



# WINGS OF CHANGE

ZOO DESIGN STRATEGIES FOR  
RAPTOR REHABILITATION CENTERS

JAKE BROTSIS

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DEPARTMENT OF LANDSCAPE ARCHITECTURE  
COLLEGE OF DESIGN  
UNIVERSITY OF OREGON

## Abstract

This master’s project explores the adaptation of zoo design principles to wildlife rehabilitation centers, specifically focusing on the Cascades Raptor Center in Eugene, Oregon. The aim is to create speculative design solutions that prioritize animal wellness, visitor education, and environmental stewardship. Through extensive research, expert collaboration, and design development, this project presents a comprehensive vision for the Cascades Raptor Center’s future expansion, demonstrating the potential for integrating zoo design principles into a wildlife rehabilitation setting.

The project includes a comprehensive analysis of the raptor center’s expansion plans and site conditions, proposing innovative approaches to designing new aviary habitats and human-occupied spaces. Using the award-winning Eagle Passage aviary at Northwest Trek Wildlife Park as a design precedent, the project explores alternative ways to meet the principles of landscape immersion and animal husbandry requirements while providing an educational experience for visitors through interpretive programs. The concept of “flex enclosures” is introduced, offering adaptable spaces that allow for controlled movement and rotation of raptors between enclosures, enhancing the immersive appeal and reinforcing educational interactives.

Guided by a conceptual framework centered on Integrated Habitat Design and Interpretive Engagement, the project emphasizes the synergistic relationship between enclosure design and education. By replicating natural habitats and providing immersive educational experiences, the design aims to foster emotional connections and a deeper understanding of raptor conservation among visitors. This project provides valuable insights for landscape architects and students on designing species-appropriate habitats and educational programs within the parameters and goals set by the client, exemplified by the Cascades Raptor Center.



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# NESTING PREPARATIONS

1.0 ABOUT ME | 1.1 TERMINOLOGY | 1.2 VOCABULARY



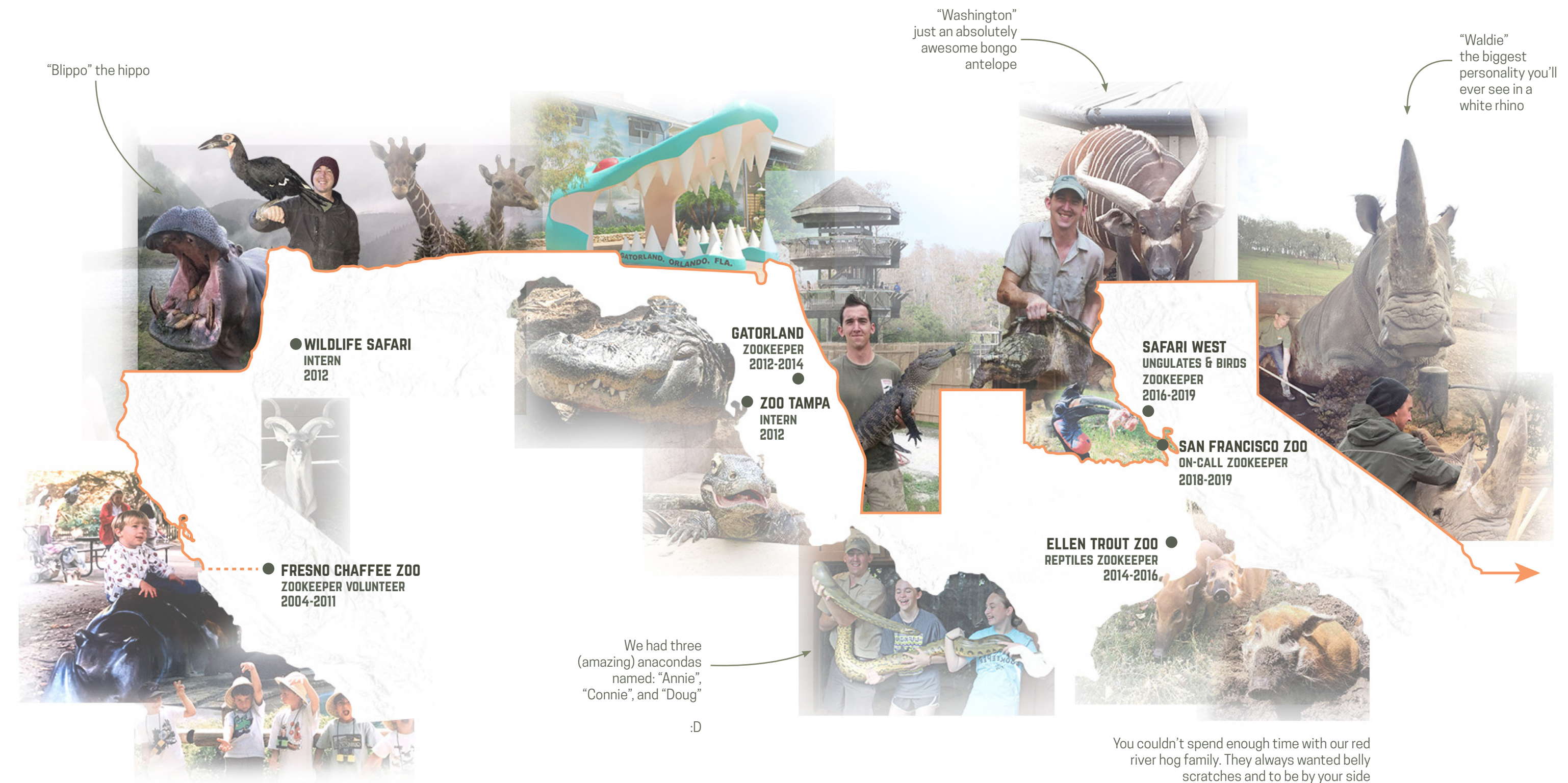
My Story

Before embarking on my journey in the MLA program, I dedicated my earlier career to being a zookeeper. I had the privilege of interning and working at several AZA-accredited zoos nationwide, including Wildlife Safari, Gatorland, Safari West, and the San Francisco Zoo. This experience allowed me to forge meaningful connections with an array of animals, ranging from crocodilians and Komodo dragons to white rhinos, greater kudu, and southern ground hornbills.

In the latter part of my time as a zookeeper, my fascination with the intricacies of designing new enclosures and zoo masterplans began to take root. The meticulous thought and attention to detail required to depict exotic environments of both ecological and cultural significance and then recreate them in a zoo setting through an artistic lens captivated me. It was this passion that ultimately drove me to transition from zookeeping to the field of landscape architecture.

My focus shifted from working directly **with** animals to working **for** them. The prospect of contributing to the creation of environments that enhance their well-being and mimic their natural habitats became a calling I couldn't resist.

CAREER TIMELINE



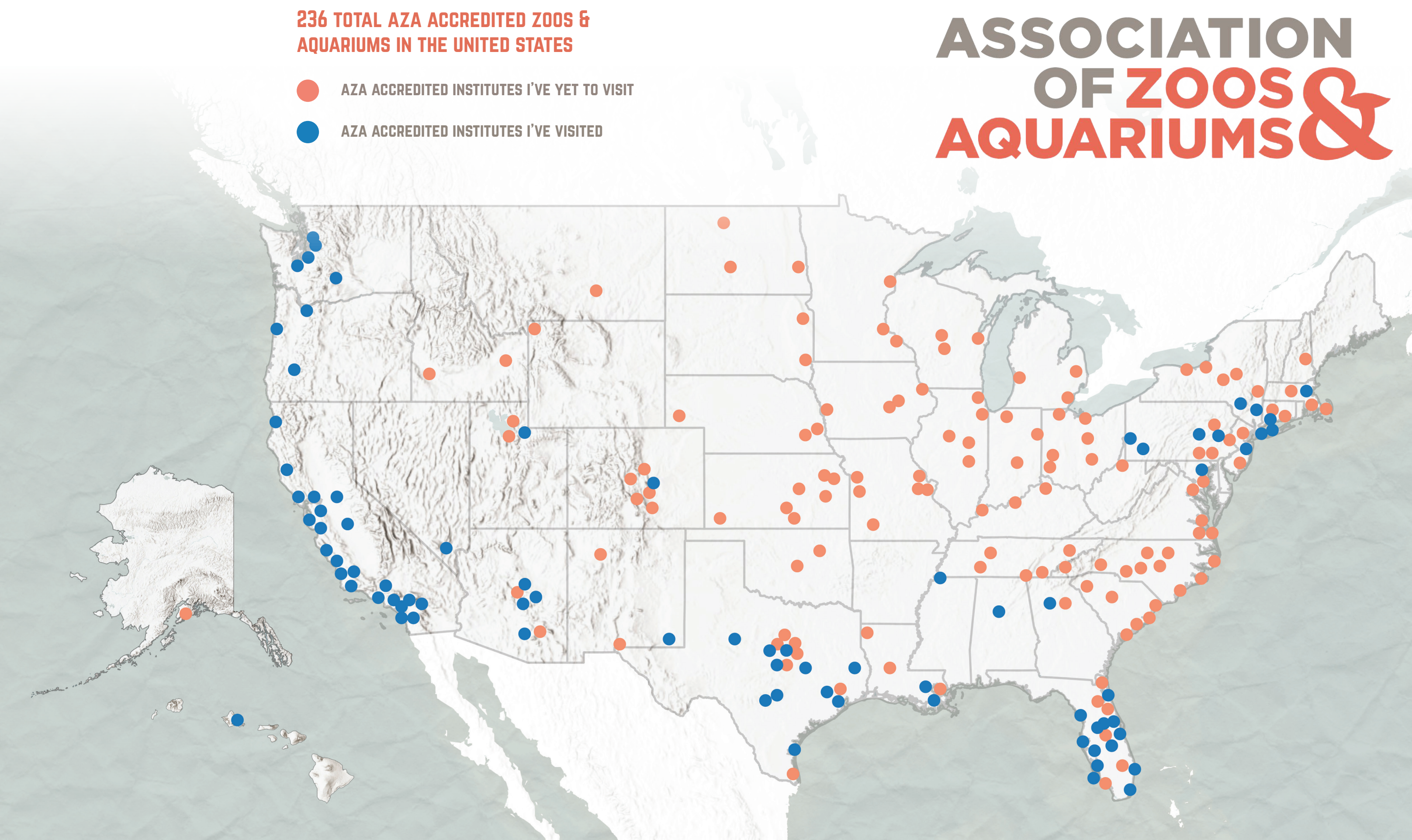
#### Setting the Standard

Throughout this project, I am going to casually use the term “zoo”. For clarification, it’s important to explain who I’m referring to when using the term “zoo.” Over the course of my roughly 15-year involvement with zoos, most of my experience has been gained in AZA-accredited zoos.

AZA, or the Association of Zoos & Aquariums, is a non-governmental organization that ensures its member zoos meet top-notch standards in animal care, conservation, and education through rigorous accreditation processes. Accreditation involves setting and upholding professional standards and evaluating organizations based on those standards, ensuring that the profession is assessed according to established best practices by industry experts (Marcy, 2020). Of the approximately 2,800 animal exhibitors licensed nationwide, less than 10% are AZA-accredited (About AZA Accreditation, 2018). AZA has been the leading accrediting body for zoos and aquariums for over 40 years, with its standards recognized as national benchmarks by agencies like OSHA and the USDA. Their standards cover all aspects of operation, from animal wellness to guest services, and are continually updated based on scientific advancements (About AZA Accreditation, 2018). Institutions undergo thorough evaluations every five years to ensure adherence to these evolving standards, reflecting a commitment to the highest levels of animal care and management.

This is not to imply that zoological organizations not affiliated with AZA necessarily reflect poor animal wellness standards. Other zoological accreditation groups exist nationally and internationally, as well as all zoological facilities adhering to state and local laws and regulations standardized by groups such as USDA and USFWS. However, I have chosen to focus on AZA in my project due to my familiarity with their standards and my trust in them.

ACCREDITED BY THE  
**ASSOCIATION  
OF ZOOS &  
AQUARIUMS**



COMPARING MISSIONS

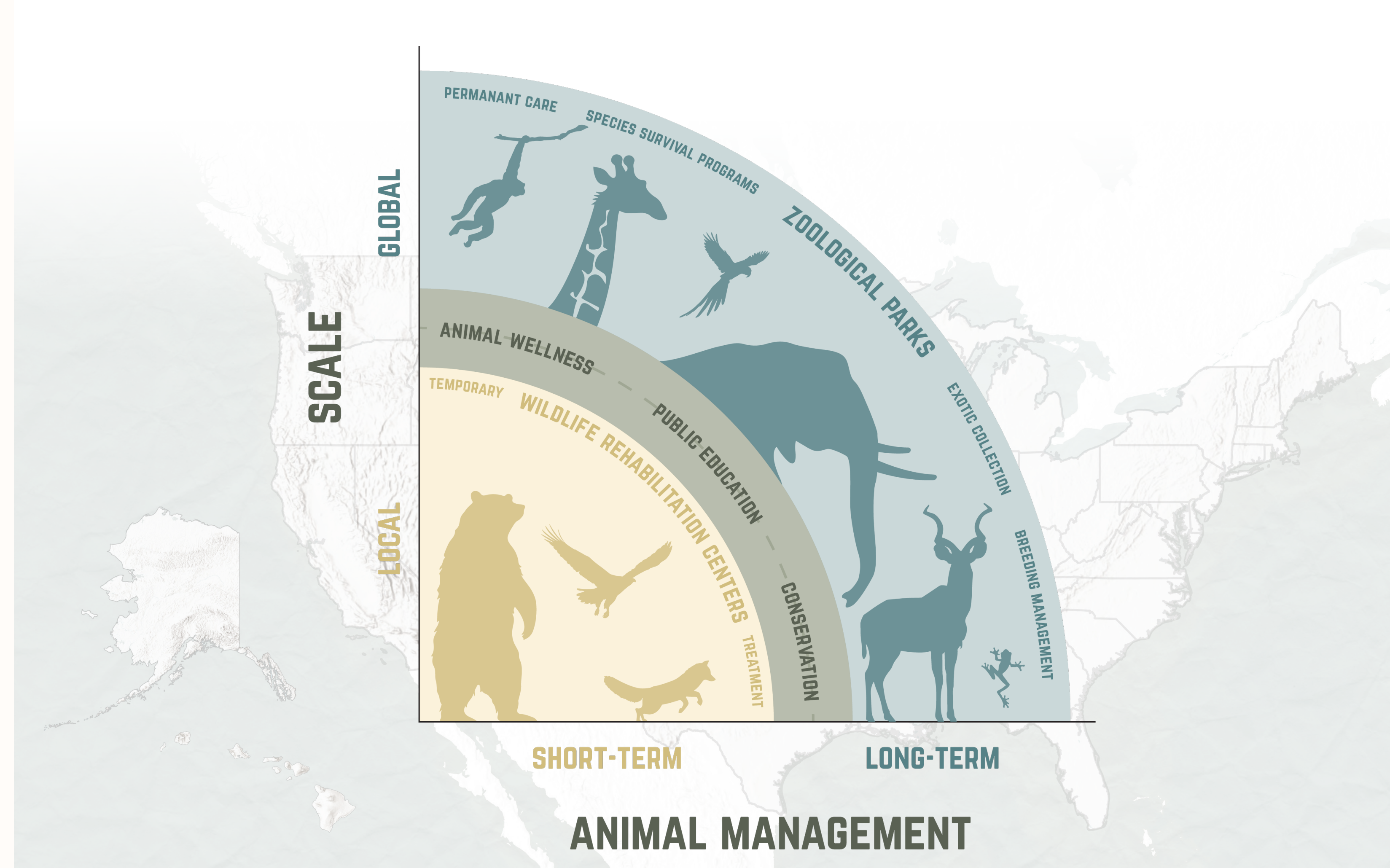
AZA ZOOS

Zoos serve a vital role in public education about a wide range of wildlife species that many people may never have the chance to encounter in the wild. AZA zoos actively participate in Species Survival Programs, Global Species Management Plans, and numerous research and conservation initiatives aimed at managing threatened species and maintaining genetically diverse populations (Marcy, 2020). Without these accredited zoos, species like the California condor or scimitar oryx would have faced extinction. While animals spend much of their lives here, they are under the care of highly trained professionals who ensure they receive proper diets and enrichment activities for a healthy and fulfilling existence.

WILDLIFE REHABILITATION CENTERS

Wildlife rehabilitation centers, on the other hand, provide critical care for local wild animals that have been injured or orphaned before they can return to their natural habitats. Unlike zoos, these centers do not breed animals and primarily serve as temporary homes for their patients. Here, the focus is on providing medical examinations, treatments, and physical therapy to prepare injured, diseased, or orphaned animals for release back into the wild (National Wildlife Rehabilitators' Association et al., 2000). Rehabilitation centers are found worldwide, each dedicated to rehabilitating various species with the ultimate goal of returning them to their natural environments. If an animal is deemed unfit for release, it may either remain in the center's care or be transferred to zoos and sanctuaries.

Both zoos and wildlife rehabilitation centers share a common mission of educating the public and raising awareness about wildlife conservation. They often collaborate closely with one another towards improving biodiversity and safeguarding species extinction. Zoos play a crucial role in inspiring people to appreciate animals from around the world while also contributing to the preservation of their genetic diversity. Meanwhile, wildlife rehabilitation centers focus on aiding local wildlife populations and mitigating human impacts through education and rehabilitation efforts. Both types of organizations rely heavily on grants, donations, and community support to sustain their operations and further their conservation goals.



#### KEY TERMS

##### **Aviary**

- a large enclosure in which birds are kept

##### **Chute**

- a contained tunnel system that allows animals to securely move from one point to another

##### **Flex Enclosure**

- flexible; enclosures that meet the requirements of housing multispecies consecutively

##### **Furnishing**

- the objects within the enclosures that provide comfort, stimulation, or practical use for the raptors

##### **Husbandry**

- the proper management and care of animals, including the regulation of water, food, environment, and breeding

##### **Mew**

- indoor and outdoor quarters designed to house one or more birds of prey

##### **Perching**

- objects or surfaces within the enclosure that allow the raptors to rest, roost, or observe their surroundings from

##### **Phylogeny**

- the evolution of a particular group of organisms

##### **Raptor**

- bird of prey; the word originates from the Latin translation “to grasp or seize” attributed to the animal’s talons and beak used to capture and secure their prey

##### **Rehabilitation**

- rehabilitate; the action of restoring something that has been damaged to its former condition

#### ABBREVIATIONS

**AZA** = Association of Zoos & Aquariums

**CRC** = Cascades Raptor Center

# FLEDGLING FOUNDATIONS

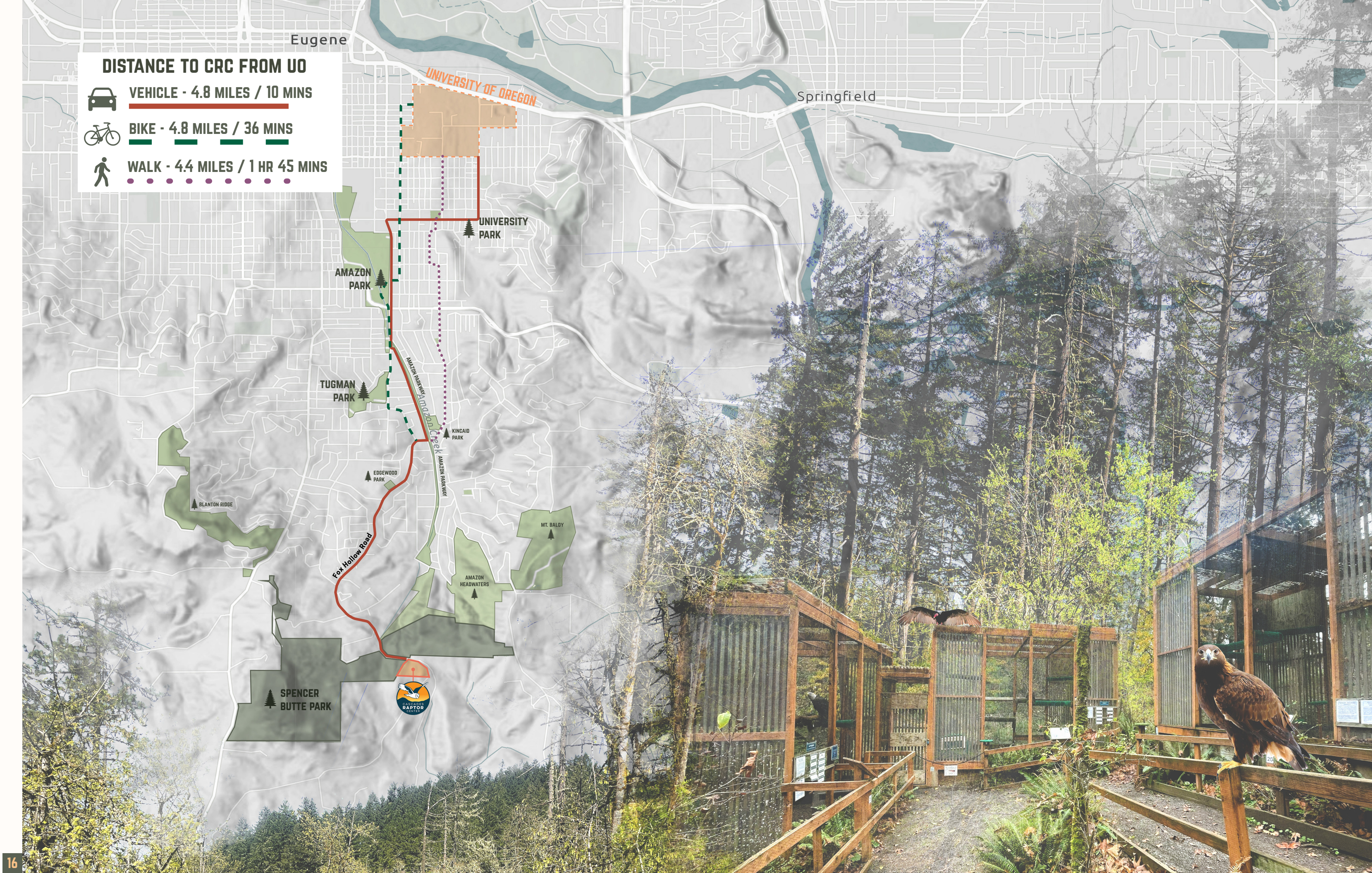
2.0 SITE CONTEXT | 2.1 SITE ANALYSIS | 2.2 COLLABORATION | 2.3 SITE EVALUATION





**Cascades Raptor Center**

Nestled in Spencer Butte Park of south Eugene on Fox Hollow Road, the Cascades Raptor Center (CRC), a 501c3 non-profit, stands as a beacon of conservation and education. Founded by Louise Shimmel in 1987, the CRC obtained its official incorporation and relocated to its current 8-acre site in 1990. Since then, the center has been an instrumental force in promoting environmental stewardship and the preservation of the natural world. Distinguished as Oregon's sole raptor-exclusive wildlife center, the center remains a vital resource for avian medical treatment and community support. CRC is a well-loved and greatly supported community destination, recognized for its impact on local culture and appreciation for natural heritage.



### Structures & Circulation

Spread across 3.7 acres, of the 8-acre property, are the core elements of the nature center. This area includes enclosures for residential raptors, a wildlife hospital, a gift shop, and educational spaces, alongside specialized enclosures for injured birds transitioning back into the wild. These particular enclosures are secluded from public view, preserving the birds' natural instincts and facilitating their acclimatization back into the wild.

Visitor parking is minimal, with a small parking lot located in the center of the property, nearest the animal hospital. Overflow parking is available across Fox Hollow Road in the Ridgeline Trail parking lot. Visitors have access to two winding path systems that circulate the property to view the raptors.

On the east side of the property lies two yurt structures for administrative personnel. These yurts are currently designated exclusively for CRC staff, with the potential for future inclusion with the general public.

### STRUCTURES

ADMINISTRATIVE BUILDINGS

STAFF BUILDINGS

EVENT SPACES

RESIDENT RAPTOR MEWS

REHABILITATION RAPTOR MEWS

### CIRCULATION

VEHICULAR PATH

VISITOR PATH

STAFF NATURE TRAIL

VISITOR ENTRY

STAFF ENTRY



### Animal Inventory

At the heart of CRC's endeavors lies their commitment to wildlife rehabilitation. Their wildlife hospital serves as a first point-of-contact for wildlife questions, emergencies, and providing medical aid for orphaned, sick, and injured birds of prey. In 2022 alone, the hospital provided care to over 430 birds from across Oregon, marking a cumulative tally of 7,200 birds treated since its establishment.

CRC boasts one of the largest North American raptor collections in the Pacific Northwest, housing a diverse collection of more than 30 residential raptors. Residential raptors refers to the birds that permanently reside at the center. Each raptor enclosure, often referred to as a 'mew,' is constructed from natural materials and designed to meet the needs of all species. These avian ambassadors offer visitors a unique opportunity to observe and learn about different species, their environmental significance, and the conservation challenges they face. Through educational programs, guided tours, and interactive sessions, the center engages thousands of visitors, students, and locals annually, fostering a deeper appreciation for their species and ecological roles.



### RESIDENT RAPTOR COLLECTION

#### EAGLES



#### VULTURES



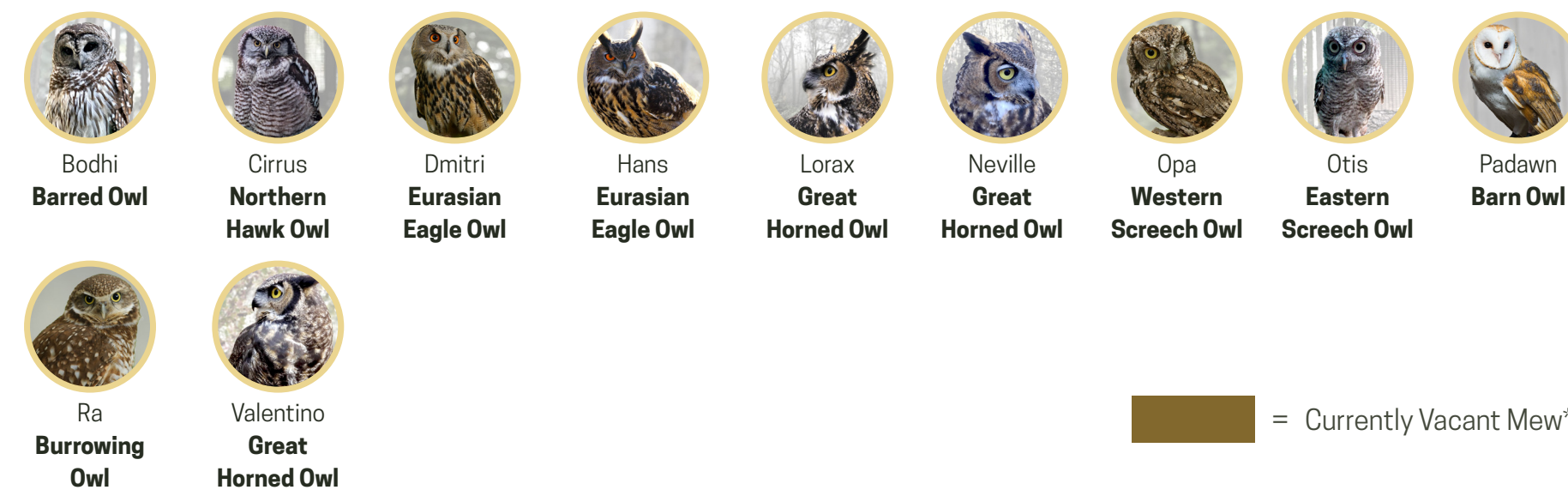
#### HAWKS



#### FALCONS



#### OWLS



 = Currently Vacant Mew\*

# 2.1 FLEDGLING FOUNDATIONS

## SITE ANALYSIS

### On-Site Educational Programs

In addition to visiting the raptors, the nature center provides several ways to learn more about both the animals and CRC's influence in the Pacific Northwest. As guests view each bird, they can read about their biology, distribution, and journey coming into care with the center through hand-crafted identification plaques.

Additionally, there are several interactive experiences guests can anticipate when visiting the nature center. These include a shaded outdoor classroom setting near the entrance of the center, an amphitheater on the north side of the property nearest the gift shop, and several cutaways in the pathways to facilitate trainer talks with raptors on a glove. These interactive experiences allow guests to engage directly with the birds and their trainers, providing a more personal learning experience.

