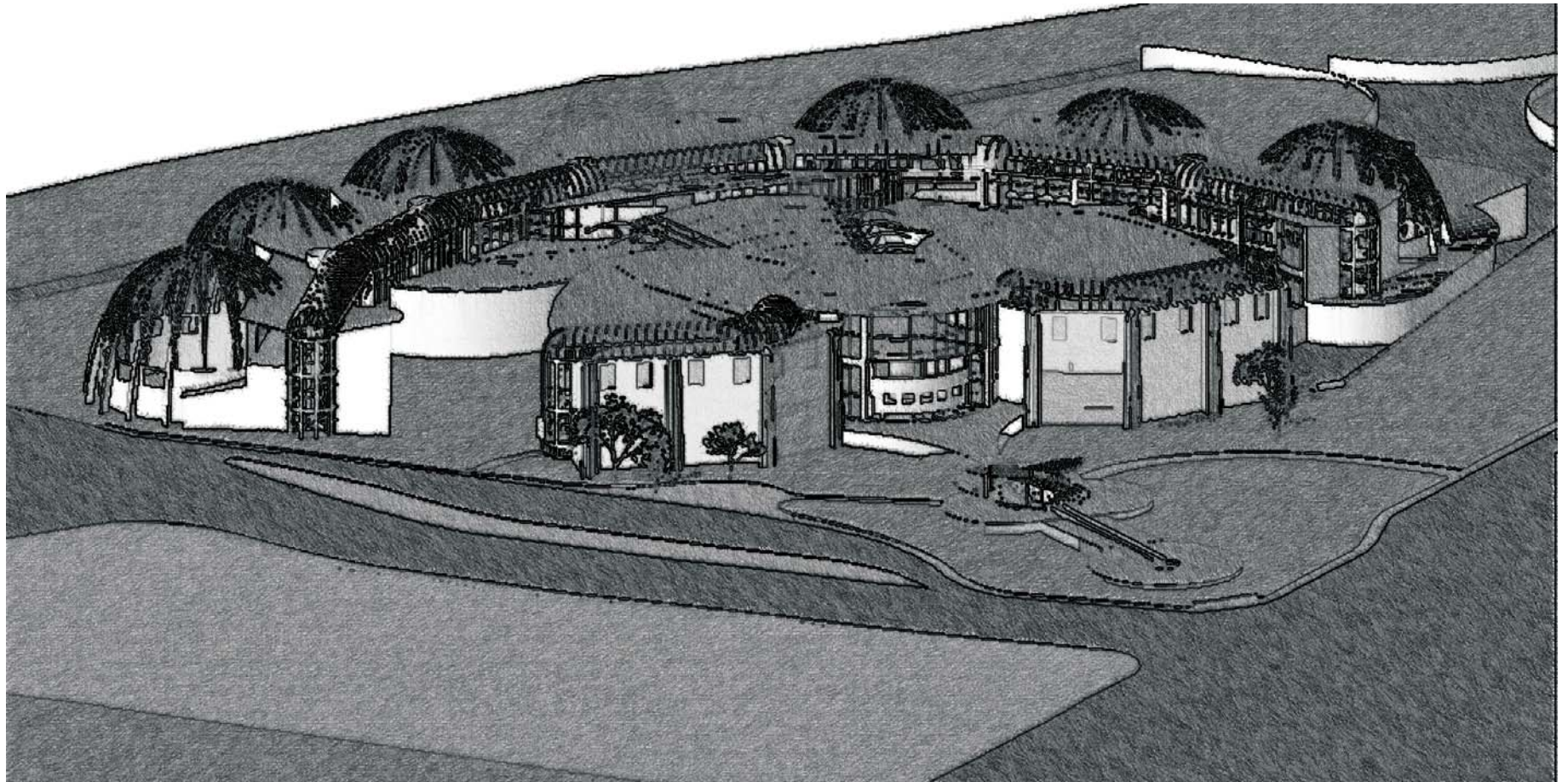




IMAGINE
DREAM
DISCOVER



IMAGINE, DREAM, DISCOVER

Travis W Hamera

A thesis submitted in partial fulfillment of the requirements for the degree of

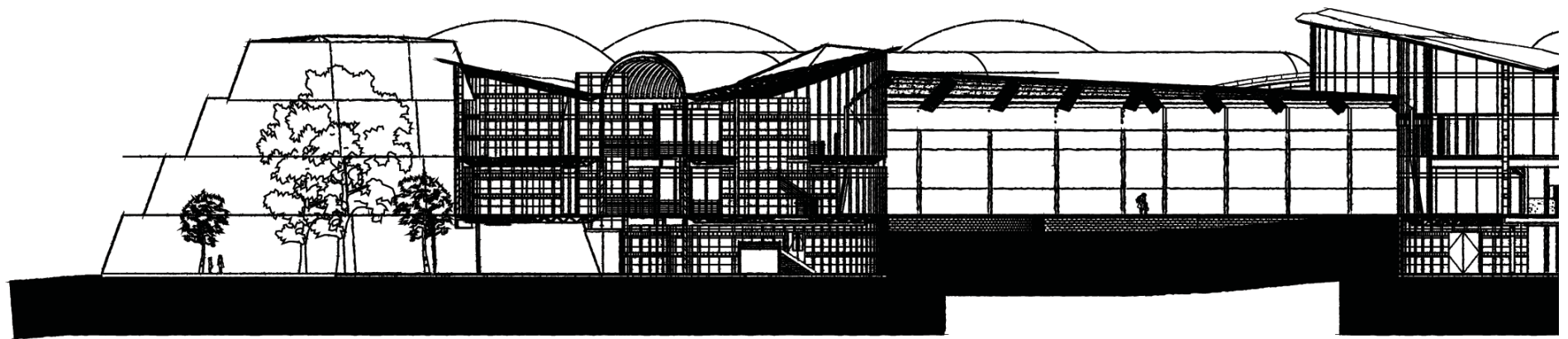
Bachelor of Architecture

at

California Polytechnic University, San Luis Obispo

June 2005

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I dedicate this book
with my deepest love and gratitude
to my wife

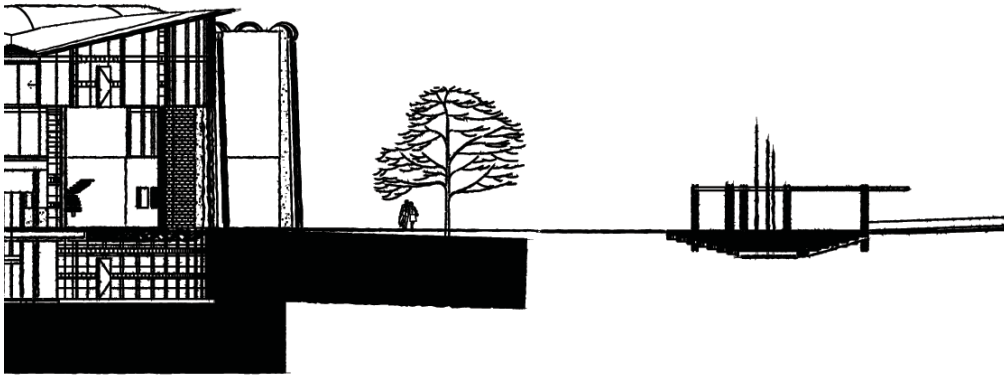
Trisha Hamera

and in loving memory of my father

David Lawrence Moorefield

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PREFACE

In the winter of 2002, my wife, a local marine biologist and educator, began formulating a concept for educating children about science. Her goal was to create a non-profit learning environment that could promote science education through play, creation, and discovery. She hoped that by providing a look into environments traditionally inaccessible to the public, children would be inspired to learn about the biological, physical, and chemical branches of science. A facility such as this would provide an opportunity for the public to explore nature and develop an understanding and respect for our environment by promoting science in a positive light.

Little did I know that I would spend the next three years in countless discussions on the subject. I found myself intrigued not only by the architectural implications of this type of project but also by the ideas and concepts behind it. The largest challenge appeared to involve bridging the gap between scientific tourism (such as is seen in traditional zoos, aquariums, and arboretums) and science education. Could we downplay the element of tourism but still emphasize the educational process? Is there an existing pedagogy to follow that could effectively supplement the curricular framework of the public educational system? And finally, how could the architecture of this place reinforce and exhibit the concepts surrounding this type of learning center?

During spring of 2004, as I began researching possible topics for the senior thesis of my Bachelor of Architecture at California Polytechnic University in San Luis Obispo, I found myself continually returning to this project. I came to realize that this was not only a possible thesis project but that this was also an opportunity for my wife and me to test our theories. The thesis was also a means of bringing this project to the attention of the general public.

This senior thesis has provided me the opportunity to move forward with the conceptual creation of “Imagine, Dream, Discover”, a science exploratorium extending beyond the traditional structure of zoos, aquariums, and arboretums. Through the integration of real self-exploration for visitors through the availability of “hands-on” learning materials, tools, and supplies, IDD can be effective and successful.

ABSTRACT

This thesis is the culmination of investigations into two ideas surrounding the feasibility of creating a new format for science education centers. The first investigation involves evaluating existing pedagogies for educating children and either developing a new style or modifying an existing one. This investigation is followed by an architectural application of these ideas and theories into a center called Imagine, Dream, Discover.

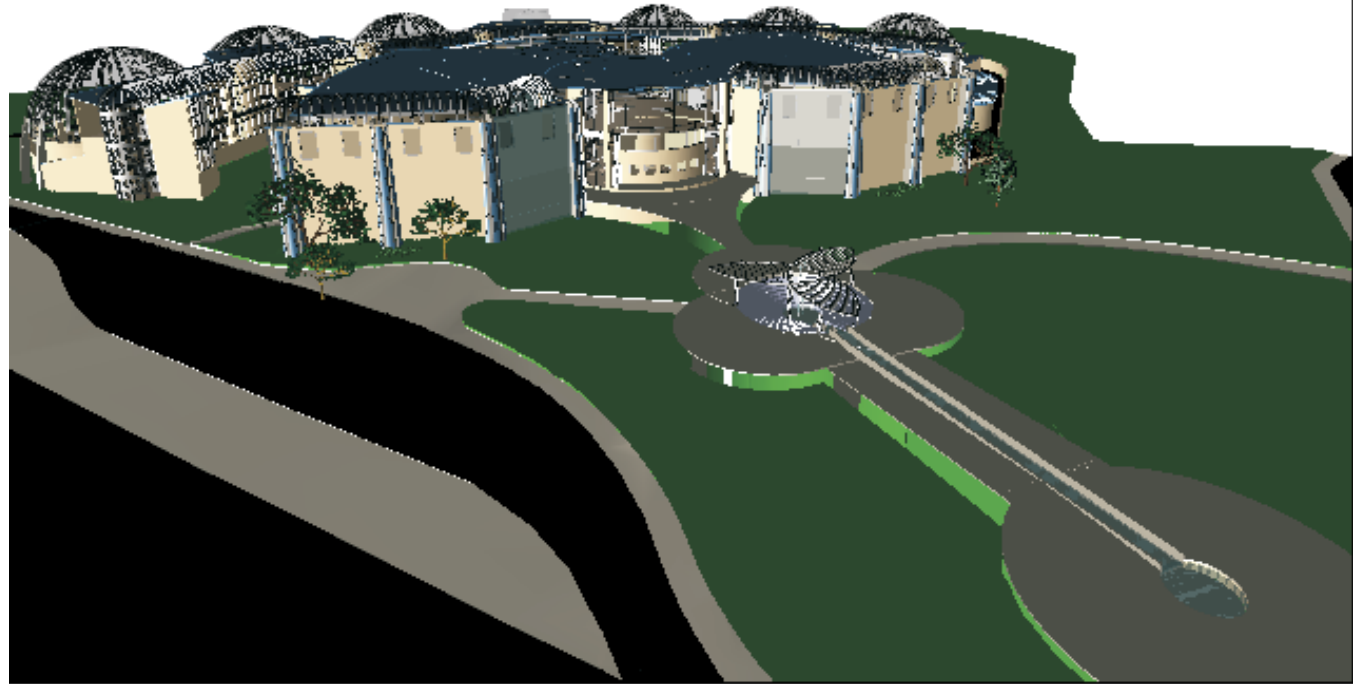
Existing Pedagogies

There are many pedagogies for education in use today. Many of them appear inadequate for effectively educating children in a positive and “hands-on” manner. Through my research, I have found that one method stands out as time tested and successful: Preschool. Most members of the science community are familiar with those who founded the curriculum used in many of today’s preschools. People such as Jean Piaget and Friedrich Froebel were pioneers in developing theories surrounding the science of human thought and development. By applying their principles to children of all ages we can begin to effectively and successfully educate children about science.

The IDD Center

The next stage of this project involved developing an architectural form to house these concepts and ideas. I believe that I have designed a nature exploratorium that is open and engaging for all age levels to discover and learn. By providing a facility rich in the diversity of exhibits, tools, and manipulatives, there can be endless possibilities for learning and discovery.

I hope both explorations will support future inquiry on the subject and the development of new science exploratoriums around the globe.



THESIS STATEMENT

Today's public school system is in dire need of a supplemental educational system for teaching science to children. The current pedagogies (set forth by many of the curricular frameworks utilized by our public systems) are inadequate, as evidenced by the lack of science-related knowledge in our youth.

My solution is to create a non-profit learning environment for all ages centered upon accessible and interactive learning. The intention is to design a symbiotic nature exploratorium to accommodate this science learning environment. The center, "Imagine, Dream, Discover," is to be located within California's San Luis Obispo County and will include, at a minimum, the integration of the concepts behind traditional zoos, aquariums, gardenscapes, libraries, and educational facilities in one cohesive design package that follows the requirements and needs of both the design client and end-user client.

Programmatically, the design will address many issues including, but not limited to:

- Site selection
- Environmental cohabitation of ecology, energy, landscape, and architecture
- Principles of sustainability where achievable
- Mechanical systems integration
- Safety and security
- ADA Accessibility
- Etc...

Other centers with similar ideas and goals have already been built in the U.S. and in various countries across the globe. The intention is to bring a project of this dimension to the California coast. Located approximately halfway between the two major California hubs (Los Angeles and San Francisco) San Luis Obispo County is an ideal location for this facility.

This project will involve the creator (a local marine biologist), and an extensive list of consultants including: the standard architect's consultants (structural, electrical, energy, geotechnical, etc...), consultants of personal selection (permaculture experts, local architects, etc...), and program specific consultants (i.e. systems engineers, biologists, museum/zoo/aquarium curators, educators, and product manufacturers).

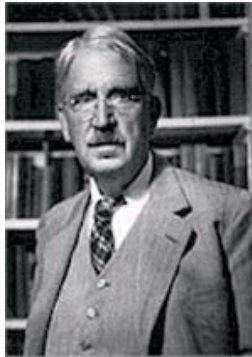
PRESCHOOL AS A PEDAGOGY FOR SCIENCE EDUCATION



Friedrich Froebel



Maria Montessori



John Dewey



educating children for life



Erik Erikson



Lev Vygotsky



Jean Piaget

“The terms and circumstances of human existence can be expected to change radically during the next human life span. Science, mathematics, and technology will be at the center of that change causing it, shaping it, responding to it. Therefore, they will be essential to the education of today's children for tomorrow's world” (From Science for All Americans (SFAA), Project 2061, <http://www.project2061.org/>)

Science education and the framework for teaching science have undergone significant changes and rethinking throughout the past few decades. Developed by Science for All Americans and the National Science Resource Center, the majority of the science curriculum within the U.S. is based on two standards “Benchmarks for Science Literacy” and the “National Science Education Standards.” Unfortunately, there are deficiencies in the public school science curriculum. This system focuses primarily on a process of studying the science literature with brief and occasional hands-on interaction with nature if any at all.

I believe that the existing systems need to be supplemented by a program that utilizes an existing and successful pedagogy: the preschool curriculum developed by theorists such as Jean Piaget and Maria Montessori. This pedagogy currently focuses only upon preschool-aged children but it is my belief that the central ideas can be expanded to people of all ages. I believe that children can be effectively educated about science by unifying three basic concepts of this curriculum: observation, exploration, and holism.

PEDAGOGICAL HISTORY

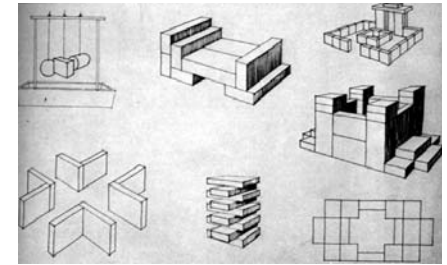
Preschool curriculum is currently based upon the ideas of six important theorists: John Dewey, Friedrich Froebel, Maria Montessori, Erik Erikson, Jean Piaget, and Lev Vygotsky. The ideas of Dewey, Froebel, and Montessori are centered on the idea of educating children by assisting them in developing ideas and understanding, either individually or within groups of other developmentally similar children. Erikson, Vygotsky, and Piaget focused upon exploration and play as the important elements of early childhood education.

John Dewey began the Early Childhood Education movement in the late 19th century when he “called for education that provided children with opportunity to learn from real objects and productive experiences.” (Taylor, 1999) He was the first to advocate for constructing one's own ideas and learning as opposed to the traditional methods that rely on memorization and the digestion of facts. Much of Dewey's work was based upon and supported by the 18th century work of Friedrich Froebel. Froebel instructed educators to observe and gently guide children, and to not interfere with the creative process. Maria Montessori further employed these ideas with the formation of schools for underprivileged children in Italy during the early 20th century. She believed that a child's self-esteem can be best developed by “intrinsic motivation.” Her approach relied upon three concepts: a carefully prepared environment, attitude of

humility (among the educators), and respect for individuality.

During the early 20th century, Jean Piaget and Lev Vygotsky began advocating for additional key elements in early childhood development: play and exploration. Piaget believed that “a child modifies and builds upon already constructed mental patterns to try to make sense of new experiences.” Under this process, “knowledge is based on what the individual brings to each situation rather than on what is accumulated from the environment.” His fundamental theory insists that “activity directed by the child is primary in development.” Lev Vygotsky's ideas were similar to Piaget yet were focused more specifically upon the developmental process behind the “make-believe.” He believed that play and exploration “are the ultimate activities for nurturing capacities that are crucial for later-life successes.” They also help children to understand the meaning and functions of “culture, life plans, and volitional motives.” These ideas are valuable for stretching children's development.

Froebel Blocks



PRESCHOOL CURRICULUM

Through the efforts of these theorists and many others, the curriculum designed for today's preschools have been proven successful in the development of children. This success has been measured and documented by the U.S. Department of Education's Institute of Educational Sciences. This institute is currently funding a four year national evaluation of preschool curricula through a program known as Preschool Curriculum Evaluation Research (PCER). After the first year of research, studies are already beginning to further support these successes.

The preschool curriculum provides a framework for activities focused upon developmental experience. These activities include: participation in healthy environments, providing appropriate guidance to children in developing stages of growth, exploration and play, creativity and self-expression, and experience with science and technology concepts.

Beginning with a healthy environment is important in childhood development. Adults play an important role in the process of creating these environments. This can help them to develop prosocial attitudes and behaviors. Adult guidance has been found to be critical to developmental growth.

Play has been proven to be the most successful stimulator of development. The value of exploration and play is the enhancement of the physical, social, emotional, and intellectual development of children. In the case of preschool-aged children, valuable learning comes from dramatic play and appropriate selection of play materials by the educators. Play can also lead to creativity and self-expression, another important factor in development. Individuals are creative in many different ways and it is the combination of raw materials, uninterrupted time, and freedom to choose activities and playmates that are most valuable to both development and artistic expression.

Finally, it is hands-on experience with science and technology that gives children a strong grounding and understanding of the natural world in which they participate. Children have shown a desire to learn about themselves and other living things. Children need multi-sensory opportunities to learn about their environment; thus requiring a strong educational focus of science appropriate to each stage of child

development.