### EDUCATIONAL PROGRAMS

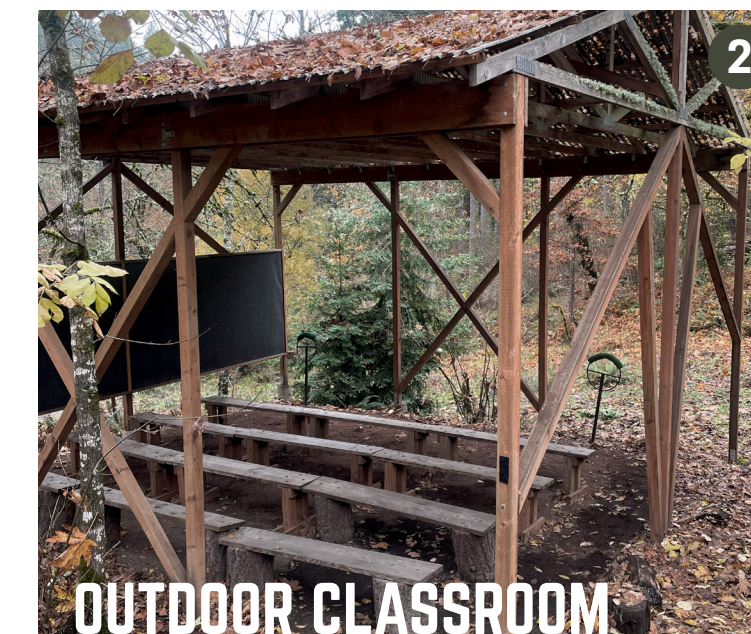
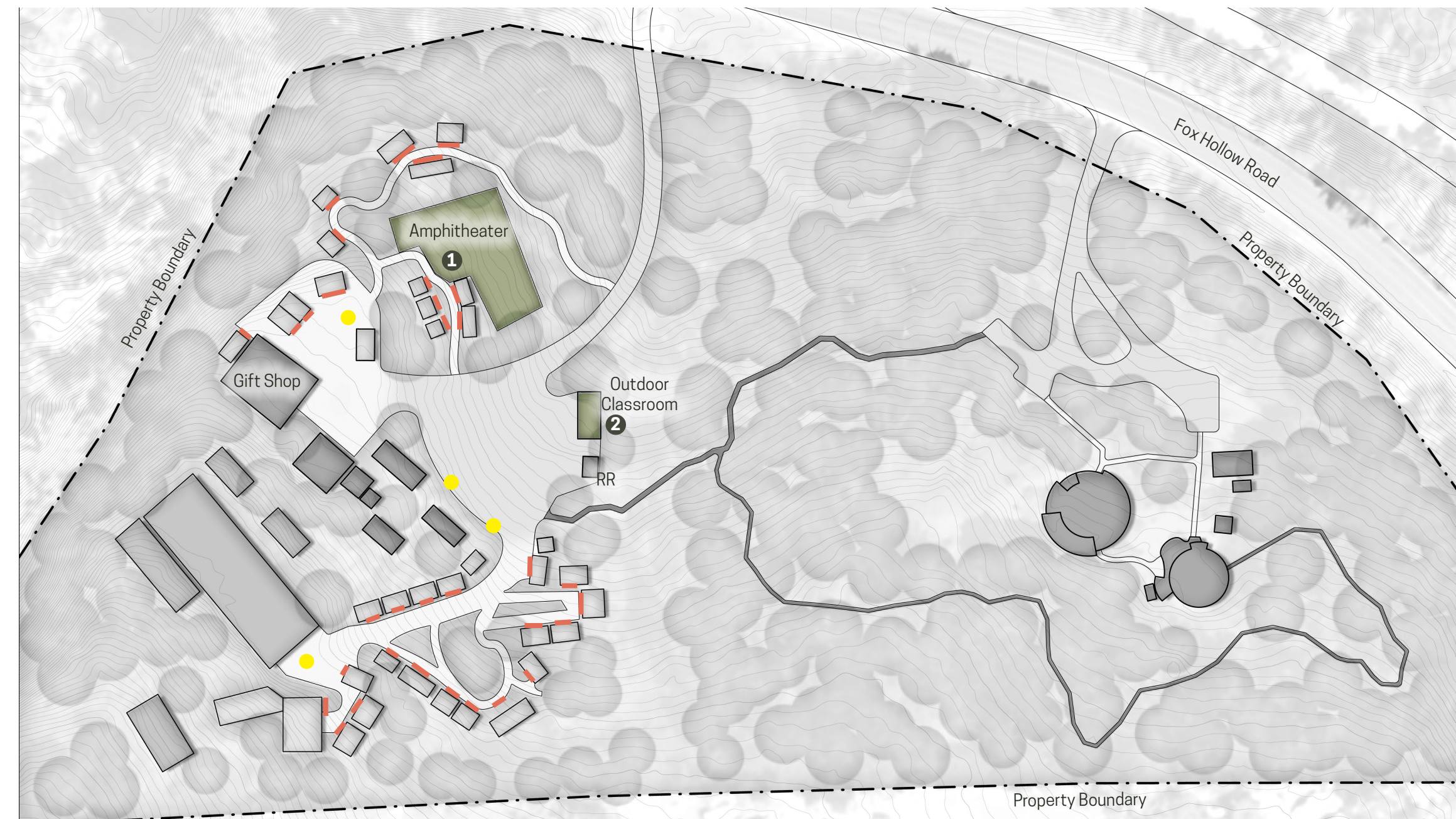
EDUCATIONAL SPACES



RAPTOR INFO SIGNAGE



INTERACTIVE OBJECTS

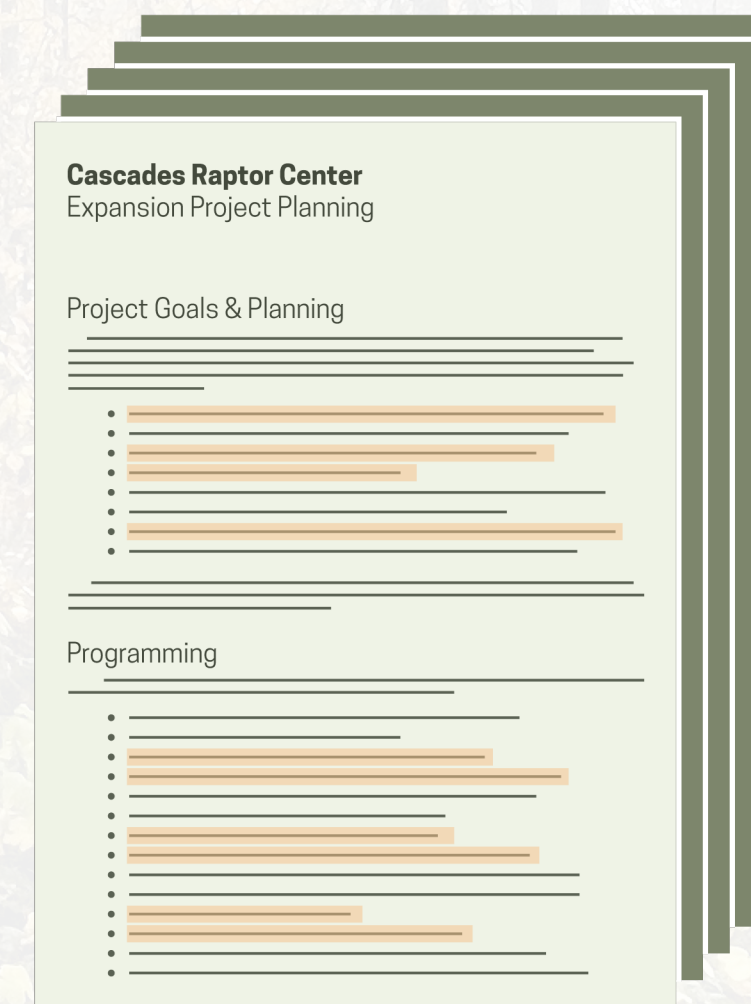


**Project Goals**

In the latter part of the winter term in 2022, I was introduced to Melissa Green, the Creative Engagement Designer at the Cascades Raptor Center, through Associate Professor Mark Eischeid. Mark, having previously discussed the raptor center’s expansion aspirations with Melissa, saw a connection between these aspirations and my post-graduation goals.

Following this introduction, Melissa and I engaged in a productive discussion about the ongoing initiatives at the Raptor Center and the potential alignment with my master’s project. Fast forward to the conclusion of the spring term in 2023, I arranged a meeting with Melissa, Julie Collins, the Executive Director, and Mark. This meeting served as a platform to explore the various projects that the Cascades Raptor Center aimed to undertake in their future expansion.

Their extensive list of expansion projects not only reflects their commitment to enhancing their facilities but also reinforces their primary mission: providing servitude to wildlife rehabilitation and public education. Recognizing the importance of aligning my design goals with their mission, I selected several primary project goals that resonated with both the center’s objectives and my own interests. For me, these chosen projects held the potential to not only further bird of prey husbandry but would also create engaging programming for future visitors. Additionally, I outlined several secondary projects with the aim of exploring additional opportunities, subject to available time and space.



“The expansion should express the center’s **two primary missions:** to **care for the raptors**, and **educate the public** about these magnificent birds. The spaces created should connect the visitors to the natural environment of the park, and allow access for all to the educational programs and experiences. Built elements should be sensitive to the ecosystems in which they reside, and should create and enhance the lives of the plants and animals that reside there while supporting the mission of the organization.”

**PRIMARY PROJECT GOALS**

- Create new bird enclosures
- One new outdoor gathering space / amphitheater for a group of 75 people near the visitor center (current admin. building)
- Create an accessible loop trail through the site. Should connect the existing areas with new trails and enclosures
- Create educational signage throughout the site. Interactive learning areas for bird encounters and educational engagement

**SECONDARY PROJECT GOALS**

- Two new outdoor classroom spaces
- Botanical design and natural landscaping
  - native plantings, pollinator gardens, swallow boxes, mason bee homes, and educational plant species signage

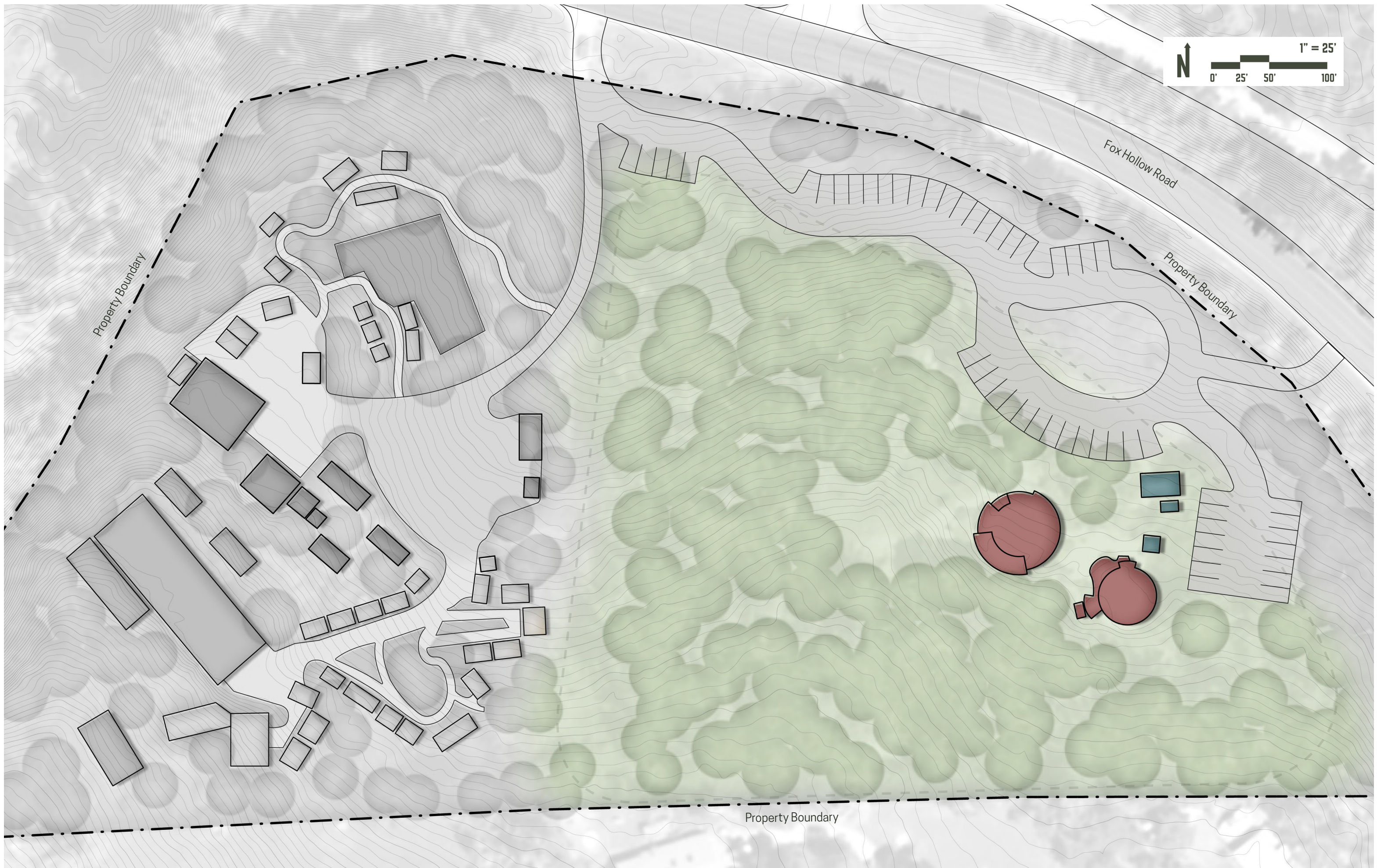
**Design Boundary**

Situated between the primary nature center and the administrative yurts lies an unused 4-acre parcel of land, acquired in 2017 and designated for future expansion. Despite initial progress by CRC and local partners in expansion planning, the onset of the COVID-19 pandemic brought these endeavors to a standstill. Consequently, the 4-acre parcel remained dormant, awaiting future development. This setback presented an opportunity for me to step in and contribute my concepts and solutions, gained from my experience working in zoos, to shape the future of this space.



### Design Boundary

While additional parking facilities remain a priority for CRC, I did not select it from their project items list as one of my design goals. However, recognizing the value of the initial concepts developed by Dougherty Landscape Architects, PIVOT Architecture, and KPFF Engineers, I sought and gained their approval to incorporate and modify their parking lot design into my proposal. This collaborative approach allowed me to integrate their vision with my own, ensuring coherence and continuity in the development of the expansion plans, and would ultimately define the official boundary of my canvas for design.



**Key Takeaways**

During my site evaluation, I walked the entirety of the site and took numerous pictures to document my observations. This process yielded several key takeaways that I wanted to investigate further in my research, apply in my design process, or keep in mind to supplement my overall design decisions. These takeaways formed the basis for my design intentions, guiding the direction of my project.

**Preserve**

In considering what aspects of the site to preserve, several factors stood out. Firstly, I noted the use of natural building materials for structures, particularly evident in the construction of the raptor mews. Additionally, the feeling of place in site's natural character, nestled in a hillside forest, emerged as another priority. It was important to me to retain as much of the natural habitat for wild birds of prey and other wildlife that inhabit the site.

**Improve**

**Raptor Enclosures** - In considering improvements for raptor enclosures, a key focus was investigating the standards of raptor mews and understanding why they differ from raptor aviaries in zoos. Additionally, this involved determining best practices for aviary sizes and creating a structured or thematic organization of enclosure locations with appropriate wayfinding for guests.

**Spatiality** - Addressing concerns about accessibility and spaciousness, I identified the essential need to create separate circulation systems for staff and guests, accommodating to the needs of both. This approach ensures efficient movement of staff for bird care and maintenance tasks while creating a fluid and uncongested experience for visitors as they meander through the site with fewer distractions from adjacent enclosures. An additional consideration was to ensure guest paths are accessible for elderly and disabled individuals.

**Education** - Expanding the scope of educational options for visitors emerged as another priority. I wanted to create an interpretive story that explores the role of birds of prey in the Pacific Northwest and connects with the mission of the nature center. Furthermore, considering how to redesign the amphitheater to seamlessly integrate with the site's natural surroundings and evolve beyond the conventional bird demonstration format to reinforce the educational objectives.



**DESIGN INTENTIONS**

Spatial Organization of Enclosures



Reimagine Animal Shows



Circulation Functionality



New Raptor Enclosures

Build with Natural Materials



Preserve Natural Character



Accessible Trail Loop



Botanical Design

Interpretive Storytelling Signage



New Amphitheater



Interactive Learning Areas



New Outdoor Classrooms

**PROJECT GOALS**



# ASCENDING ASPIRATIONS

3.0 KEY INQUIRIES | 3.1 RAPTOR MEWS | 3.2 ONGOING EXPLORATION  
3.3 RESEARCH QUESTION | 3.4 CONCEPTUAL FRAMEWORK



# 3.0 ASCENDING ASPIRATIONS

## KEY INQUIRIES

### Zoo History

From the list of project items, I chose to focus on constructing new raptor enclosures for several reasons. Apart from the opportunity to gain in-depth knowledge about enclosure construction in zoos and its relevance to my career pursuits in landscape architecture, one of the primary reasons for this selection was to understand the standards practiced in raptor mew design. This master's project wasn't my first visit to the raptor center. I have made several visits in the past, instilling a longstanding curiosity about the design of these mews and the disparity between how bird of prey enclosures are designed in rehabilitation centers compared to zoos.

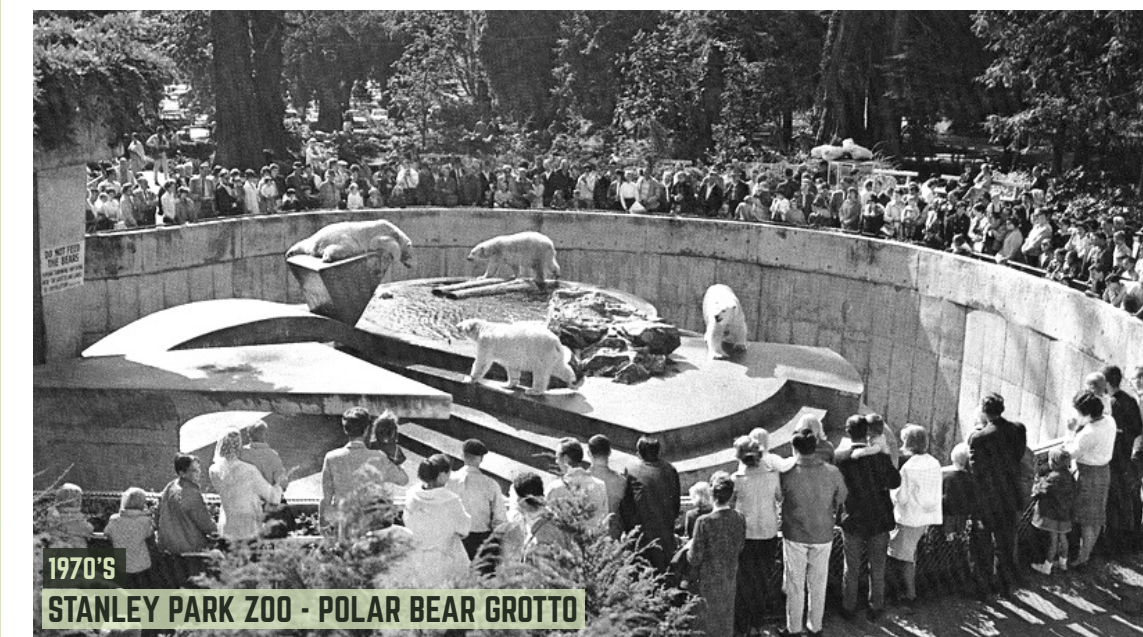
From my initial perspective, I approached this project with an understanding of how zoos have evolved over the past several centuries, reflecting advancements in the representation of their animals. To illustrate my perspective, a brief recap of zoo evolution is essential.

Zoos have existed since ancient civilizations such as Egypt and China, initially serving as hunting parks for exotic animals. During medieval Europe, monarchs, monasteries, and municipalities maintained private collections called menageries (Chin & Gusset, 2016). The 18th century brought the Age of Enlightenment, promoting science and logic in society, leading to a scientific focus on zoology. Early zoos were more like museums of living animals, with small display areas as featuring many species as space would allow. The concept of the urban zoo emerged in the 19th century, with a significant increase in zoological gardens open to the public for education and entertainment (Bisgrove, 2022). Enclosures evolved from metal bar cages and concrete pits to grottos and much larger enclosures.

Until the 1970's, most animal displays lacked reference to natural habitats or the physical and behavioral needs of animals (Coe, n.d.). However, as zoos shifted their focus towards conservation and animal husbandry, and with the increasing embrace of humanity's biophilic connection to nature, advancements in enclosures, such as immersion design, led to highly detailed presentations of nature (Mellor et al., 2015).

**“AN ANIMAL CANNOT BE ISOLATED, EVEN CONCEPTUALLY, FROM THE PARTICULAR ENVIRONMENT TO WHICH IT HAS BECOME ADAPTED DURING EONS OF GEOLOGIC TIME WITHOUT A SERIOUS MISUNDERSTANDING OF ITS TRUE NATURE.”**

**MARY AKELEY**  
NATURALIST & AUTHOR



1970'S  
STANLEY PARK ZOO - POLAR BEAR GROTTTO



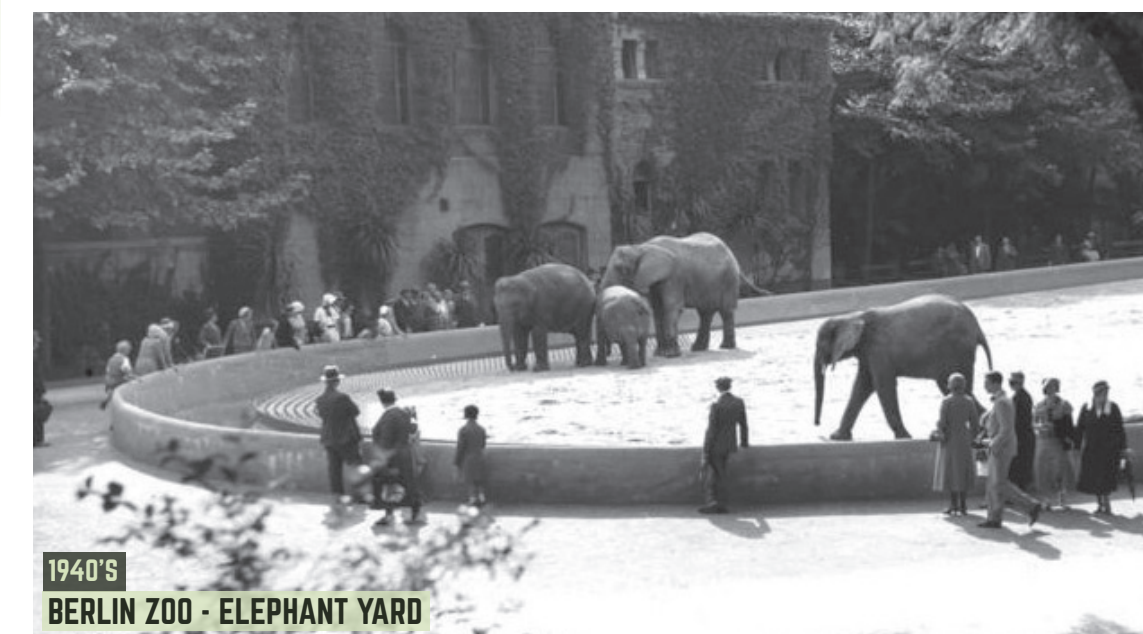
1994  
WOODLAND PARK ZOO - NORTHERN TRAILS



1950'S  
ST. LOUIS ZOO - SEA LION POOL



2020  
OMAHA'S HENRY DOORLY ZOO - SEA LION SHORES



1940'S  
BERLIN ZOO - ELEPHANT YARD



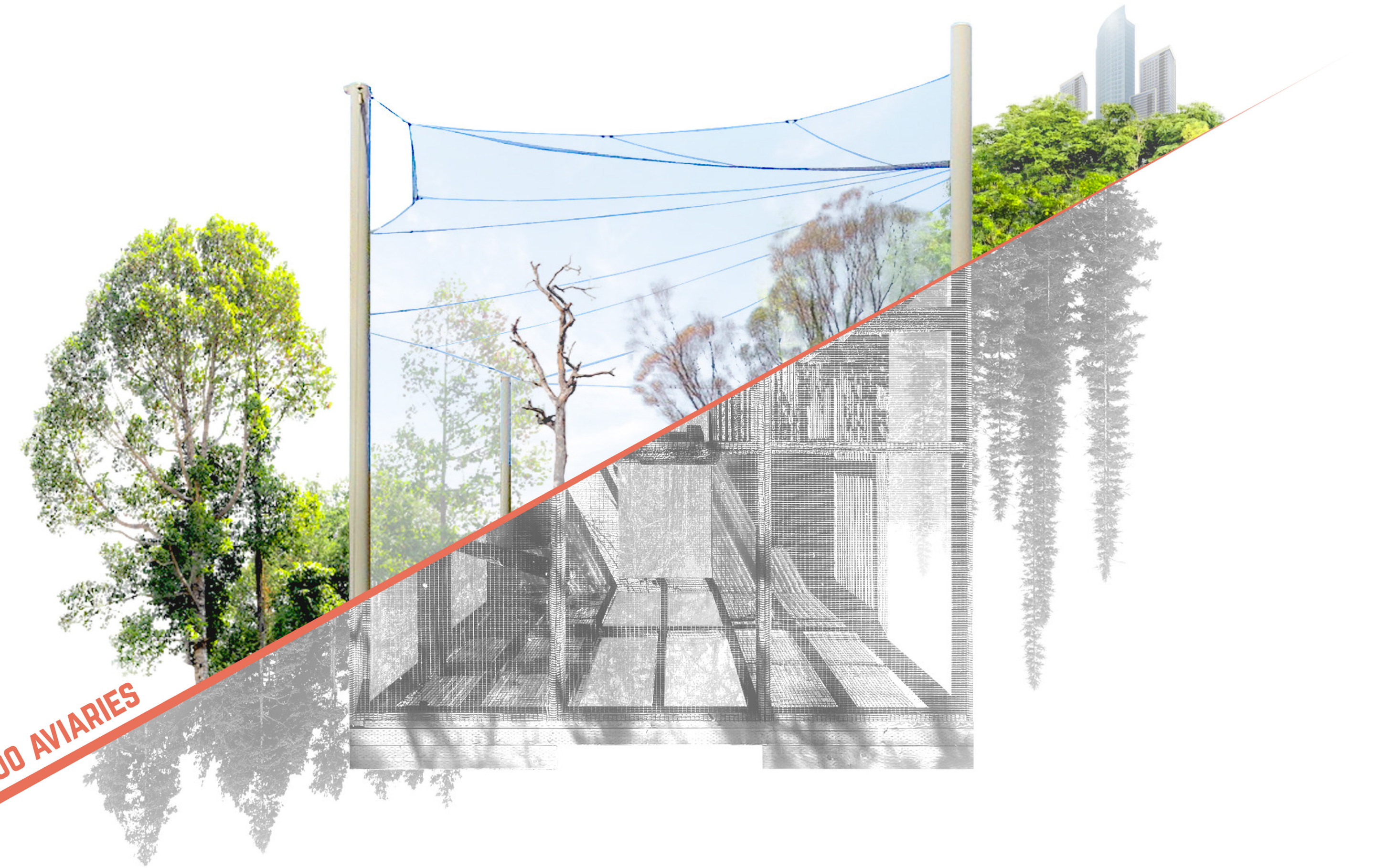
2009  
DALLAS ZOO - GIANTS OF THE SAVANNA

## Design Contrast

Animal enclosures serve as the zoo's natural voice, providing the most effective means to communicate their message to the public (Coe, 1994). This message, promoting empathy and fostering positive changes in public attitudes toward wildlife and our role in nature, stands as one of the most significant contributions these institutions offer (Association of Zoos & Aquariums, 2023).

If zoos have come to recognize that well-designed enclosures can effectively communicate the essence of both the animals and their natural habitats, then it was crucial for me to understand why raptor mews are designed in stark comparison. Understanding this disparity could inform my exploration of how their framework could be translated into my enclosure proposals.

ZOO AVIARIES



**Mew Overview**

Managing raptors in rehabilitation centers is a multifaceted endeavor governed by regulations at both state and federal levels. These centers must adhere to standards outlined in the Animal Welfare Act overseen by the USDA and the Migratory Bird Treaty Act by the USFWS to maintain permits essential for their operations (United States Fish and Wildlife Service, 2024). Moreover, organizations like the International Wildlife Rehabilitation Council and National Wildlife Rehabilitators Association have established minimum standards, informed by current knowledge and best practices in biology, medicine, behavior, and natural history (National Wildlife Rehabilitators' Association et al., 2000). While the scope of these regulations is vast, my research was directed towards uncovering the design philosophy and planning of raptor mews.

To provide effective care for raptors, I identified three key factors that shape the design of these mews: understanding the birds' natural history, incorporating this knowledge into interior furnishings, and integrating these conditions into the stages of rehabilitation. Understanding these factors not only informs the functionality of the enclosures but also contributes to the animal's eventual release back into the wild.

**MEW DESIGN & FUNCTION:**

**1. NATURAL HISTORY**

**2. FURNISHINGS**

**3. STAGES OF REHABILITATION**

**RAPTOR REHABILITATION CENTERS OPERATE WITHIN A COMPLEX REGULATORY FRAMEWORK, GOVERNED BY STATE AND FEDERAL LAWS. ADDITIONALLY, VARIOUS WILDLIFE REHABILITATION ASSOCIATIONS SET THEIR OWN STANDARDS BASED ON CURRENT SCIENTIFIC AND MEDICAL KNOWLEDGE.**

**CRC'S GOVERNING GROUPS & MEMBERSHIPS:**



**CALIFORNIA RAPTOR CENTER**

Natural History

Understanding the natural history of each species and their habitat requirements is crucial for designing effective enclosures tailored to individual patient's needs. Each species has specialized requirements for survival and failure to account for these requirements can lead to high stress levels, prolonged healing times, and even death (Caudell & Riddleberger, n.d.). To successfully rehabilitate wild patients, it's essential to minimize both psychological and physical stress (Mannas, 2016). Enclosures play a dual role in providing secure containment and acting as temporary habitats for patients to fully recover from injuries. Patients utilize the same adaptations in human care as they do in the wild, so creating an environment that closely resembles their natural habitat allows them to employ these adaptations for learning, maintaining, or recovering species-specific behaviors (Mannas, 2016).

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CRC'S GOVERNING GROUPS & MEMBERSHIPS:



NATIONAL WILDLIFE REHABILITATORS ASSOCIATION



### Interior Furnishings

Each element of the enclosure, from materials and furnishings to structural integrity, highlights the importance of thoughtful planning to meet the general needs of multispecies use. For stability and predator-proofing, it is advised for the construction of cages to use treated lumber and vinyl-coated wiring (Moore, 2014). The setup should allow the bird to observe the natural world, be suitable for year-round use, and feature visual barriers from other raptor enclosures (National Wildlife Rehabilitators' Association et al., 2000). In terms of interior furnishings, it is crucial to prioritize the animal's well-being, ensuring choices that promote both comfort and safety. These choices include providing access to shade or sun, nest boxes, and various perch types (Mannas, 2016). Raptor foot health remains a constant concern, so various perching options like wall-mounted branches made from natural materials or covered in AstroTurf are favored, as well as substrates such as wood chips, gravel, or river rock to safeguard the bird's footpads (Moore, 2014) and provide ease of maintenance. Living trees are typically discouraged due to enclosure limitations.

### MEW DESIGN & FUNCTION:

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CRC'S GOVERNING GROUPS & MEMBERSHIPS:



NATIONAL WILDLIFE REHABILITATORS ASSOCIATION



ALASKA RAPTOR CENTER

### Stages of Rehabilitation

When an injured or orphaned raptor arrives at a rehabilitation center, it undergoes a progression through three types of enclosures as part of its recovery journey. These stages, ordered as holding areas, behavioral training, and pre-release flight conditioning, are tailored to the specific needs of the raptor species, with enclosure sizes guided by the Minimum Standards for Wildlife Rehabilitation (National Wildlife Rehabilitators' Association et al., 2000). Throughout each stage, attention is given to applying those principles of natural history and providing suitable interior furnishings to aid in the bird's recuperation.

Holding mews offer injured raptors a space to recuperate and acclimate after recovering from injuries in indoor environments. These areas feature perches at varying heights to facilitate movement and assist in the bird's physical recovery. Behavioral training mews provides raptors an area to practice or regain skills necessary for survival. This allows rehabilitators to assess the bird's physical capabilities, ensuring their readiness for release. Pre-release flight conditioning mews involves training raptors to increase stamina and muscle mass (Moore, 2014), optimizing their readiness for release. Flight paths with perches only at each end encourage sustained flight rather than short hops, promoting stronger flight abilities.

If the raptor makes a full recovery, it will be fit to return to the wild. However, complications can arise during the recovery process that may deem the animal unfit to be released. In these situations, there are several placement options that can take place for long-term, permanent care. Either the rehabilitation center can opt to keep the animal in their care, becoming a residential raptor used for training and educational purposes, or it can be relocated to other facilities such as zoos (Moore, 2014).

### MEW DESIGN & FUNCTION:

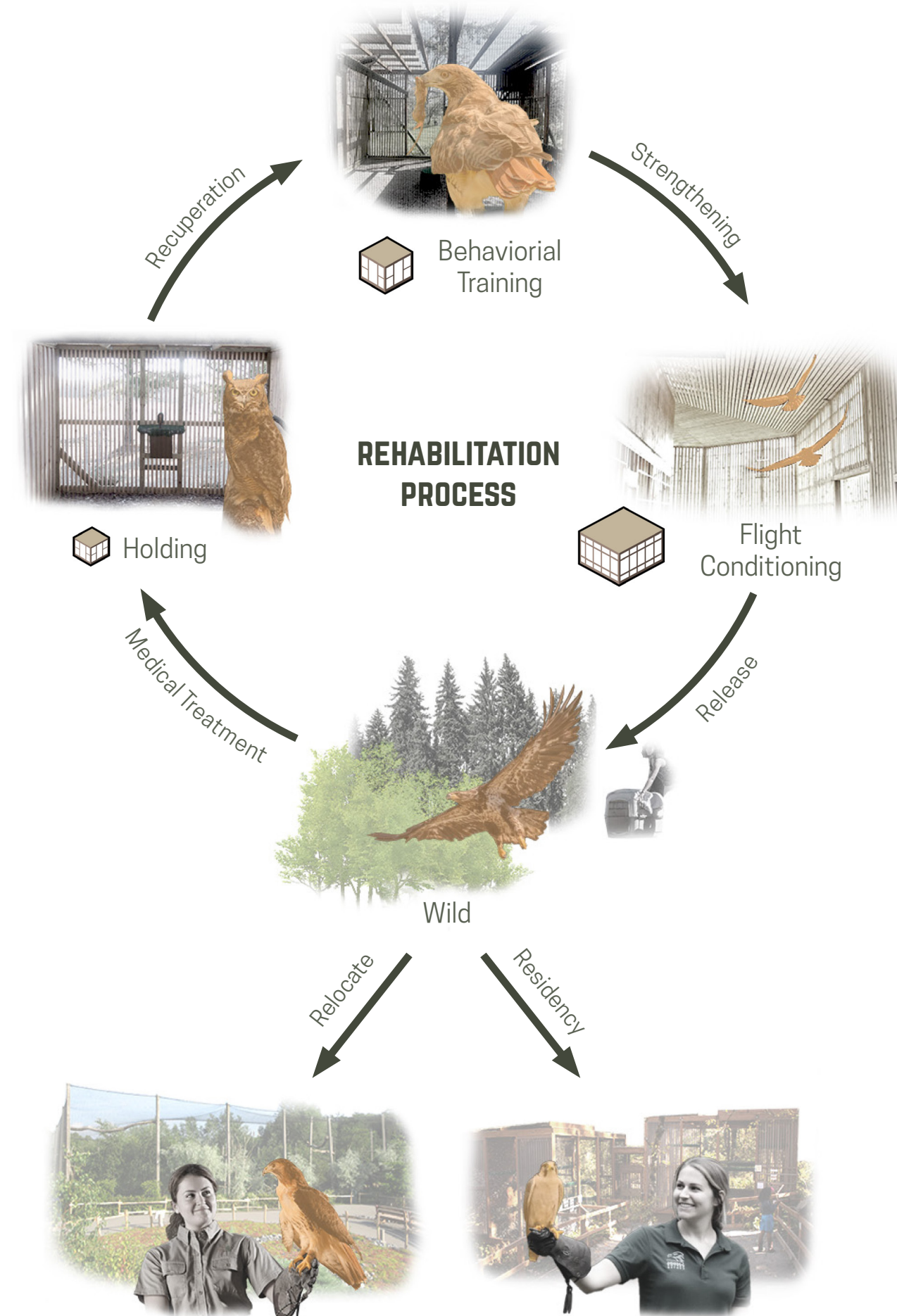
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RAPTOR REHABILITATION CENTERS OPERATE WITHIN A COMPLEX REGULATORY FRAMEWORK, GOVERNED BY STATE AND FEDERAL LAWS. ADDITIONALLY, VARIOUS WILDLIFE REHABILITATION ASSOCIATIONS SET THEIR OWN STANDARDS BASED ON CURRENT SCIENTIFIC AND MEDICAL KNOWLEDGE.

#### CRC'S GOVERNING GROUPS & MEMBERSHIPS:



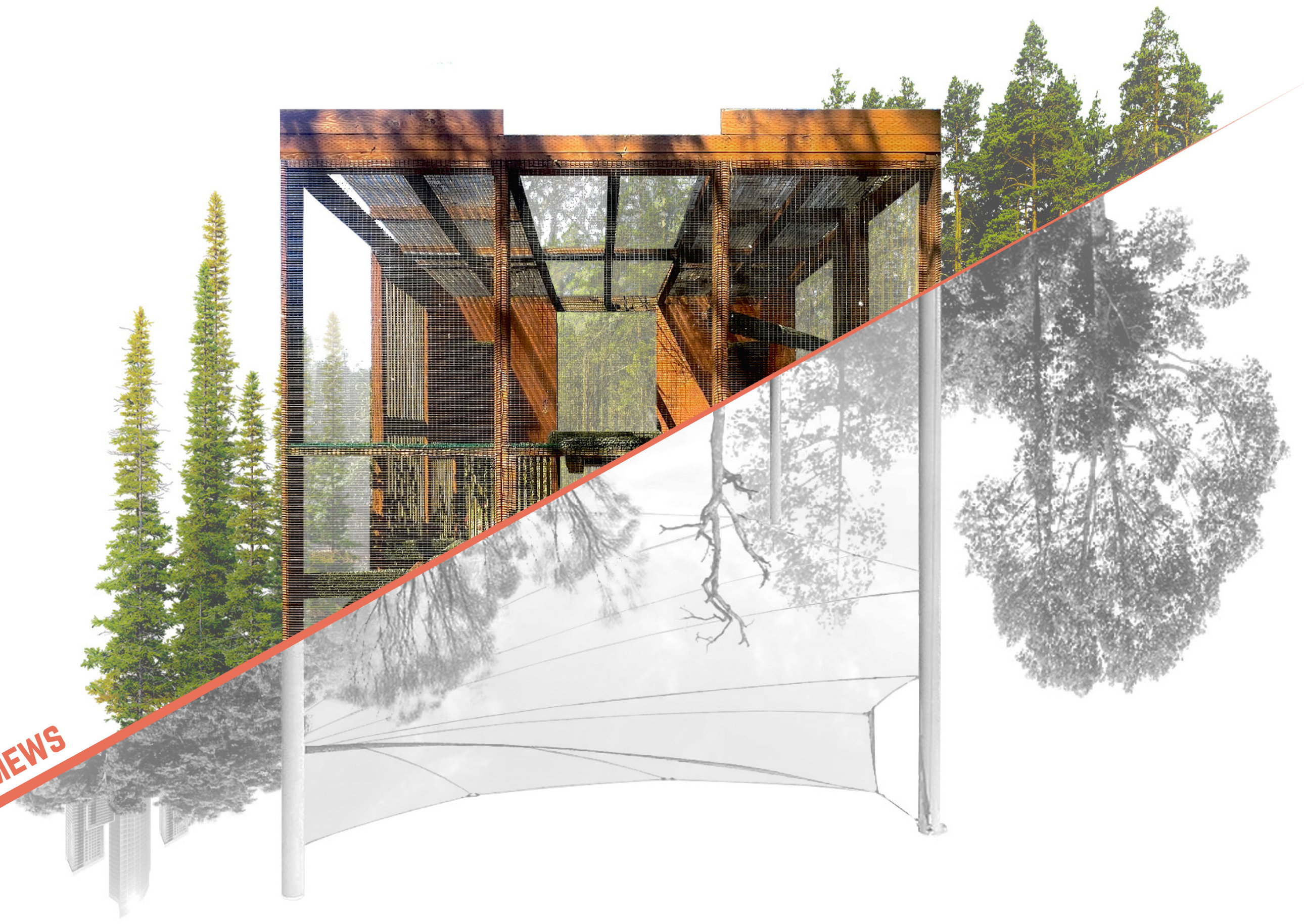
CHINTIMINI WILDLIFE CENTER

### Design Contrast

Upon reflection, it became evident that while there are established housing standards for mews aiding in the recovery of temporary raptors, there became a lack of consistent criteria for permanent, resident raptors. It's important to note, that the information previously discussed about the design and function of mews, was specifically identified for recovering raptors. Despite extensive research, I found limited information regarding housing standards for raptors intended to reside permanently in rehab centers.

These findings prompted the question: why does there appear to be an absence of standardized housing criteria for residential raptors at rehab centers? Unlike those relocated to zoos, resident raptors at rehabilitation centers lack enclosures reflective of their natural habitat. While there are well-documented standards for mews designed for rehabilitating raptors, the absence of a shift in housing standards for resident birds requires further investigation. This raised an interesting discussion for creating a new enclosure format for residential raptors, one that continues to prioritize the animal's wellness while providing educational value through their representation in nature.

**RAPTOR MEWS**





### Inquiry Focus

In light of these observations, I formulated my research question to explore potential solutions in my design proposal. This question aims to investigate how principles from zoo design can be effectively adapted to the Cascades Raptor Center.

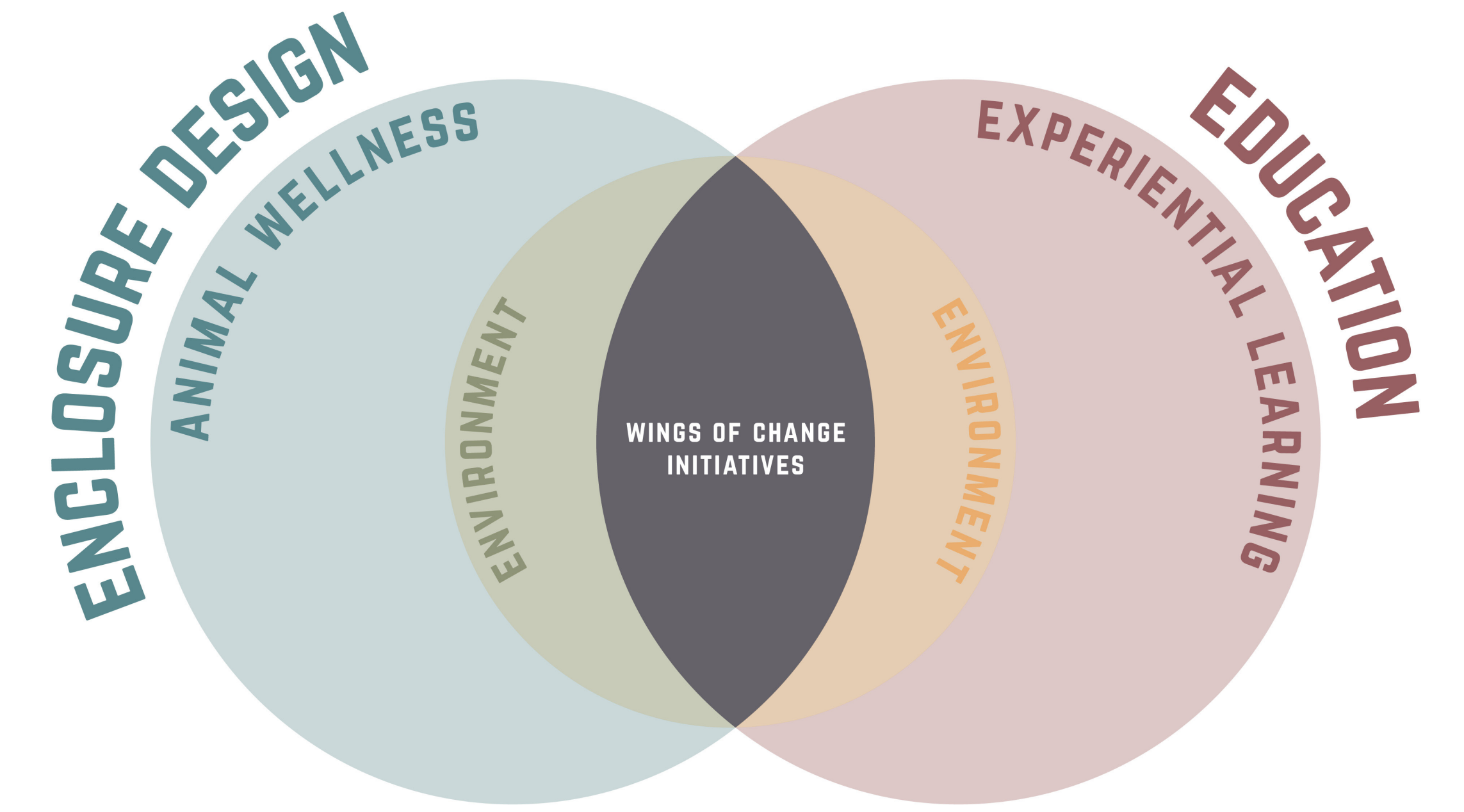


## RESEARCH QUESTION

WHICH PRINCIPLES FROM THE FIELD OF ZOO DESIGN CAN BE EFFECTIVELY ADAPTED FOR USE IN WILDLIFE REHABILITATION CENTERS, SPECIFICALLY IN THE CONTEXT OF THE CASCADES RAPTOR CENTER?

**Enclosure Design & Education**

As indicated by my research question and informed by the selected project goals, I developed a conceptual framework centered around enclosure design and education. These two pillars form a symbiotic relationship, where advancements in one area naturally complement and reinforce the other. By expanding the center's enclosures in line with current trends in zoological design, we not only reflect the natural living conditions for resident raptors but also create a dynamic platform for impactful educational experiences. These educational experiences, in turn, contribute to shaping a more informed and empathetic understanding of these animals in human care. The synergy between enclosure design and education is essential for creating an effective strategy that not only enhances the raptor center but also aligns with the goals outlined in their expansion proposal.



# SOARING SOLUTIONS

4.0 DESIGN DEVELOPMENT | 4.1 SLOPE ANALYSIS | 4.2 SITE DESIGN ANALYSIS



Design Process

Transitioning into the design development, I envisioned engaging enclosures that would be paired with informative programs, to educate and inspire visitors to become conscientious and compassionate advocates for the birds of prey native to the Pacific Northwest.

Throughout this journey, I was accompanied by leading experts, former colleagues, and close friends, who provided invaluable feedback to inform the final outcome of my design. These people ranged from fellow landscape architects and engineers to those associated with zoos in chief operation managerial, curator, and zookeeper roles. Some locally based and others nationwide. Not only was it influential to hear their best practical solutions but it was fun to connect with people who all share common goals in these merging sectors of design and zoology.

Moving through the design process, I remained guided by the chosen project goals and informed by my design intentions to test and implement optimal solutions towards realizing these concepts. My objectives were to create enclosures mimicking natural habitats tied to the theme of the Pacific Northwest. The design of these enclosures would not only meet the husbandry needs of the raptors but also adhere to a set of research-based criteria developed from my study of zoo design principles. Additionally, it was important to be mindful of how visitors would move through the entirety of the site, determining where interpretive and interactive programs would take place, and considering the impact of construction on the existing landscape. These efforts culminated in a speculative blueprint with expanded attention to animal wellness and visitor experience, while maintaining ecological integrity.

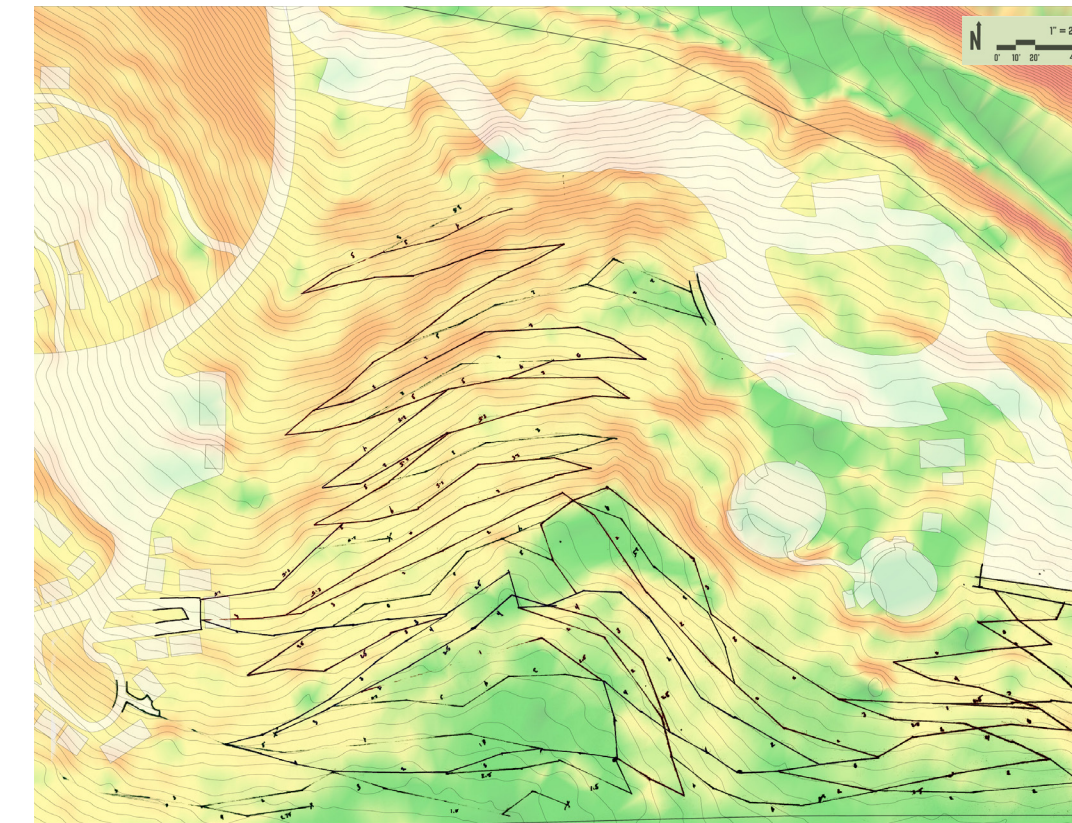
PROFESSIONAL INFLUENCE TIMELINE

<b>DECEMBER</b>	
 CRC specifics	designing for raptors 
 accreditations & research	accreditations & research 
 zoo design practices	aviary dimensions 
 architecture & design logistics	aviary architecture 
<b>FEBRUARY</b>	
 secondary holdings	eagle habitat design 
 flex habitat design	mesh netting best practices 
<b>MARCH</b>	
 grading & construction	flex habitat application 
 enclosure design	animal show programming 
<b>APRIL</b>	



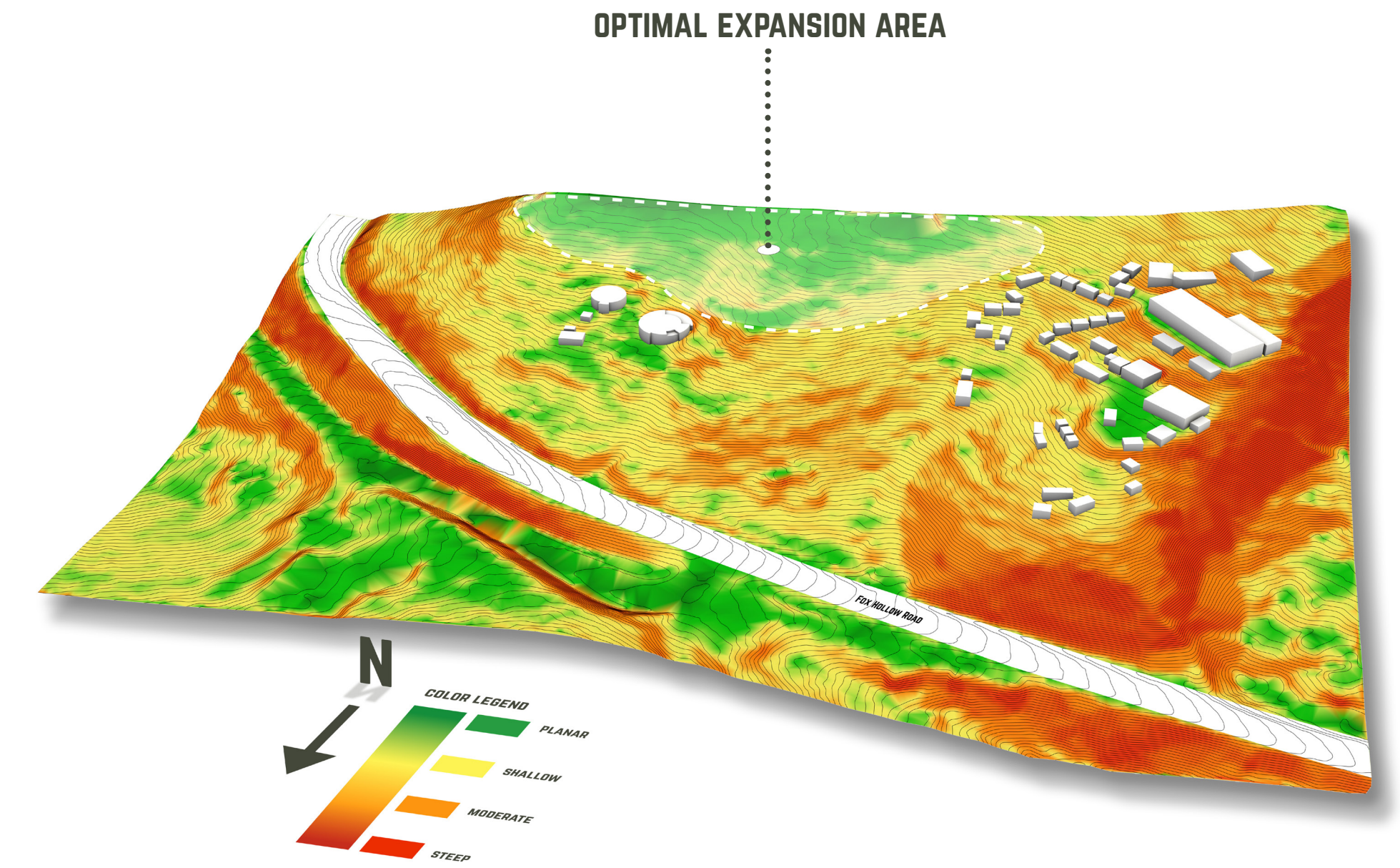
### Hillside Constraints

The majority of the change takes place on the south portion of the design boundary. Upon analyzing the slope of this area, it became clear that constructing any structures on the hillside would require extensive grading. This posed a challenge to my design intentions which was crucial to maintaining the site's character. After conducting multiple analyses with a maximum grading limit of 5%, I concluded that the top of the hill offered optimal opportunities for expansion with the least amount of environmental impact.



**SLOPE ANALYSIS PROCESS**  
MAXIMUM 5% GRADING

### PRIMARY CONSTRUCTION REGION



### Evergreen Exploration Trail

Instead, the base of the hillside would serve as an entry point, welcoming visitors from the parking lot. This deck would then connect to a moderately elevated boardwalk, winding through the forest and showcasing its natural beauty. This nature trail not only preserves much of the forest but also addresses one of the secondary project goals in providing natural landscaping and homes for local wildlife such as swallows, mason bees, and bats. Additionally, this nature trail would feature plant species identification plaques and interpretive signage focused on forest ecology. By designating this extent to the site's ecological systems, we reinforce the raptor center's mission to promote appreciation for the natural world in the Pacific Northwest. The boardwalk leading to the summit of the raptor aviaries gradually reveals glimpses of the birds amidst the forest soundscape, creating a 'hide and reveal' experience enhancing visitor anticipation and excitement.



### Thematic Organization

Following the trend seen in zoos, where animal enclosures are organized into thematic regions such as zoogeographic or taxonomy, I've structured the expansion around the phylogeny of raptors. Divided into accipiters (eagles and hawks), falcons, and owls, this framework allows for flexible rotation of raptors within their designated aviaries, catered to the specific needs of each group. Additionally, each individual aviary features a secondary holding, serving various functions such as providing nightly quarters, facilitating medical procedures, and the shifting of several birds. Lastly, this framework will further improve guest navigation, providing clearer wayfinding to their desired bird encounters.

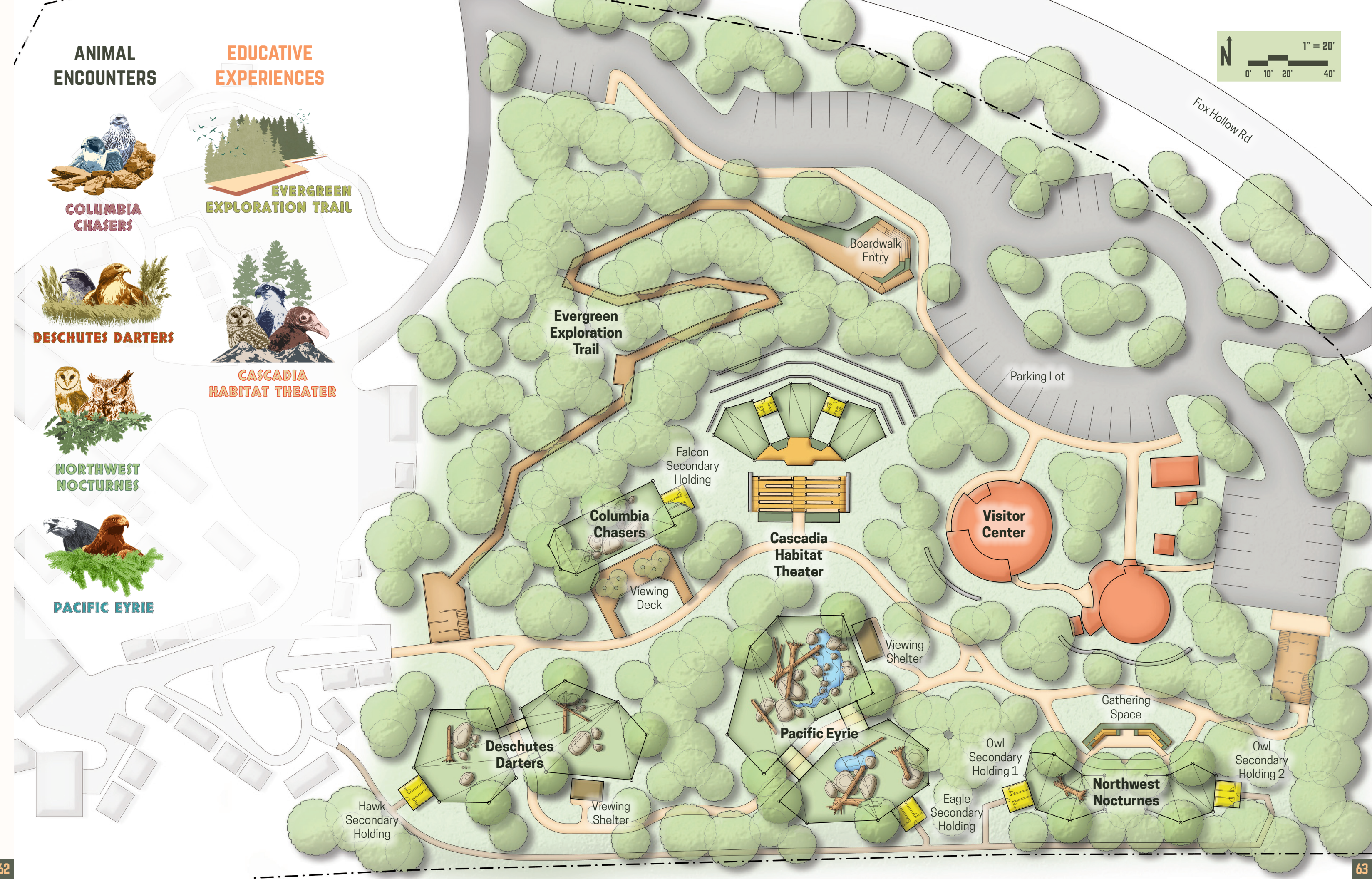


# 4.2 SOARING SOLUTIONS

## SITE DESIGN ANALYSIS

### Structures

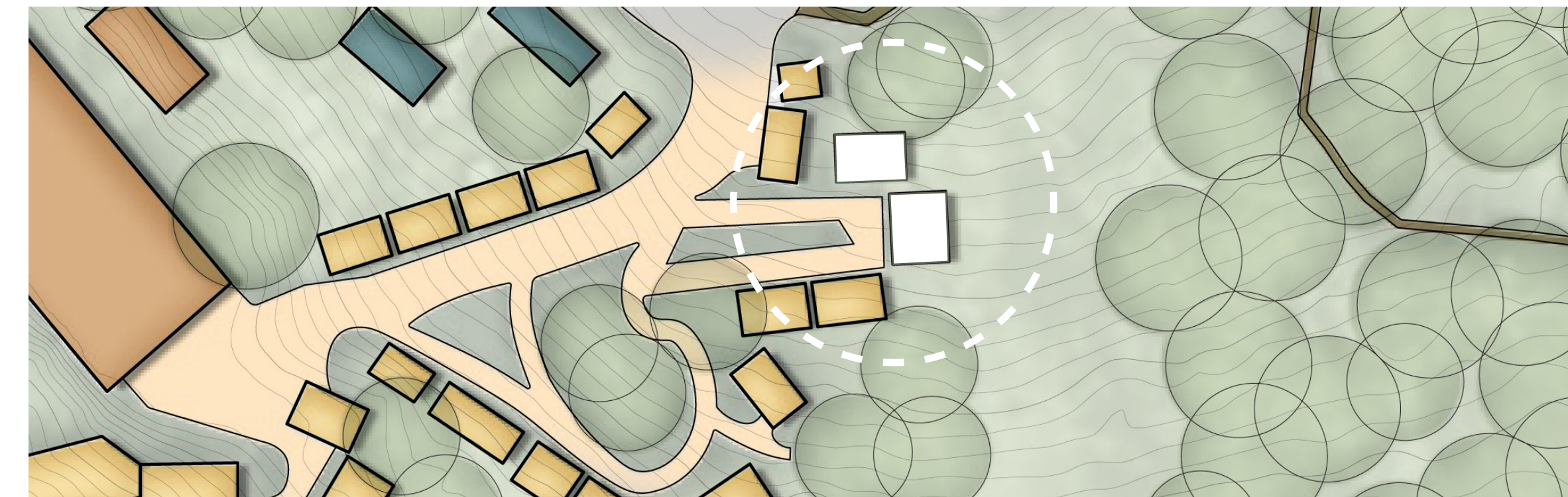
Adjacent to most aviaries are secondary trails leading to viewing platforms, offering new viewing experiences for guests. These platforms range from covered shelters to open gathering spaces with outdoor seating. While direct bird viewing and interactions with staff offer richer experiences, each platform features interpretive media and educative elements.





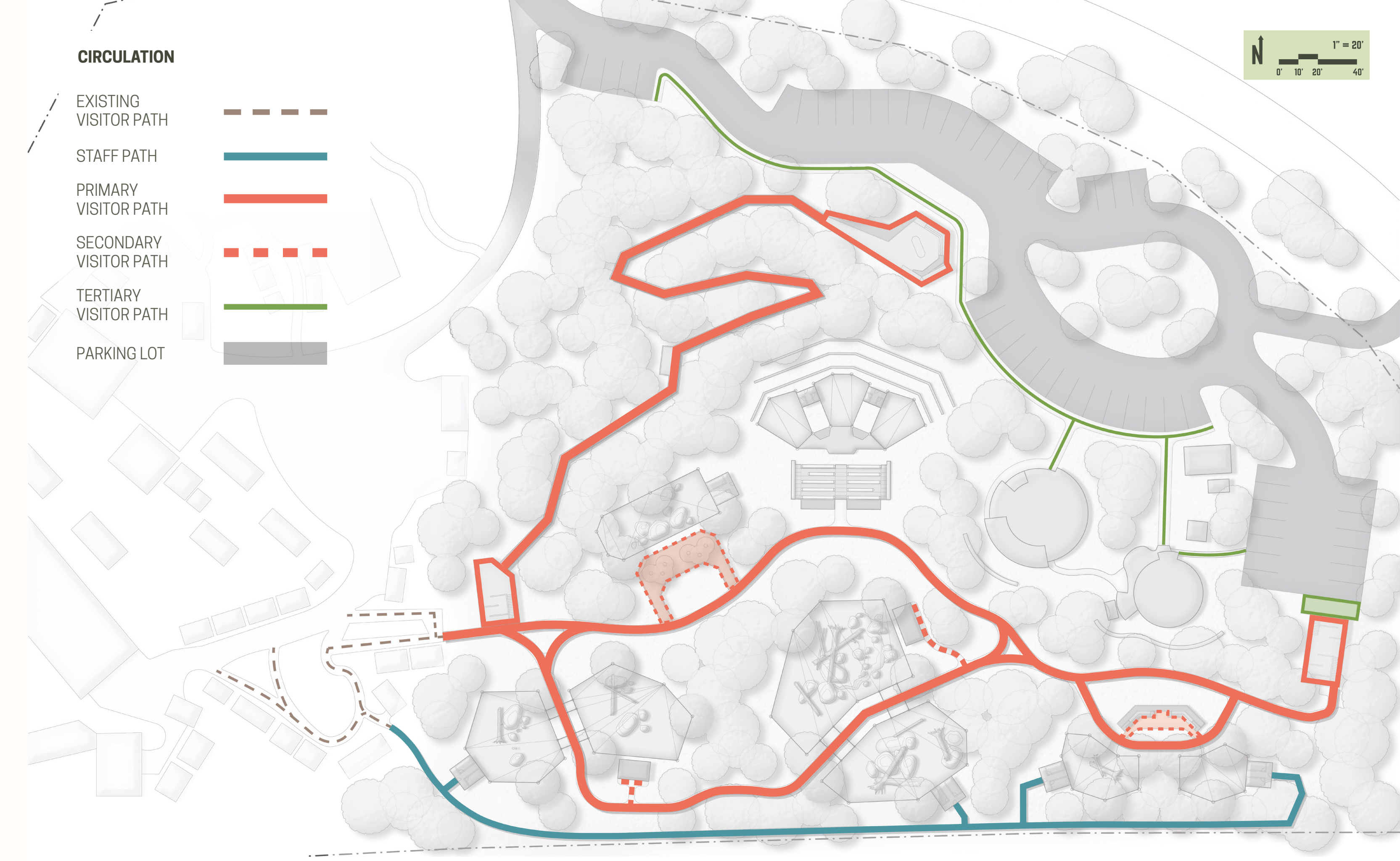
### Circulation

In January 2024, Eugene experienced a severe ice storm, impacting the raptor center. While all raptors weathered the storm unharmed, several mews suffered irreparable damage. Fortunately, swift efforts were made to recover the displaced raptors. The loss of these mews presented an opportunity, in the midst of the design process, to seamlessly attach the existing property with my expansion proposal, without disrupting its current infrastructure.