THE CONCEPT

I believe this system of education can be successfully applied to all age groups. It can be further categorized into three basic concepts: observation, exploration, and holism. According to the Project 2061 publication, *Benchmarks for Science Literacy*, “when people know how scientists go about their work and reach scientific conclusions, and what the limitations of such conclusions are, they are more likely to react thoughtfully to scientific claims and less likely to reject them out of hand or accept them uncritically.” Furthermore, “once people gain a good sense of how science operates along with a basic inventory of key science concepts as a basis for learning more later they can follow the science adventure story as it plays out during their lifetime.” (American Association for the Advancement of Science, 1985)

If a hands-on educational system is to be successful it must equally apply the concepts of observation and exploration. These concepts are most efficiently applied in a setting that allows both the experiences of the individual parts and the whole systems to be experienced.

According to the National Association for the Education of Young Children, direct observation, such as witnessing interactions within a living coral reef system, has been proven to be the most effective way to begin the learning process. Educators such as David Elkind have shown that media, such as books and videos, are incapable of capturing the entire cycle of life that the science curriculum is attempting to display. The success of existing zoos and aquariums, for example, relies upon exhibiting that which cannot be observed within an encyclopedia or documentary. Observations, however, only begin the learning process. They serve to spark an individual's interest in a subject.

These interests should then be disseminated through a process of exploration and discovery. While the process of observation is generally the same for all age levels, exploration varies for each individual. To facilitate the explorations of children, they can be fairly easily separated into three groups identified by their developmental levels.

Within the first developmental group, commonly three to six year old children, imitative, dramatic, and sociodramatic play are most important. “Play is the basis of all later cognitive functioning” according to Jean Piaget. This group focuses on excitement and stimulation of the sense. These children, for example, might be drawn more to the marine sciences because of the diverse colors and sounds found within this environment.

The next developmental group, roughly ages six to twelve, is beginning to mature beyond the stage of traditional childhood play and desires a greater understanding of what they observe in their environments. While they may not yet be ready for in-depth research and analysis of specific details, they are becoming capable of understanding “the big picture.” They are intrigued by interactions within the environment and will begin to understand that life is not centered around them and that everything is part of a greater system. At this developmental stage, children can begin to explore idea that both living and non-living things coexist and cooperate within the world.

The final stage of childhood development, from thirteen years old to the early adult years, involves exploring the details. Children at this stage are maturing more rapidly and desire a greater understanding of the scientific world. They also begin using tools in the process of exploration. These tools can vary from those used for scientific experimentation to using computers for gathering research.

The final educational concept and quite possibly the most important is holism. Holism is the element that ties together the vast array of scientific knowledge children will acquire. By focusing on a holistic approach in science education, these connections that children are making can be strengthened and reinforced.

Children also appear to show greater interest in holistic systems. An exhibit of a working environment for example, attracts more attention than a combination of multiple exhibits, each showing just a piece of that environment, with physical separations between each individual display. Holism can be further emphasized by revealing the support systems. For example, by exposing an educational center's structural support systems and the mechanical systems used to maintain exhibit environments, a child will gain a greater understanding of immense artificial support requirements that are necessary for recreating ecological environments that we find naturally throughout the world.

CONCLUSION

By applying the educational concepts utilized by today's preschools we can effectively educate children of all ages. Through observation, exploration, and holism we can create a new way of teaching that will encourage children to learn through self discovery. This could be the idea that will assist the educational process in transcending the traditional structure of classroom learning in which an educator must teach that which is to be learned. Education that is discovered is likely to be retained much longer than that which is taught.

“The principal goal of education is to create men who are capable of doing new things, not simply repeating what other generations have done . . . men who are creative, inventive and discovers. The second goal of education is to form minds which can be critical, can verify, and not accept everything they are offered. The great danger today is of slogans, collective opinions, ready-made trends of thought. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly by their own spontaneous activity and partly through materials we set up for them. We learn early to tell what is verifiable and what is simply the first idea to come to tem.”

(Jean Piaget, 1952)

IMAGINE, DREAM, DISCOVER

A Science Exploratorium

Imagine, Dream, Discover is a nature exploratorium based upon an alternate pedagogy that seeks to educate families and encourage them to develop a better understanding of our environment. Learning is brought about through play, creation, and discovery. While this is not a new way of teaching, it brings about new obstacles and opportunities for those of us who design the edifice that houses these places of learning. Imagine, Dream, Discover is an educational center designed in response to these issues.

This exploratorium focuses on educating children of all ages about the vast world of science.

Marine Ecosystem

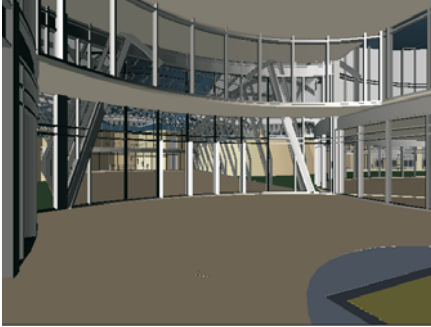
The exploratorium experience begins with the marine ecosystem. The marine ecosystem is a three story aquarium facility divided similar to the division of ocean depths.

The upper floor of the aquarium consists of exhibits focusing upon the ocean's intertidal zones. The aquarium is split into two sides delineated by water temperature. The western aquarium exhibit represents the warm water regions of the tropical shores and sandy beaches normally found closer to the earth's equator. To the east is the rocky shores exhibit of the colder ocean waters.

Below the intertidal aquarium level is the pelagic zones. Again, the aquarium is separated by water temperature with coral reefs to the west and kelp forests to the east. Located over the ocean basins, the pelagic ocean zones are limited to the depths that light can reach.

At the lowest level, the aquarium converges to exhibit the abyssal ocean plains. This area represents the dark, relatively unvarying region that is largely inhabited by sparse populations of bottom dwelling organisms.

Additional elements of the aquarium are the two sardine tanks. The sardine tanks are part of the entry foyer elevator cores. Each elevator core consist of an 8' diameter elevator shaft accommodating a glass cylindrical elevator. Surrounding the shaft, are two 10.5" thick acrylic tubes designed and engineered by U.S.



View into lobby as entering the building

Nipurra, Inc. for this application. The outer tube is approximately 3' larger than the inner tube and both tubes are supported by 8"x10" tube steel columns spaced no more than 6' apart. These tubes span the three floors of the building creating a 30' continuous tubular aquarium display with openings at each floor for elevator access. Surrounding this outer tube is a 4' wide cantilevered spiral stair from which visitors can see both into the tube aquarium display and the main aquarium.

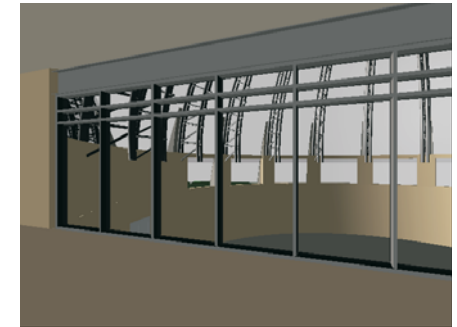
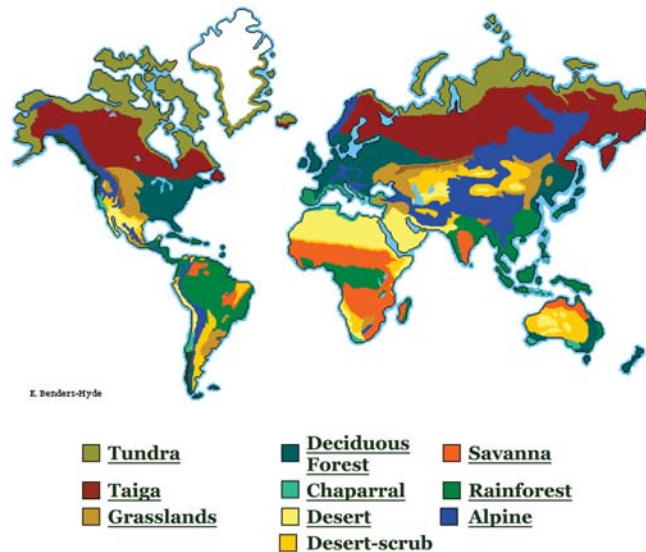
Land Mass Ecosystem

The land mass counterpart of the marine environment consists of two major parts: Earth's biomes and the Biosphere Experiment.

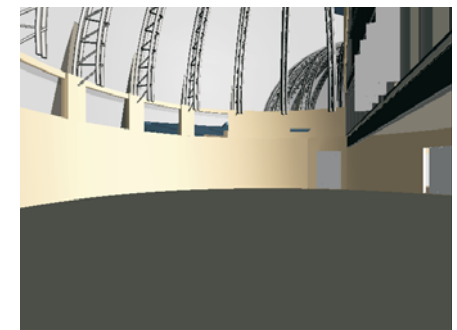
The Earth's environment is typically categorized into groups known as biomes. There are 6 major biomes that represent the majority of the earth's land mass. Each of these biomes is represented within Imagine, Dream, Discover. While the external layout of each biome exhibit is identical, the interiors are each designed to be a unique representation of their respective environments. Temperatures and lighting within each biome exhibit are carefully controlled to maintain levels that are similar to the natural environment without being extreme for the visitors experience these exhibits.

The six biomes represented in Imagine, Dream, Discover include:

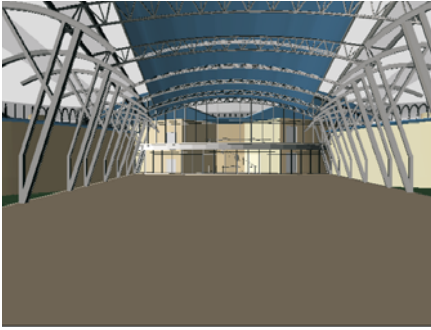
- ❖ Tundra (the arctic & alpine regions)
- ❖ Taiga (cold needleleaf forests of North America & Northern Eurasia)
- ❖ Desert
- ❖ Grasslands (chaparral and savannas)
- ❖ Temperate (Deciduous) Forests
- ❖ Tropical Forests



View into biome from main level corridor



Biome interior

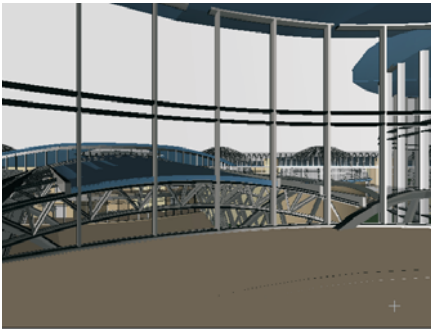


View inside lobby

At the center of the biome exhibits is a 4 story medium scale biosphere. The biosphere serves as an experiment of maintaining an entire ecosystem within a space that is separated from the rest of the world. This experiment is similar to small glass globe terrariums only at a much larger scale and with a greater diversity of living organisms. The biosphere's purpose is to provide children with the opportunity to understand the workings of planet Earth. It also exhibits the immense energy inputs required to maintain systems that exist naturally as ecosystems.

Lobby

Connecting the two ecosystems is a large open lobby with views of natural gardens and exterior exhibits. Almost entirely encompassed by the building's perimeter, these gardens serve as exhibits of the local environments providing children with a connection to the ecosystems in their own backyards.



View inside Young Explorers discovery room

Discovery Rooms

The binding thread and the most important elements of Imagine, Dream, Discover are the three discovery rooms. A discovery room serves as a place for children to expand upon what they have observed in the exhibit spaces. The rooms are separated into three developmentally appropriate groups and dispersed around the exhibit areas.

Each discovery room contains five major components: science center, manipulative center, art center, library, and technology area. The three rooms each contain material and equipment within these components that are appropriate for their respective developmental levels.

The first discovery room, Young Explorers, is intended for the early childhood development group (approximately 3-6 years of age). The Junior Adventurer discovery room accommodates the next developmental group, school aged children (approximately 6-12 years old). The final discovery room, Senior Scientists, includes the remaining age levels including young adults and college students.

FACILITIES SCHEMATIC DESIGN PROGRAM

Mission Statement: The mission of Imagine, Dream, Discover is to inspire learning, exploration, and discovery while educating the public about the sciences.

PRIORITY STATEMENT

Form

Nature exploratorium focusing on the three elements of water, air, land, and the flora and fauna characteristic to them (As emphasized by a Venn diagram).

Utilize a central space with extended discovery rooms to serve as a unique classroom for the community. Visitors would be able to freely explore areas of interest in the nature exploratorium and then develop their ideas, thoughts, images, and curiosities further in the discovery rooms.

Provide endless possibilities for learning within the facility due to the rich diversity of exhibits, tools, and visitors.

Expose the efforts required to maintain artificial representations of systems and organisms found naturally in the environment

Function

Provide a safe and educational facility for the community to explore nature and develop an understanding & respect for our environment.

Extend beyond the traditional structure of zoos, aquariums, and gardens.

Provide a look into an environment which may be traditionally inaccessible by the public (i.e. disabled, low-income families, intercity children).

Focus on both the part and the whole. The part being fish in an aquarium or the caged monkey at a zoo. The whole showing the interactions of the three biosystems (air, land, sea) emphasizing the unity and necessity of all parts of nature and our natural environment.

ISSUES, OBJECTIVES, CONCEPTS

Issue: Access - Site, Building

- Objective:** Clear separation of employee and service access from visitor access should be considered
- Objective:** Handicapped access should be clearly identifiable

Issue: Accommodation - Site, Building, Vehicles, Equipment

- Objective:** Site parking should accommodate the minimum average number of guest with overflow if needed
- Objective:** The project should provide a look into an environment which may be traditionally inaccessible to the public (i.e. Disabled, inner city children)
- Objective:** Location should be such that, at a minimum, children could easily travel to and gain access to the site for after school programs

Issue: Accommodation, Means Of - Climate, Utilities, Ventilation, Lighting

- Objective:** Climate systems (HVAC, ventilation, etc...) Should be accommodated for in an efficient and sustainable manner
- Objective:** Support systems (for aquarium, zoo systems management, etc.) Should be accommodated for in a safe and efficient manner
- Objective:** Emergency access should be available and free from obstruction
- Objective:** Natural systems should always take priority to other processes/technologies
- Objective:** Energy conservation must be both utilized and identifiable to visitors if possible
- Objective:** Available local resources should be utilized

Issue: Change, Adaptability to

- Objective:** Architectural form should be capable of adapting to

Objective: organizational and technological changes
Shared use with the community would be in character for this organization

Issue: Circulation - Site, Building, Emergency, Pedestrians, Vehicular, Services, Parking

Objective: Visitor flow should be maintained in a natural and organic system while service and employee flow would be direct

Objective: The project should integrate exploration and discovery for the visitors

Objective: Visitor-Staff and Visitor-Support Systems conflicts should be minimized

Objective: A Strong sense of arrival should be emphasized

Objective: A system of psychologically induced wayfinding should be incorporated as opposed to literal signage

Issue: Comfort - Physical

Objective: Spaces should not feel confined and enclosing

Concept: Utilize open space as part of the building, avoid low level lighting, connect insiders with the outside environment

Issue: Maintenance - Building, Building Systems, Unimproved/Improved Site

Objective: Life span of buildings and systems should be of critical concern

Objective: Maintenance systems for the displays should be visible but safe

Issue: Environmental Impact - Protection of Site

Objective: Environmental sustainability

Concept: Sustainable principles, practices, and technologies should have a significant role in all decision making process

Objective: Preservation of natural habitats and systems

Concept: Identify all habitats/ecosystems and minimize impacts where

Concept: possible
Control runoff, map shadow casting, minimize use-generated pollutants, and accommodate recycling efforts

Issue:Image & Ambience - Identity, Symbolism, Character

Objective: There should be a strong identity for each use group such as: employees, visitors, service, and the general public

Objective: Identify the desired “spirit of place”

Issue:Olfactory - Positive/Negative Odors

Objective: Avoid emission of negative odors within the community

Concept: Control all process generated fumes at EPA standard levels and above those levels if possible

Concept: Analyze wind direction and utilize natural ventilation where possible

Issue:Safety Hazards

Objective: Ensure the protection of all visitors and employees

Concept: Utilize fire protection/suppression systems in all spaces

Concept: Provide lab safety equipment/systems where needed

Concept: Provide for hazardous material storage

Concept: ensure adequate egress from all space

ARCHITECTURAL & ENGINEERING CRITERIA

Occupancy Group: A-3 Assembly, Miscellaneous

Approximate Area: Level 1 - 99,000 sq. ft.
 Level 2 - 68,000 sq. ft.
 Level 3 - 68,000 sq. ft.

OCCUPANCY GROUP A-3: ASSEMBLY, MISCELLANEOUS

		Noncombustible							
CONSTRUCTION TYPE		3-Hour (page 308)		2-Hour (page 309)		1-Hour (page 310)		Unprotected (page 311)	
IBC NOMENCLATURE		Type I-A		Type I-B		Type II-A		Type II-B	
MAXIMUM HEIGHT IN FEET		Spr	Unspr	Spr	Unspr	Spr	Unspr	Spr	Unspr
HEIGHT IN STORIES		UH	75'	180'	75'	88'	65'	75'	88'
MAXIMUM FLOOR AREA IN SF FOR ANY SINGLE FLOOR		UH	UA	UA					
12			12,000/floor						
11			144,000		132,000				
10			132,000		120,000				
9			120,000		108,000				
8			108,000		96,000				
7			96,000		84,000				
6			84,000		72,000				
5			72,000		60,000				
4			60,000		48,000	139,500			
3			48,000		36,000	139,500	36,000	85,500	
2			36,000		24,000	93,000	24,000	57,000	19,000
1			24,000		12,000	62,000	12,000	38,000	9,500
			12,000		12,000	62,000	12,000	38,000	9,500

Each number in the table represents the maximum total area in square feet for all floors for a building of the indicated story height.

Key to Abbreviations

Fire Ratings					
	2-Hr Type I-B	1-Hr Type II-A	Unprotected Type II-B	1-Hr Type III-A	Unprotected Type III-B
Structural Frame	2	10	1	0	
Extr Bearing Walls	2	10	2	2	
Intr Bearing Walls	2	10	1	0	
Floor Diaphragm	2	10	1	0	
Roof Diaphragm	1	1	0	1	0
Party & Fire Walls	2-4	2-4	2-4	2-4	2-4
Egress Enclosures	2	11	1	1	
Exit Access Corridors	0-1	0-1	0-1	0-1	0-1
Tenant Space Separations	1	11	1	1	
Other Non-Bearing Partitions	Non-Combustable			0	0

Type I-B – 2-Hr Noncombustable

Structural Steel protected w/ 2hr Fireproofing, Reinforced Concrete columns @ 10” and Walls @ 5” thk w/ floors @ 5” thk, Post-tensioned concrete @ 5” thk, Precast concrete columns @8” w/ beams @ 7” wide and panels @ 5”, Hollow-core precast slabs @ 8” thk, Brick Masonry @ 6” thk, Concrete Masonry @ 6” thk.

Type II-A – 1-Hr Noncombustable

Structural Steel protected w/ 1hr Fireproofing, Light Gauge Steel floor joists protected with (2)-1/2” layers of Type X gypsum board, Light Gauge Steel Walls faced on both sides w/ single layer of 5/8” Type X gypsum board, Reinforced Concrete columns @ 8” and Walls @ 3.5” thk w/ floors @ 3.5” thk, Post-tensioned concrete @ 3.5” thk, Precast concrete columns @6” w/ beams @ 4” wide and panels @ 3.5”, Hollow-core precast slabs @ 8” thk, Brick Masonry @ 4” thk, Concrete Masonry @ 4” thk.

Type II-B – Unprotected Noncombustable

Structural Steel w/out protection, Light Gauge Steel w/ minimum facings of of Type X gypsum board, Reinforced Precast& Posttensioned Concrete dimmensioned per structural requirements only, Masonry dimmensioned per structural requirements

Type III-A – 1-Hr Combustable

Interior Framing of wood not less than 2” nominal. Wood and Steel framing to be protected by 5/8” Type X or 1/2” ordinary gypsum board. Noncombustible exterior walls

Type III-B – Unprotected Combustable

Interior Framing of wood not less than 2” nominal. Noncombustible exterior walls

Area Calculations:

Lower Level

Circulation	25,782.96 sq. ft.
Biomes (4829.55 ea)	28,977.30 sq. ft.
Biosphere	9,469.36 sq. ft.
Aquarium	4,843.55 sq. ft.
Office	1,421.40 sq. ft.
Support	6,669.87 sq. ft.
Mechanical	23,780.22 sq. ft.
<u>Other</u>	<u>1,353.54 sq. ft.</u>
Total	102,298.20 sq. ft.