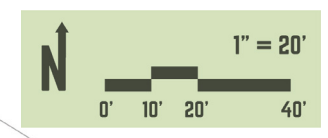
**Circulation**

I established two types of trail networks: one designated for visitor movement and the other optimized for staff efficiency. Visitor trails offer a more spacious and fluid experience, allowing visitors to observe raptors, at their own pace, while immersing themselves in the surrounding forest. A dedicated trail for trainers to and from the secondary holdings, ensures the streamline movement of animal husbandry and maintenance related tasks. Each trail network ensures functionality without impeding on the other.



**CIRCULATION**

- EXISTING VISITOR PATH
- STAFF PATH
- PRIMARY VISITOR PATH
- SECONDARY VISITOR PATH
- TERTIARY VISITOR PATH
- PARKING LOT



# LANDING INSIGHTS

5.0 CONCEPTUAL FRAMEWORK | 5.1 INTEGRATED HABITAT DESIGN

5.2 INTERPRETIVE ENGAGEMENT



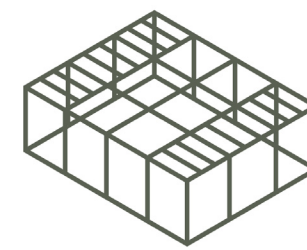
**Integrated Habitat Design & Interpretive Engagement**

The conceptual framework, guiding my design decisions, developed into two pivotal concepts. Initially defined as enclosure design and education, these developed into: Integrated Habitat Design and Interpretive Engagement. These concepts represent the cornerstone of my approach to elevating both the raptor living conditions and the visitor experience. This chapter touches on the influences that shaped these concepts, how they were translated into my proposal, and the significant benefits they offer to both raptors and visitors, all while aligning with CRC's mission.



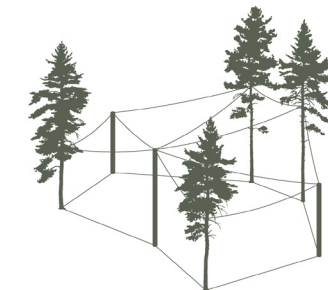
**INTEGRATED HABITAT DESIGN**

**HABITAT PLANNING**



**CARING CAPACITY**  
**SCALING CONFIGURATION**  
**SPECIES SELECTION**

**AVIAN ARCHITECTURE**



**NORTHWEST TREK**  
**BALDIE BLUEPRINT**  
**SITE APPLICATION**

**LANDSCAPE IMMERSION**



**CONCEPT OVERVIEW**  
**GUIDING PRINCIPLES**  
**FLEXIBLE INNOVATIONS**

**INTERPRETIVE ENGAGEMENT**

**STATIC INTERPRETATION**

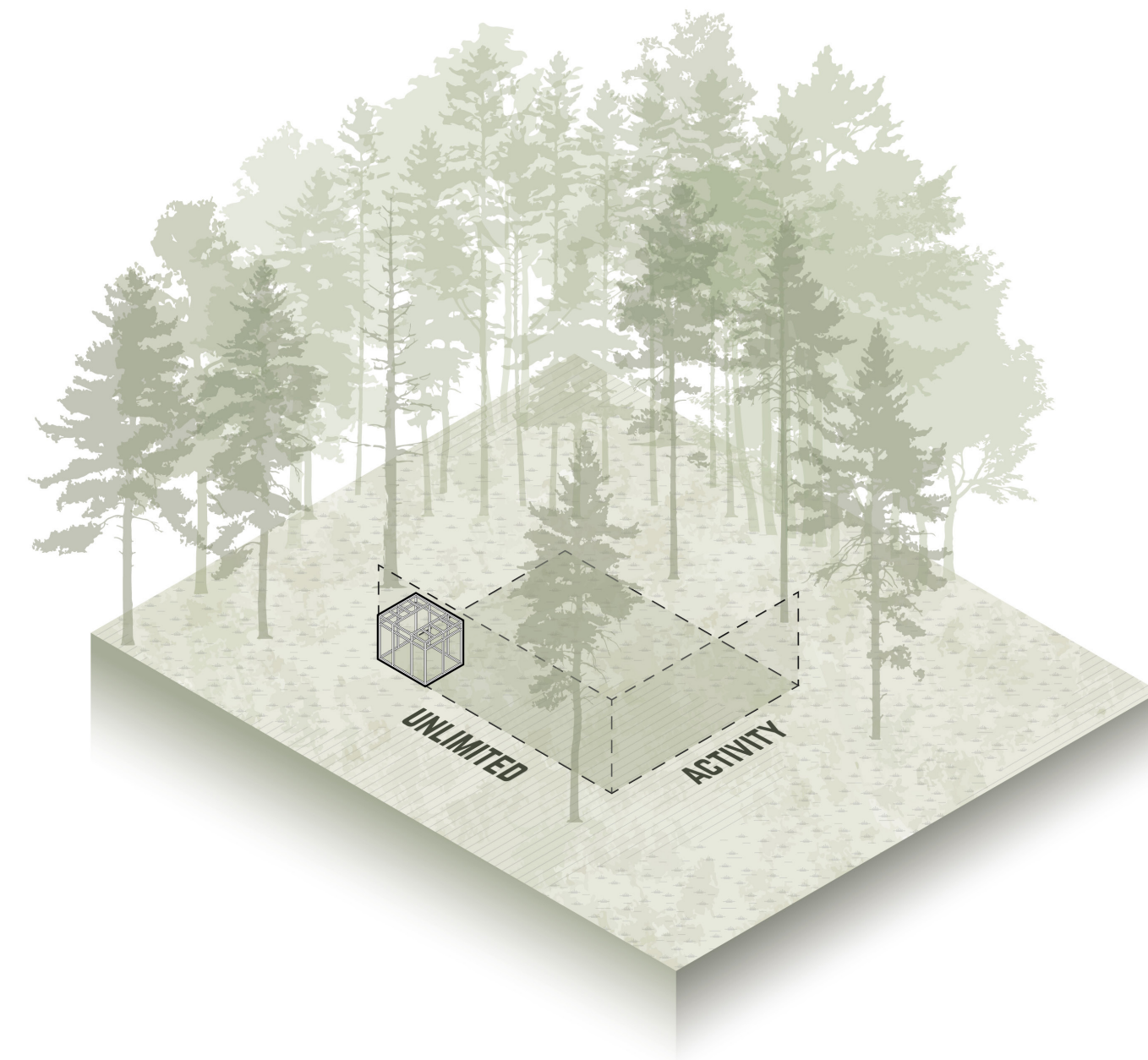


**DYNAMIC INTERPRETATION**



### Caring Capacity

In determining the optimal enclosure sizes, I consulted the Minimum Standards of Wildlife Rehabilitation manual, which provides housing guidelines categorized into three activity groups: Restricted, Limited, and Unlimited, corresponding to housing per each stage of recovery. These standards are determined based on the animals' size and flight styles (National Wildlife Rehabilitators' Association et al., 2000). I used the Unlimited Activity parameters as the baseline exhibit size, with the intent to expand further. Given the constraints of limited building space and my intent to preserve the site's character, I prioritized striking a balance between construction needs and site preservation. Instead of maximizing the number of aviaries, I focused on providing ample space for raptors with greater spatial requirements. Determining the appropriate aviary size is delicate; it requires offering sufficient space for the animal(s) while ensuring ease of bird accessibility by the trainers. While this process is typically a collaborative decision involving administrative personnel, animal handlers, and design professionals, I made informed choices based on consultations with zoo experts, analysis of other zoo aviaries, and relevant research.



### MINIMUM STANDARDS FOR WILDLIFE REHABILITATION: BIRDS OF PREY

EAGLES	HAWKS	FALCONS	OWLS	LIMITED ACTIVITY (W x L x H)	UNLIMITED ACTIVITY (W x L x H)
			W. Screech E. Screech	3' x 6' x 8'	8' x 8' x 8'
		Kestrel Merlin	N. Hawk	6' x 6' x 8'	8' x 16' x 8'
			Barn Owl	3' x 8' x 8'	10' x 30' x 12'
	Goshawk Red-tailed Swainson's N. Harrier		Barred Owl Great Horned	3' x 6' x 8'	10' x 50' x 12'
Bald Eagle Golden Eagle Turkey Vulture	Ferruginous	Gyr Falcon Peregrine Prairie		8' x 10' x 8'	20' x 100' x 16'

#### SPATIAL NEEDS COMPARISON:

#### SMALL RAPTORS VS. LARGE RAPTORS

#### American Kestrel

Size: 8-12 in.

Unlimited Activity Space Req:

8' x 16' x 8'

Area: 128 sq. ft.  
Volume: 1,024 cubic ft.



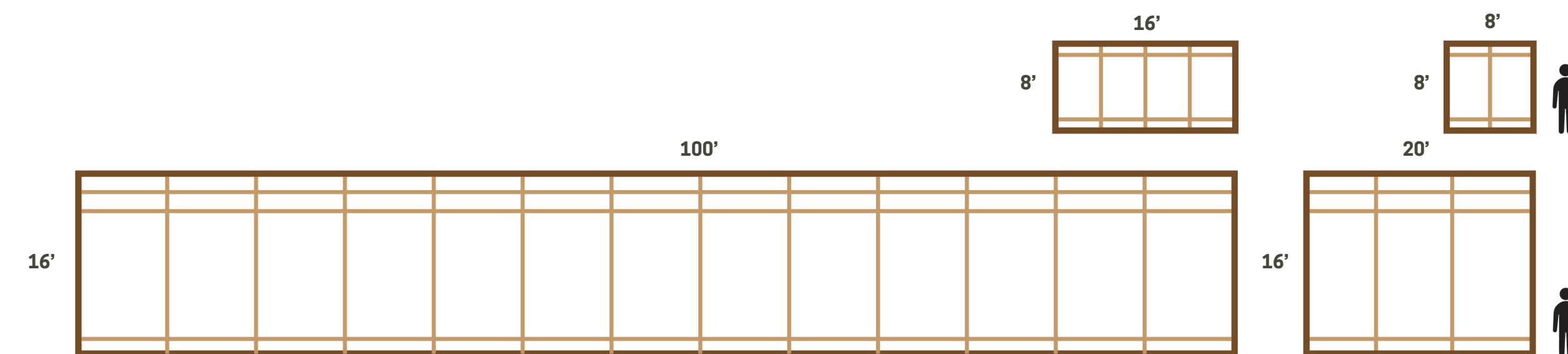
#### Bald Eagle

Size: 28-40 in.

Unlimited Activity Space Req:

20' x 100' x 16'

Area: 2,000 sq. ft.  
Volume: 32,000 cubic ft.

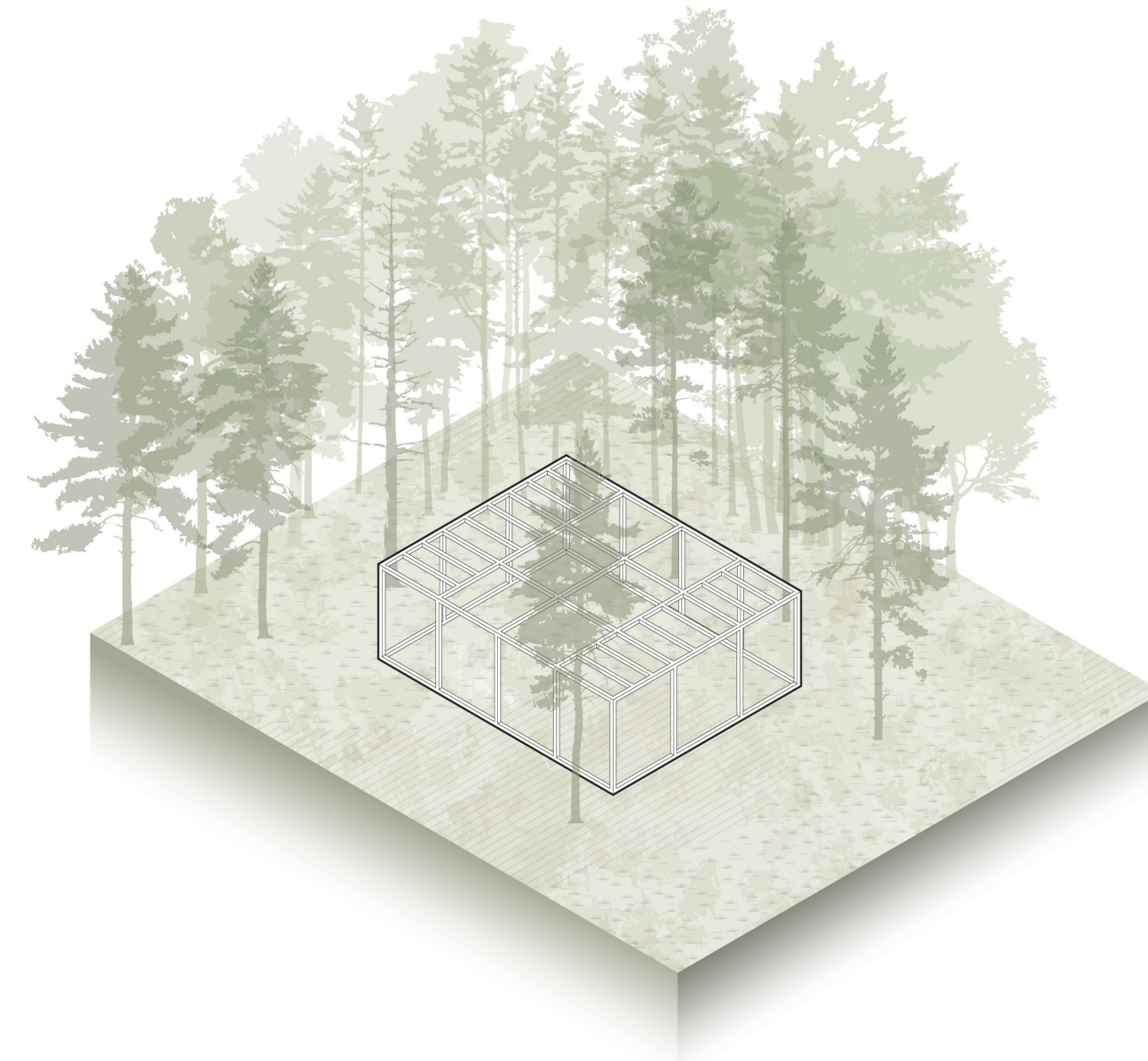


# 5.1 | LANDING INSIGHTS

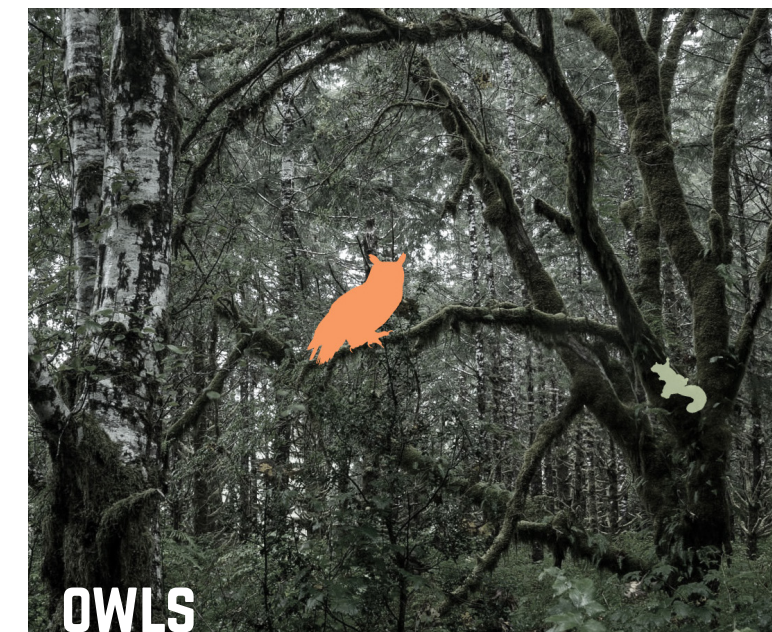
## INTEGRATED HABITAT DESIGN - HABITAT PLANNING

### Scaling Configuration

Similarly, establishing suitable aviary heights entailed navigating a lack of consistent standards across organizations. Referencing various sets of minimum standards revealed disparities in height recommendations. Like the aviary size determination, this decision aimed to achieve a balance between providing ample space for the animals and trainer accessibility to the bird(s). Ultimately, I selected aviary heights based on a median range derived from these standards and the natural flight elevations of each group. Aviaries for high-flying raptors such as eagles and falcons were designed taller, aligning with their hunting behaviors at greater altitudes, while those for low-flying species like owls and hawks were kept at slightly lower heights.

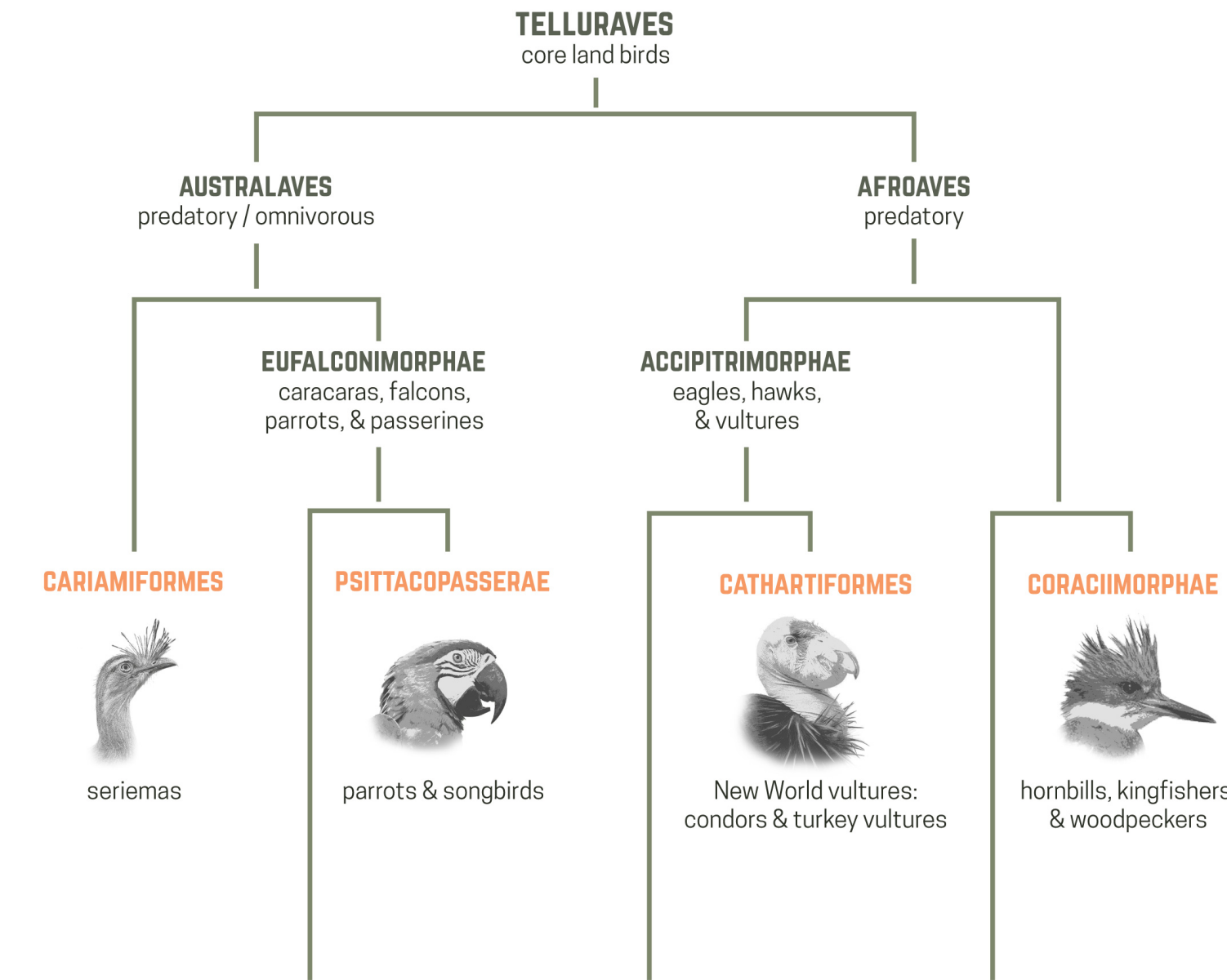
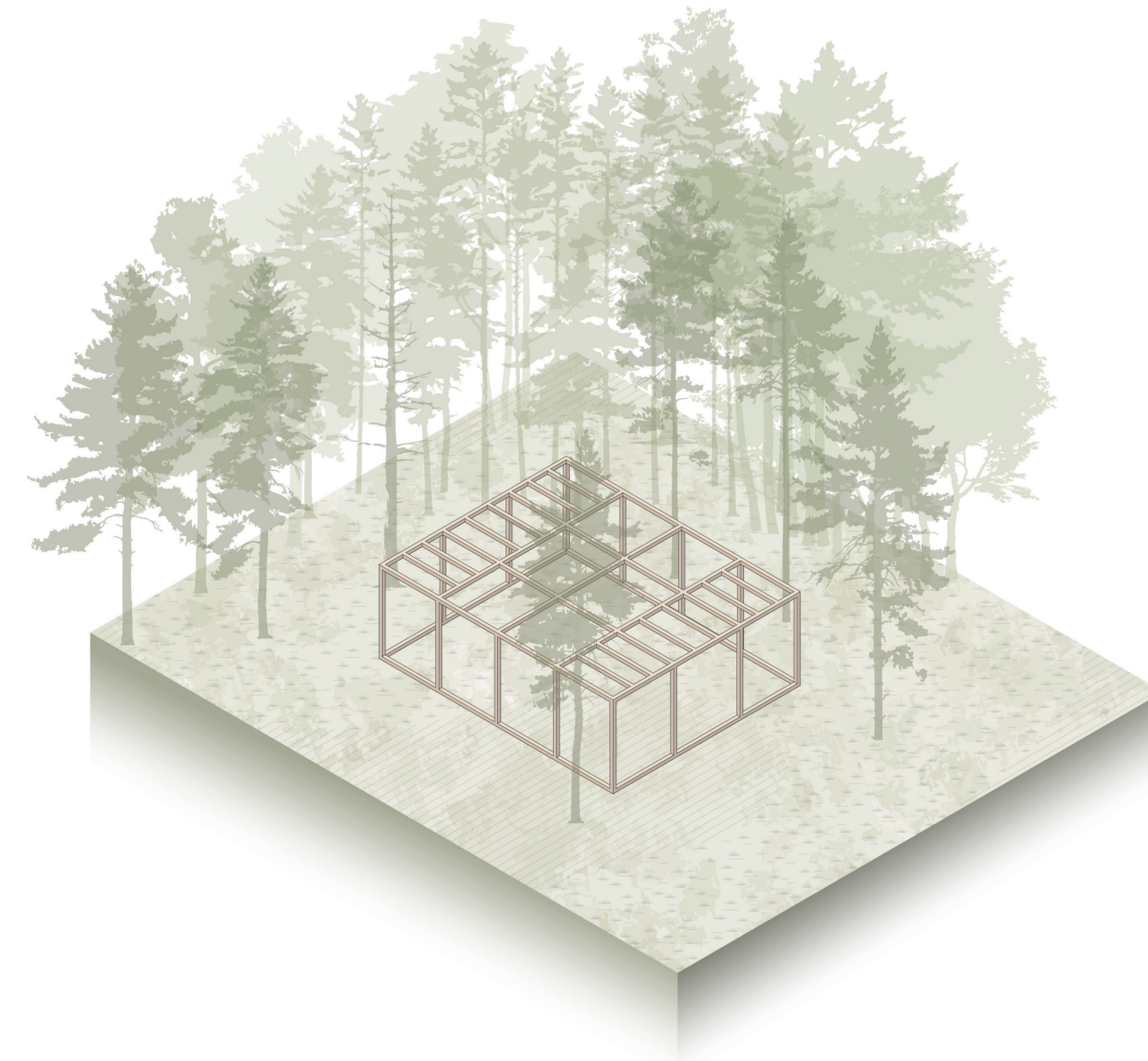


ORGANIZATIONS	EAGLES	HAWKS	FALCONS	OWLS
MINIMUM STANDARDS FOR WILDLIFE REHABILITATION	16' min.	12' min.	16' min.	12' min.
CALIFORNIA FISH & WILDLIFE SERVICES	24' min.	24' min.	16' min.	24' min.
GLOBAL FEDERATION OF ANIMAL SANCTUARIES	10' min.	10' min.	10' min.	10' min.
NORTHWEST TREK WILDLIFE PARK	40' max.			20' max.
<b>VERY "HELPFUL" QUOTES TAKEN FROM VARIOUS SOURCES WHEN DETERMINING AVIARY HEIGHTS</b>	<b>"USE YOUR BEST JUDGEMENT"</b>	<b>"YOU CAN NEVER REALLY GO TOO HIGH FOR THE BIRDS. IT'S ALL VERY SUBJECTIVE"</b>		<b>"USE COMMON SENSE"</b>







**Species Selection**

The thematic choice to organize aviaries according to raptor phylogeny serves several purposes. First, it allows each aviary designated for a specific raptor group to be tailored to meet the particular requirements of that group, including building materials and interior furnishings. For instance, an owl aviary is designed specifically for owls, rather than accommodating a mix of raptor species. Second, caretakers have the flexibility to either permanently house specific raptors in these aviaries or rotate them periodically, such as on a monthly basis, with birds utilized in live educational presentations. This rotation strategy ensures that raptors participating in educational shows have opportunities for rest while mitigating stress levels associated with frequent shifting on and off display. Lastly, educational signage accompanying each group's aviary provides comprehensive information, minimizing the need for frequent signage changes if birds rotate.



**TARGETED SPECIES AT CRC FOR PROPOSED AVIARY HABITATS**

	<b>EAGLES</b>		<b>HAWKS</b>	
				
	Bald Eagle	Golden Eagle	Red-Tailed Hawk	Ferruginous Hawk
<b>OWLS</b>	<b>FALCONS</b>			
				
Great Horned Owl	Barn Owl	Peregrine Falcon	Gyr Falcon	Swainson's Hawk
				
				American Goshawk

<b>FALCONIFORMES</b>	<b>ACCIPITRIFORMES</b>	<b>STRIGIFORMES</b>
	 	
caracaras & falcons	eagles, hawks, kites, & Old World vultures	owls

Aviary Overview

The aviary template has seen a variety of forms, evolving throughout the history of zoos. Today, this template can not only house birds, but are often used to display big cats and primates.

When selecting the structure and appearance of the aviaries at CRC, it was important for me to find a precedent that harmonized with the natural landscape of Spencer's Butte and would allow me to visit firsthand.

# AVIAN ARCHITECTURE





### Northwest Trek Wildlife Park

Northwest Trek Wildlife Park is a 723-acre wildlife park located near Eatonville, Washington, managed by Metro Parks Tacoma. The park exclusively cares for North American wildlife. Its primary attraction, the Wild Drive tour, takes visitors through a 435-acre free roam expanse displaying their ungulate species. Additionally, guests can explore the park on foot, encountering bears, big cats, otters, wolves, and birds of prey on a self-guided walking tour.



### Northwest Trek's Eagle Passage

In 2019, Northwest Trek unveiled Eagle Passage, an entrancing wooded aviary emulating the rainforests of Mount Rainier, housing four bald eagles. The aviary, nestled amidst lush foliage, features high airy netting, ingeniously attached to living Douglas firs. A central tunnel walkway allows visitors up-close encounters with the bald eagles while providing safe passage for the birds between habitat sections. To capture the look and feel of Mount Rainier's rainforests, old snags, nursery stumps, and other vegetation were repurposed from across the park inside the aviary. The excellence in this in-house-design was recognized in 2021 when Eagle Passage received top honors in the National Exhibit Award category from the AZA.



**2021 AZA NATIONAL EXHIBIT AWARD**  
The Association of Zoos and Aquariums, through its Exhibit Award, recognizes excellence in the area of live animal display and exhibit design by an AZA-Accredited Institution or Certified Related Facility member.  
**TOP HONORS:**  
Northwest Trek Wildlife Park - Eagle Passage: Wings of Hope

# 5.1 | LANDING INSIGHTS

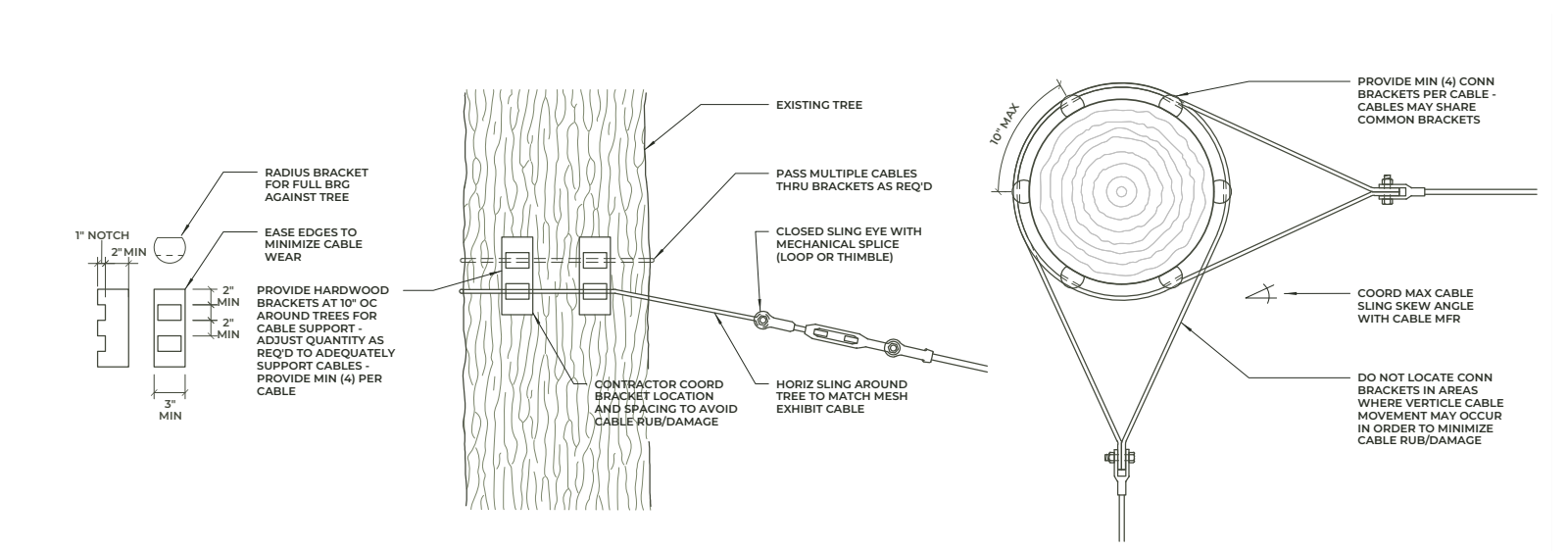
## INTEGRATED HABITAT DESIGN - AVIAN ARCHITECTURE

### Baldie Blueprint

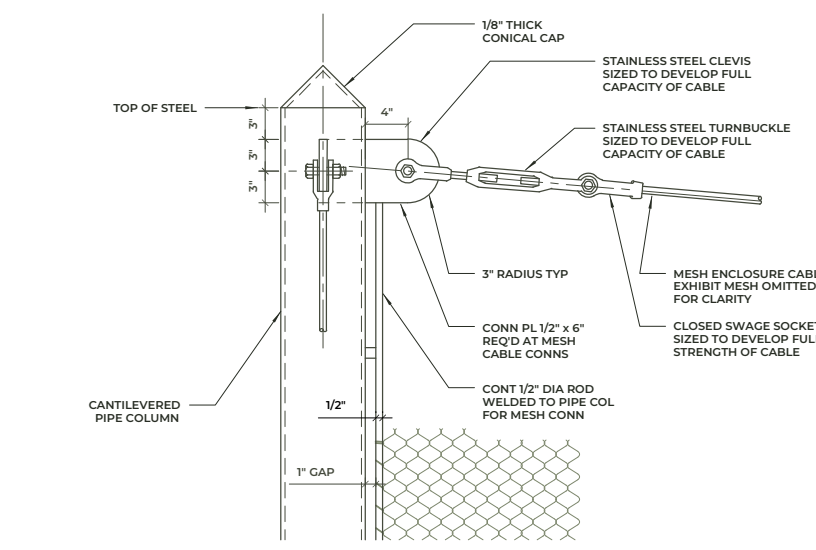
I drew inspiration from Northwest Trek's Eagle Passage for several key reasons. Firstly, Eagle Passage resourcefully utilizes existing trees on the property without harming them. Mesh and cables are attached using a unique block-and-collar system that allows the trees to grow uninhibited. By utilizing the existing trees, it minimizes tree removal during construction, fosters a design harmonious with nature.