Main Level

Circulation	18,853.84 sq. ft.
Biomes (3191.81 ea)	4,787.72 sq. ft.
Aquarium	16,948.60 sq. ft.
Discovery Room	4,373.50 sq. ft.
Office	497.41 sq. ft.
Lobby	8,568.00 sq. ft.
Restaurant	4,373.94 sq. ft.
Multi Use Room	4,373.94 sq. ft.
<u>Other</u>	<u>787.76 sq. ft.</u>
Total	63,564.71 sq. ft.

Upper Level

Circulation	16,215.11 sq. ft.
Biome	1,410.93 sq. ft.
Aquarium	12,867.46 sq. ft.
Discovery Room	4,373.50 sq. ft.
Office	1,886.91 sq. ft.
<u>Other</u>	<u>782.76 sq. ft.</u>
Total	37,536.67 sq. ft.

Upper Discovery Room

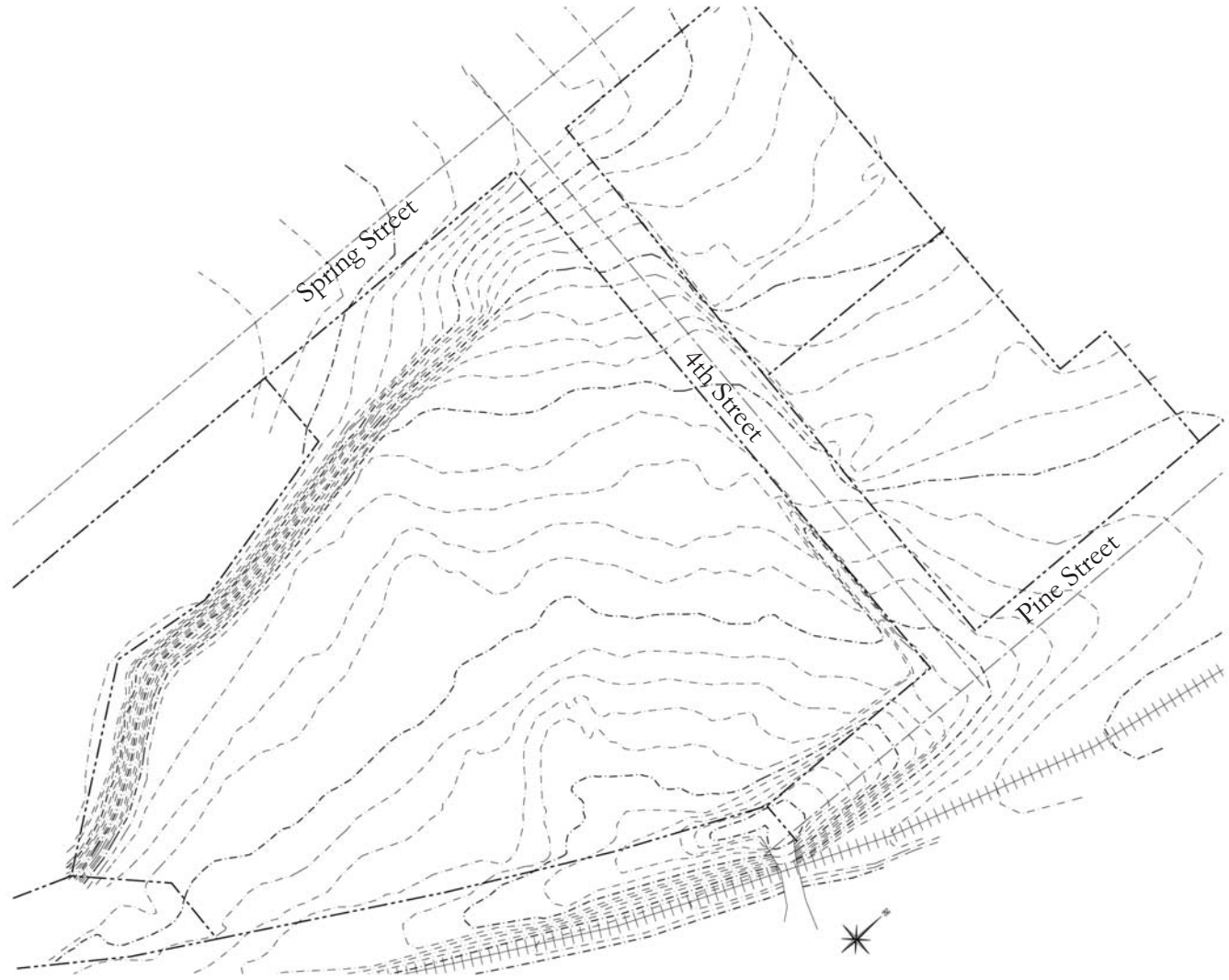
Circulation	2,096.84 sq. ft.
Discovery Room	3,831.37 sq. ft.
<u>Other</u>	<u>472.66 sq. ft.</u>
Total	6,400.87 sq. ft.

Project Totals

Lower Level	102,298.20 sq. ft.
Main Level	63,564.71 sq. ft.
Upper Level	37,536.67 sq. ft.
<u>Top Discovery Room</u>	<u>6,400.87 sq. ft.</u>
Total	201,232.45 sq. ft.

Site Total

Total Area	8.20 acres
Building Footprint	4.62 acres

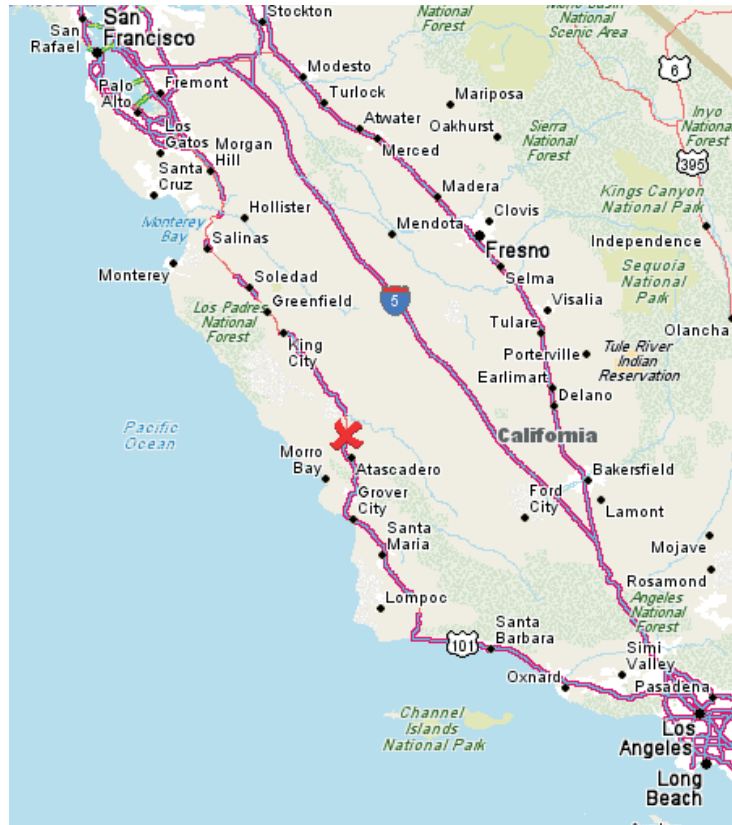


Existing Site Plan

SITE DESCRIPTION

Located 206 miles north of Los Angeles and 204 miles south of San Francisco, the city of El Paso de Robles lies at the northern edge of California's Central Coast. Historically, Paso Robles was known for the almond orchards that comprised the majority of its land mass but has more recently become popularized by strong support industries such as wine and tourism. Even though the city incorporated within San Luis Obispo County in 1889, Paso Robles has only recently seen steady growth. In the past ten years, this once small town has grown to a busy and bustling city of over 27,000 residents. While Paso Robles only contains 10% of the county population, the city has 22% of the retail sales, 34% of the manufacturing jobs, and in 2003 accounted for 23% of all the new homes built. With the population estimated to double in less than 20 years, El Paso de Robles is an ideal location Central Coast location for this project.

The site is located at the southern end of the downtown development district and is bordered by Spring, 4th, and Pine streets. The site was once the location of the Blue Diamond almond processing plant that once served the agriculture industry of this area. Currently, it is zoned for manufacturing/planned development and is set to be developed as commercial and housing. The land itself is currently unsuitable for agriculture and might even be considered a brown field, depending on the types of chemicals that had been used during the operation of the almond processing plant that has since been demolished. The site consists of 8.2 acres of land sloping gradually downward toward the south east corner at an average 3% grade.

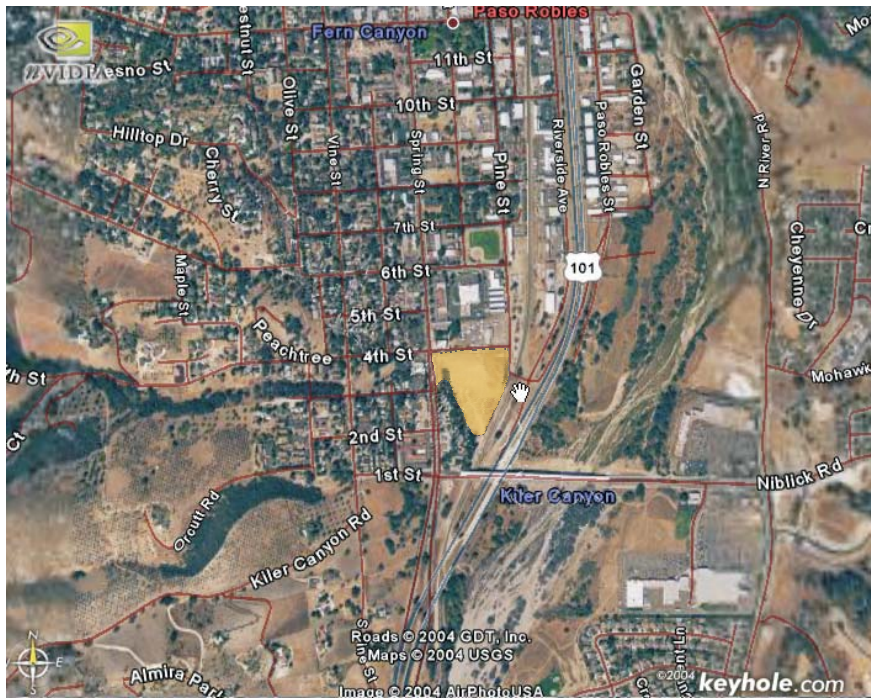


Along the western edge of the site, a small section of topography creates a tall steep mound along the street. This provides both a noise and windbreak to and from the site. With a large cluster of residential further to the west, this becomes a positive asset for the project and the community. It also provides a more gradual approach to the site with the building slowly looming into view.

With a project requiring such a strong community support, minimizing the visual impact of the building is desirable. From the opposite end of the site, the conditions are reversed and provide a much stronger visual statement that is easily seen from the nearby freeway. This provides both navigation for out-of-town visitors but also serves to advertise that there is something unique here that which would intrigue the passerby.

Another benefit of this sites orientation and topography is the solar anchor. The direction of the site slope leads to the southern edge of the site which provides ideal solar orientation to the backside of the building

where displays requiring solar lighting and heating are required. The topography also serves as solar protection. The steep western edge protects display adjacent display area which require minimal solar access whiel those requiring high levels of solar radiation can be located to the east where the sun is not limited throughout the day. Additionally, the sun itself serves as visual anchor behind the building, psychologically implying the importance of nature and the environment to this project.



THE ARCHITECTURE OF IMAGINE, DREAM, DISCOVER

The building form of Imagine, Dream, Discover is derived from the organic nature of the program and as a response to the site constraints. In an attempt to decrease the visual impact of the structure, the building is entered at the main level from just above grade. This places the aquarium mechanical systems and abyssal aquarium exhibit at below grade which further serves to limit light within the exhibit and to maintain a naturally cool space for the aquarium mechanical/support systems.

The aquarium /entry wing of the building consists of 2 exhibit areas to either sides of the entrance/foyer. The northwestern facade of this wing is comprised of glazed curtain walls at the entry with split limestone faced masonry walls to either sides at the exhibits spaces. One face of the facade to either side of the entry is further accented by a constant sheet of water the full length of the face that is feed from the roof structure and collected at the base of the wall. This “water wall” adds a transparent transition from the entry glass to the adjacent solid surfaces. At each bend in the facade are a series of full height buttressing elements accented by vertical lighting with a lense at the top of each element. The southeast portion of the building consists of massive curtain wall glazing systems within a steel framed support system to maximize daylighting at the main and upper levels.

The land mass wing houses the six biome exhibits with the Biosphere Experiment at the center. The biosphere is four story stepped pyramid constructed entirely of glass. The glass is supported by a steel space truss system with critical connection details designed to maintain the best possible level of air tight integrity within this space. The six biomes are located to either side of the biosphere. The biomes are 80’ diameter circular spaces constructed of 20’ masonry walls. Large clerestory windows are located near the top of these walls. Atop each biome is a steel trussed glass dome. The dome thrust on the walls is further supported by concrete buttresses arrayed along the exterior face of the spaces. The biomes/biosphere are entered from a three story circulation space along the northwestern side of this wing. To either side of the biomes are additional circulation passages further connecting the biomes to each other.

Running the full width of each wing is a 20’ diameter, steel supported, glass barrel vault located within the

roof plane. These barrel vaults provide a high level wash of daylight to the circulation spaces within the building wings. These circulation spaces are open directly below the barrel vault to the lower levels providing this light element at all levels. The barrel vaults serve as an aesthetic and structural continuity throughout the building and further emphasizes exhibit spaces from circulation. At both ends, the vault is grounded by egress cores constructed of glass within a concrete structural system.

To accommodate fire safety requirements, all glazing systems are to be constructed of a fire-rated glass product such as the Pilkington Pyrostop fire-rated transparent wall panels. The panels are to be housed within a fire-rated curtain wall assembly. These products allow for the building to be rated as Type III-A construction while maintaining the immense quantity of exterior glazing.

The interior surfaces of the non-exhibit spaces are finished in a 4'x4' white marble panel system with a 1'x1' beige split-faced horizontal marble band at specified intervals. The majority of lighting within these spaces is provided by both direct and indirect natural daylighting with high luminous reflectivity from these surfaces. The lighting is accented by carefully placed incandescent and fluorescent lighting fixtures. The flooring is to be constructed of a recycled rubber flooring material such as ECOsurfaces' resilient recycled flooring with an appearance similar to terrazzo. These flooring materials provide a high-comfort resilient floor with a further benefit of utilizing sustainable materials.

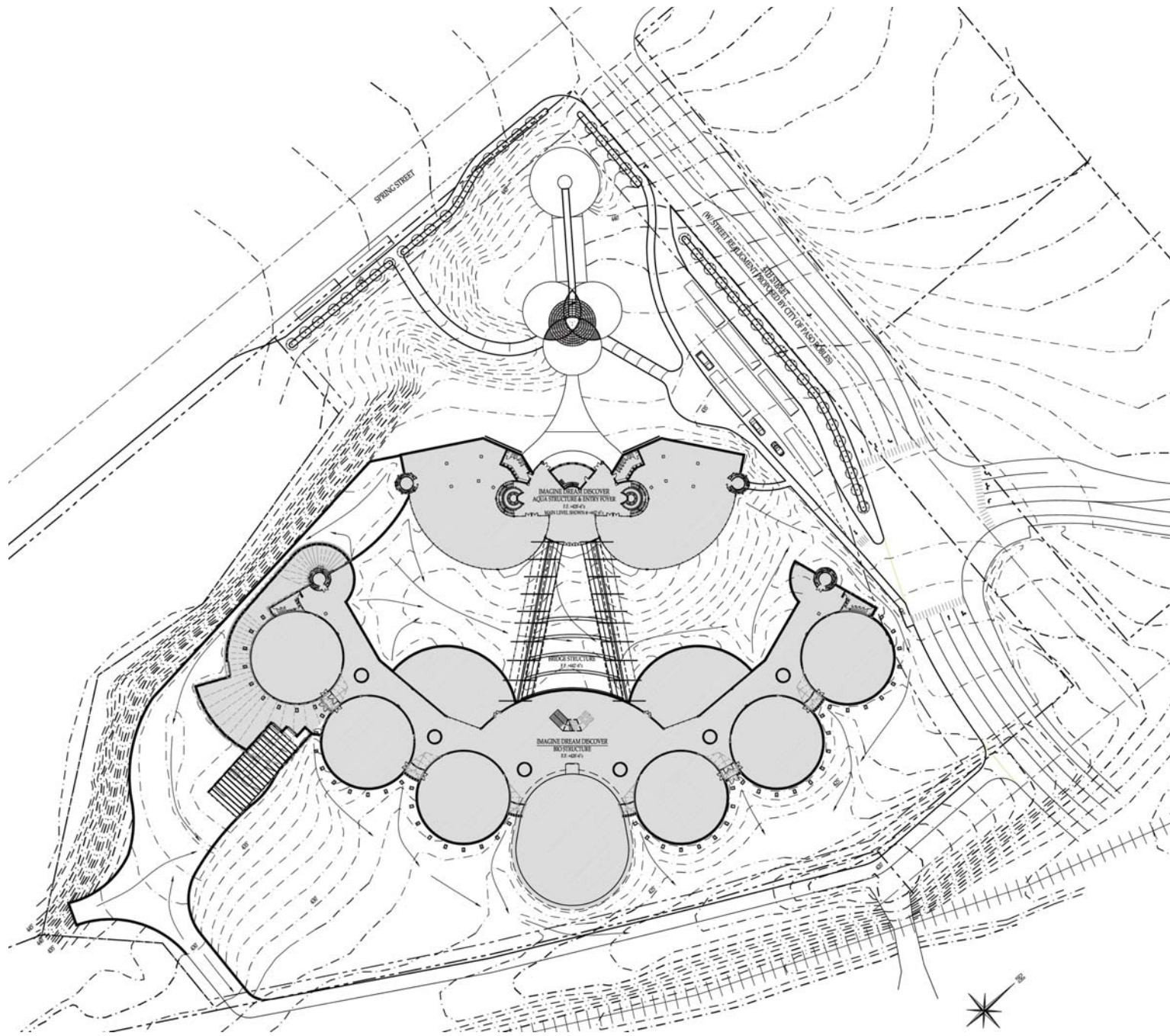
Where possible sustainable materials and technologies are to be used to decrease the environmental impact of constructing a building of this immense scale. This building has been designed with the intent of attempting to achieve compliance with the L.E.E.D. rating system provided by the U. S. Green Building Council by employing the concepts of sustainable design and construction.

SITE / GRADING

To emphasize a connection to the local community, I began by orienting the project along an axis with the corner of the site at the crossing of Spring street and 4th street. Leading up to the entrance from this corner are two plazas utilizing a water feature to connect the elements. The first plaza has a fountain at its center that spills into a trough leading to the second plaza. The second plaza is designed in the shape of a ven diagram, a very popular symbol within the scientific community. The diagram is further emphasized by a steel cantilevered trellis above, which provides shade to visitors. At the center, the plaza steps down to create a sunken reflecting pool fed from the fountain and trough at the first plaza. The pool is stepped providing a place for pedestrians to rest and enjoy the surroundings. These plazas were inspired by the public gardens of Hong Kong. They would be maintained in way which would carry the spirit of serenity and peaceful repose that those gardens expressed within the busy and sometimes chaotic atmosphere of their urban settings.

The edge of the site along 4th street has been designed to accommodate large visiting groups and provide a safe place for local families to pick-up/drop-off their children. Across 4th street from this location, on either of the two sites available, the program calls for a cooperative effort with the local government to design and construct a parking structure with retail and offices along the street frontage. This would be used to service not only visitors to Imagine, Dream, Discover but local residents and downtown visitors as well. By cooperating with the city and surrounding communities, the structure could also provide parking for the local downtown district and the general community.

At the southeast corner of the site, a service yard has been added in a manner that would be obscured from the general public. This allows large vehicles to deliver exhibits and equipment with minimal impact to the community and also provides room for expansion of support services if need in the future.



LOWER LEVEL

Biosphere Experiment

At the center of the southeast end of the building is the Biosphere Experiment. Housed under a glass pyramidal space truss, this space would act as a constant experiment in a manner similar to the Biosphere 2 experiment located in the foothills of Arizona's Santa Catalina mountains. During the late 1980's, Biosphere 2 was built as an air-tight replica of Biosphere 1 (the earth's environment). The Imagine, Dream, Discover Biosphere Experiment would be constructed and operated in a similar fashion with only two major changes. This experiment would be an open/closed system (allowing people to come and go from the experiment) and would be maintained by the children using this facility under the supervision of local members of the science community (teachers, biologist, etc...).

Biomes

To either side of the Biosphere are the six biome exhibits. These spaces are individually climate controlled to simulate condition similar to their natural environment. For example, the Desert Biome would be kept at warmer temperatures with low humidity while the Tundra Biome would be slightly cold and musty. By glazing both sides of the truss dome, the chamber between the panels of glass could act as an air plenum which would theoretically provide both climate control and insulation from the outside heat and solar gains.

Abyssal Aquarium

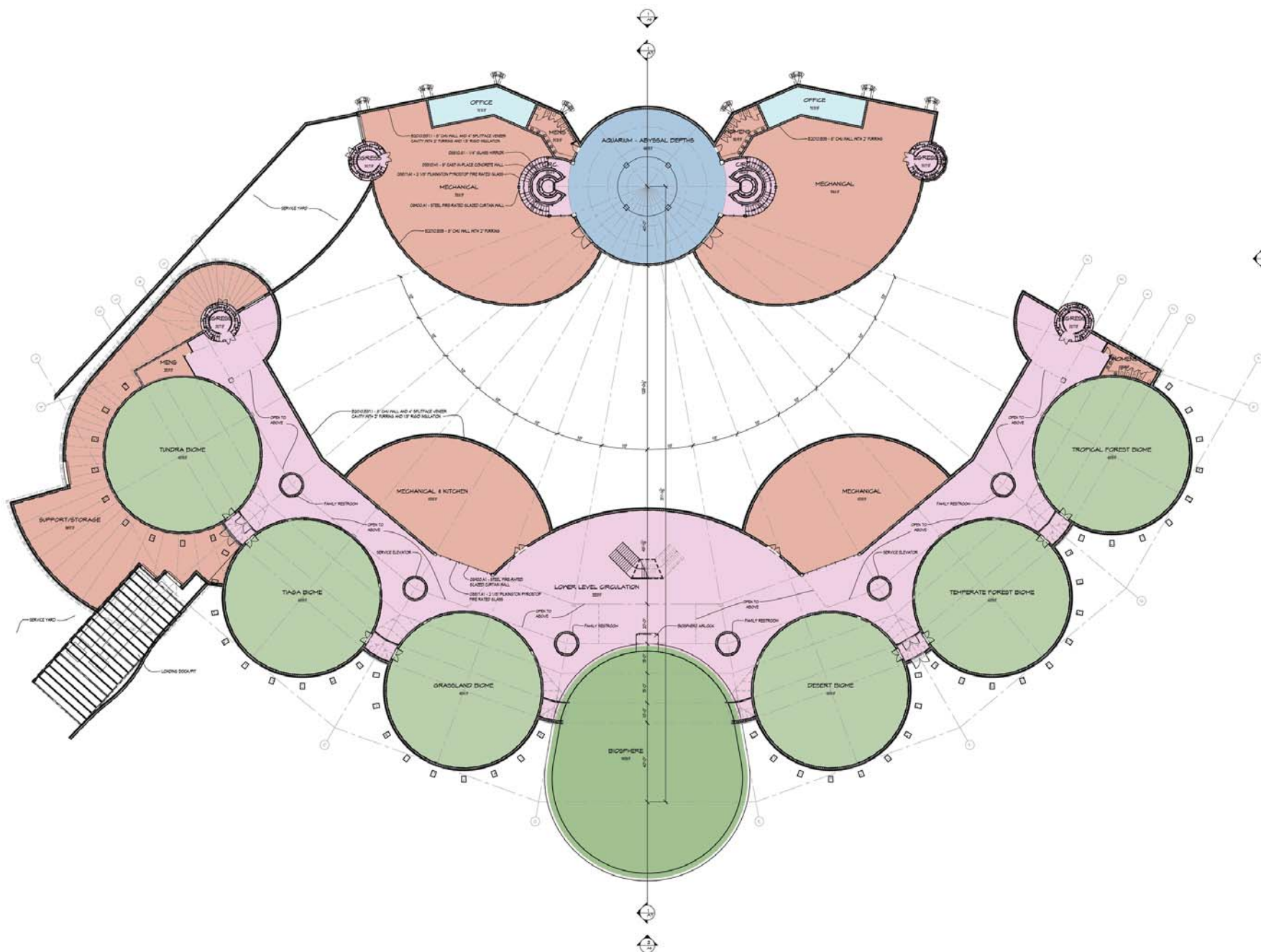
At this level, located directly underneath the entry, is the abyssal depth of the I.D.D. Aquarium. This space would house exhibits of the deeper ocean depths. The primary exhibit would be a raised floor constructed of structural glass and housing an exhibit of the ocean floor. Visitors could walk on the exhibit as though they were walking upon the ocean floor.

Mechanical Equipment

Also located at this level the majority of the mechanical equipment spaces. These areas houses the primary mechanical equipment for maintaining the facilities display spaces. The spaces are also viewable by the visitors from various location, allowing the visitors to begin to understand the complexity of maintaining replications of environments that are found naturally throughout the earths ecosystems.

Support Spaces

Finally, the lower level of this facility also houses support spaces which include storage, exhibit staging areas, and two receiving bays for large delivery vehicles. This portion of the building is designed to flow with the aesthetic rhythm of the building so as to minimize it's impact.



MAIN LEVEL

Entrance

The visitor entrances are located to either side of the ticketing office/kiosk. Visitors enter into a foyer with a tall ceiling to increase the openness of a small space. From the foyer, visitors can either continue forward into the lobby or to the elevator cores to either side of the lobby.

Pelagic Region Aquariums

The main level of the aquarium is located to either side of the foyer and houses the pelagic ocean region displays. The west side serves as a display of the warm water coral reefs with the cold water kelp forests to the east. The aquarium is located closest to the entry for many reasons, the most prominent being that the oceans comprise more than 75% of the earth's biomass. In combining land ecosystems with marine ecosystems, I felt that emphasizing this importance of marine life was crucial for designing a layout for this facility.

Lobby

The lobby, directly following the foyer, spans between the two building wings (entry/aquarium wing and land mass wing). A unique structural system combining vertical trusses with curvilinear horizontal trusses provides tall ceilings and canted floor-to-ceiling full length glass walls. This space allows for large group gathering in addition providing for gallery layouts and formal functions.

Discovery Room

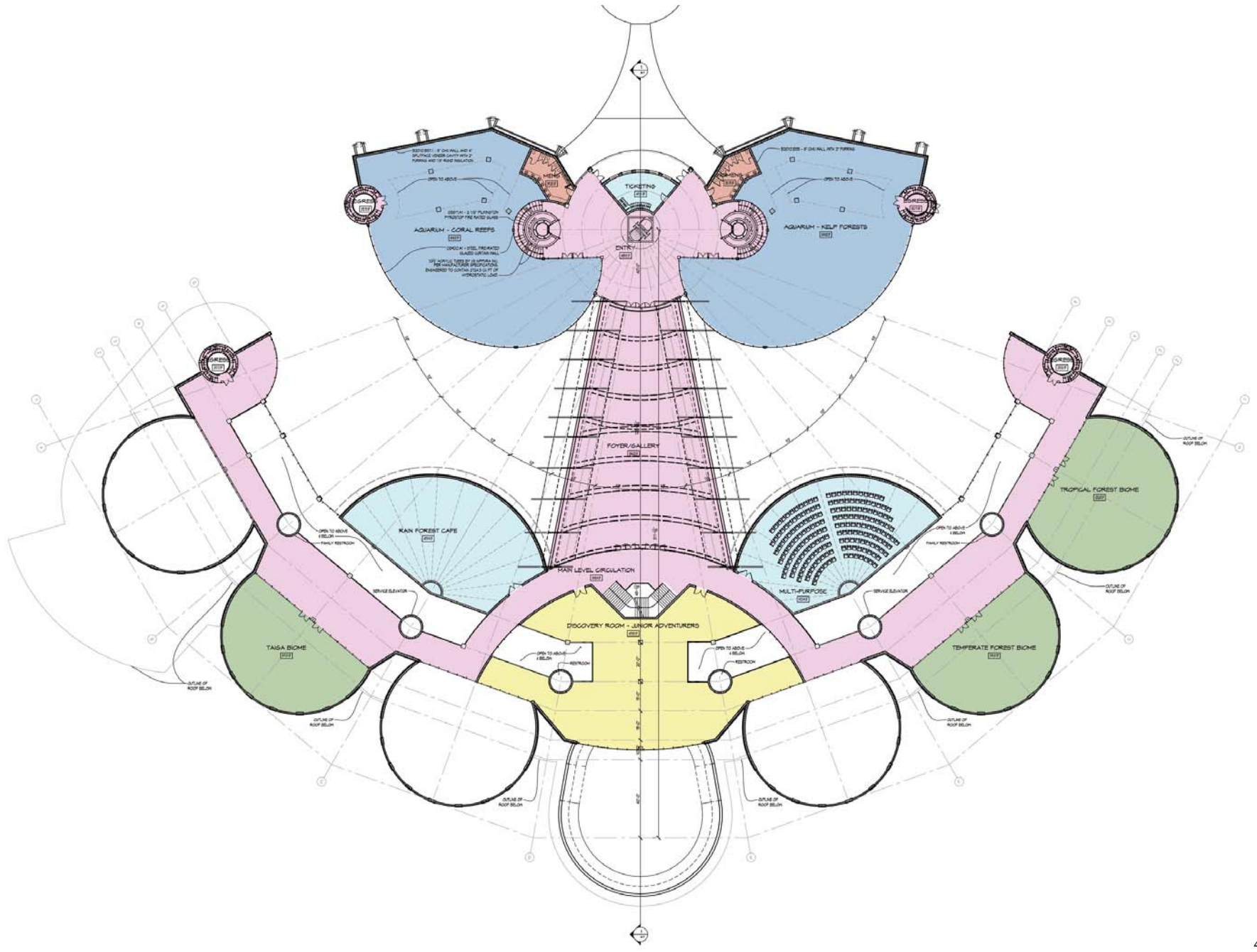
Across from the southeast end of the lobby is the first of the three discovery rooms. Each of the discovery rooms is designed to accommodate one of three developmentally appropriate age groups. At this level, the discovery room has been designed for the "Junior Adventurer" (elementary school through middle school). The discovery room can accommodate multiple groups and activities. This discovery room can be viewed by visitors via glass walls from the circulation corridors.

Support Spaces

Adjacent to the discovery room, on either side of the lobby, are the restaurant and multi-use space. Each of these spaces can be accessed via the circulation corridors.

Biomes

From this level, three of the biome exhibits can be accessed. The Tropical Forests, Temperate Forests, and Tundra biomes all include an upper floor display area of catwalks and suspension bridges located among the trees of each of the forests.



U P P E R L E V E L

Tidal Zone Aquariums

At the upper level of the marine ecosystems wing, the aquarium is again split into two sides by water temperature. On the west, the exhibit focuses upon the sandy beaches and tropical shores while the east exhibit displays the colder environment of the rocky shores. At this level, these two exhibits are connected by a 10' catwalk viewable from the lobby and foyer below allowing visitors to easily cross from one side to the other. The northwestern portion of these spaces also includes offices for curators and staff.

The land mass ecosystems wing house a third and final level of exhibit space for the Tropical Forest biome (suspension bridges above the tropical canopy) and the second of the three discovery rooms.

Tropical Forest Biome

The tropical forest are typically studied in relation to the three levels of the forest. The two lower layers are underneath the forest canopy and rarely receive any direct sunlight if any at all. At this level, the exhibit is representing the third and uppermost level, the canopy itself. This area would consist of a small network of suspension bridges allowing visitors to experience a portion of the rainforest that is very difficult to reach in nature.

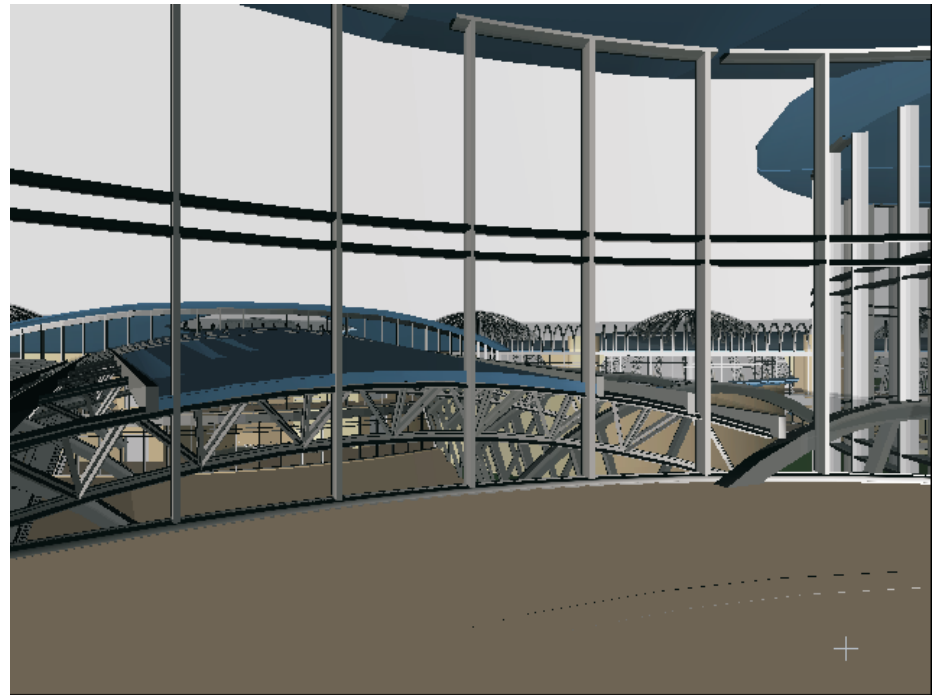
Discovery Room

At this level, the discovery room is designed to accommodate the eldest childhood development group, the "Senior Scientist" (high school and college students). This discovery room is almost identical to the discovery room below in its layout with the exception of the type of equipment and tools available. This room would contain the most advanced tools for scientific discovery and exploration available.

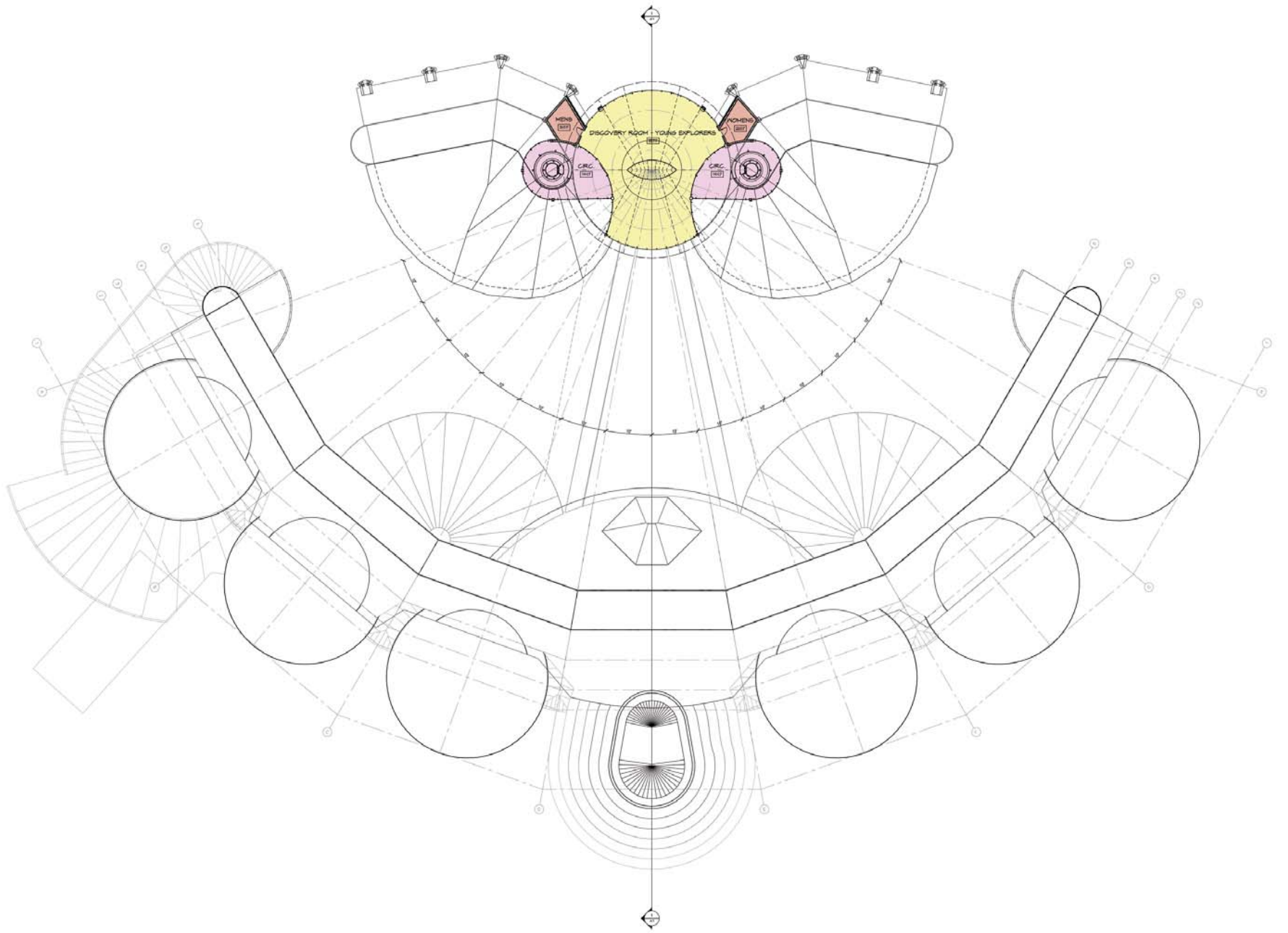


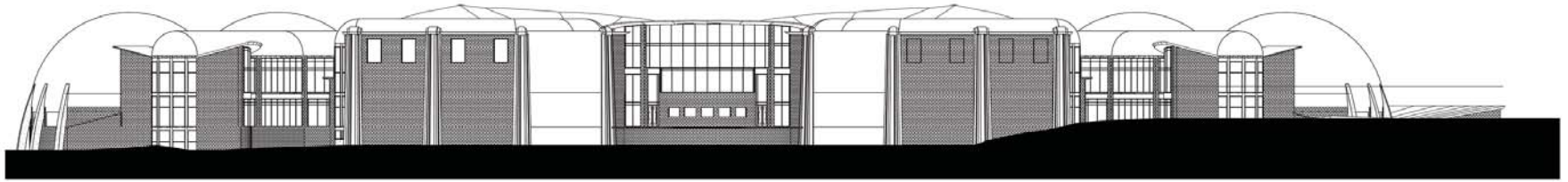
ROOF LEVEL & UPPER DISCOVERY ROOM

An additional mezzanine level has been included between the upper level aquarium exhibits and above the foyer. Within this space is the final discovery room. This discovery room accommodates the youngest developmental group, “Young Explorers” (preschool and kindergarten). From this room, the children are not only able to learn and explore. There is also a visual connection to the upper level aquarium exhibits. This connection has been emphasized due to the colorful and exciting nature of these displays. These are the displays that would most attract children of this developmental group allowing them the opportunity to begin to explore science at an early age and grow with an appreciation for nature and the environment.