Secondly, galvanized steel posts, strategically positioned for added stability, are coated with polyurethane rubber and meticulously textured to mimic natural tree bark. This additional aesthetic further enhances the immersive appeal. Furthermore, the transition from vinyl-coated wiring to hand-woven "invisible" mesh netting ensures both unobtrusive viewing and secure containment for the birds.

Lastly, similar to the resident raptors at CRC, the four bald eagles at Northwest Trek—Salish, Sucia, Sequoia, and Chevevo—suffered injuries in the wild and recovered under the human care of other wildlife rehabilitation centers, nationwide. Due to their permanent injuries, they were deemed non-releasable and relocated to living at this zoo. The successful transition of these eagles from residing in mews to a zoo aviary mirrors the potential role envisioned for the proposed aviaries at CRC in accommodating their resident raptors.

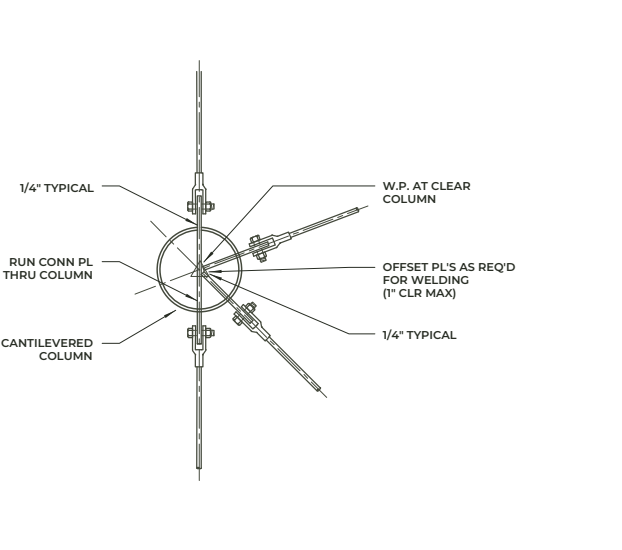


**BLOCK & COLLAR CONNECTION SECTION**  
SCALE 1" = 1'

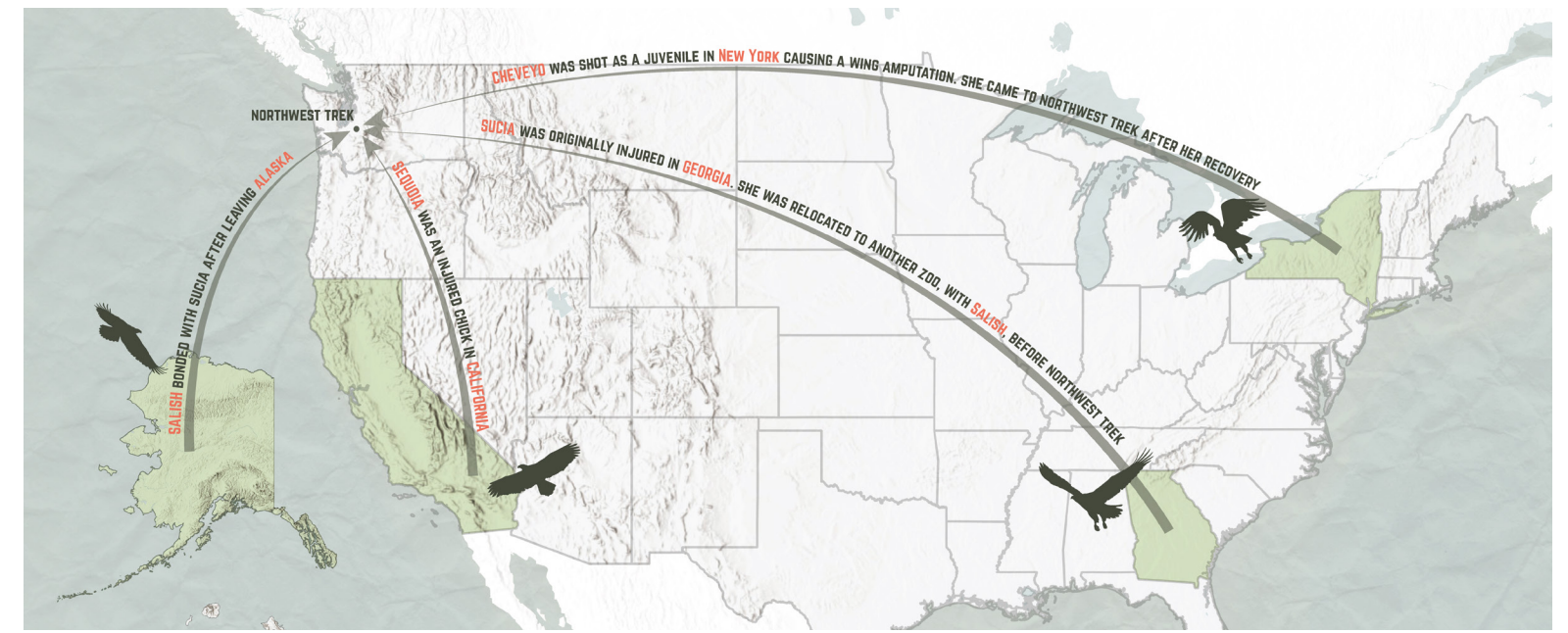


**STEEL POST CABLE CONNECTION SECTION**  
SCALE 1" = 1'

**BLOCK & COLLAR CONNECTION PLAN**  
SCALE 1" = 1'

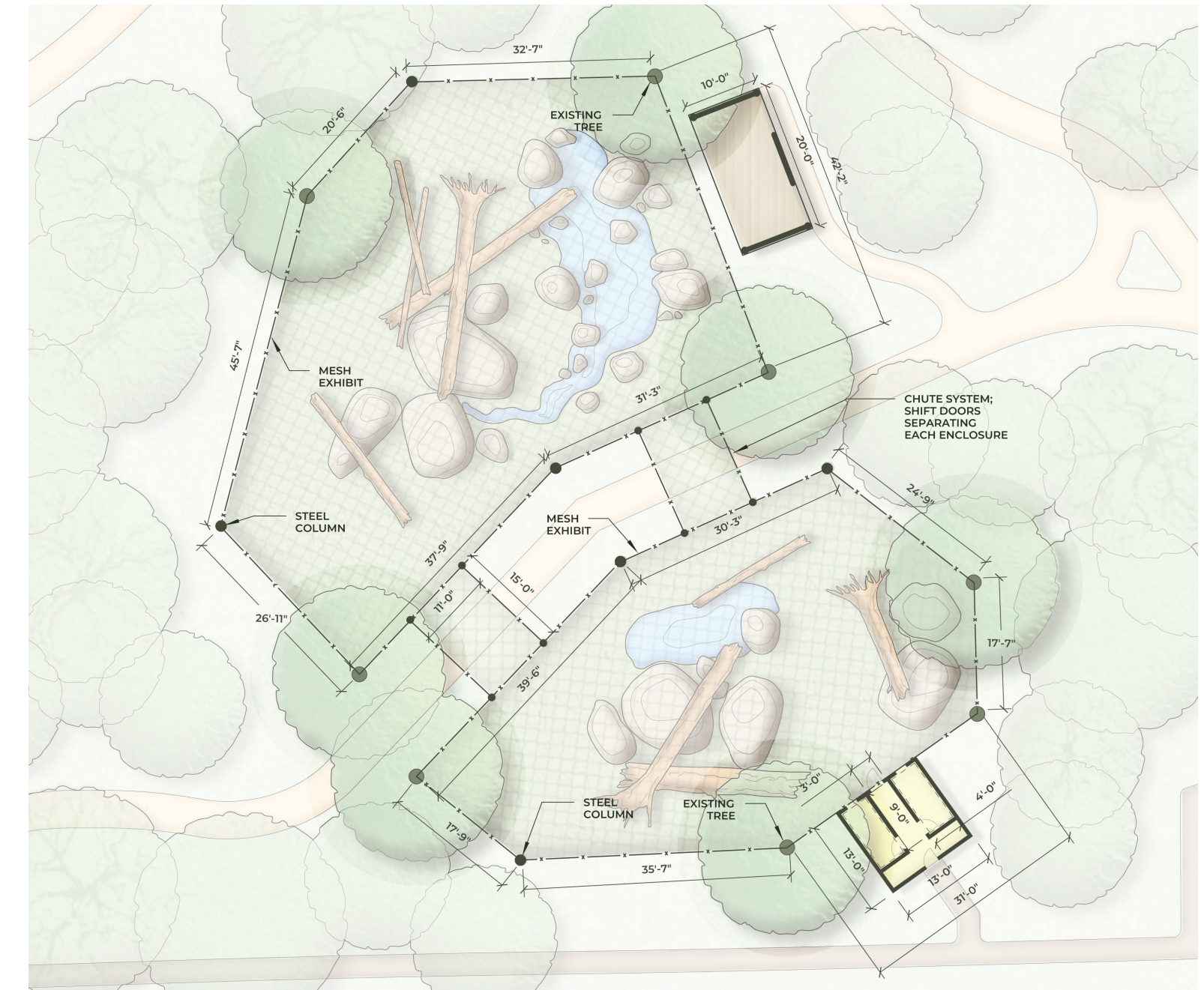
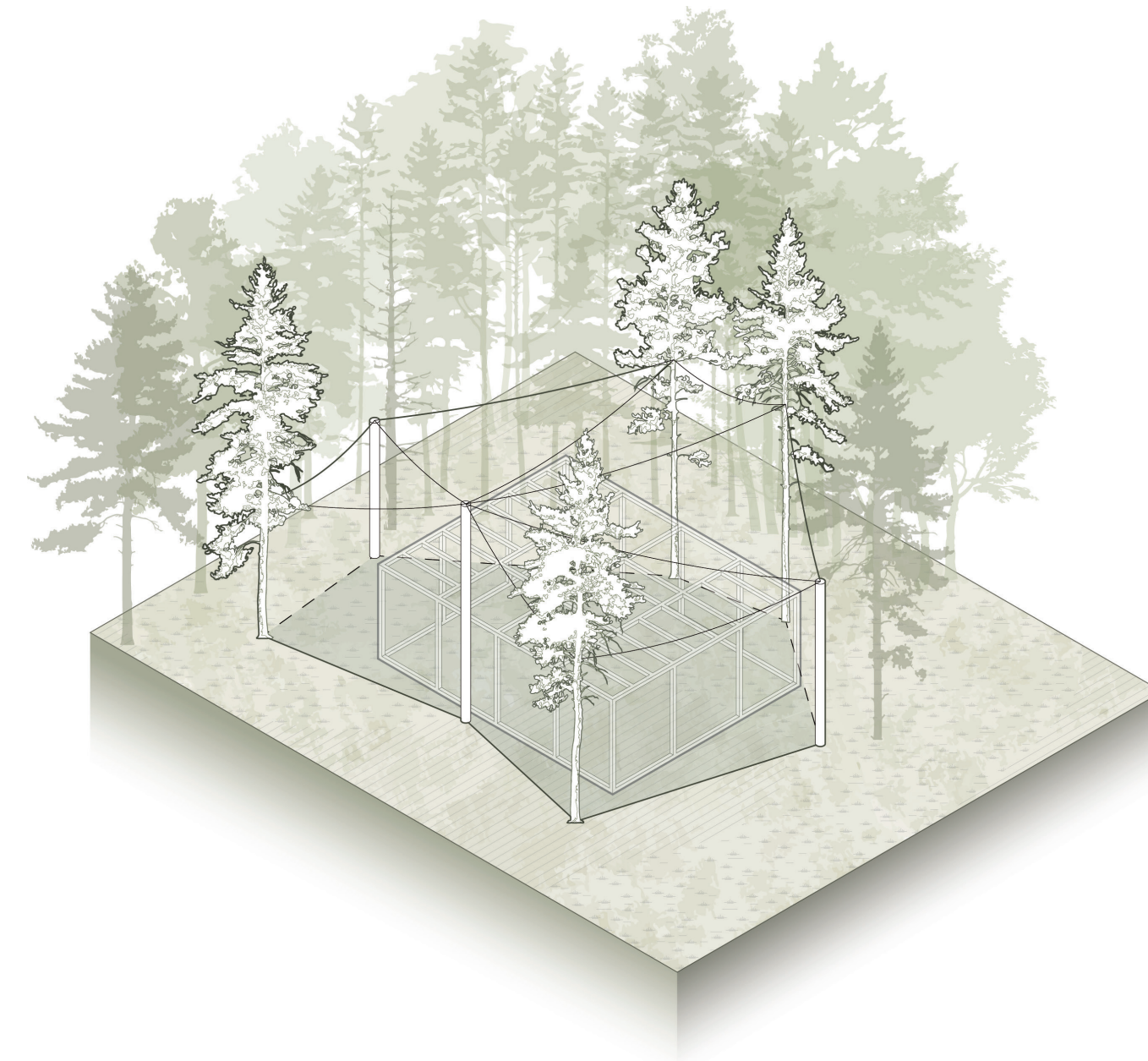


**STEEL POST CABLE CONNECTION PLAN**  
SCALE 1" = 1'



**Site Application**

Informed by this precedent, I utilized Northwest Trek's aviary blueprint as a guiding framework for the design of each aviary within this expansion. After establishing the base size and location of each enclosure, I identified suitable fir and pine trees on the property, using information provided by local site surveyors. This allowed me to expand each enclosure accordingly to ensure spatial comfort for the raptors, while also considering accessibility for trainers. Similar to the approach taken at Northwest Trek, steel posts would receive a bark coating treatment, offering the flexibility to customize the appearance to mimic different tree species.



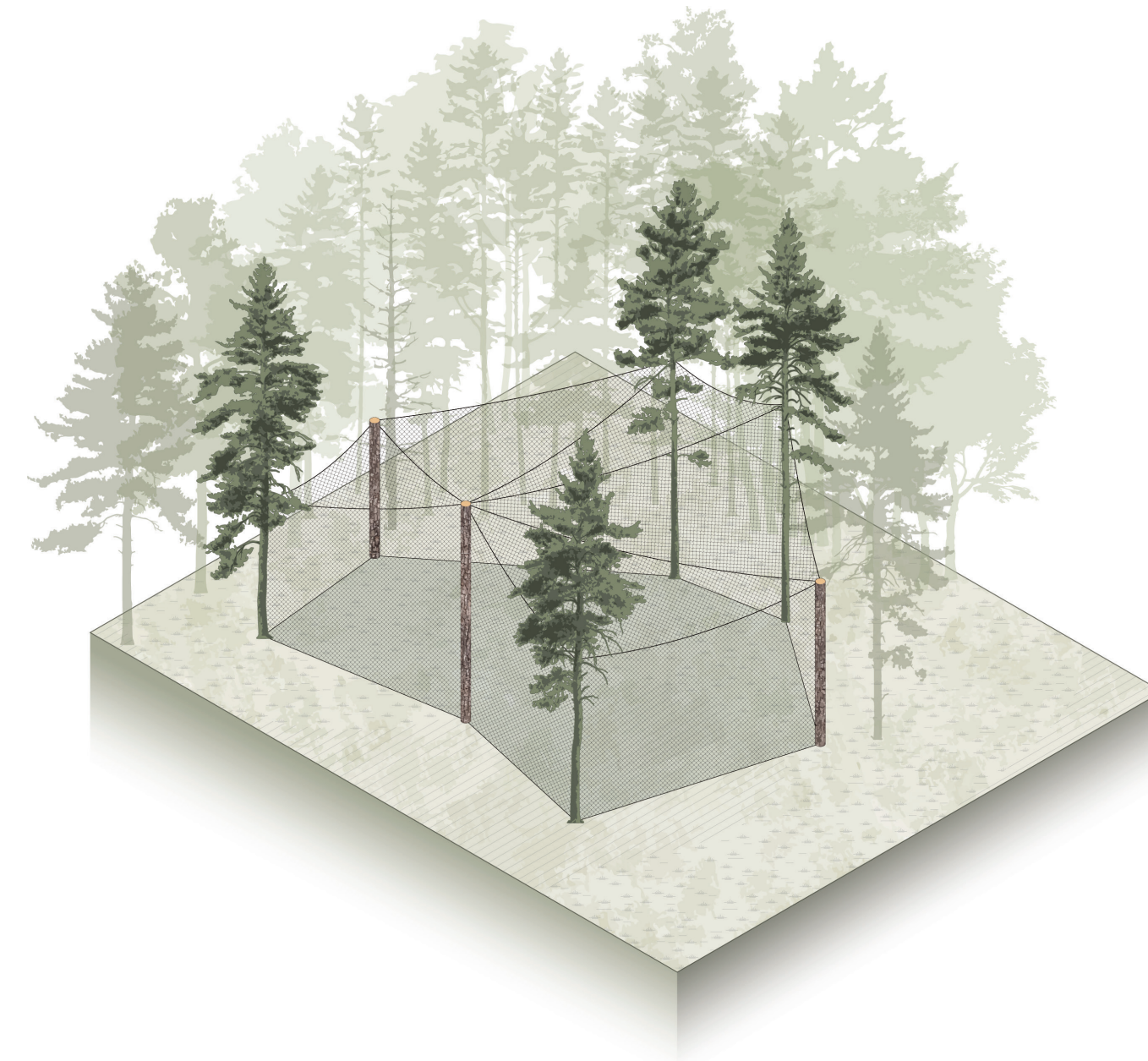
**“THE GOOD BUILDING IS NOT ONE THAT HURTS THE LANDSCAPE, BUT ONE WHICH MAKES THE LANDSCAPE MORE BEAUTIFUL THAN IT WAS BEFORE THE BUILDING WAS BUILT.**

**...IT IS THE NATURE OF ANY ORGANIC BUILDING TO GROW FROM ITS SITE, COME OUT OF THE GROUND INTO THE LIGHT.”**

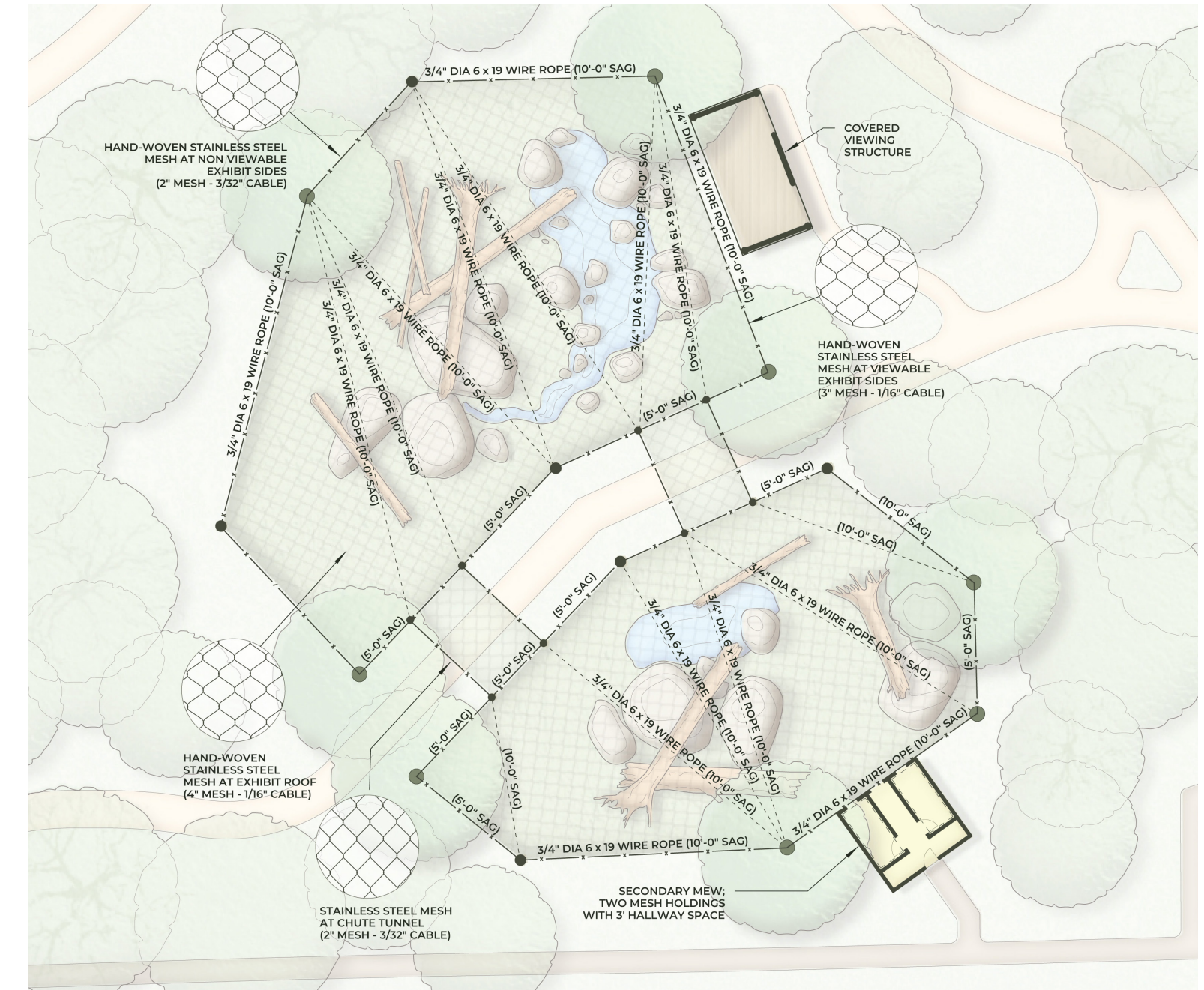
**FRANK LLOYD WRIGHT**  
**ARCHITECT & DESIGNER**

**Site Application**

Conversations with Nets Unlimited informed the determination of mesh size for each aviary, with large raptors issuing 3" mesh in 1/16" steel cables, while moderate sized species would utilize 2" mesh in 1/16" cables. Additionally, varying the mesh sizes would ensure unobstructed viewing for visitors while maintaining security for the birds and structural integrity for the aviaries themselves. For example, the roof to each aviary could be one inch larger to prevent fallen debris damage and the sides of each for non-visitor viewing, could be one inch smaller to reinforce security and prevent wild animals from trying to access the enclosures.



**VARIED BARK SLEEVE COATINGS CHOSEN BASED ON AVIARY HABITAT RESEMBLANCE OR SITE SPECIFIC TREES IN THE DESIRED CONSTRUCTION LOCATION**



**“THE GOOD BUILDING IS NOT ONE THAT HURTS THE LANDSCAPE, BUT ONE WHICH MAKES THE LANDSCAPE MORE BEAUTIFUL THAN IT WAS BEFORE THE BUILDING WAS BUILT.**

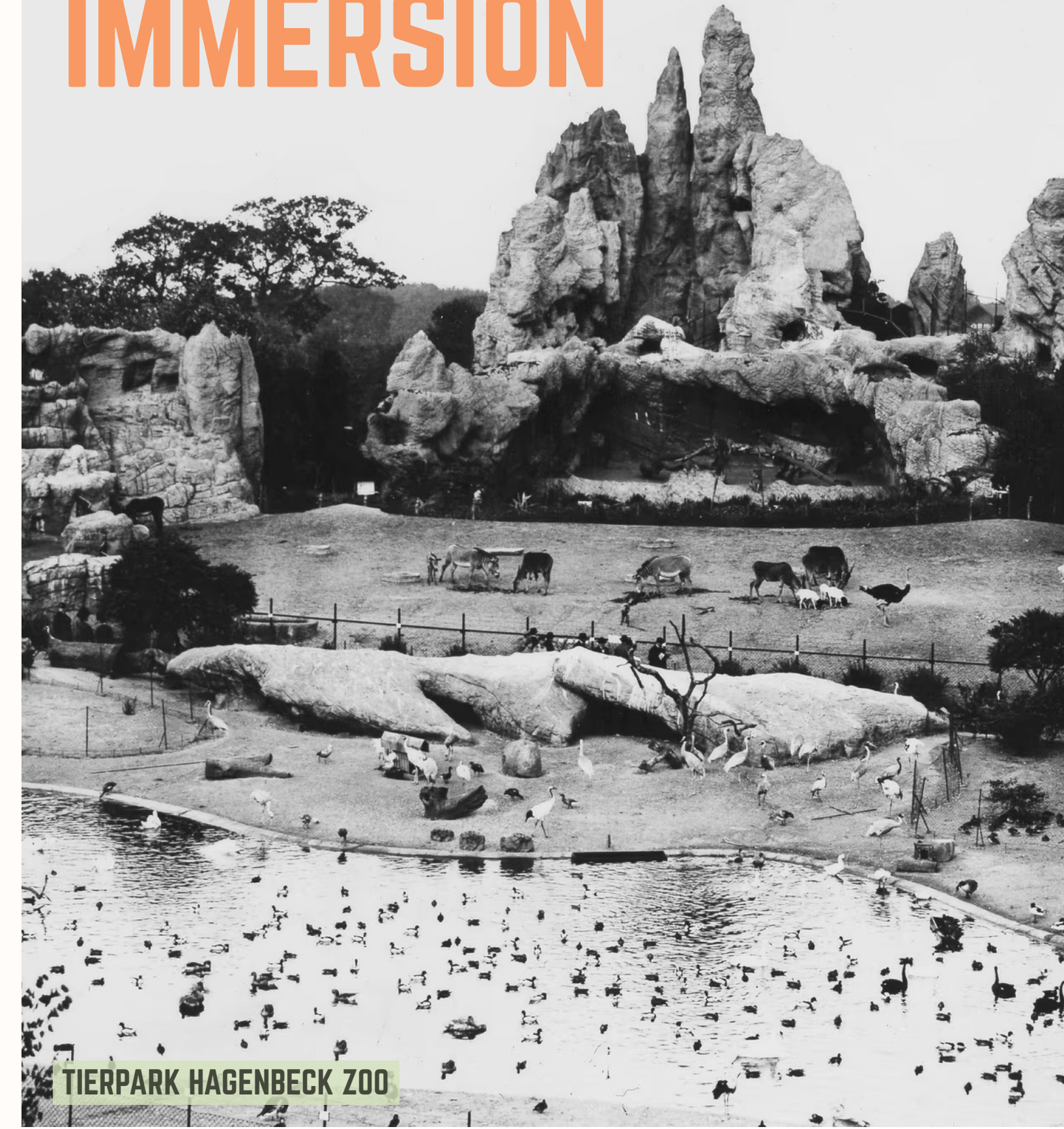
**...IT IS THE NATURE OF ANY ORGANIC BUILDING TO GROW FROM ITS SITE, COME OUT OF THE GROUND INTO THE LIGHT.”**

**FRANK LLOYD WRIGHT**  
**ARCHITECT & DESIGNER**

**Landscape Immersion Overview**

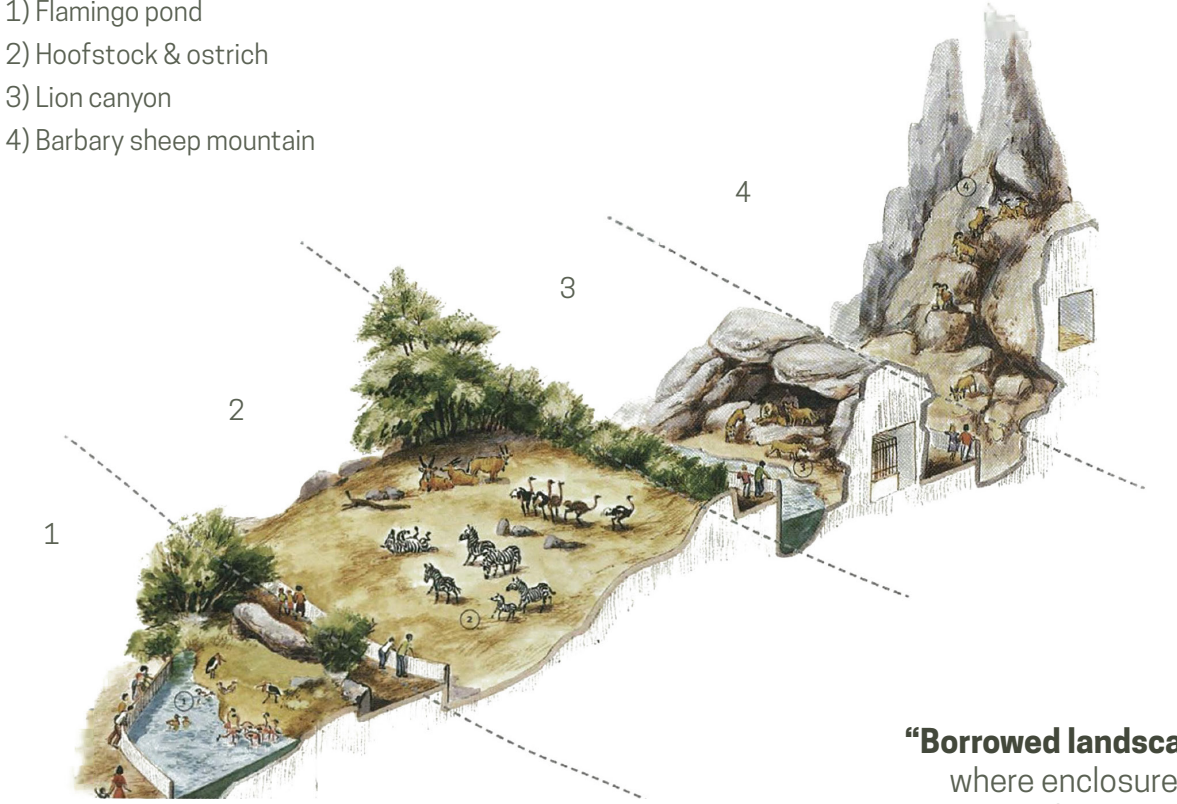
The concept of landscape immersion originated in the early 20th century with Carl Hagenbeck's innovative enclosure format at Tierpark Hagenbeck Zoo in Hamburg, Germany. Hagenbeck's enclosures replicated ecological and geographical habitats native to the animals on display (Meuser, 2019). Subsequent enclosures were elevated above those in the foreground, separated by concealed moats, ha-ha's, and pathways, creating the illusion that viewers were observing the animals coexisting in a single habitat. This simulated habitat transcendence would later extend beyond the animal barriers and into the visitor space, unifying the simulated environment between people and animals, and thus defining landscape immersion (Coe, 1994). This concept gained momentum in the 1980's, after being beautifully exemplified in Woodland Park Zoo's Northern Trails, subsequently influencing the direction of enclosure design practices.