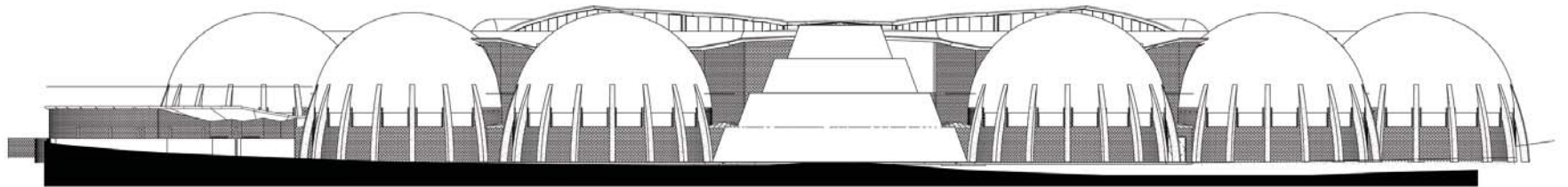


View Southeast from “Young Explorers” discovery room

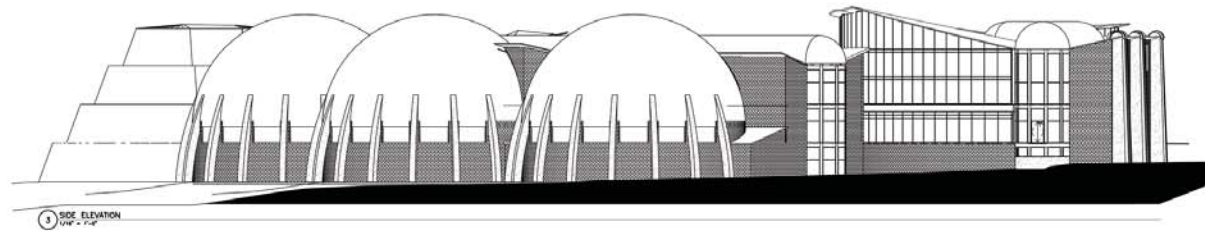




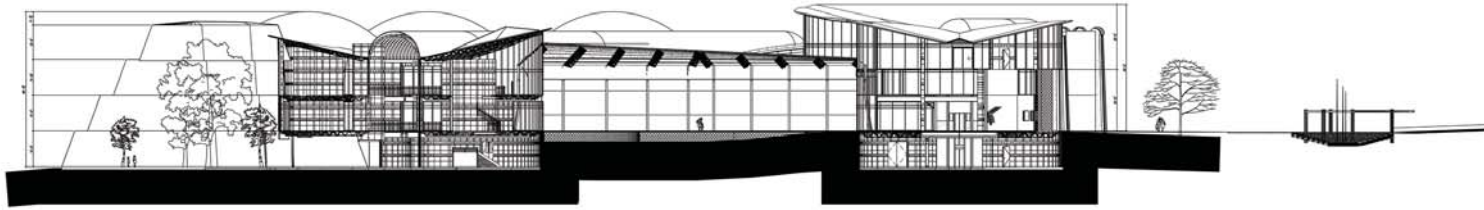
1 ENTRY ELEVATION
1/8" = 1'-0"



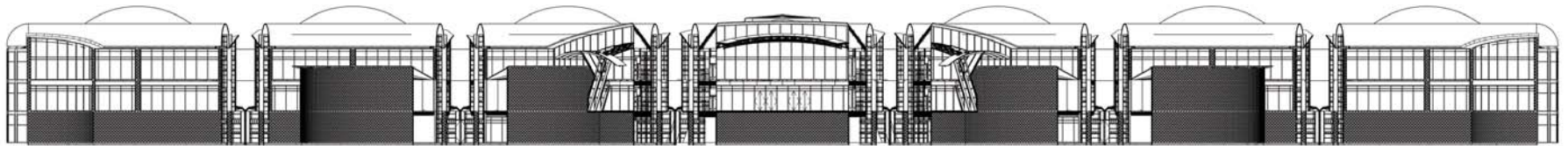
2 BACK ELEVATION
1/8" = 1'-0"



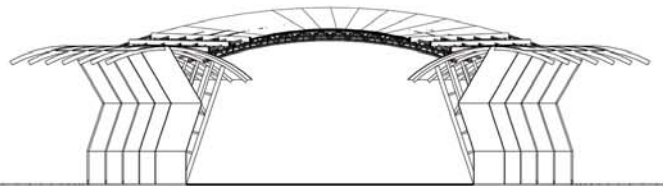
3 SIDE ELEVATION
1/8" = 1'-0"



1 SITE SECTION
1/16" = 1'-0"



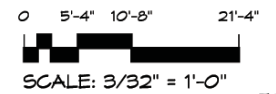
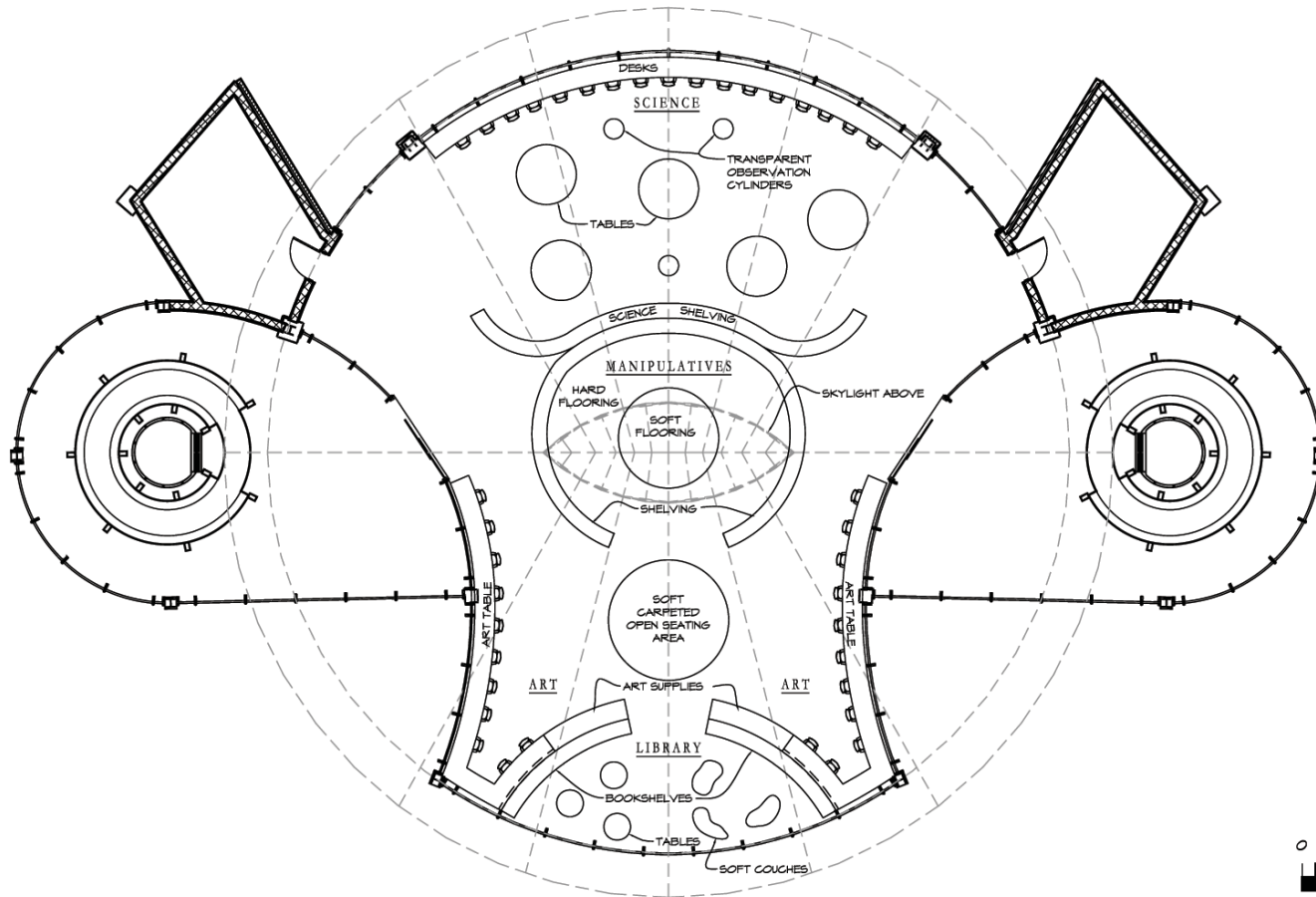
2 BUILDING ELEVATION THROUGH LOBBY
1/16" = 1'-0"