# LANDSCAPE IMMERSION



**TIERPARK HAGENBECK ZOO**

- 1) Flamingo pond
- 2) Hoofstock & ostrich
- 3) Lion canyon
- 4) Barbary sheep mountain



**“Borrowed landscapes”** is a planning strategy where enclosures are elevated above those in the foreground, creating the illusion that viewers are observing the animals coexisting in a single habitat.

This method is still heavily utilized today, as seen below.



**ASSINIBOINE ZOO PARK - JOURNEY TO CHURCHILL**

### Landscape Immersion Overview

From an animal wellness perspective, immersion design emphasizes the importance of recreating species' natural environments to better meet their needs (Coe, 2005), thus enhancing their overall well-being. Similarly, from an educational perspective, immersion design theory asserts that learning is triggered by emotional responses (Andersen, 2003). These responses stimulate higher levels of motivation to learn and engage with the subject, leading to deeper cognitive outcomes.

To further extend the immersive experience in the visitor space, I designed with reclaimed wood from trees removed during the expansion, and living trees, not only into the habitat design but also as the primary construction material for built structures.

**“ANIMAL ENCLOSURES ARE THE ZOO OR AQUARIUM’S NATURAL VOICE, THE BEST MEANS AVAILABLE TO COMMUNICATE OUR MESSAGE TO THE PUBLIC.”**

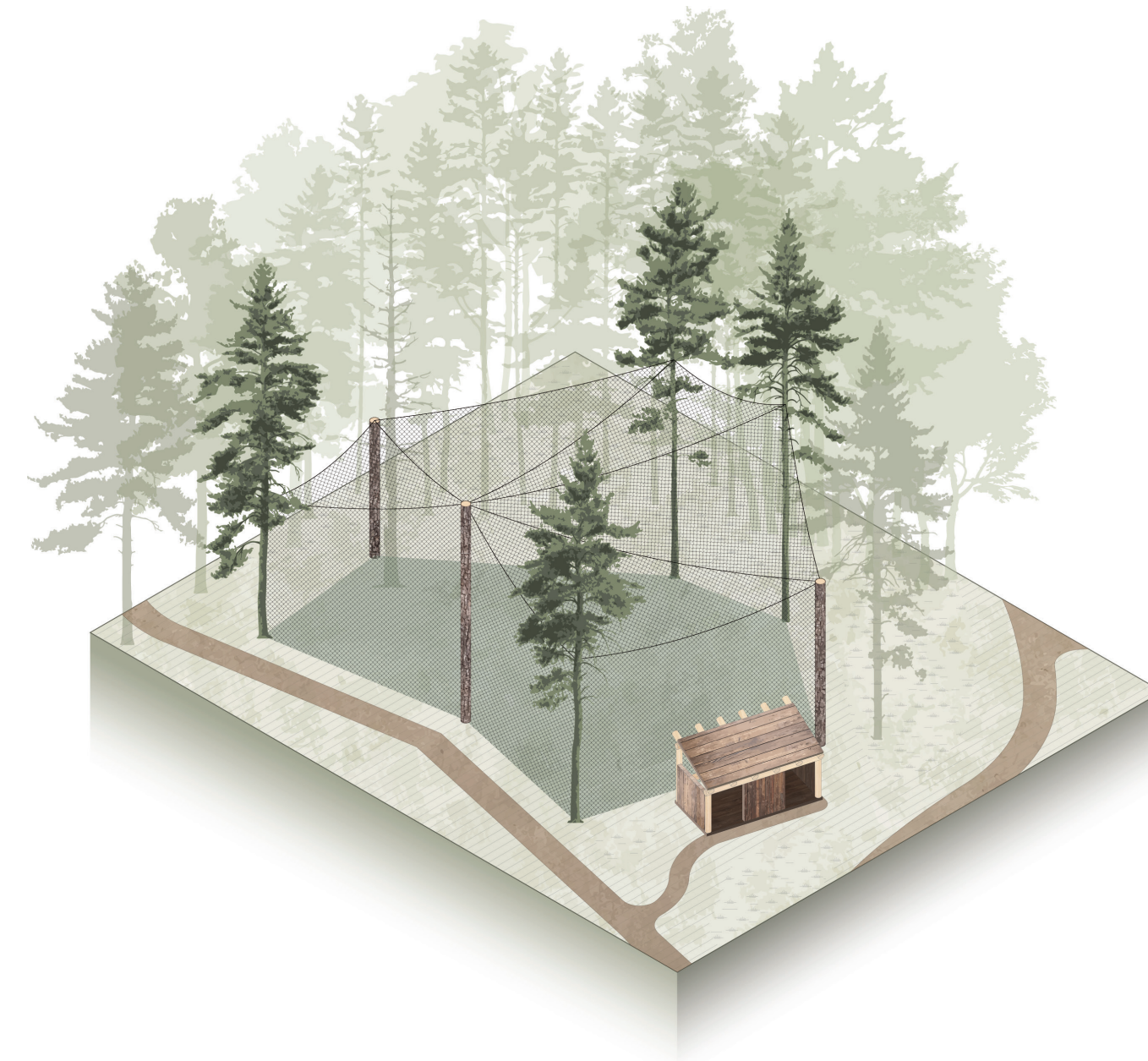
**-JON COE  
ZOO LANDSCAPE ARCHITECT**

**DENVER ZOO - PREDATOR RIDGE**



**Guiding Principles**

To design within the landscape immersion framework, designers have evolved the principles initially inspired by Carl Hagenbeck and further refined by the impactful practices pioneered at Woodland Park Zoo. While many of these principles offer valuable objectives, some were not applicable for this project. For instance, it becomes challenging to maintain the directive of “concealing enclosure boundaries to create the illusion of boundless space for the animal” in the context of designing a fully enclosed, three-dimensional space (an aviary). In response, I curated my own set of guidelines from landscape immersion principles relevant to the constraints of my project, influencing decisions regarding both animal and human spaces. Aligned with landscape immersion principles, my goal was to create impactful first impressions, imprinting memorable experiences that connect visitors to the authentic ambiance of the raptors’ natural habitats, reflected in the restored mixed hardwood forest of Spencer Butte Park.



**LANDSCAPE IMMERSION FOUNDATIONS:**

- 1) NATURE IS THE MODEL; COPY NATURE (NOT OTHER ZOOS)**
- 2) IF WE WOULD TEACH RESPECT FOR NATURE, WE MUST PRESENT NATURE RESPECTFULLY**
- 3) DEMONSTRATE LANDSCAPE AS APPROPRIATE HABITAT AND ECOSYSTEM**
- 4) IMMERSE VISITORS IN THE SIMULATED OR RESTORED NATURAL LANDSCAPE DOMINATED BY ANIMALS**

**GUIDING PRINCIPLES TO LANDSCAPE IMMERSION**

	The animals should be located at or above the visitor's eye level		The plants are to be chosen and arranged according to the shown animal species' natural habitat
	No complete view into the enclosure or “cross views”; visitors cannot see each other from different viewpoints		The visitor should be given the opportunity to discover the animal within the enclosure
	Attention to the animal's necessary escape distance; arrangement of diverse, freely selectable retreats		Animals of identical habitats should be accommodated in neighboring enclosures
	The visitor is already engaged in the enclosure thanks to the immersive designs before they see the animals		Enclosures should be situated to allow guests to see animals from several viewpoints interspersed with views of other interrelated animals
	Architecture should resign in favor of the animals and/or landscape		Viewing structures should have designated pathways, leaving the primary circulation paths



**Guiding Principles**

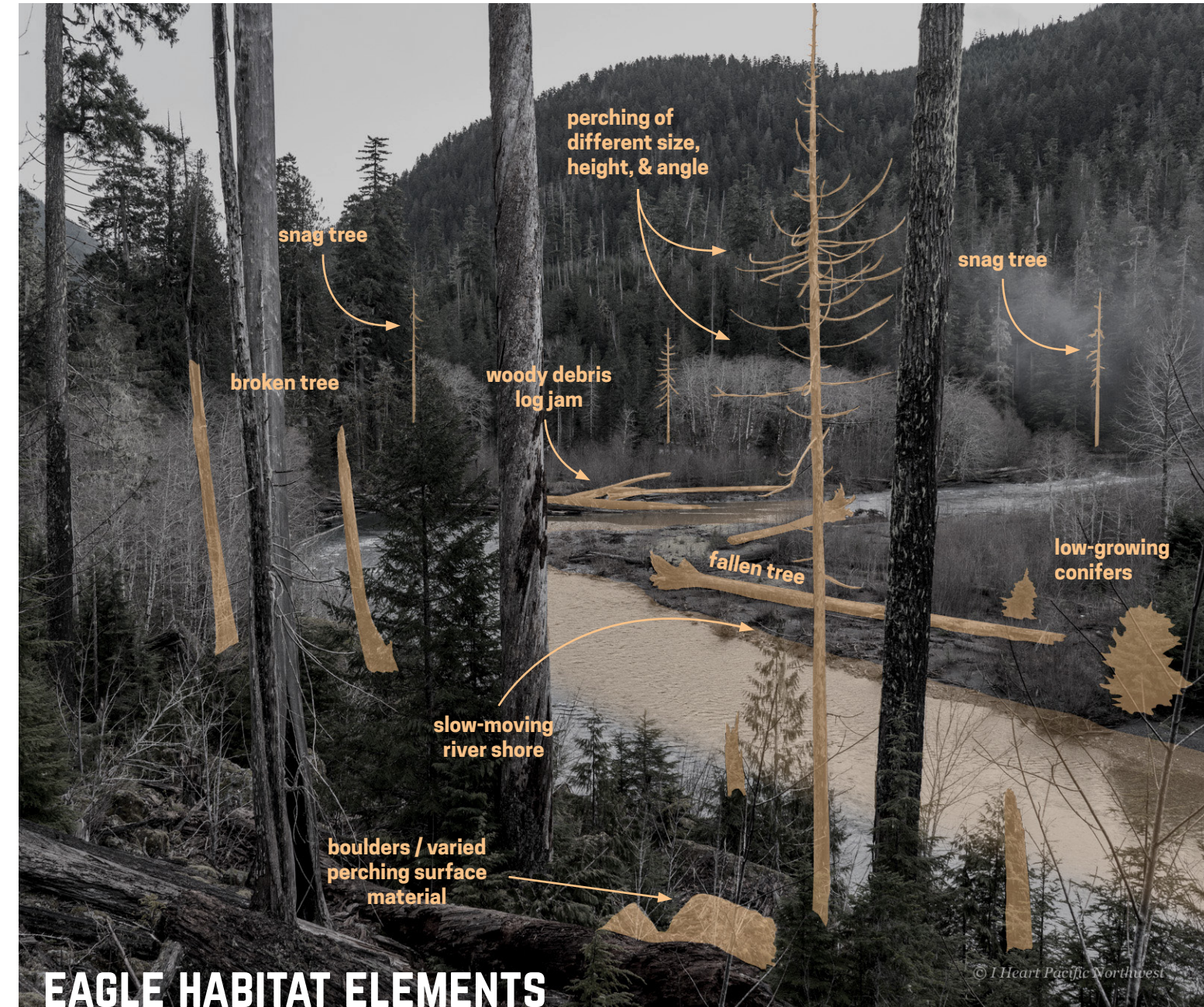
**Animal Habitat**

Guided by the foundation that “Nature is the model”, the selection of a habitat type serves as the foundation for replicating elements from the chosen landscape within the enclosure. This approach ensures that the created landscape is respectful and aligned with natural habitat systems. Additional furnishing items, informed by raptor mews, would be incorporated to accommodate the animals’ preferences and husbandry requirements. These would include varied perching types, with color appropriate perch wraps, and nest boxes.



**LANDSCAPE IMMERSION FOUNDATIONS:**

- 1) NATURE IS THE MODEL; COPY NATURE (NOT OTHER ZOOS)
- 2) IF WE WOULD TEACH RESPECT FOR NATURE, WE MUST PRESENT NATURE RESPECTFULLY
- 3) DEMONSTRATE LANDSCAPE AS APPROPRIATE HABITAT AND ECOSYSTEM
- 4) IMMERSE VISITORS IN THE SIMULATED OR RESTORED NATURAL LANDSCAPE DOMINATED BY ANIMALS



**EAGLE HABITAT ELEMENTS**

**Guiding Principles**

**Human Habitat**

In creating a seamless transition between human and animal spaces, the landscape appears continuous on both sides of the barriers, effectively making the visitor space an extension of the animals' habitat. This approach fosters a sense of shared environment sensation, where visitors and animals coexist harmoniously.



**SUGGESTED PLANTING**



**LANDSCAPE IMMERSION FOUNDATIONS:**

- 1) NATURE IS THE MODEL; COPY NATURE (NOT OTHER ZOOS)
- 2) IF WE WOULD TEACH RESPECT FOR NATURE, WE MUST PRESENT NATURE RESPECTFULLY
- 3) DEMONSTRATE LANDSCAPE AS APPROPRIATE HABITAT AND ECOSYSTEM
- 4) IMMERSE VISITORS IN THE SIMULATED OR RESTORED NATURAL LANDSCAPE DOMINATED BY ANIMALS



**HUMAN HABITAT ELEMENTS**

# 5.1 | LANDING INSIGHTS

## INTEGRATED HABITAT DESIGN - LANDSCAPE IMMERSION

### Guiding Principles

#### Site Layout

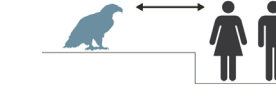
Additionally, the site layout was also guided by other principles to improve both visitor and animal experiences. Cross-viewing is eliminated, ensuring that viewers cannot see each other from different overlooks, thus preventing the animals from feeling surrounded by people. Viewing platforms are strategically located along secondary pathways, leaving primary circulation paths free from obstruction. Known as "borrowed landscapes", viewing areas are placed so that visitors can enjoy can spot other raptors in the backdrop, creating an experience true to nature.



The plants are to be chosen and arranged according to the shown animal species' natural habitat



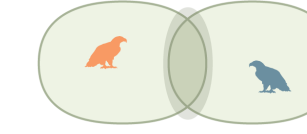
The visitor should be given the opportunity to discover the animal within the enclosure



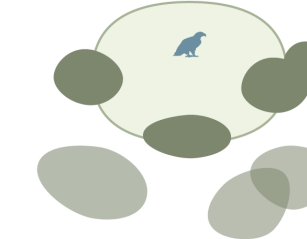
The animals should be located at or above the visitor's eye level

### SITE LAYOUT

Animals of identical habitats should be accommodated in neighboring enclosures



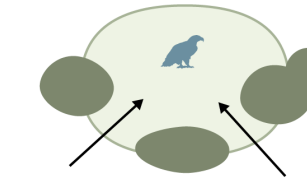
The visitor is already engaged in the enclosure thanks to the immersive designs before they see the animals



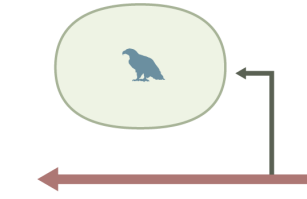
Architecture should resign in favor of the animals and/or landscape



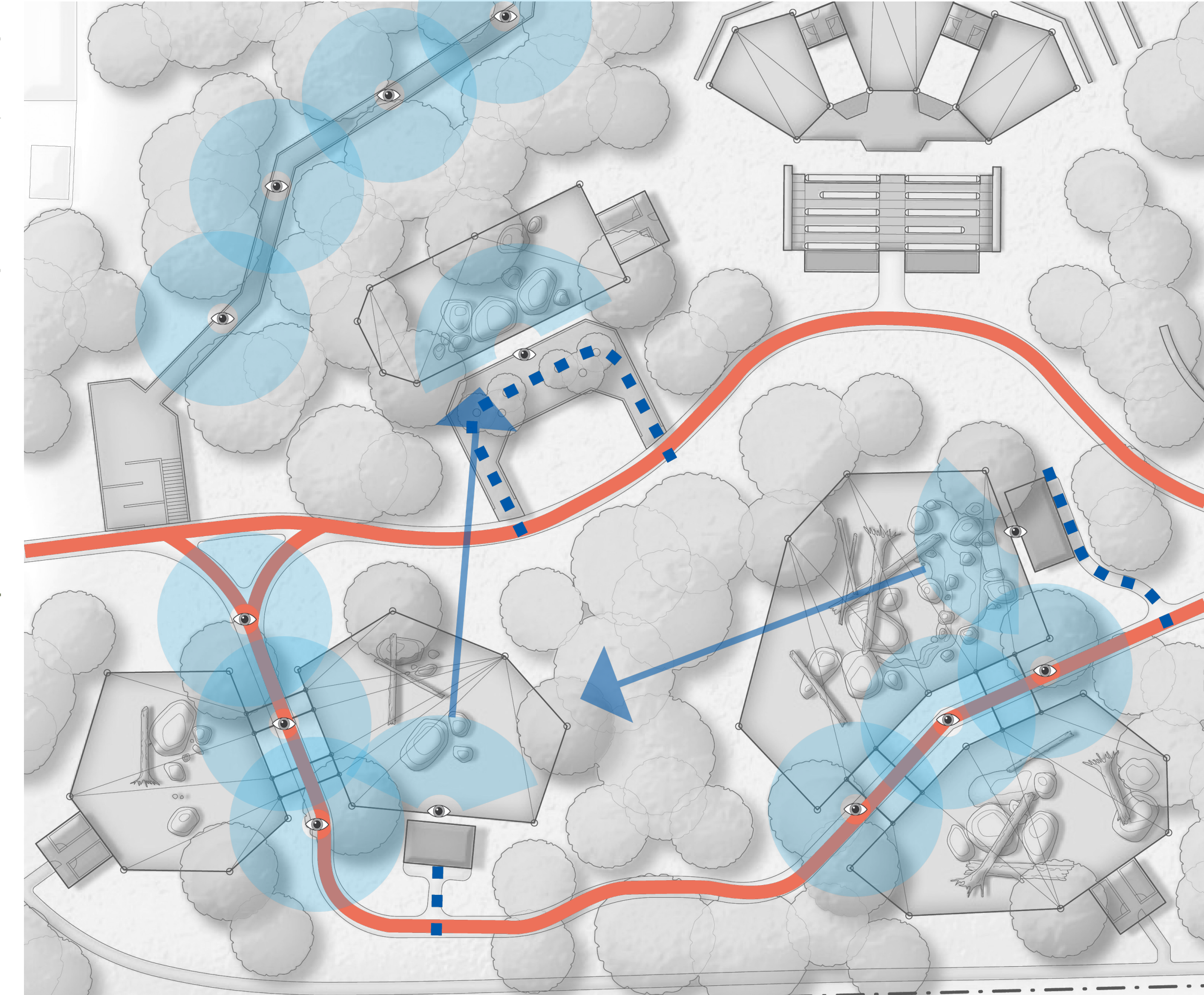
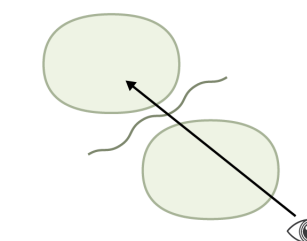
No complete view into the enclosure or "cross views"; visitors cannot see each other from different viewpoints



Viewing structures should have designated pathways, leaving the primary circulation paths

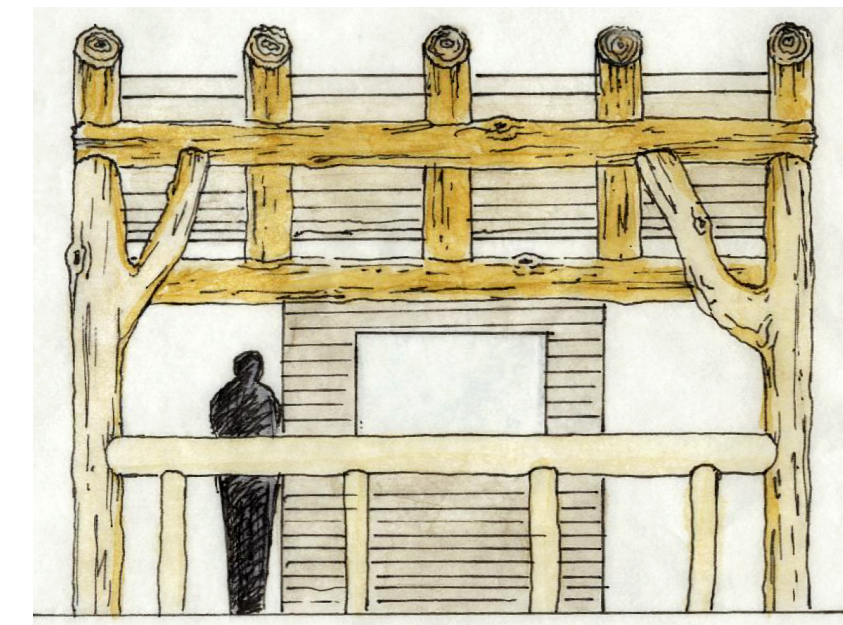
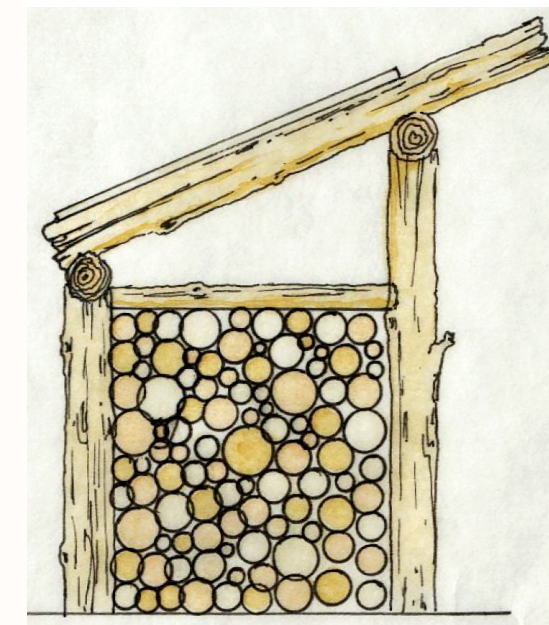


Enclosures should be situated to allow guests to see animals from several viewpoints interspersed with views of other interrelated animals



### Viewing Structures

Adjacent to the aviaries, the viewing structures offer more than just a platform for observing the raptors; they serve as integral components of the immersive experience, harmonizing with the surrounding landscape. Using the natural form of both reclaimed and living trees, each becomes an essential element of the architectural framework. Seen from afar, these structures seamlessly blend human and animal spaces, extending the aviary habitat and merging with the backdrop to form a cohesive forest. By integrating the sights and sounds of the landscape foreground with the tactile presence of the structural trees, this creates a multisensory experience, nurturing a deeper connection between visitors and the environment. This design creates a shared experience, reflecting the principles of landscape immersion by creating an intersection between human and animal spaces.



**Flex Habitats**

To push the concept of landscape immersion further, zoos have begun designing flex enclosures. Short for flexible, flex enclosures assist in the controlled animal movement between enclosures via a system of chutes, operated through animal training procedures (Coe, 1995). While these enclosures are common for mammals, my proposal explores their application for free-flight raptors. This design aims to capture the essence of an animal's home range, giving them more choice and activity in their environments.

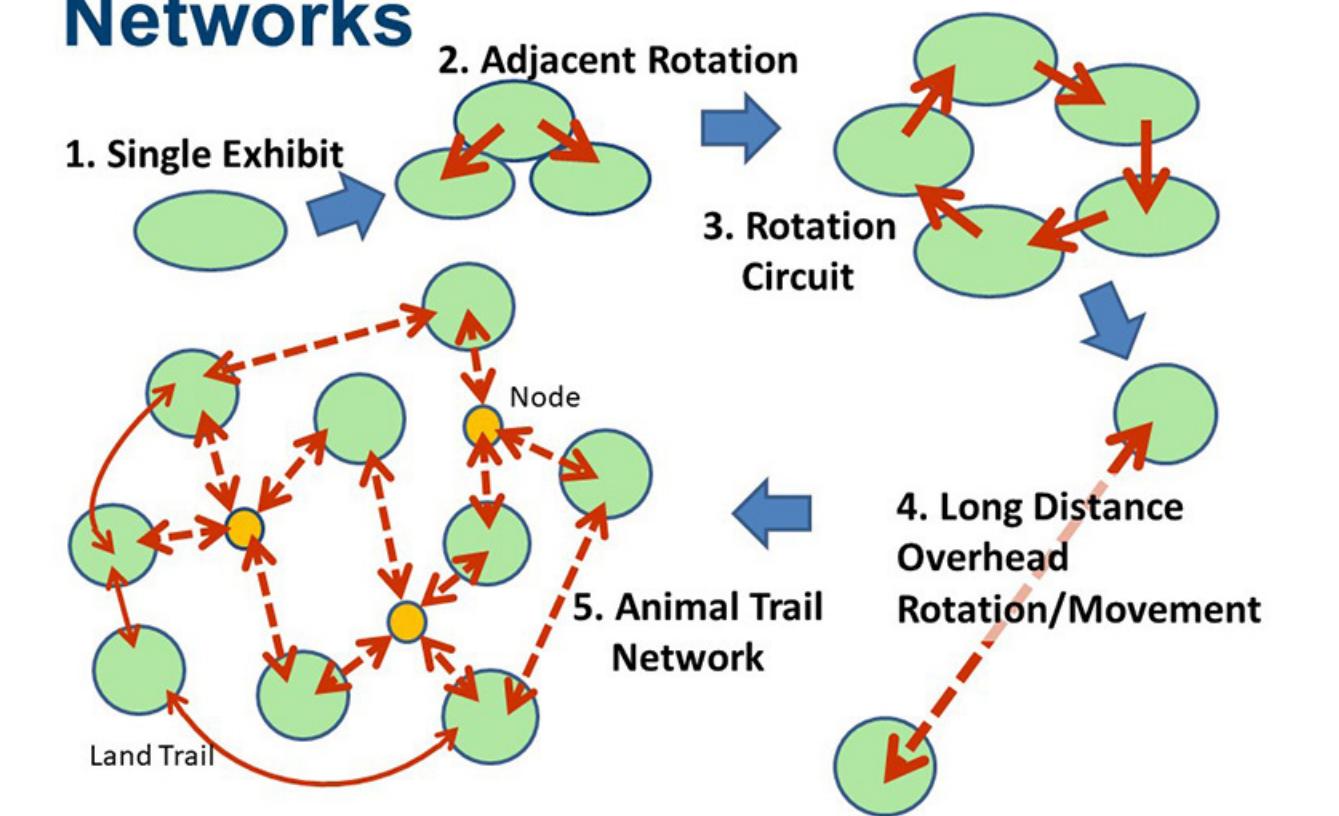


**DUBLIN ZOO - ORANGUTAN FOREST**



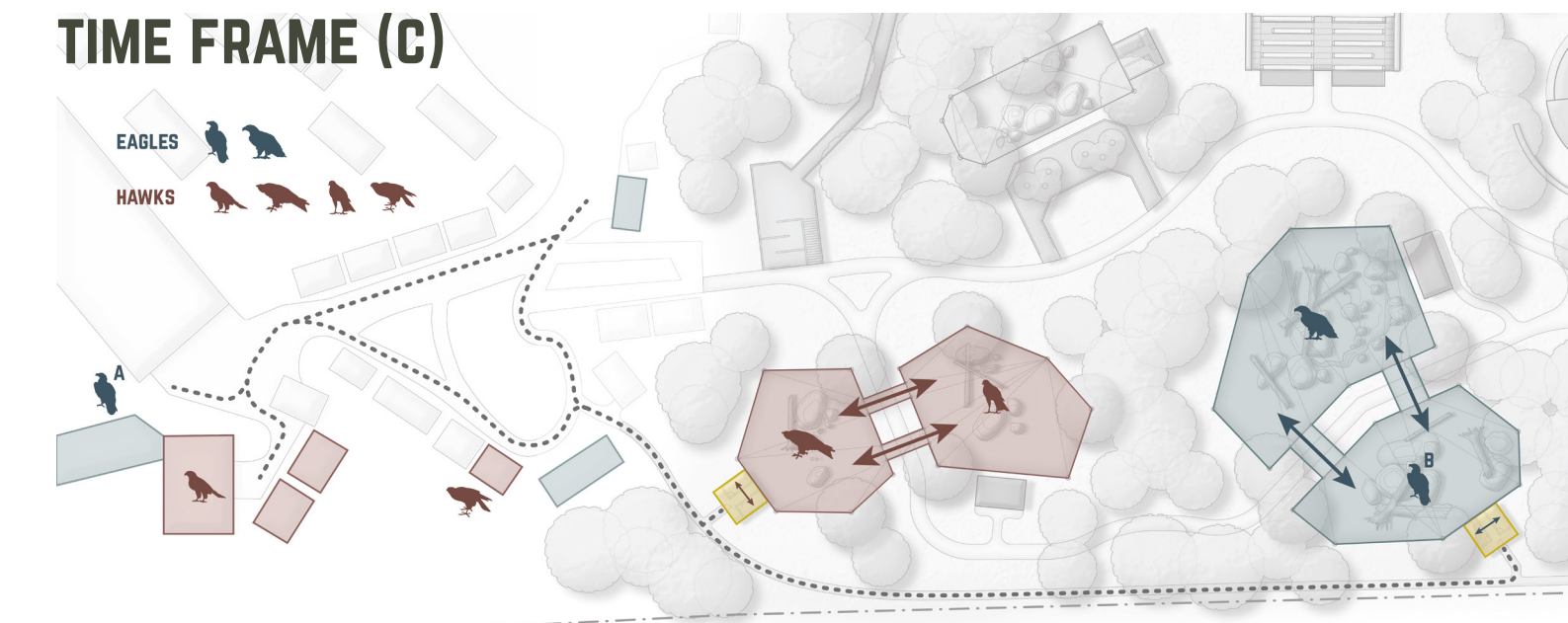
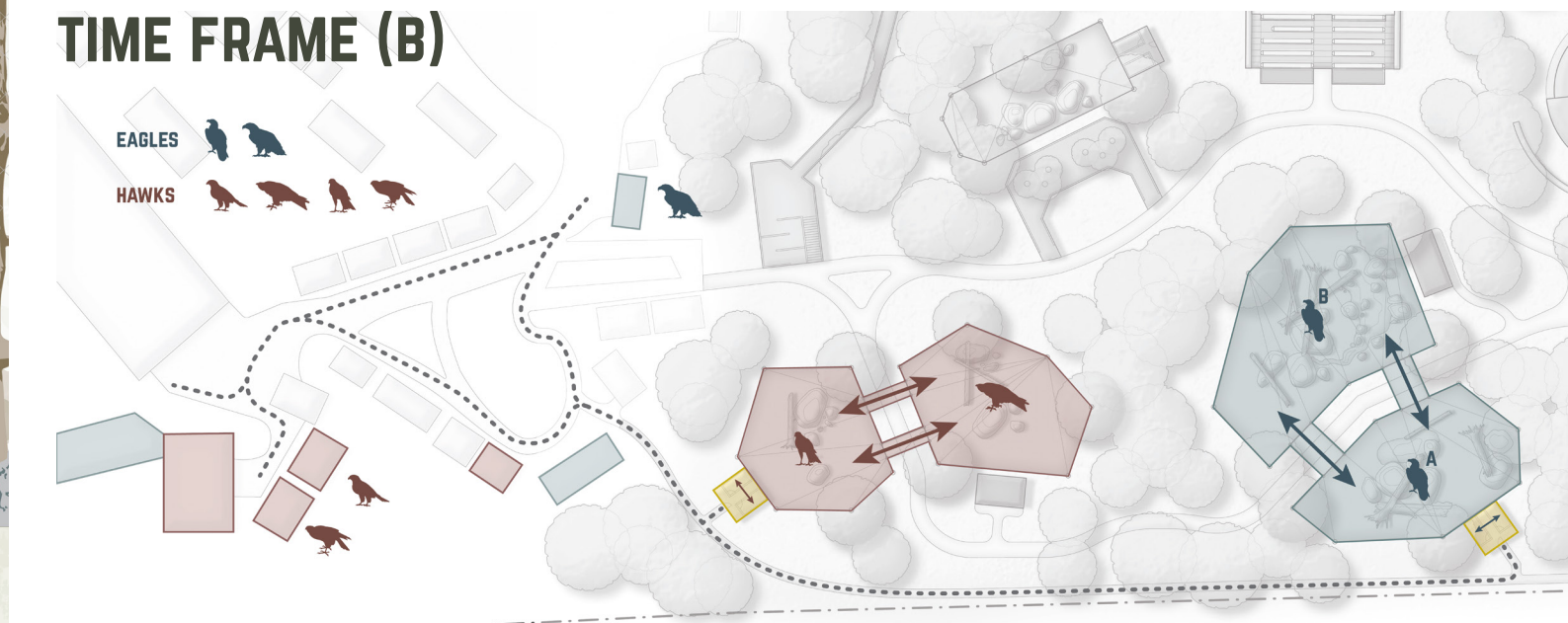
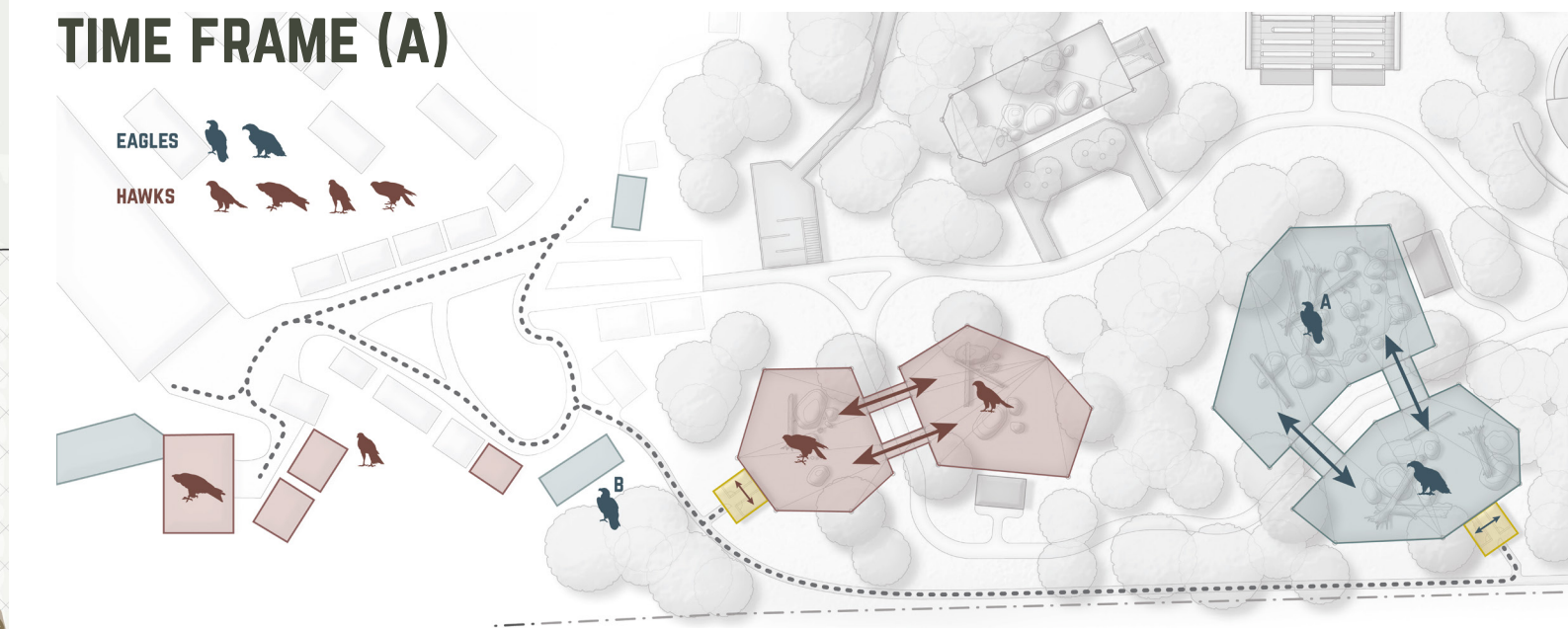
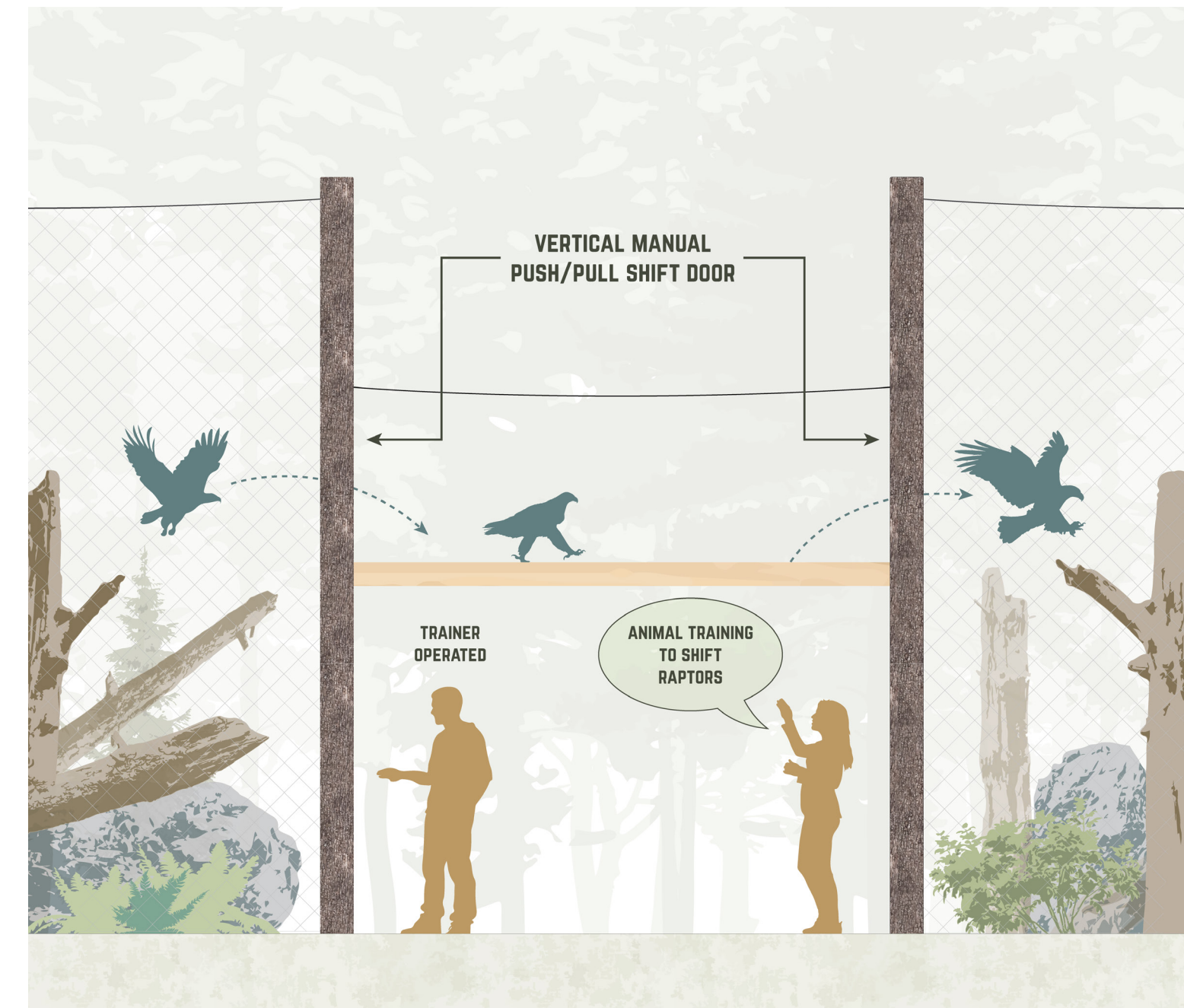
**JACKSONVILLE ZOO - LAND OF THE TIGER**

**Evolution of Animal Rotation Networks**



**Flex Habitats**

Flex enclosures, or rotational habitats, serve several purposes. Primarily, it offers a form of environmental enrichment by exposing animals to new surroundings, alleviating boredom, and promoting physical exercise (Meuser, 2019). Secondly, it assists animals in regaining behaviors characteristic in migration, hunting, or territorial movement (Coe, 2004). Lastly, it enhances the visitor experience, allowing guests to observe more active animals portraying behaviors more reflective of nature. While no enclosure can fully replicate the space and environmental complexity animals experience in the wild, the managed “time share” concept of flex enclosures aims to significantly increase both space and complexity for animals within the constraints of available space (Coe, 1995).



**Flexible Innovations**

Inspired by my experiences as an avid bird watcher, where I often spot birds perched on the branches of towering trees, these stylized trees are designed to mimic the natural form and characteristics found in various forest typologies of the Pacific Northwest. Crafted from milled and cured wood sourced from the site, these installations are securely fastened to the bridges of each flex chute. Serving not only as visual barriers for the rotating raptors, but also as points of fascination for visitors, these tree-like structures invite curiosity as guests approach. As visitors traverse the thoroughfare between each aviary, these installations, complemented by native plantings, aim to evoke the feeling of walking through a forested holloway. Each chute bridge is constructed with brachiating beams to create the illusion of looking up into a tree canopy, offering glimpses of the birds perched above. This enchanting encounter not only enriches the visitor experience but also serves as a poignant reminder of the vital ecological role that trees play in supporting our biodiversity.



**VARIOUS TREE PROTOTYPES**

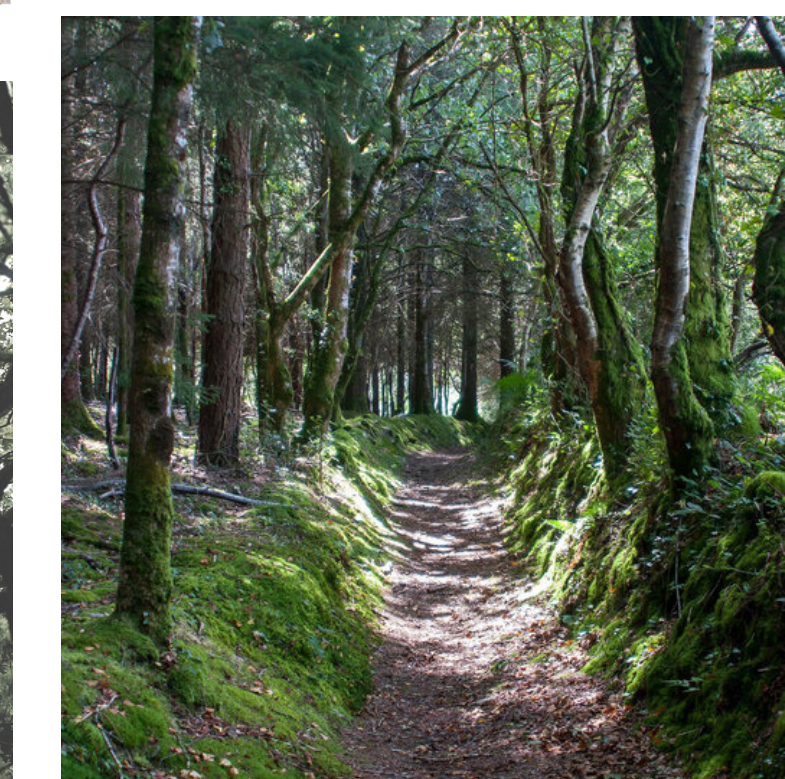
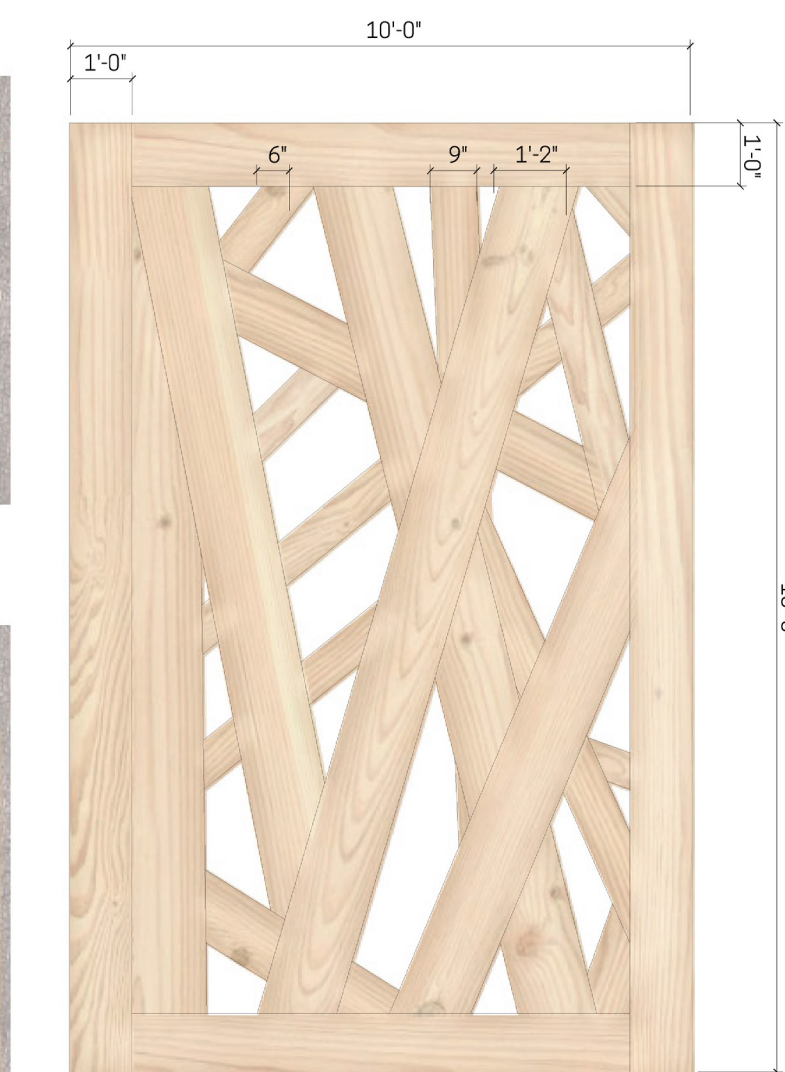
**HAWK CHUTE SYSTEM**



**EAGLE CHUTE SYSTEM**

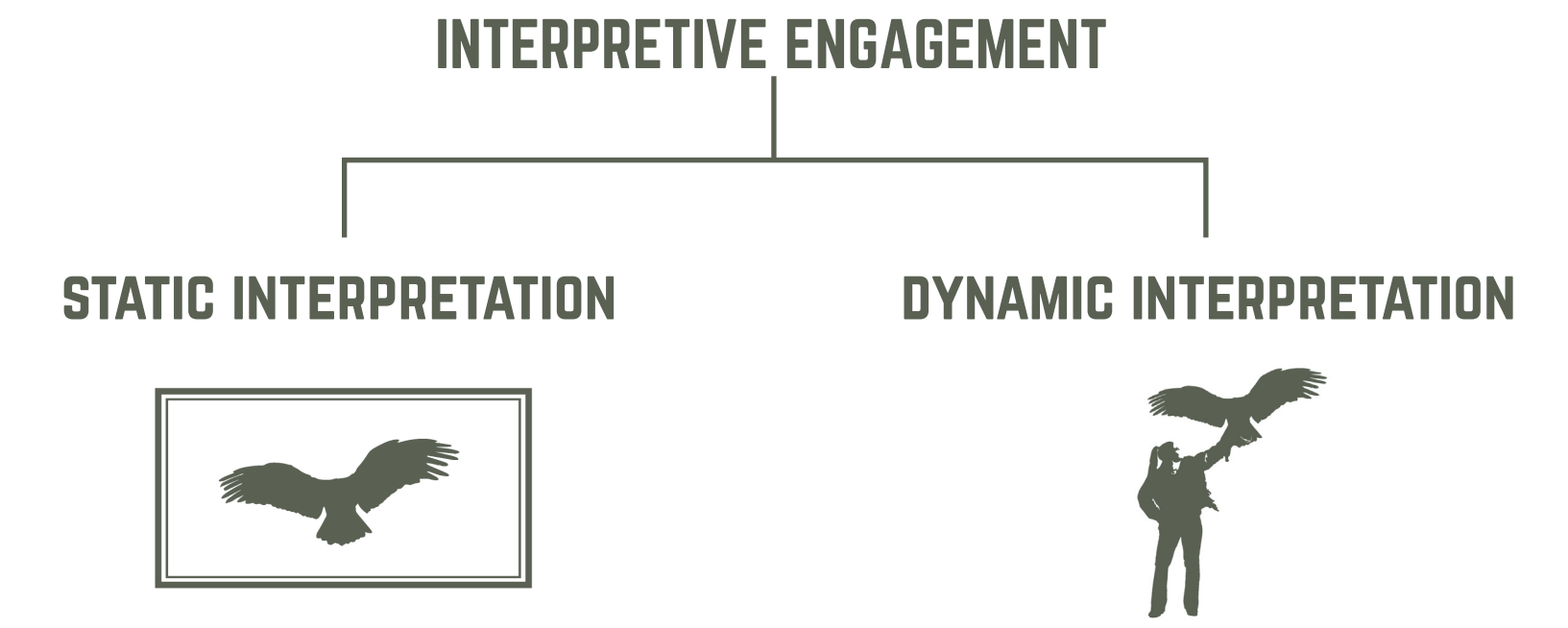
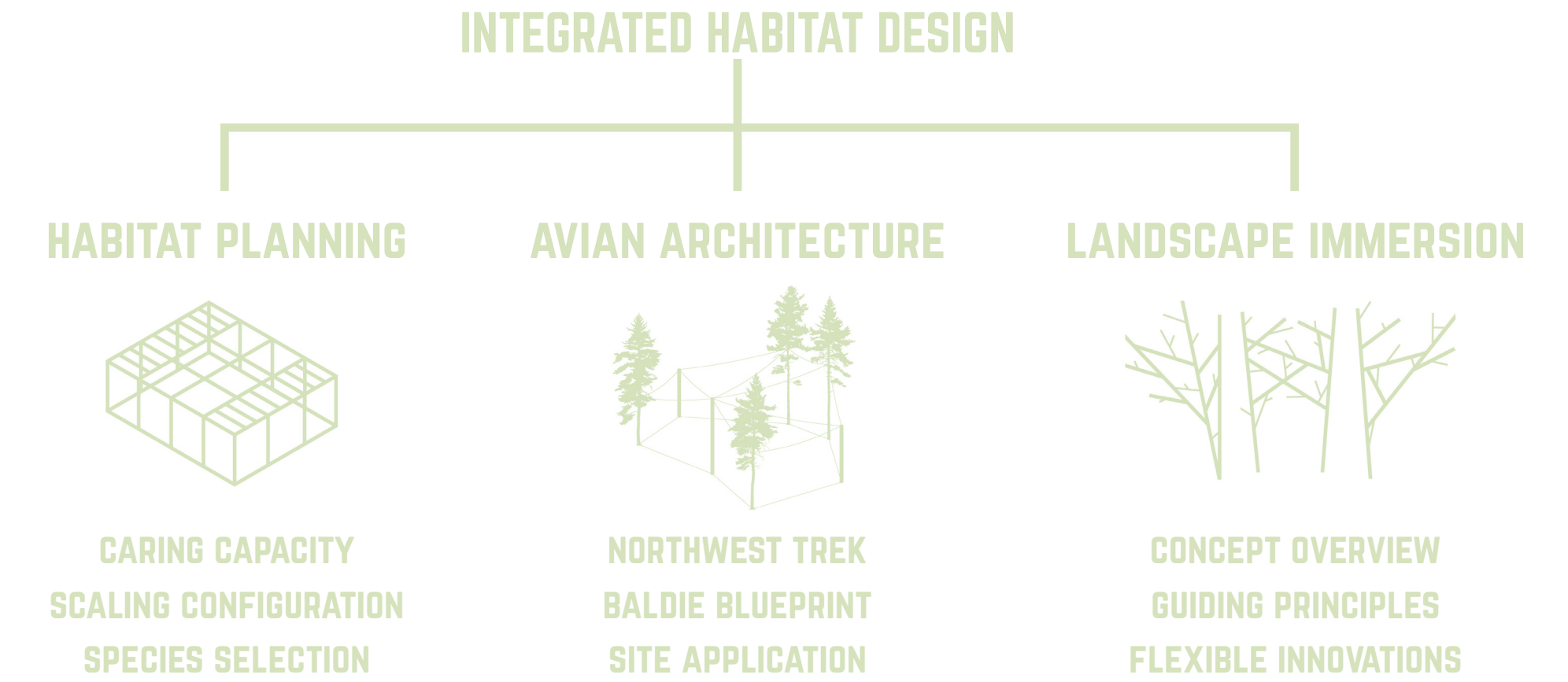


**BRACHIATING CHUTE BRIDGE**



**Interpretation Overview**

Interpretive programs utilize a range of communication methods designed to inspire meaningful connections with wildlife and the natural world. They go beyond merely presenting facts; they strive to reveal deeper meanings and relationships, potentially influencing visitor attitudes and understanding (Andersen, 1991). At the raptor center, interpretive programming will continue to play a crucial role in educating and engaging visitors.





### Interpretive Initiatives

This engagement focuses on two core components:

1. Static Interpretation  
This includes signage, interactive displays, and wayside posts that provide foundational knowledge about key issues related to birds of prey. The goal is to connect the interest of the reader, through engaging visuals, in way that encourages care, empathy, or an emotional response.

2. Dynamic Interpretation  
Raptor shows and encounters allow visitors to witness these birds' display species-appropriate behaviors first-hand. Demonstrations use the power of personal interaction and storytelling to create more emotionally engaging experiences, creating lasting impressions.

# STATIC INTERPRETATION



# DYNAMIC INTERPRETATION



# 5.2 | LANDING INSIGHTS

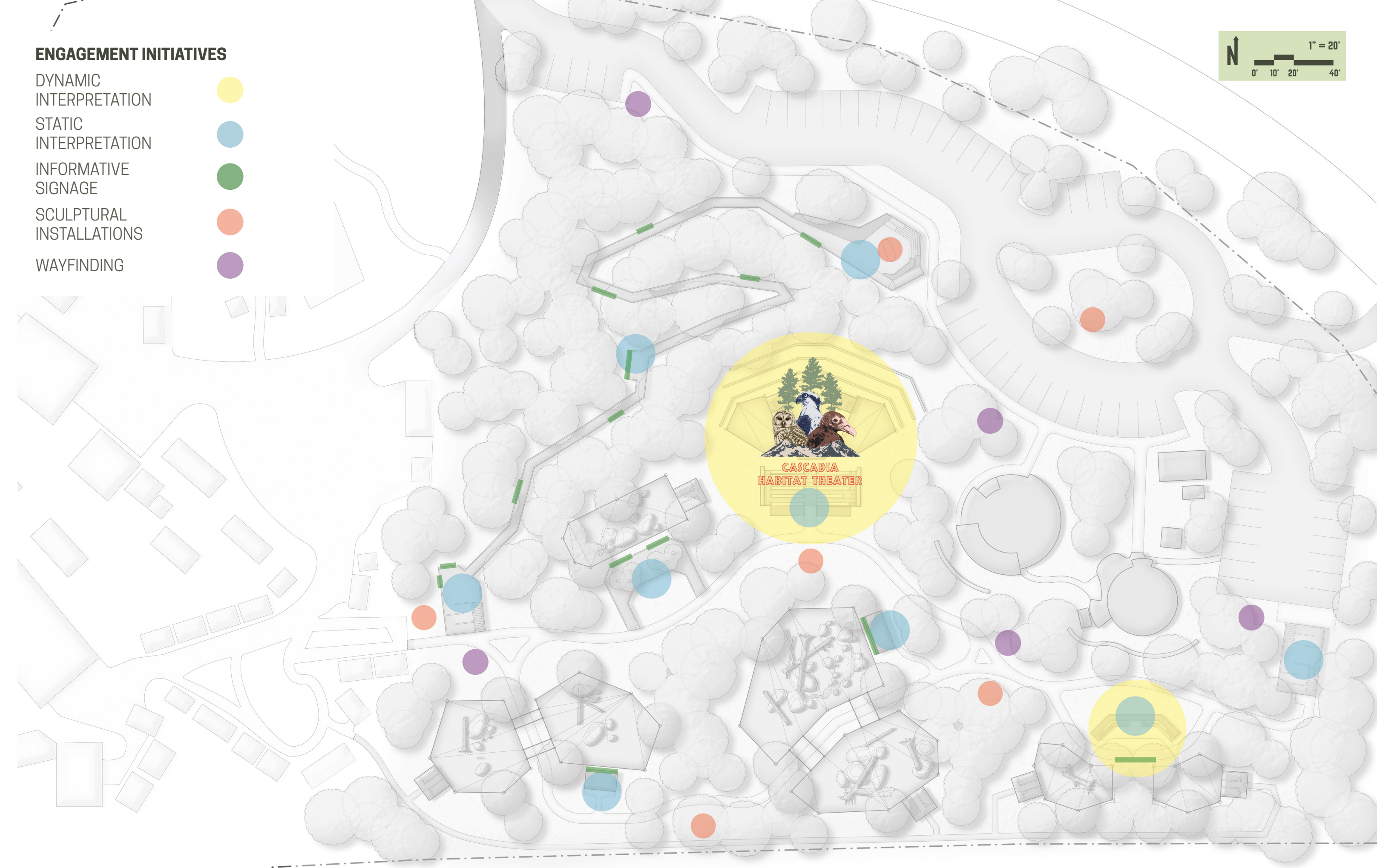
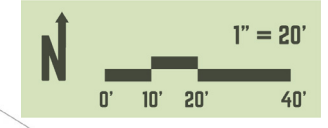
## INTERPRETIVE ENGAGEMENT

### Interpretive Initiatives

By synergistically combining static and dynamic interpretive programs, the raptor center can provide a multi-faceted, educational experience catered to diverse learning styles and preferences. Ultimately, these interpretive initiatives strive to create a greater appreciation for raptors by engaging visitors intellectually and emotionally. Through both initiatives, the raptor center can empower visitors to become raptor advocates and environmental stewards.

### ENGAGEMENT INITIATIVES

- DYNAMIC INTERPRETATION ●
- STATIC INTERPRETATION ●
- INFORMATIVE SIGNAGE ●
- SCULPTURAL INSTALLATIONS ●
- WAYFINDING ●



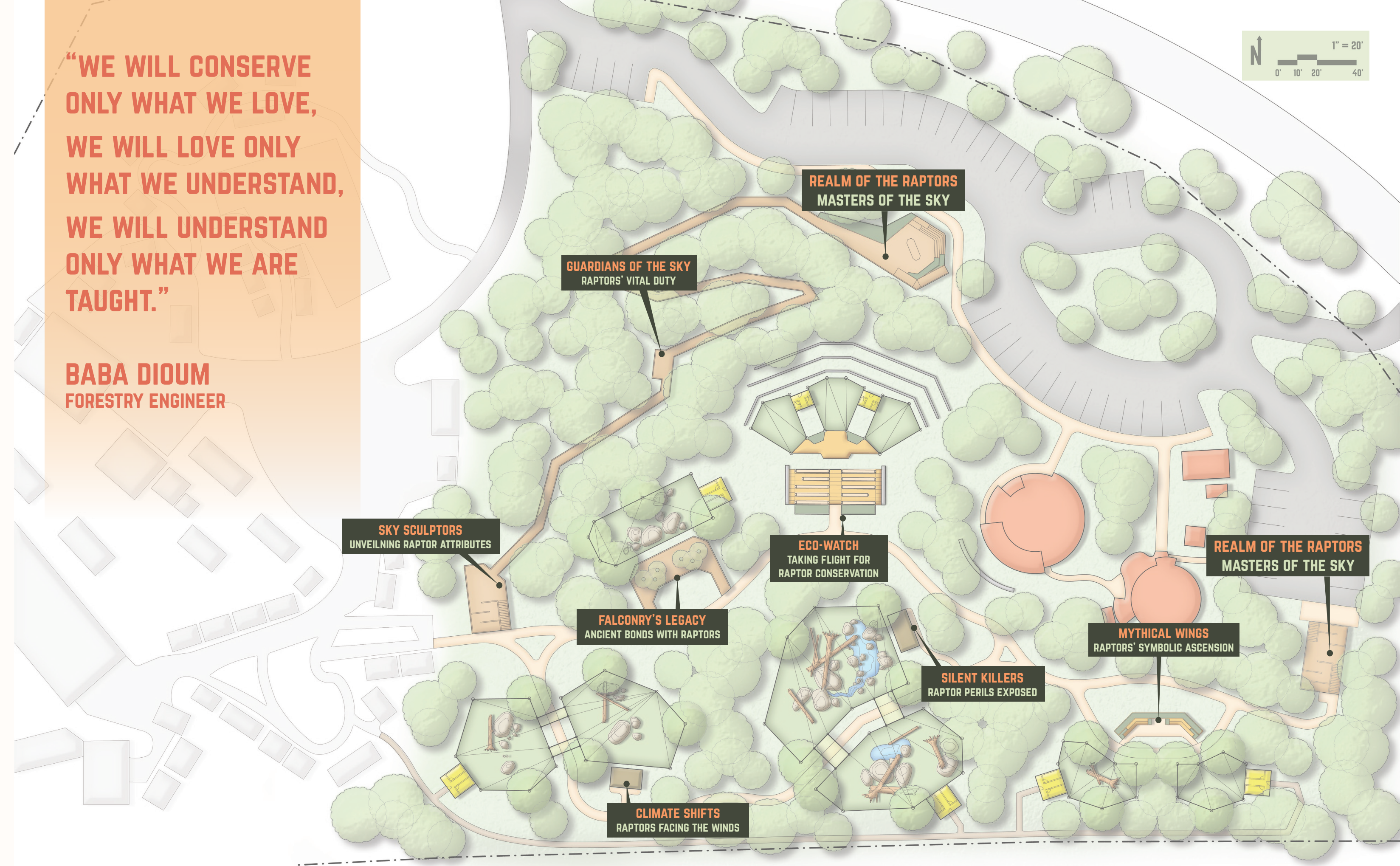
**Interpretive Signage**

Interpretive signage is crucial in zoological institutions for engaging visitors and delivering impactful topical messages through illustrative media and storytelling. The most effective interpretive signs respond to the the visitor's immediate experience, shifting attitudes and perceptions. By actively collaborating with interpreters during enclosure development, designers can ensure the enclosure elements align with the intended or embedded messages.

A series of interpretive displays have been strategically installed along the visitors' pathway. Titled "Realm of the Raptors", these signs provoke thought and care about a variety of issues related to raptors, ranging from environmental impacts to their ecological and cultural significance. The goal is to instill an emotional reaction that lingers, motivating visitors to become active participants in raptor agency and other environmental efforts. The integration of interpretive signage within the visitor's journey enhances the educational experience provided by 'Realm of the Raptors'. Visitors gain not just knowledge, but a profound appreciation for why protecting these remarkable birds is so vital. These signs elevate the overall guest experience, providing meaningful takeaways that supplement their visit.