3 SECTION THROUGH LOBBY STRUCTURE
1/8" = 1'-0"

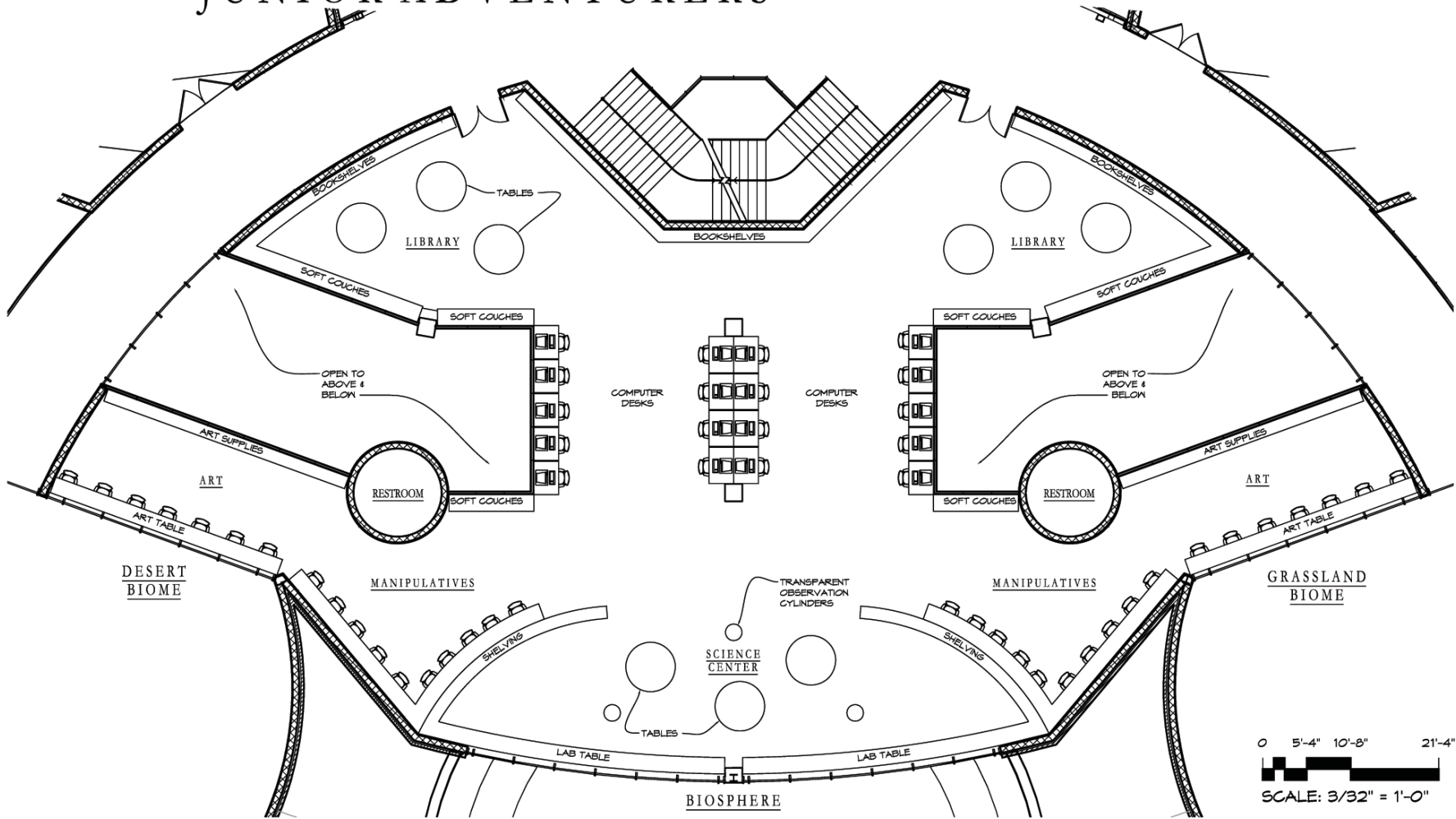
APPENDIX A
Discovery Room Layouts

DISCOVERY ROOM #1
YOUNG EXPLORERS



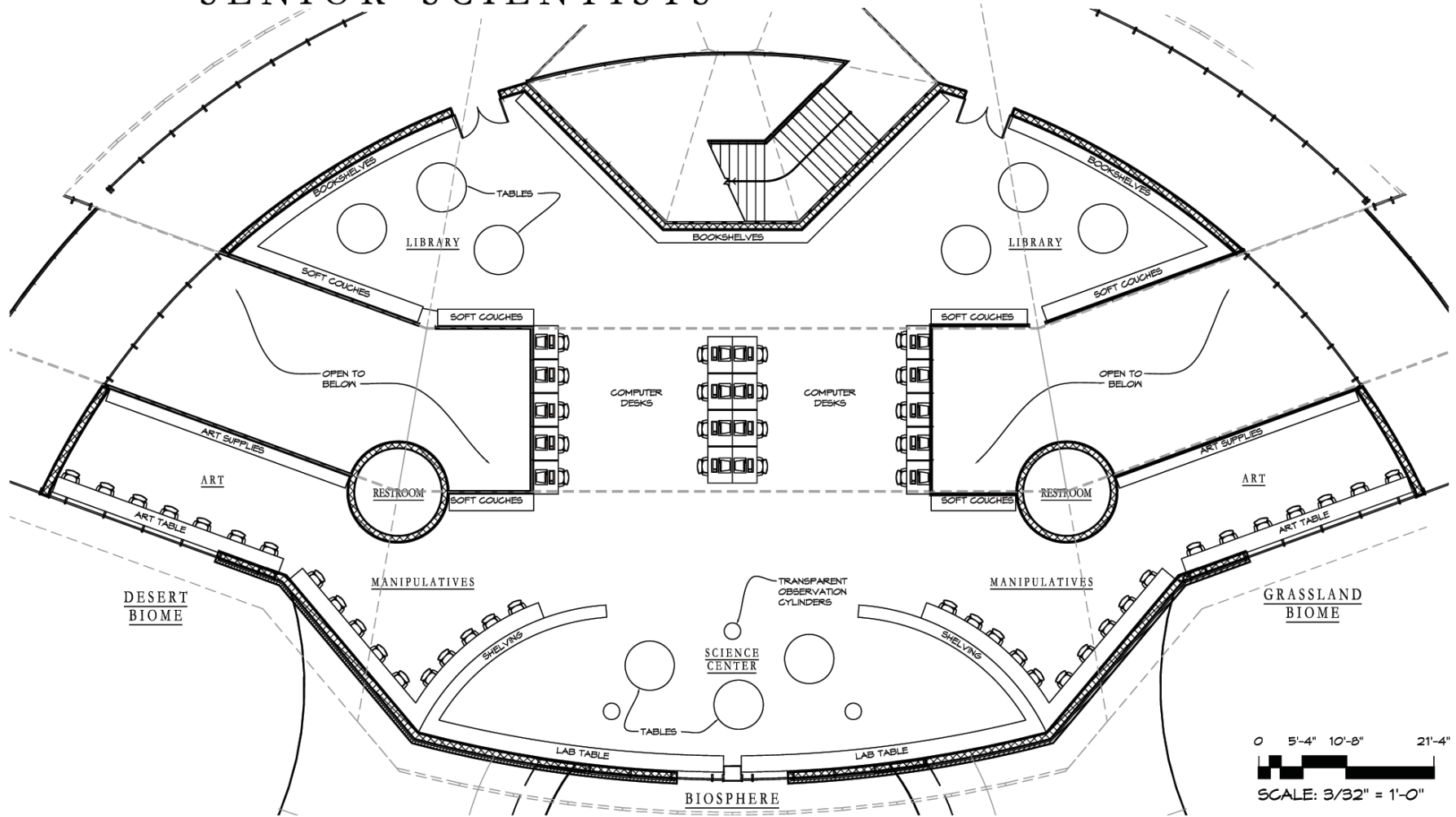
DISCOVERY ROOM #2

JUNIOR ADVENTURERS



DISCOVERY ROOM #3

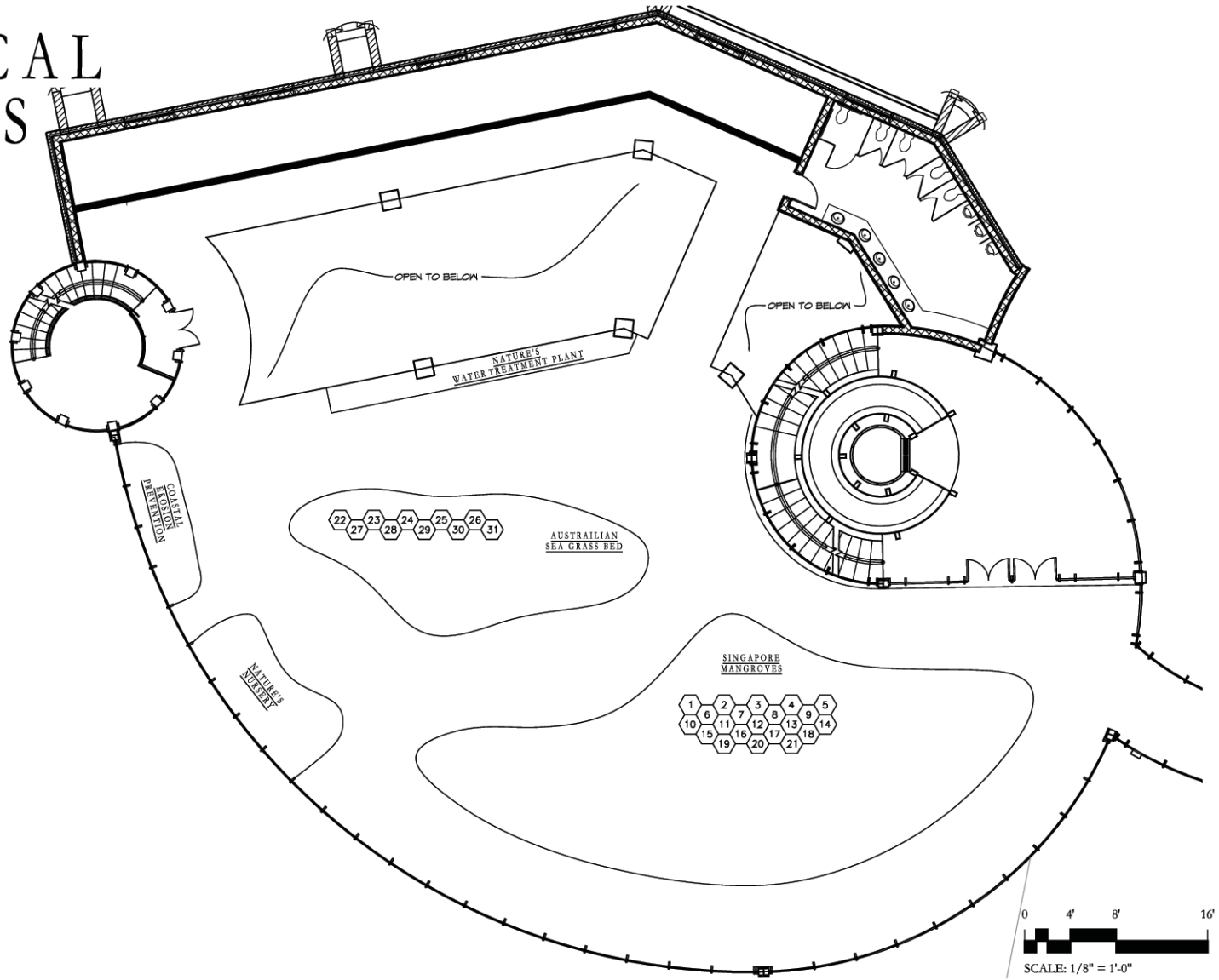
SENIOR SCIENTISTS
































APPENDIX B

Aquarium Exhibit Layouts

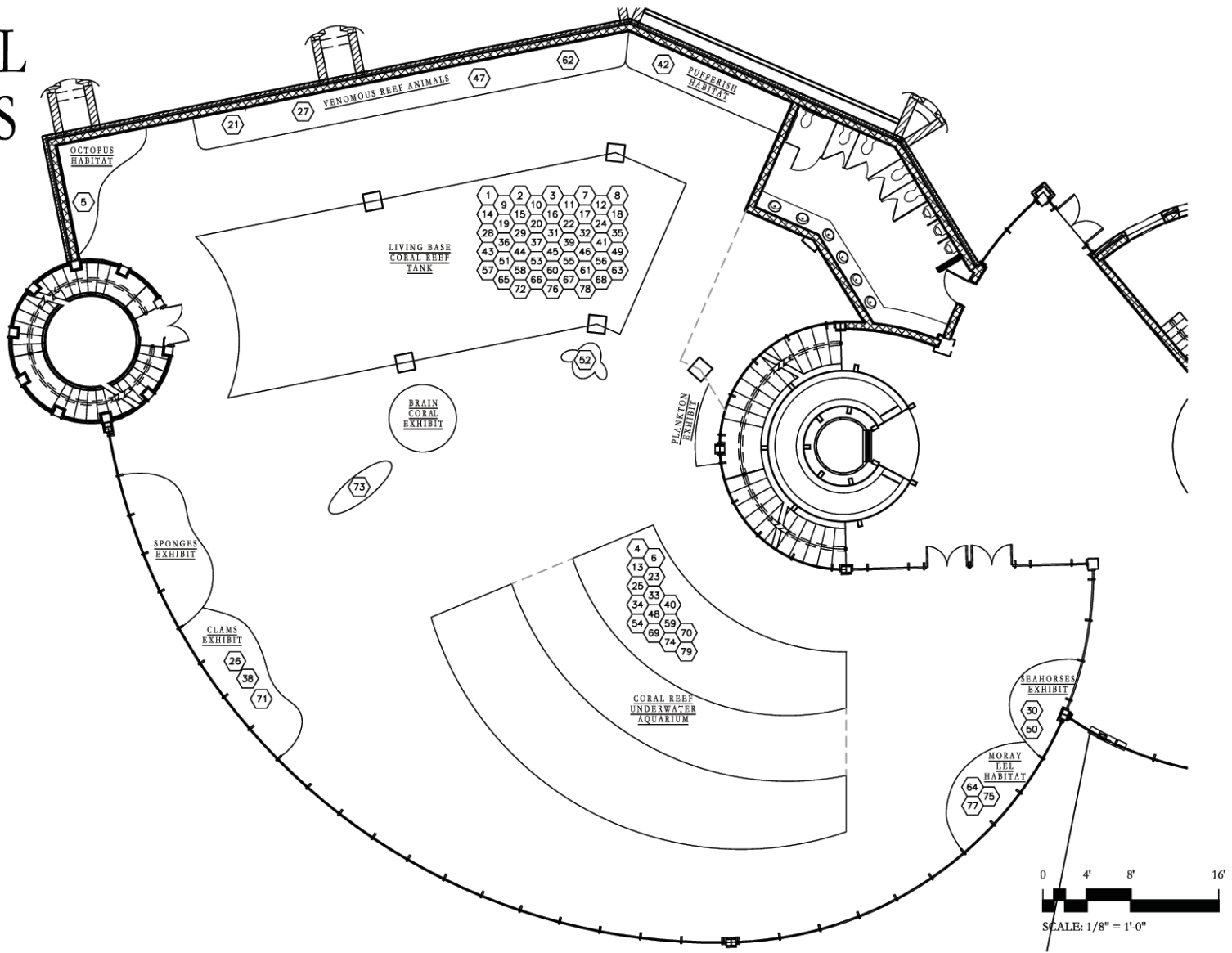
TROPICAL SHORES
























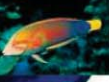


























TROPICAL SHORE

- | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|-----------------------|-----|-------------------------------------------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------|----------------------------------|
| 1. |  | Bumblebee goby | 13. |  | Mudskipper | 25. |  | Luderick |
| 2. |  | Common gecko | 14. |  | Silver Moony | 26. |  | Seagrass |
| 3. |  | Crab eating frog | 15. |  | Snakehead gudgeon | 27. |  | Pygmy leatherjacket |
| 4. |  | Dwarf gecko | 16. |  | Spottail needlefish | 28. |  | Tarwhine |
| 5. |  | Grey knight goby | 17. |  | Spotted green puffer | 29. |  | Various juvenile coral reef fish |
| 6. |  | Malayan monitor | 18. |  | Spotted scat | 30. |  | White's seahorse |
| 7. |  | Mangrove trees | 19. |  | Tampan | 31. |  | Yellowfinned leatherjacket |
| 8. |  | Mangrove grouper | 20. |  | Tropical silverside | | | |
| 9. |  | Mangrove brittlestar | 21. |  | Whitespot | | | |
| 10. |  | Mangrove cardinalfish | 22. |  | Blue spot goby | | | |
| 11. |  | Mangrove gudgeon | 23. |  | Blue groper | | | |
| 12. |  | Mangrove lace coral | 24. |  | Leaf fish | | | |
































CORAL REEFS



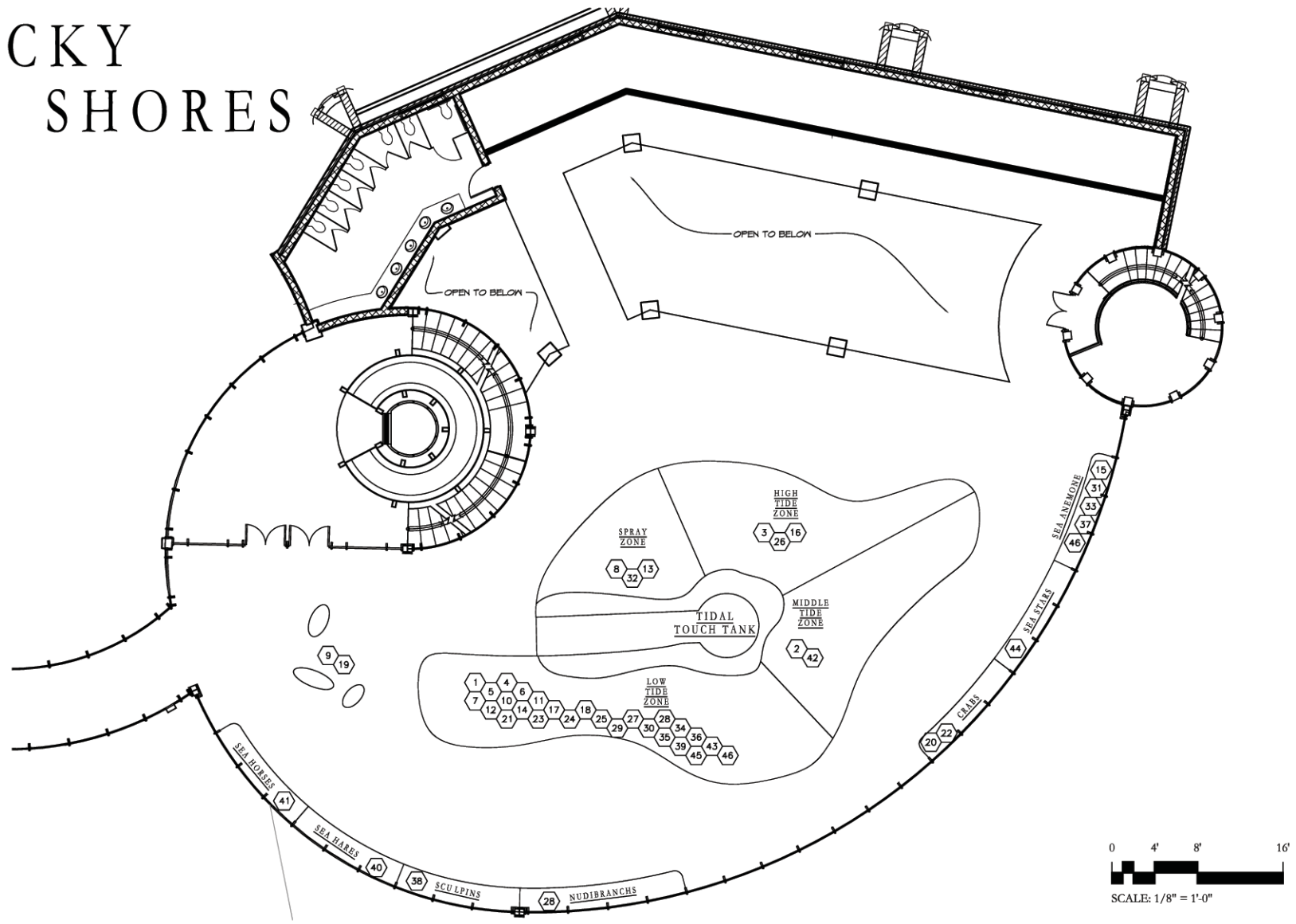
CORAL REEF

- | | | | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|----------------------------|-----|-------------------------------------------------------------------------------------|-------------------------|-----|---------------------------------------------------------------------------------------|--------------------------|-----|---------------------------------------------------------------------------------------|------------------------|
| 1. |  | Anemone fish | 13. |  | Candycane coral | 25. |  | Cortex rainbow wrasse | 37. |  | Fox coral |
| 2. |  | Assorted mushroom anemones | 14. |  | Caribbean anemone | 26. |  | Crocus clam | 38. |  | Giant clam |
| 3. |  | Barlett's anthias | 15. |  | Carpet anemone | 27. |  | Crown of thorns | 39. |  | Gorgonians |
| 4. |  | Blackfin barracuda | 16. |  | Checkerboard wrasse | 28. |  | Dash dot goatfish | 40. |  | Green mushroom anemone |
| 5. |  | Blue ring octopus | 17. |  | Chocolate chip sea star | 29. |  | Devils finger coral | 41. |  | Green star polyps |
| 6. |  | Blue spotted stingray | 18. |  | Christmas wrasse | 30. |  | Dwarf seahorse | 42. |  | Guineafowl puffer |
| 7. |  | Blue-banded Surgeon fish | 19. |  | Clown triggerfish | 31. |  | Elegance coral | 43. |  | Hammer coral |
| 8. |  | Blue-fire coral | 20. |  | Colt coral | 32. |  | Elephant ear anemone | 44. |  | Harlequin tusk Fish |
| 9. |  | Blue mushroom anemone | 21. |  | Cone shell | 33. |  | Emperor angelfish | 45. |  | Humbug |
| 10. |  | Bubble anemone | 22. |  | Convict tang | 34. |  | Epaulette shark | 46. |  | Humphead wrasse |
| 11. |  | Button Polyps | 23. |  | Coral cardinal fish | 35. |  | Five-stripe surge wrasse | 47. |  | Lionfish |
| 12. |  | Cabbage coral | 24. |  | Coral grouper | 36. |  | Forceps fish | 48. |  | Long-fin bannerfish |
















































CORAL REEF (CONT.)

- | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|--------------------------|-----|-------------------------------------------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------|-----------------------|
| 49. |  | Long-jawed squirrel fish | 61. |  | Redtooth triggerfish | 73. |  | Whitetip reef shark |
| 50. |  | Longsnout seahorse | 62. |  | Sea snake | 74. |  | Yellowheaded jawfish |
| 51. |  | Long tenacled anemone | 63. |  | Sleek Unicornfish | 75. |  | Yellow-margined moray |
| 52. |  | Marine turtle | 64. |  | Snowflake moray | 76. |  | Yellow tang |
| 53. |  | Moorish idol | 65. |  | Spiny sea star | 77. |  | Zebra moray |
| 54. |  | Orange spine unicornfish | 66. |  | Spotted unicornfish | 78. |  | Zebra shark |
| 55. |  | Parrotfish | 67. |  | Squarespot | 79. |  | Zooanthids |
| 56. |  | Pearl coral | 68. |  | Staghorn coral | | | |
| 57. |  | Picasso triggerfish | 69. |  | Stonefish | | | |
| 58. |  | Pinktail triggerfish | 70. |  | Thornback ray | | | |
| 59. |  | Porcupine fish | 71. |  | Tridacna clams | | | |
| 60. |  | Red mushroom anemone | 72. |  | Tube anemone | | | |

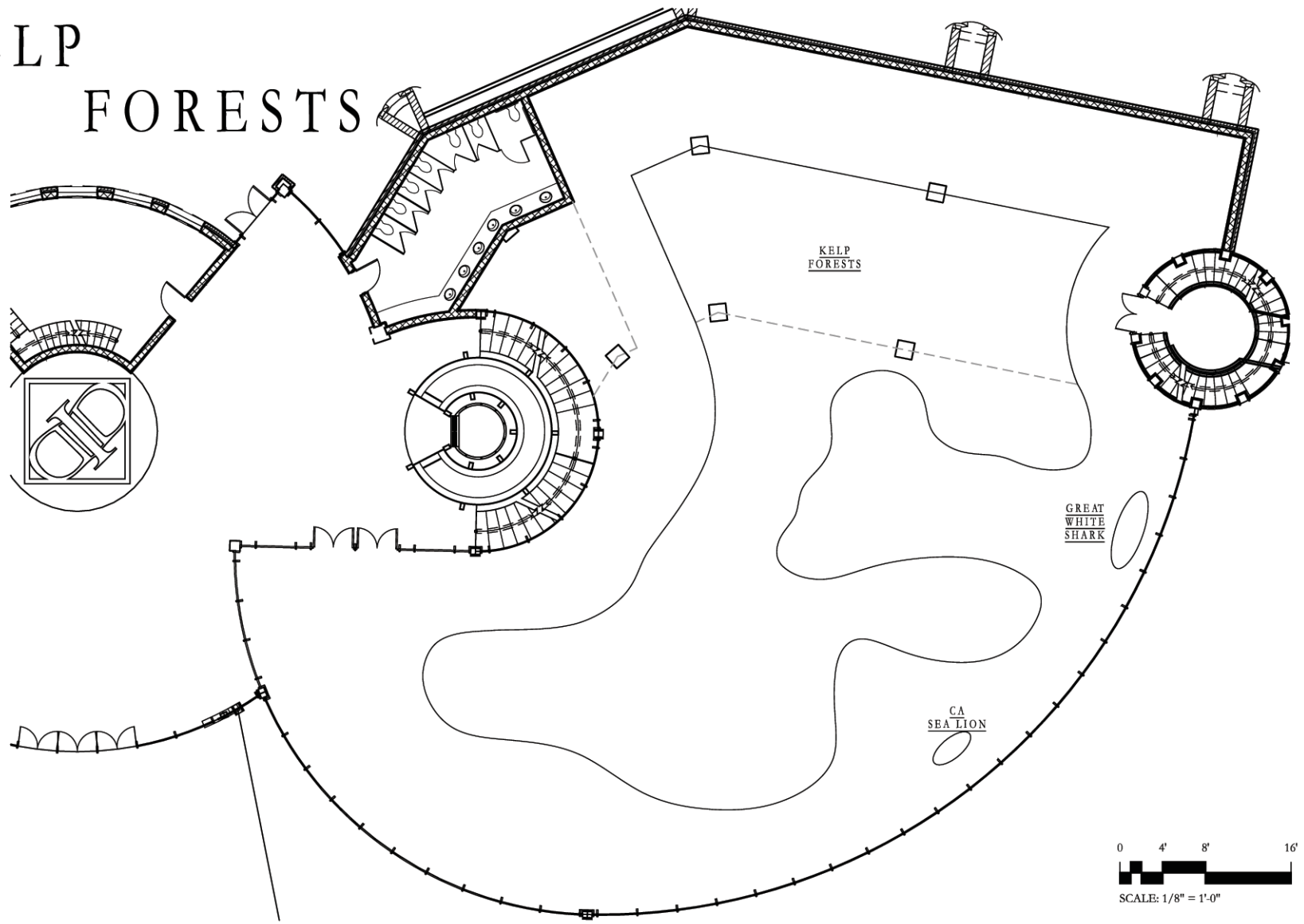
ROCKY SHORES



































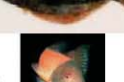


















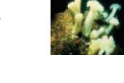

ROCKY SHORE

1.		Abalone	13.		Fingernail limpet	25.		Monkeyface eel	37.		Sandrose anemone
2.		Aggregating anemone	14.		Fish eating urchin	26.		Mussels	38.		Sculpins
3.		Balanus barnacles	15.		Giant green anemone	27.		Northern clingfish	39.		Sea cucumber
4.		Bat sea stars	16.		Gooseneck barnacles	28.		Nudibranch	40.		Sea hare
5.		Blennies	17.		Green sea urchin	29.		Ochre sea star	41.		Seahorse
6.		Blood star	18.		Gumboot chiton	30.		Orange cup coral	42.		Short spined star
7.		Brittle star	19.		Harbor seal	31.		Painted urchin	43.		Slipper sea cucumber
8.		Buckshot barnacles	20.		Hermit crab	32.		Periwinkle snail	44.		Sunflower star
9.		CA sealion	21.		Hairy chiton	33.		Proliferating anemone	45.		Surfgrass
10.		Coraline algae	22.		Kelp crab	34.		Purple sea urchin	46.		Two-spotted octopus
11.		Dawson's sun star	23.		Kelpfish	35.		Red sea urchin	47.		White spotted rose anemone
12.		Dungeness crab	24.		Leather sea star	36.		Rock scallop			

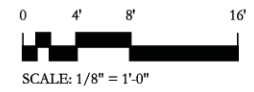
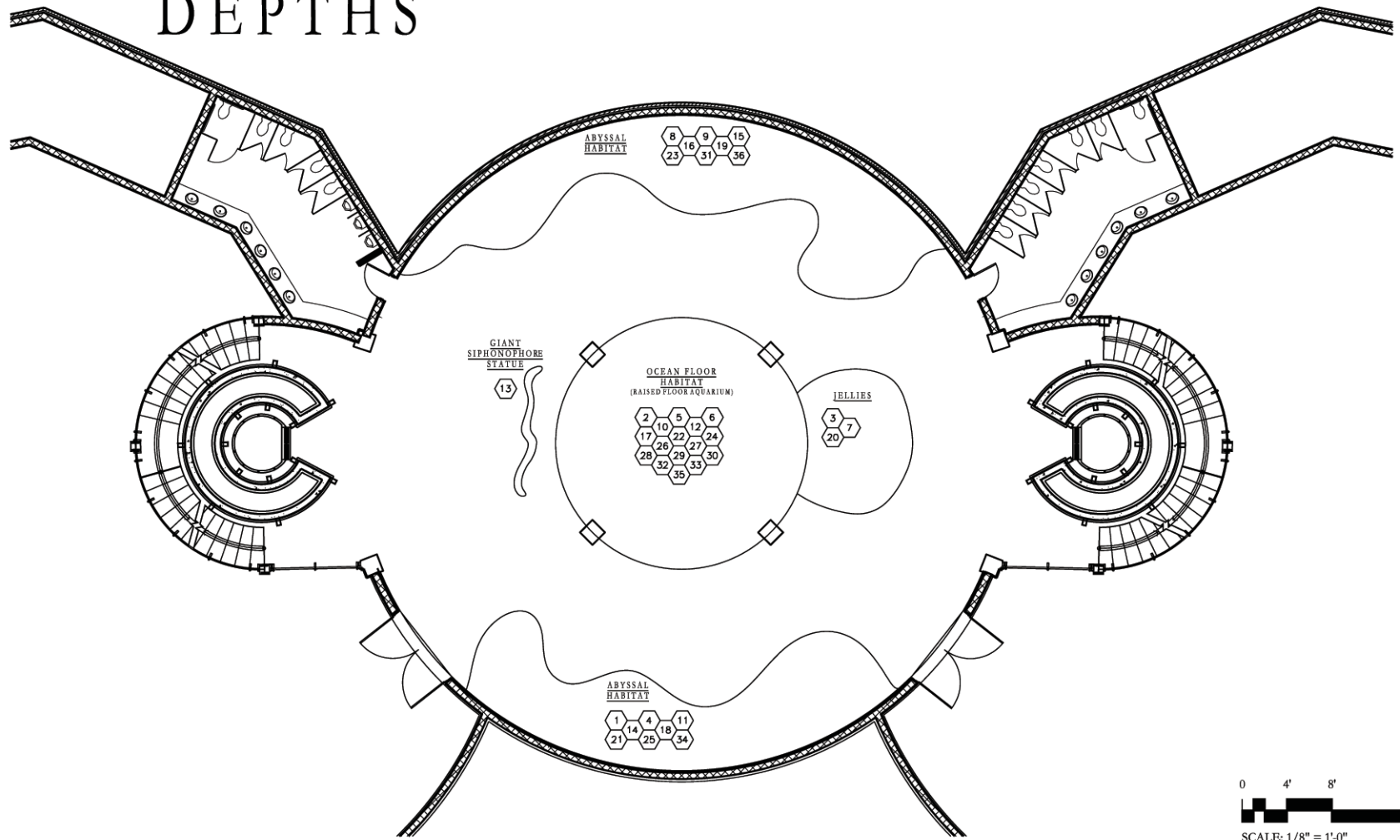
KELP FORESTS








































KELP FOREST

- | | | | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------|--------------------|-----|---------------------------------------------------------------------------------------|------------------------|-----|---------------------------------------------------------------------------------------|--------------------|
| 1. |  | Acid seaweed | 13. |  | China rockfish | 25. |  | Lingcod | 37. |  | Rosy rockfish |
| 2. |  | Barred Perch | 14. |  | Copper rockfish | 26. |  | Melibe | 38. |  | Sanddab |
| 3. |  | Bat Ray | 15. |  | Cuttlefish | 27. |  | Oarweed | 39. |  | Sanddollar |
| 4. |  | Big skate | 16. |  | Dogfish shark | 28. |  | Octopus | 40. |  | Sea otter |
| 5. |  | Black rockfish | 17. |  | Feather boa kelp | 29. |  | Olive rockfish | 41. |  | Senorita |
| 6. |  | Blue rockfish | 18. |  | Giant kelp | 30. |  | Orange puffball sponge | 42. |  | Shiner perch |
| 7. |  | Bocaccio | 19. |  | Giant kelp fish | 31. |  | Pacific electric ray | 43. |  | Silver perch |
| 8. |  | Bull kelp | 20. |  | Great white shark | 32. |  | Pacific seahorse | 44. |  | Smoothhound shark |
| 9. |  | CA halibut | 21. |  | Horn shark | 33. |  | Painted greenling | 45. |  | Striped perch |
| 10. |  | CA sheephead | 22. |  | Kelp bass | 34. |  | Plumose anemone | 46. |  | Tiger rockfish |
| 11. |  | Cabezon | 23. |  | Kelp greenling | 35. |  | Quillback rockfish | 47. |  | Treefish |
| 12. |  | Canary rockfish | 24. |  | Leopard shark | 36. |  | Rainbow perch | 48. |  | Vermilion rockfish |
| 49. |  | Walleye perch | 51. |  | Wolf eel | 53. |  | Yellowtail rockfish | | | |
| 50. |  | White plumed anemone | 52. |  | Yelloweye rockfish | | | | | | |

ABYSSAL DEPTHS



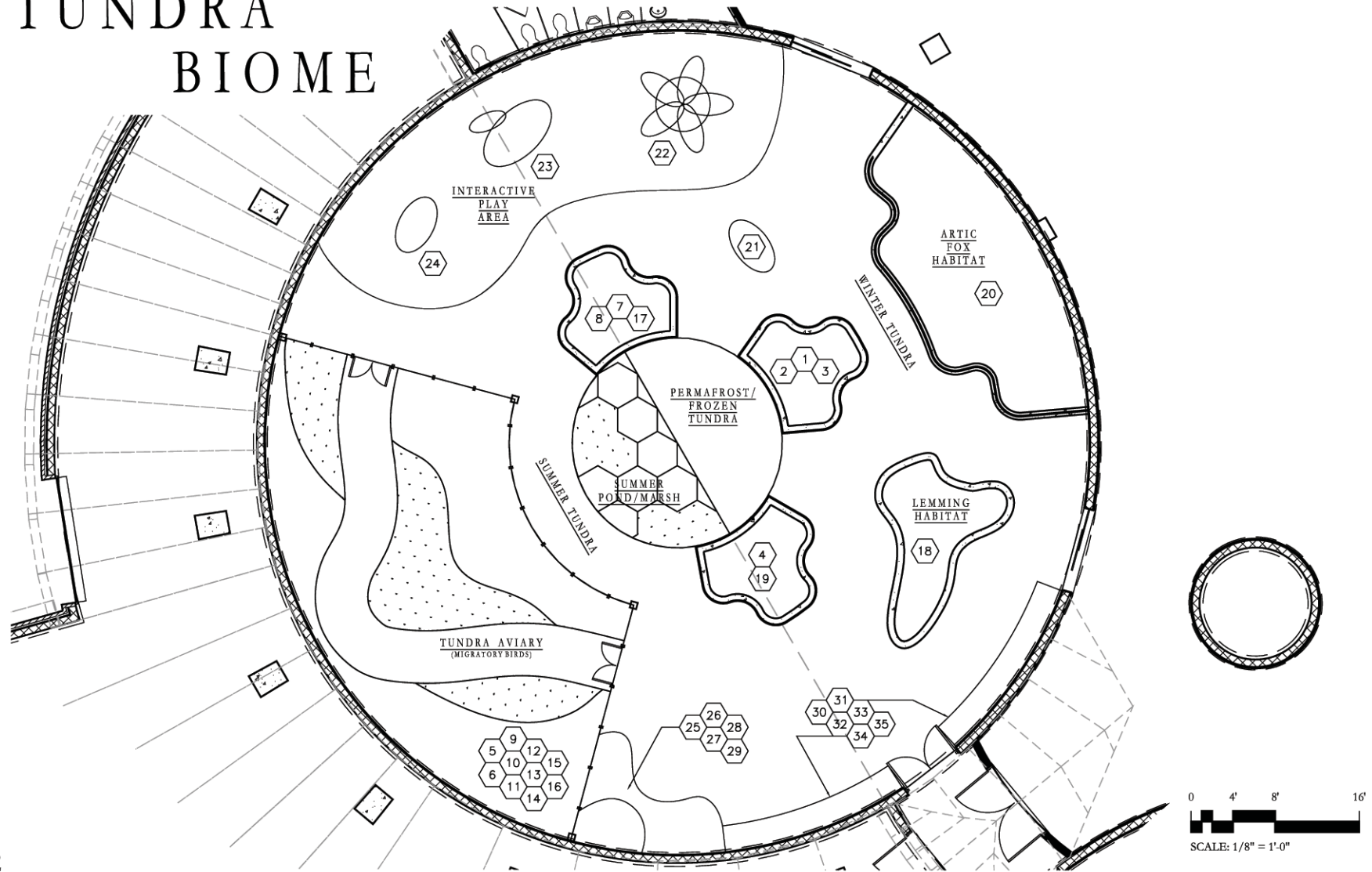
ABYSSAL DEPTHS

- | | | | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|-------------------------|-----|-------------------------------------------------------------------------------------|-------------------------|-----|---------------------------------------------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------|-------------------|
| 1. |  | Anglerfish | 13. |  | Giant siphonophore | 25. |  | Pacific viperfish | 37. |  | Tadpole snailfish |
| 2. |  | Apple anemone | 14. |  | Gulper eel | 26. |  | Pom-pom anemone | | | |
| 3. |  | Bloodybelly comb jelly | 15. |  | Hatchetfish | 27. |  | Predatory tunicate | | | |
| 4. |  | Bristlemouth | 16. |  | Hula skirt siphonophore | 28. |  | Red sea fan | | | |
| 5. |  | Deep sea clams | 17. |  | Johnson's sea cucumber | 29. |  | Riftia tubeworms | | | |
| 6. |  | Deep sea brittle star | 18. |  | Laternfish | 30. |  | Sea whip | | | |
| 7. |  | Dinner plate jelly | 19. |  | Midwater eelpout | 31. |  | Shining tubeshoulder | | | |
| 8. |  | Fangtooth | 20. |  | Midwater jelly | 32. |  | Slender snipe eel | | | |
| 9. |  | Filetail catshark | 21. |  | Midwater shrimp | 33. |  | Spiny king crab | | | |
| 10. |  | Fragile pink sea urchin | 22. |  | Mushroom soft coral | 34. |  | Spotted ratfish | | | |
| 11. |  | Giant ostracod | 23. |  | Pacific blackdragon | 35. |  | Squat lobster | | | |
| 12. |  | Giant red mysid | 24. |  | Pacific hagfish | 36. |  | Squid | | | |

APPENDIX C

Biome Exhibit Layouts

TUNDRA BIOME



TUNDRA BIOME



1. Raven
2. Peregrine Falcon
3. Gyr Falcon
4. Redpoll
5. Arctic Tern
6. Pomarine Skua
7. Rock Ptarmigan
8. Snowy Owl
9. Grey Phalarope
10. Arctic Warbler
11. Willow Warbler
12. Red Throated Pipit



13. Dunlin
14. Turnstone
15. Long-Tailed Duck
16. Brent Goose
17. Short-Eared Owl
18. Lemming
19. Arctic Hare
20. Arctic Fox
21. Tundra Wolf
22. Musk Ox
23. Polar Bear
24. Caribou

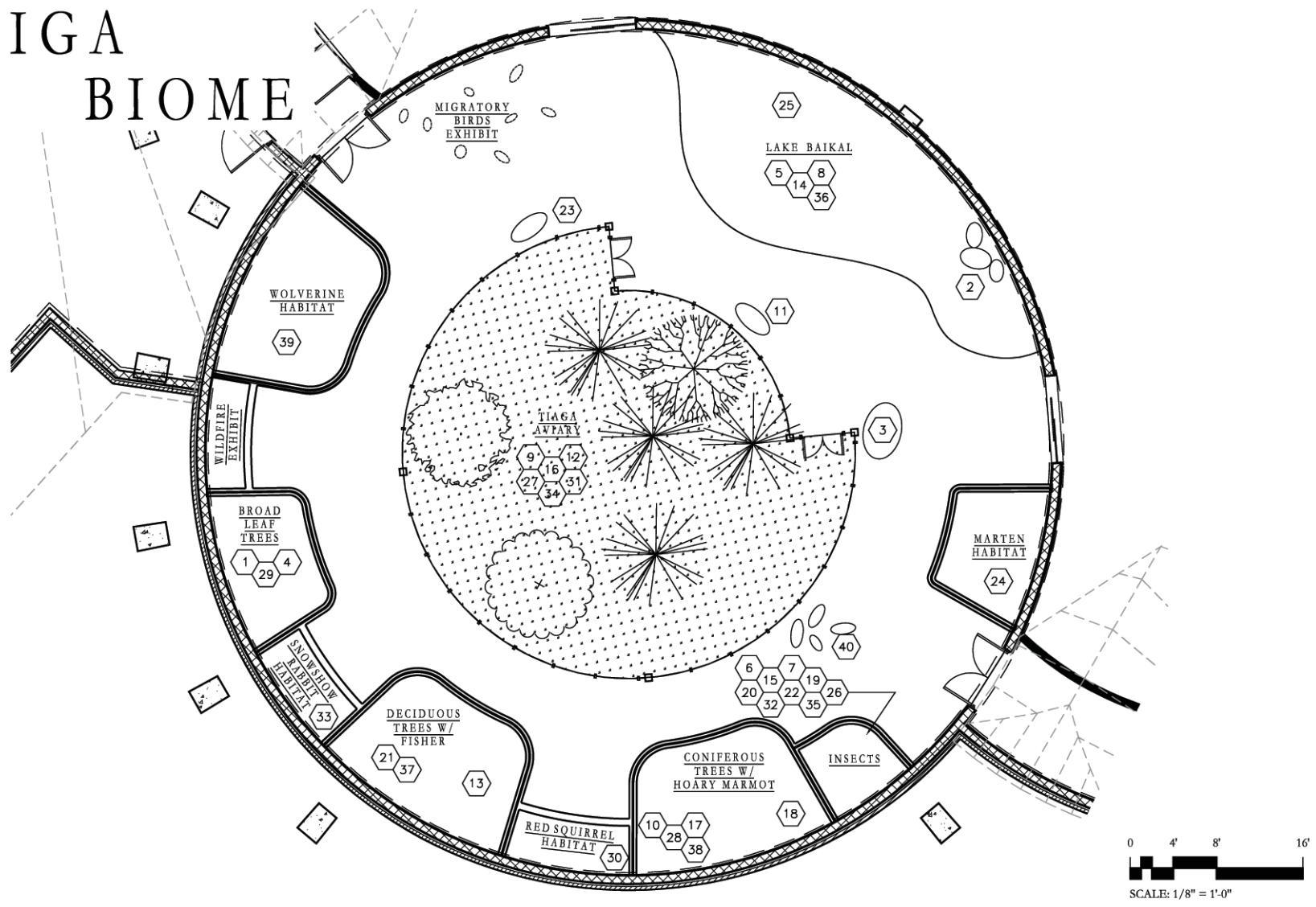


25. Mayflies
26. Stoneflies
27. Water Beetles
28. Mosquito
29. Dragonfly
30. Wood Cranesbill
31. Clubmoss
32. Purple Saxifrage
33. Sphagnum Moss
34. Cladonia















35. Tundra Plants













TAIGA BIOME







TAIGA BIOME

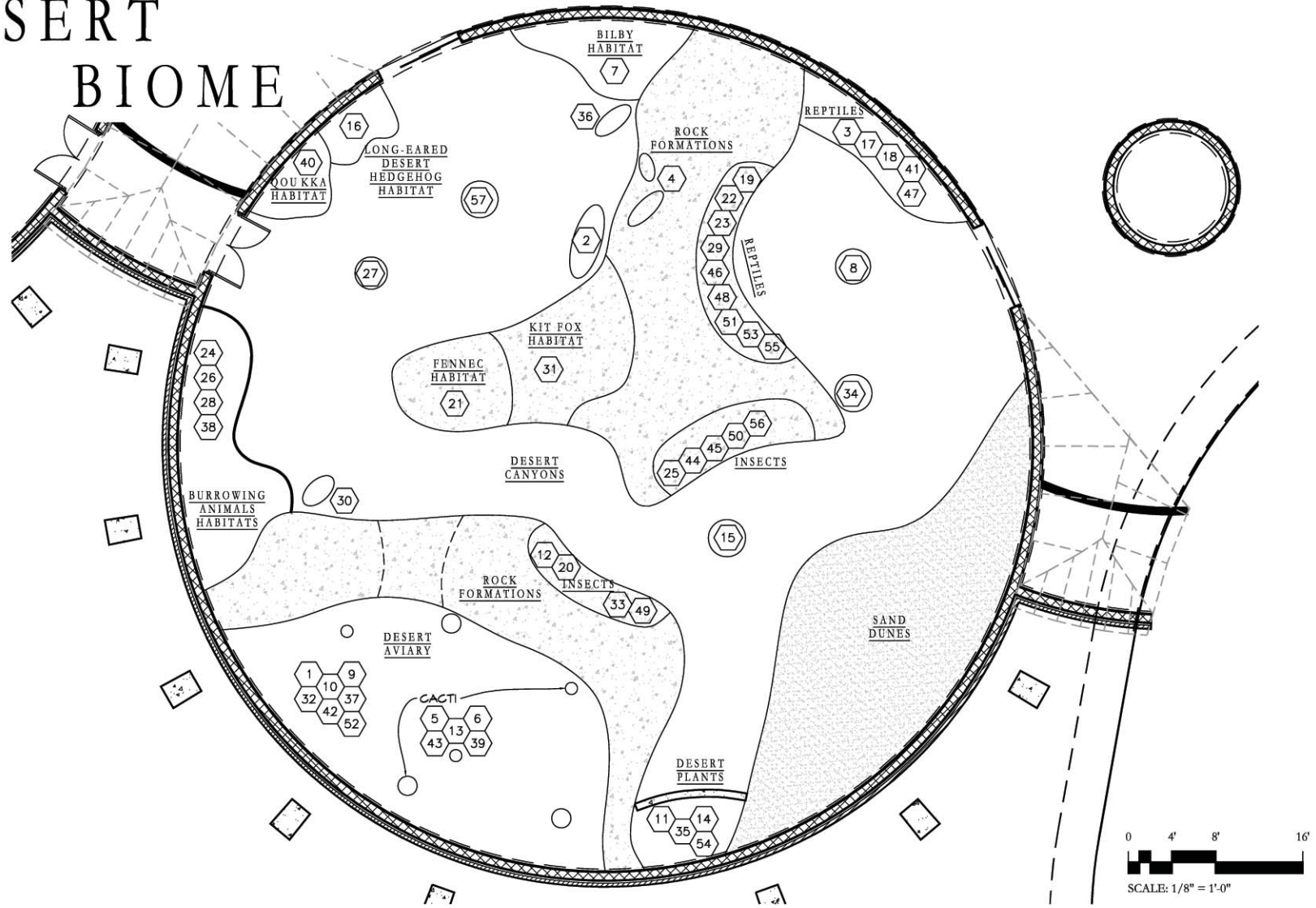
1.  Aspen tree
2.  Baikal seal
3.  Bear
4.  Birch tree
5.  Burbot
6.  Carpenter bee
7.  Crab spider
8.  Crayfish
9.  Crossbill
10.  Douglas fir
11.  Elk
12.  Finches

13.  Fisher
14.  Golomyank
15.  Green bottle fly
16.  Hazel hen
17.  Hemlock tree
18.  Hoary marmot
19.  Horse fly
20.  Lace bugs
21.  Larch tree
22.  Long-horned pine sawyer
23.  Lynx
24.  Marten


























































25.  Nerpa
26.  Northern rock crawler
27.  Pine grosbeak
28.  Pine tree
29.  Poplar
30.  Red squirrel
31.  Siberian jay
32.  Snow scorpionfly
33.  Snowshoe rabbit
34.  Sparrows
35.  Spruce-fir moss spider
36.  Sturgeon

37.  Tamarck
38.  White spruce
39.  Wolverine
40.  Wolves

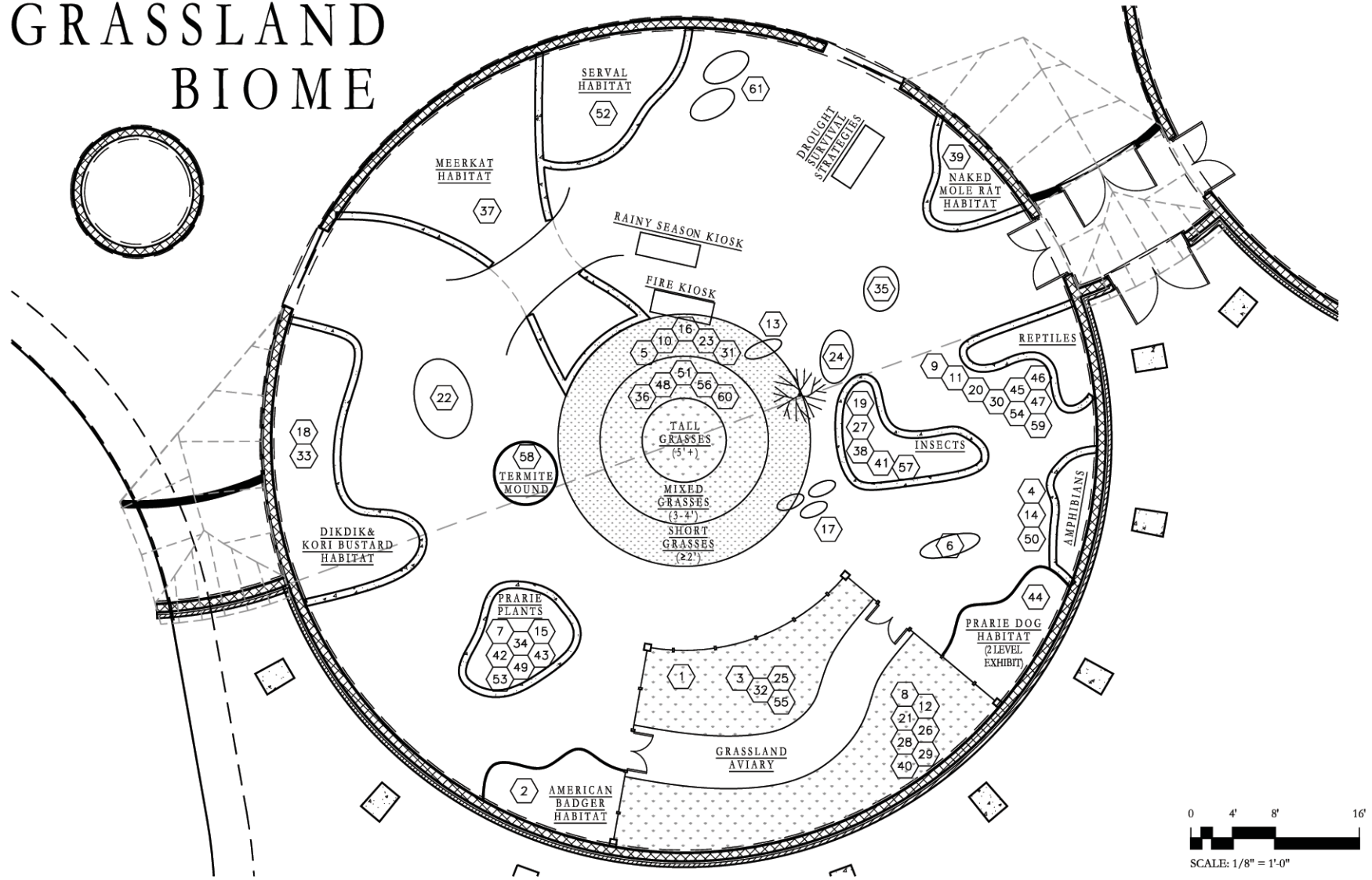
DESERT BIOME








DESERT BIOME

- | | | | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|--------------------|-----|-------------------------------------------------------------------------------------|---------------------|-----|---------------------------------------------------------------------------------------|----------------|-----|---------------------------------------------------------------------------------------|---------------------|
| 1. |  | American kestrel | 13. |  | Chain fruit cholla | 25. |  | Honey pot ant | 37. |  | Owl |
| 2. |  | Arabian camel | 14. |  | Creosote bush | 26. |  | Jack rabbit | 38. |  | Pocket mouse |
| 3. |  | Arabian cobra | 15. |  | Datil yucca | 27. |  | Joshua tree | 39. |  | Prickly pear cactus |
| 4. |  | Arabian oryx | 16. |  | Desert hedgehog | 28. |  | Jumping spider | 40. |  | Quokka |
| 5. |  | Barrel cactus | 17. |  | Desert horned viper | 29. |  | Kangaroo rat | 41. |  | Rattlesnake |
| 6. |  | Beavertail cactus | 18. |  | Desert monitor | 30. |  | Kangaroo | 42. |  | Roadrunner |
| 7. |  | Bilby | 19. |  | Desert tortoise | 31. |  | Kit fox | 43. |  | Saquaro cactus |
| 8. |  | Boab tree | 20. |  | Dung beetle | 32. |  | Kookaburra | 44. |  | Scarab beetle |
| 9. |  | California quail | 21. |  | Fennec | 33. |  | Millipede | 45. |  | Scorpion |
| 10. |  | Cactus wren | 22. |  | Frisled lizard | 34. |  | Mustard tree | 46. |  | Shovel lizard |
| 11. |  | Camelthorn | 23. |  | Gila monster | 35. |  | Night cereus | 47. |  | Sidewinder |
| 12. |  | Centipede | 24. |  | Great jerboa | 36. |  | Ostrich | 48. |  | Spadefoot toad |
| 49. |  | Tarantula | 52. |  | Vulture | 55. |  | Wolf spider | | | |
| 50. |  | Tenebrionid beetle | 53. |  | Web footed gecko | 56. |  | Woodlice | | | |
| 51. |  | Thorny devil | 54. |  | Welwitschia plant | 57. |  | Yucca | | | |

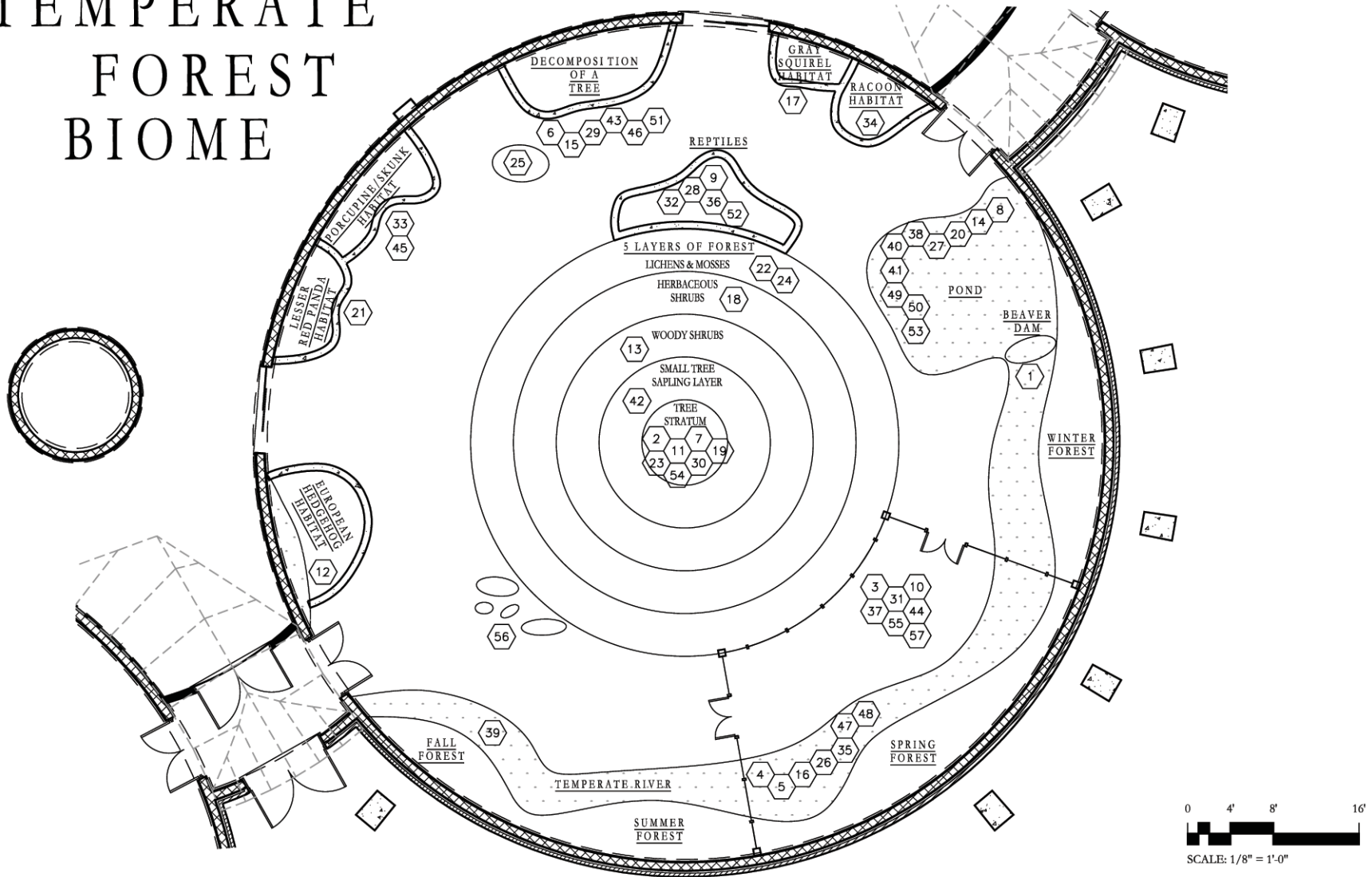
GRASSLAND BIOME




GRASSLAND BIOME

- | | | | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|-------------------------|-----|-------------------------------------------------------------------------------------|----------------------|-----|---------------------------------------------------------------------------------------|-------------------------|-----|---------------------------------------------------------------------------------------|------------------------|
| 1. |  | Acacia Tree | 13. |  | Cheetah | 25. |  | Golden Rod | 37. |  | Meerkats |
| 2. |  | American Badger | 14. |  | Common Mudpuppy | 26. |  | Grasshopper Sparrow | 38. |  | Milkweed Beetle |
| 3. |  | Aster | 15. |  | Compass Plant | 27. |  | Grasshopper | 39. |  | Naked Mole Rat |
| 4. |  | Barred Tiger Salamander | 16. |  | Cord Grass | 28. |  | Greater Prairie Chicken | 40. |  | Northern Harrier |
| 5. |  | Big Blue Stem | 17. |  | Coyote | 29. |  | Henslow's Sparrow | 41. |  | Northern Mole Cricket |
| 6. |  | Bison | 18. |  | Dikdik | 30. |  | Hognose Snake | 42. |  | Prairie Blazingstar |
| 7. |  | Black-Eyed Susan | 19. |  | Dogbane Leaf Beetle | 31. |  | Indian Grass | 43. |  | Prairie Coneflower |
| 8. |  | Bobolink | 20. |  | Eastern Garter Snake | 32. |  | Indigo | 44. |  | Prairie Dogs |
| 9. |  | Box Turtle | 21. |  | Eastern Meadowlark | 33. |  | Kori Bustard | 45. |  | Prairie Earless Lizard |
| 10. |  | Buffalo Grass | 22. |  | Elephant | 34. |  | Lead Plant | 46. |  | Prairie Kingsnake |
| 11. |  | Bull Snake | 23. |  | Foxtail | 35. |  | Lion | 47. |  | Prairie Rattlesnake |
| 12. |  | Burrowing Owl | 24. |  | Giraffe | 36. |  | Little Bluestem | 48. |  | Purple Needlegrass |
| 49. |  | Purple Prairie Clover | 52. |  | Serval | 55. |  | Sunflower | 58. |  | Termite Mound |
| 50. |  | Red Spotted Toad | 53. |  | Sideoats Gamma | 56. |  | Switch Grass | 59. |  | Western Fox Snake |
| 51. |  | Rye Grass | 54. |  | Skinks | 57. |  | Swordbearing Conehead | 60. |  | Wild Oats |

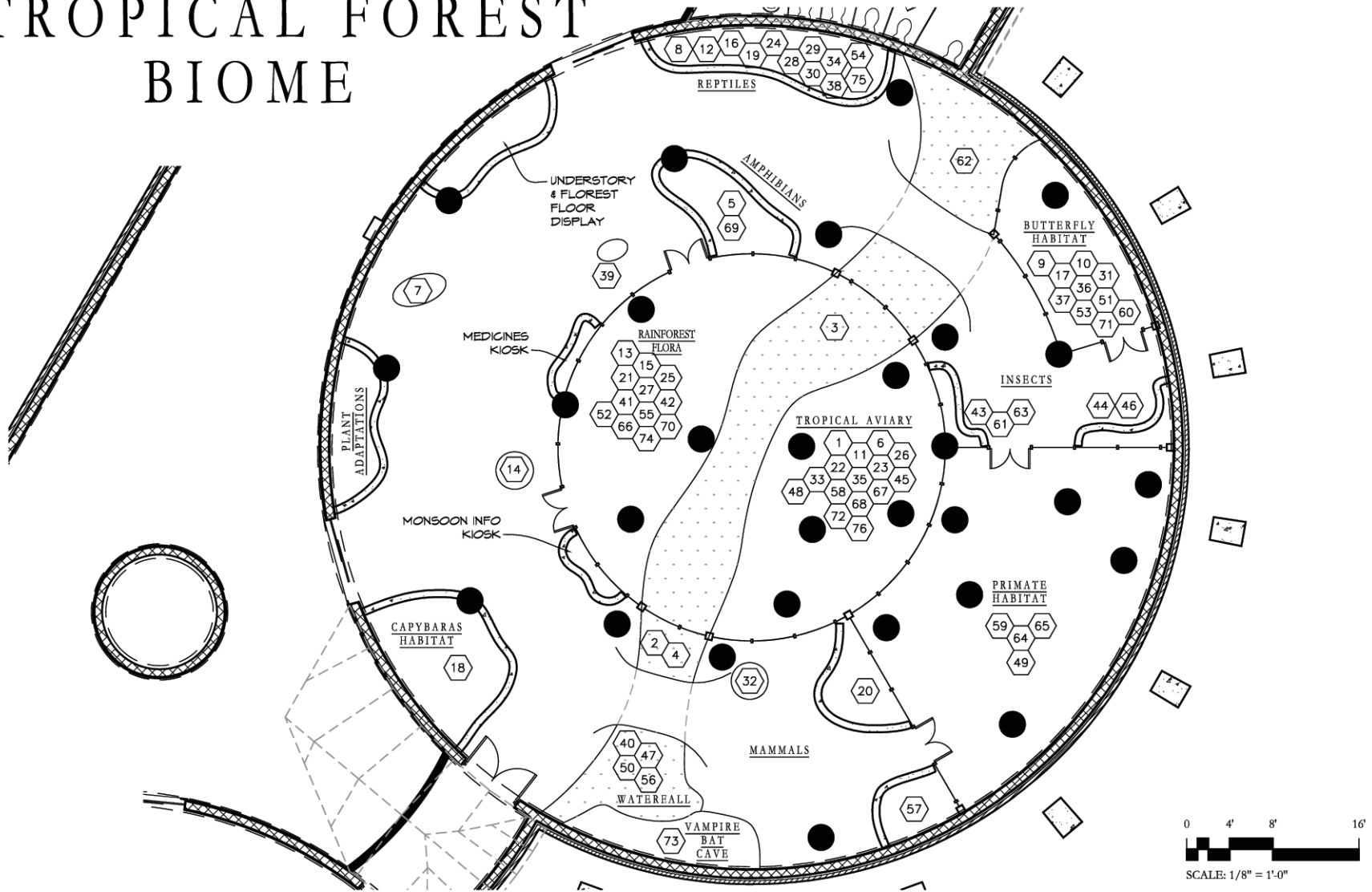
TEMPERATE FOREST BIOME














































TEMPERATE FOREST BIOME

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|-----|-------------------------------------------------------------------------------------|-----------------------|-----|-------------------------------------------------------------------------------------|---------------------|-----|---------------------------------------------------------------------------------------|---------------------------|-----|---------------------------------------------------------------------------------------|--------------------|
| 1. |  | Beavers | 13. |  | Forest shrubs | 25. |  | Mountain lion | 37. |  | Redstart |
| 2. |  | Beech tree | 14. |  | Frogs | 26. |  | Mountain whitefish | 38. |  | Ringed salamander |
| 3. |  | Blue jay | 15. |  | Fungi | 27. |  | Northern dusky salamander | 39. |  | River otters |
| 4. |  | Brown trout | 16. |  | Grass carp | 28. |  | Northern scarlet snake | 40. |  | Rough-skinned newt |
| 5. |  | Catfish | 17. |  | Gray squirrel | 29. |  | Northern scorpion | 41. |  | Salamander |
| 6. |  | Centipede | 18. |  | Herbs | 30. |  | Oak tree | 42. |  | Sapling |
| 7. |  | Chestnut tree | 19. |  | Hickory tree | 31. |  | Ovenbird | 43. |  | Sawfly |
| 8. |  | Eastern toad | 20. |  | Jordan's salamander | 32. |  | Pine woods snake | 44. |  | Scarlet tanager |
| 9. |  | Eastern hognose snake | 21. |  | Lesser red panda | 33. |  | Porcupine | 45. |  | Skunk |
| 10. |  | Eastern wood peewee | 22. |  | Lichen | 34. |  | Raccoon | 46. |  | Slug |
| 11. |  | Elm tree | 23. |  | Maple tree | 35. |  | Rainbow trout | 47. |  | Smallmouth bass |
| 12. |  | European hedgehog | 24. |  | Mosses | 36. |  | Rat snake | 48. |  | Spotted bass |
| 49. |  | Spotted turtle | 52. |  | Three-toes amphiuma | 55. |  | Warbler | | | |
| 50. |  | Spring peeper | 53. |  | Turtles | 56. |  | White tailed deer | | | |
| 51. |  | Termite | 54. |  | Walnut tree | 57. |  | Woodpecker | | | |





























TROPICAL FOREST BIOME



TROPICAL RAINFOREST BIOME

- | | | | |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <p>1.  Amazon Kingfisher</p> | <p>13.  Bougainvillea</p> | <p>25.  Curare</p> | <p>37.  Hercules Moth</p> |
| <p>2.  Anableps</p> | <p>14.  Brazilian Tapir</p> | <p>26.  Dark-Billed Cuckoo</p> | <p>38.  Iguana</p> |
| <p>3.  Anaconda</p> | <p>15.  Bromeliads</p> | <p>27.  Durian</p> | <p>39.  Jaguar</p> |
| <p>4.  Arapaima</p> | <p>16.  Caiman</p> | <p>28.  Emerald Tree Boa</p> | <p>40.  Jaguar Ray</p> |
| <p>5.  Poison Arrow Frog</p> | <p>17.  Cairns Birdwing Butterfly</p> | <p>29.  Flying Dragon</p> | <p>41.  Jambu</p> |
| <p>6.  Bell Bird</p> | <p>18.  Capybaras</p> | <p>30.  Gaboo Adder</p> | <p>42.  Kapok Tree</p> |
| <p>7.  Bengal Tiger</p> | <p>19.  Chameleon</p> | <p>31.  Goliath Birdwing Butterfly</p> | <p>43.  Leaf Cutting Ants</p> |
| <p>8.  Bird Eating Spider</p> | <p>20.  Coati</p> | <p>32.  Gorilla</p> | <p>44.  Leaf Mimic Katydid</p> |
| <p>9.  Birdwing Butterfly</p> | <p>21.  Coconut Tree</p> | <p>33.  Green Aracari</p> | <p>45.  Lettered Aracari</p> |
| <p>10.  Blue Morpho Butterfly</p> | <p>22.  Common Potoo</p> | <p>34.  Green Vine Snake</p> | <p>46.  Lichen Katydid</p> |
| <p>11.  Blue Winged Parrotlet</p> | <p>23.  Congo Peafowl</p> | <p>35.  Gray Parrot</p> | <p>47.  Lungfish</p> |
| <p>12.  Boa Constrictor</p> | <p>24.  Coral Snake</p> | <p>36.  Heliconid Butterfly</p> | <p>48.  Macaw</p> |

TROPICAL RAINFOREST BIOME (CONT.)

- | | | | | | | | | |
|-----|-------------------------------------------------------------------------------------|-----------------------------|-----|-------------------------------------------------------------------------------------|-------------------|-----|-------------------------------------------------------------------------------------|-----------------------|
| 49. |  | Maned Sloth | 61. |  | Rhino Beetle | 73. |  | Vampire Bat |
| 50. |  | Ocellated Ray | 62. |  | River Turtle | 74. |  | Vines |
| 51. |  | Orchard Butterfly | 63. |  | Safari Ants | 75. |  | Wagler's Pit Viper |
| 52. |  | Orchids | 64. |  | Spider Monkey | 76. |  | White Necked Puffbird |
| 53. |  | Owl Butterfly | 65. |  | Squirrel Monkey | | | |
| 54. |  | Parrot Snake | 66. |  | Strangler Fig | | | |
| 55. |  | Philodendron | 67. |  | Stripped Cuckoo | | | |
| 56. |  | Piranha | 68. |  | Toucan | | | |
| 57. |  | Prehensile Tailed Porcupine | 69. |  | Tree Frog | | | |
| 58. |  | Quetzal | 70. |  | Tualang Tree | | | |
| 59. |  | Red Howler Monkey | 71. |  | Ulysses Butterfly | | | |
| 60. |  | Red Lacewing Butterfly | 72. |  | Umbrella Bird | | | |

ACKNOWLEDGMENTS

The creation of a project of this dimension cannot be realistically attributed to one person. This project required consulting with many experts and professionals to create a realistic design proposal that could actually be built.

I would first like to thank my wife, Trisha Hamera, for more than three years of hard work creating the concept behind this project. Without her, this project would not exist. It has been through her ideas and desires that this Imagine, Dream, Discover could one day be built.

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Phil Hawes, Architect - Architect of Record, Biosphere II

Alan Varsik - General curator, Santa Barbara Zoological Gardens

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