**"WE WILL CONSERVE ONLY WHAT WE LOVE, WE WILL LOVE ONLY WHAT WE UNDERSTAND, WE WILL UNDERSTAND ONLY WHAT WE ARE TAUGHT."**

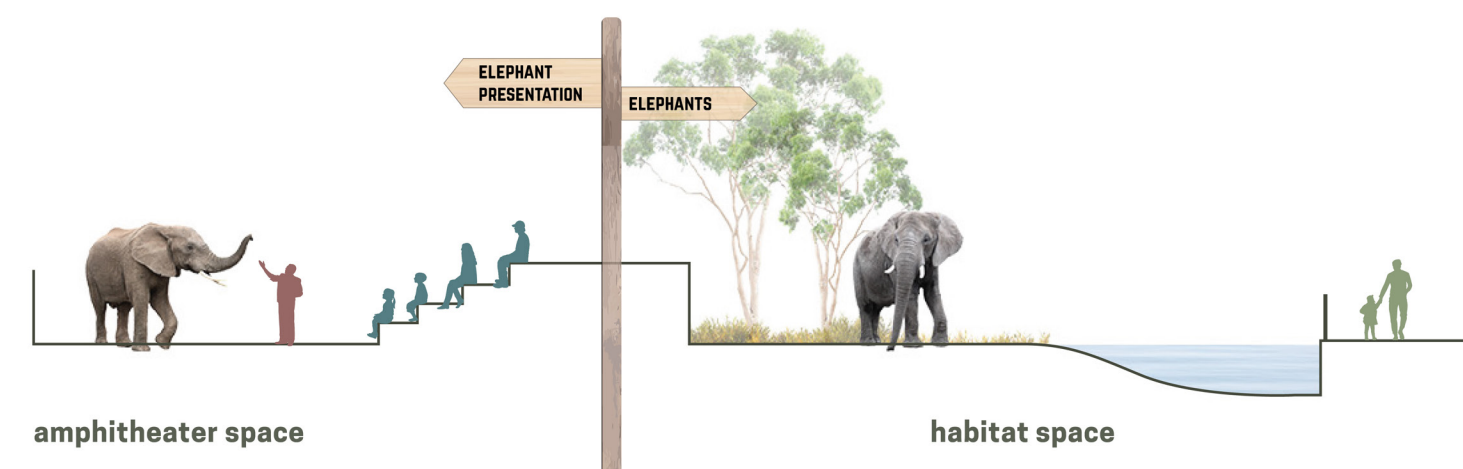
**BABA DIOUM FORESTRY ENGINEER**



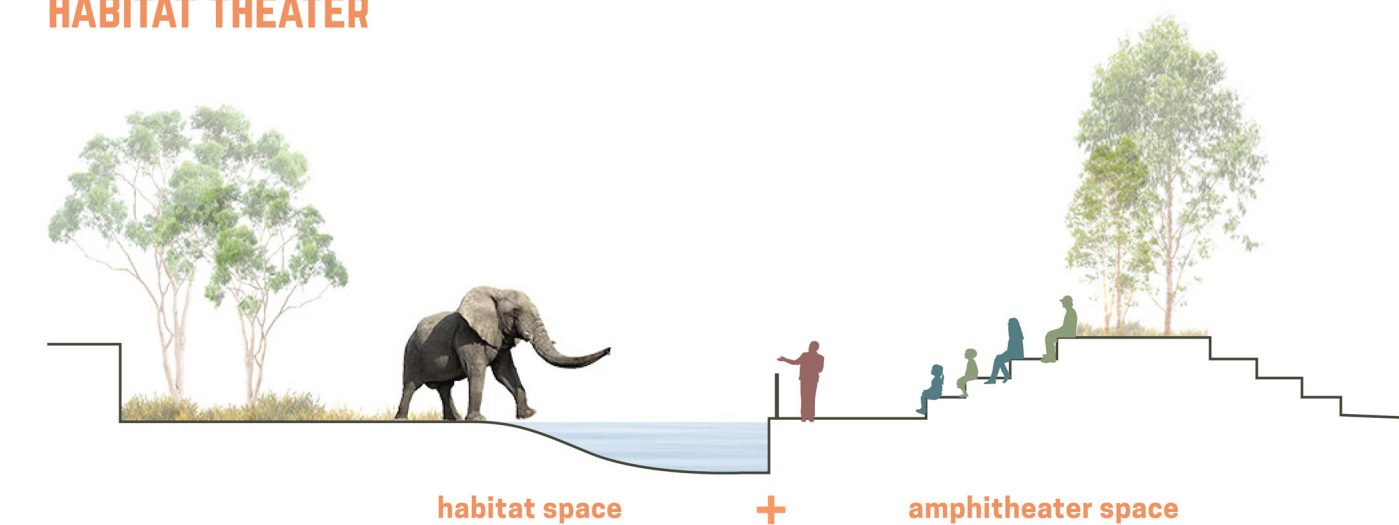
**Habitat Theaters**

Zoos have a long history of utilizing animal shows to provide visitors with dynamic and intimate experiences with wildlife. Traditionally, these shows involve moving animals from their enclosures to participate in shows or keeping a separate collection solely for show purposes (Edney et al., 2023). Recently, the emergence of habitat theaters have begun to gain traction, serving as the intersection between animal enclosures and amphitheaters. (Martin, n.d.). In essence, habitat theaters aim to showcase animals' natural behaviors within their simulated environments, offering visitors a more authentic and immersive experience. The inspiration behind habitat theaters stems from the idea that observing animals behaving naturally in their enclosures can be a form of live entertainment in itself (Edney et al., 2023).

**CONVENTIONAL FORMAT**



**HABITAT THEATER**



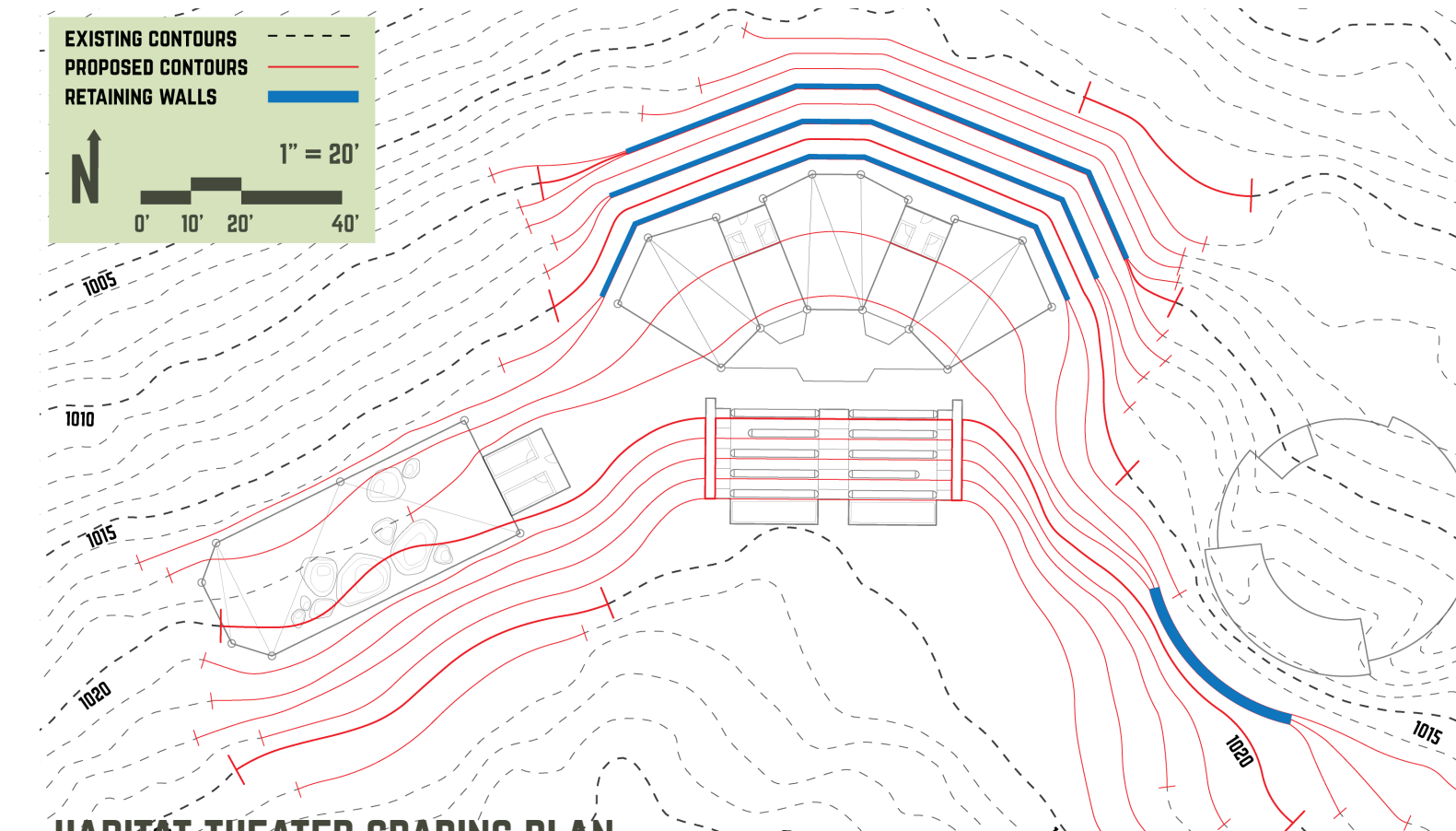
**DENVER ZOO - TOYOTA ELEPHANT PASSAGE**

**Cascadia Habitat Theater**

My proposal, the Cascadia Habitat Theater, looks to integrate the traditional bird show format with the habitat theater concept. Graded into the existing landscape, this theater seats up to 100 visitors providing a panoramic view of the Spencer Butte forest. To further capture that feeling of place in the landscape, the aviary habitats appear to emerge into the staging area, creating a unified experience for the visitors. Secondary holdings provide flexibility for trainers to shift raptors from across the nature center to align with show themes and objectives. The Cascadia Habitat Theater not only provides a space for showcasing animals' natural behaviors but also serves as a platform for educational programming. Beyond its role as a venue for raptor shows, the Cascadia Habitat Theater serves as a secondary outdoor classroom, expanding the educational offerings of the raptor center.



**HABITAT THEATER SECTION**



**HABITAT THEATER GRADING PLAN**

### Cascadia Habitat Theater

Through engaging presentations and close encounters, visitors are immersed in novel ways to learn about raptors and their environments. Through dynamic interpretation, the theater engages, inspires, and empowers audiences, demonstrating the power of entertainment as a vehicle for education. The habitat theater serves as a dynamic platform for education, entertainment, and conservation, harnessing the transformative power of raptor shows to inspire and advocate for environmental actions in the greater Pacific Northwest.



**“I BELIEVE THAT EDUCATION IS ALL ABOUT BEING EXCITED ABOUT SOMETHING. SEEING PASSION AND ENTHUSIASM HELPS PUSH AN EDUCATIONAL MESSAGE.”**

**STEVE IRWIN**  
CONSERVATIONIST & WILDLIFE EDUCATOR

# PERCHED REFLECTIONS

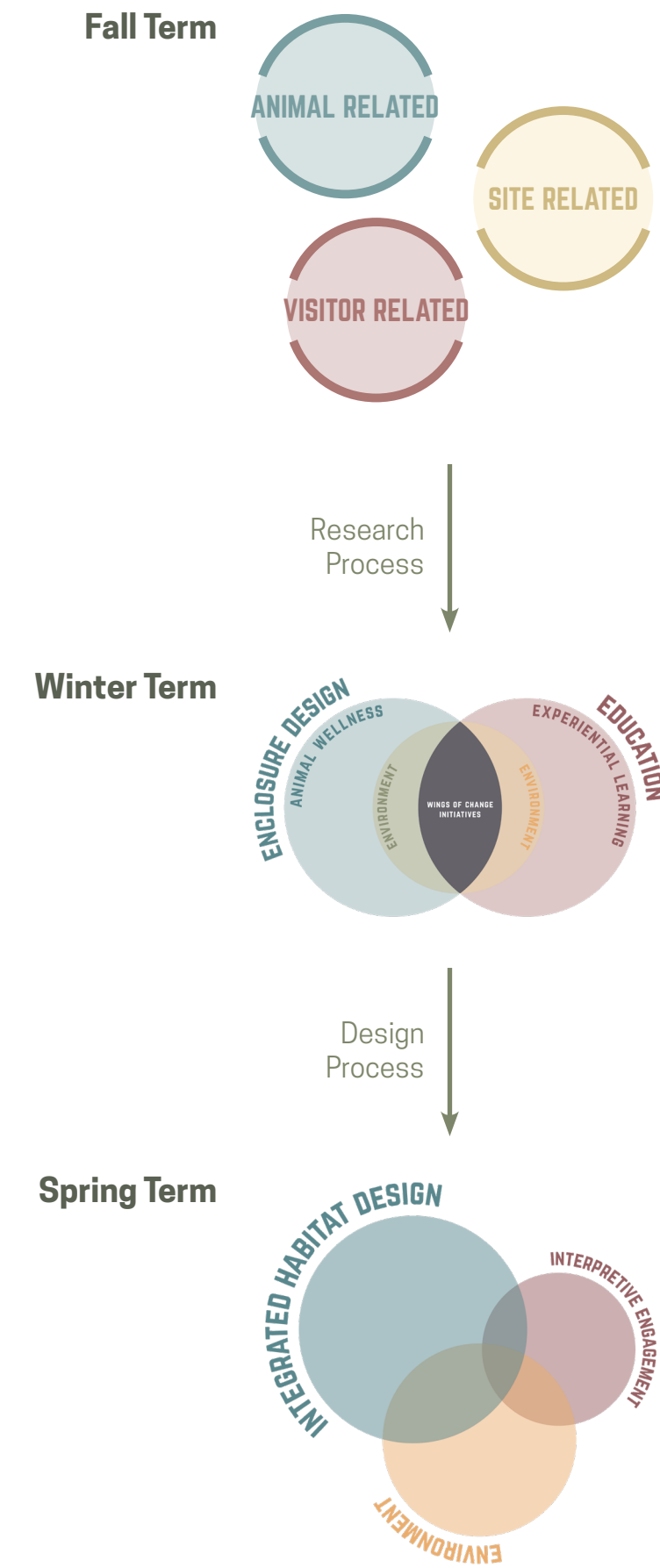
6.0 GOALS REVISITED | 6.1 NEXT STEPS | 6.2 FUTURE OPPORTUNITIES  
6.3 ZOO DESIGN NICHE | 6.4 CLOSING REMARKS



**Project Evaluation**

As this project draws to a conclusion, it's important to revisit how my design solutions align with my initial goals. Initially, my focus was evenly split between enclosure design and education, with the environment as the core link. However, as the project evolved, my attention and interest began to shift more towards enclosure design. Despite this shift, my designs remained committed to creating enriching experiences that offer educational value, all while respecting and enhancing the natural environment on the site. Each aspect of the proposal, from the refined raptor habitats to the visitor programs such as the habitat theater and exploration trail, have been crafted to strike a balance between functionality and environmental harmony. Through these initiatives, my proposal has created a deeper connection between humans and nature, ultimately contributing to the mission of the Cascades Raptor Center.

**PROJECT EVOLUTION**





## Future Phases

While this proposal addresses the goals that resonate most with my interests, it represents merely the first phase of the raptor center's ambitious expansion plans.

In future phases, CRC could explore ways to integrate their remaining project goals into the existing, now vacant, conditions of the site. The former amphitheater could become a children's playground or the existing parking lot could be transformed into a vibrant pollinator garden, educating visitors on native plant and pollinator communities.

Numerous opportunities remain for creative solutions including future collaborations. I encourage other students to take on these challenges, offering fresh perspectives and innovative ideas to further enhance the raptor center. This collaborative spirit ensures the raptor center remains dynamic and adaptive, continually embracing new ideas and approaches towards their eventual expansion.



### Additional Insights

I'd like to personally touch upon some design strategies that were not addressed in this project but are significant in the realm of zoo design. If I had more time, I would have liked to have explored the following:

**Artificial Rockwork** - Incorporating artificially themed environments, crafted by skilled artisans using materials like shotcrete and non-toxic paints, allows zoos to go even further to recreate accurate representations of animals' natural habitats. These installations not only expand the possibilities of enclosure design but also greatly enhance the immersive experience for visitors, transporting them into the animals' domains.

**Cultural Landscape Immersion** - Creating landscapes that resemble real locations and integrating cultural elements into both animal and human environments offers valuable opportunities for multicultural education. Research reveals that the more authentic and real a location is captured and the more engaging the themes are explored, the stronger the connection can be forged with audiences.

**Hand-drawn Concept Art** - I was hoping to take this project as an opportunity to do more hand drawn renders. Renders such as these onscreen, are part of what inspired me to enter landscape architecture and pursue zoo design. While digital renders are essential and commonplace, hand-drawn sketches add a more personal touch and can capture the initial vision more intimately.

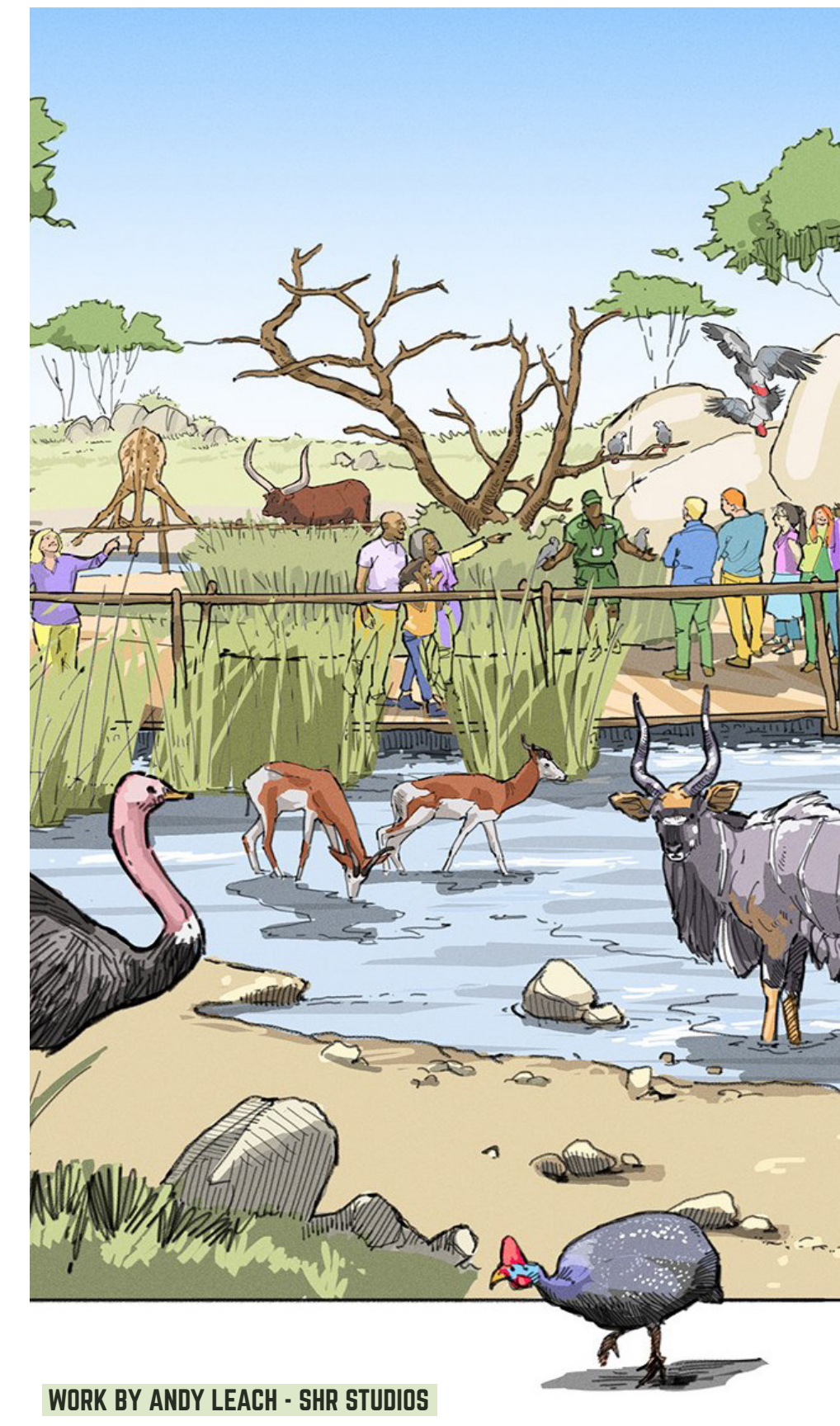
## ARTIFICIAL ROCKWORK



## CULTURAL LANDSCAPE IMMERSION



## HAND-DRAWN CONCEPT ART

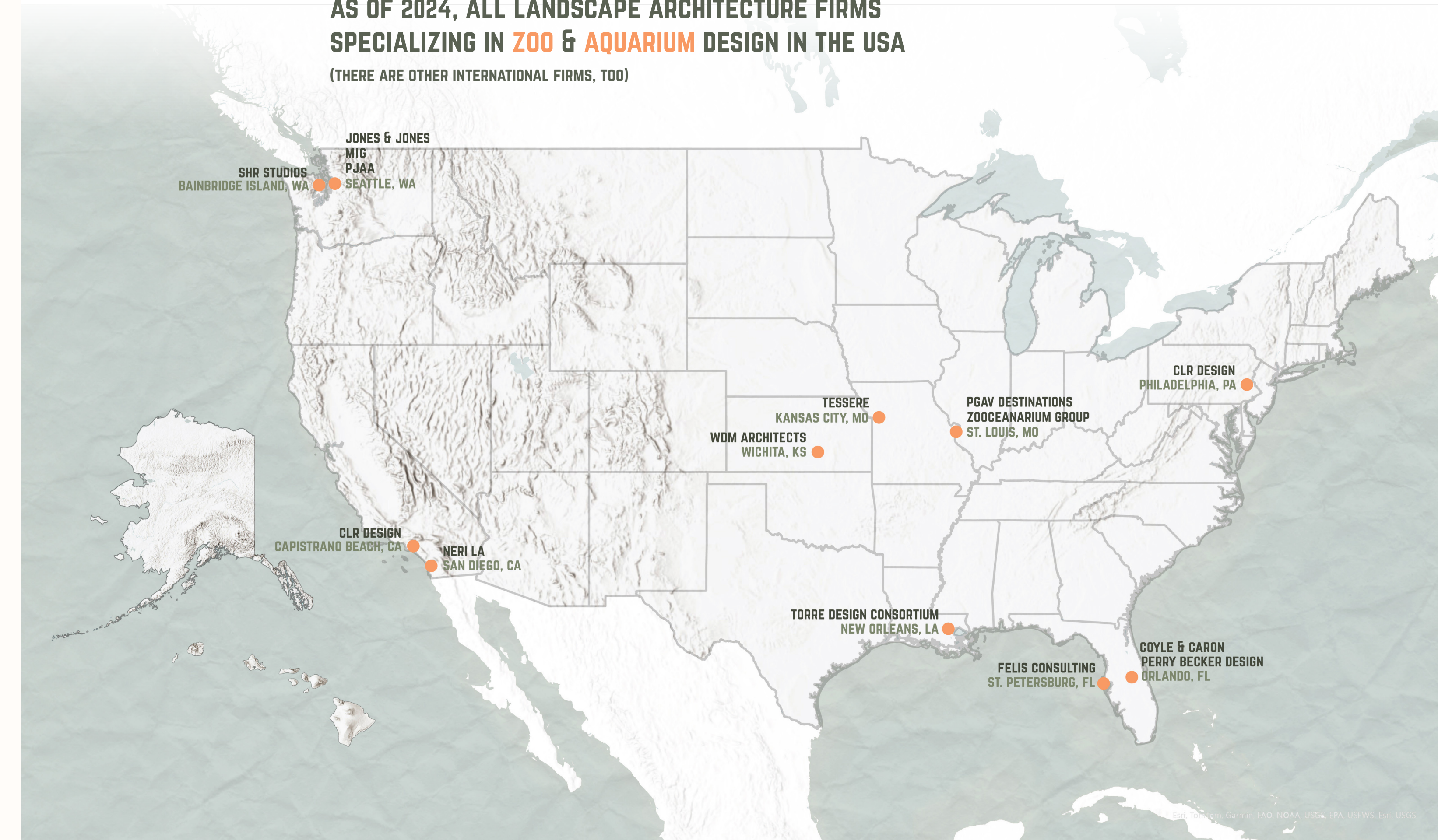


### Designing for Wildlife

To you, reading my masters project, if you have found my masters project intriguing and would like to more about how landscape architecture plays a role in shaping zoos, then I encourage you to explore the incredible work zoo specialized firms are doing. They play a crucial role in directing modern zoos and aquariums, improving visitor perceptions, and promoting conservation efforts. This project only scratches the surface of the litany of principles and creativity zoo design has to offer, but I believe everyone will find this niche to be creatively engaging and impactful, not only for the animals, but the generations of people who experience your work.

## AS OF 2024, ALL LANDSCAPE ARCHITECTURE FIRMS SPECIALIZING IN ZOO & AQUARIUM DESIGN IN THE USA

(THERE ARE OTHER INTERNATIONAL FIRMS, TOO)



### Gratitude

On a personal note, this project has been more than just an academic endeavor for me. It has been a transformative journey. As a kid, I spent hours playing a computer game called Zoo Tycoon and always dreamt of building zoos when I grew up. When I couldn't see a path to designing zoos, I chose the next best thing, becoming a zookeeper.

To be here now, merging my passion for animals with my enthusiasm for design, is truly a dream come true. The relationships I've built with animals and now the opportunity to design spaces, with Studio Hanson Roberts, means so much to me. This project, and my time in school, have been pivotal in making this dream a reality and I am deeply grateful for the support I've received and the friendships I've made.

Thank you all for sharing in this journey with me.



# THANK YOU!



## ACKNOWLEDGEMENTS

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Julie Collins  
Executive Director  
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Aaron Rubin  
Wildlife Specialist  
**High Desert Museum**

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Creative Engagement Designer  
**Cascades Raptor Center**

Mckenzie Bender  
Ambassador of Animals  
**Zoo Atlanta**

Nikki Dzialowy  
Facilities Manager  
**Northwest Trek Wildlife Park**

Erika Defer  
Animal Department  
Assistant Manager &  
Director of Research  
**Safari West**

Wendi Mello  
Zookeeper  
**Northwest Trek Wildlife Park**

Jenny Sloat  
Ungulates Zookeeper  
**San Francisco Zoo**

Lyn Myers  
Chief Operations Officer  
**Fresno Chaffee Zoo**

Ronnie Kerestus-Reeves  
Curator of Bird Show,  
Outreach & Animal Welfare  
**Fresno Chaffee Zoo**

### Facebook Group Communities

Zookreepers

You Know You're A Zookeeper When

Once A Keeper, Always A Keeper

### Design Industry Professionals

Gregg Leicester  
Principal, Landscape Architect  
RLA, ASLA, LEED GA  
**CLR Design Inc.**

**Nets Unlimited**  
20625 N. 29th Pl.  
Phoenix, AZ

**Pivot Architecture**  
44 W. Broadway #300  
Eugene, OR

**KPFF Consulting Engineers**  
800 Willamette St. #400  
Eugene, OR

**Dougherty Landscape Architects**  
474 Willamette #305  
Eugene, OR

**EGR & Associates Inc.**  
2535 Prairie Rd.  
Eugene, OR

### University of Oregon

**Instructors**

Arica Duhrkoop-Galas

David Buckley Borden

Ignacio Lopez Buson

Mark Eischeid

Mary Polites

**Classmates**

My Cohort:

- Basil Khalid
- Caitlin Jeffs
- Cameron Coronado
- Giff Glastonbury
- Holly Phares
- Katherine Harrison
- Katie Sinclair
- Mikayla McKone
- Phoebe Chuang
- Sarah Goldstein
- Sarah Phillips
- Ted Myers
- Tress Cummings
- Tristan Matlock

Ashley Ferguson

Blake Schouten

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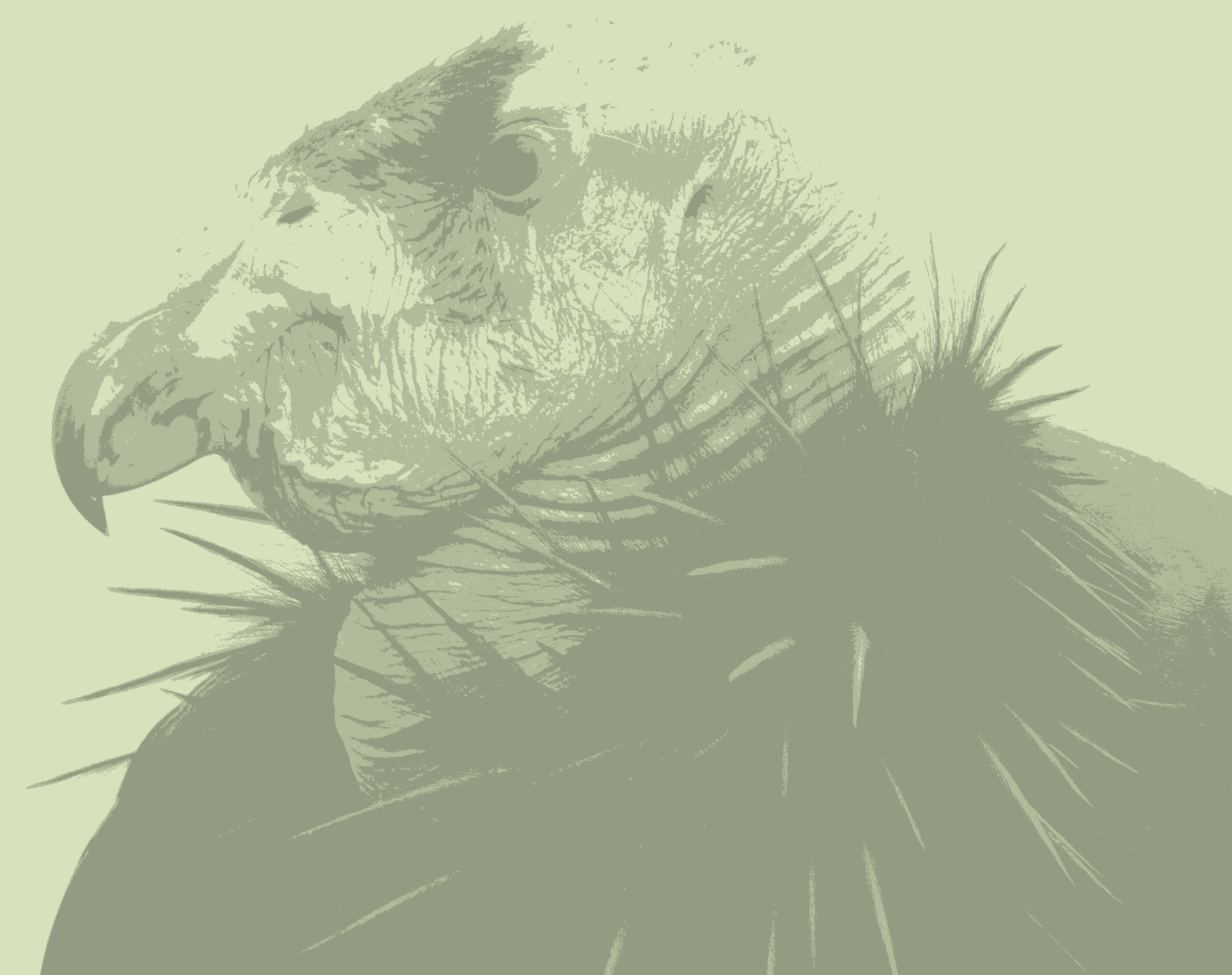
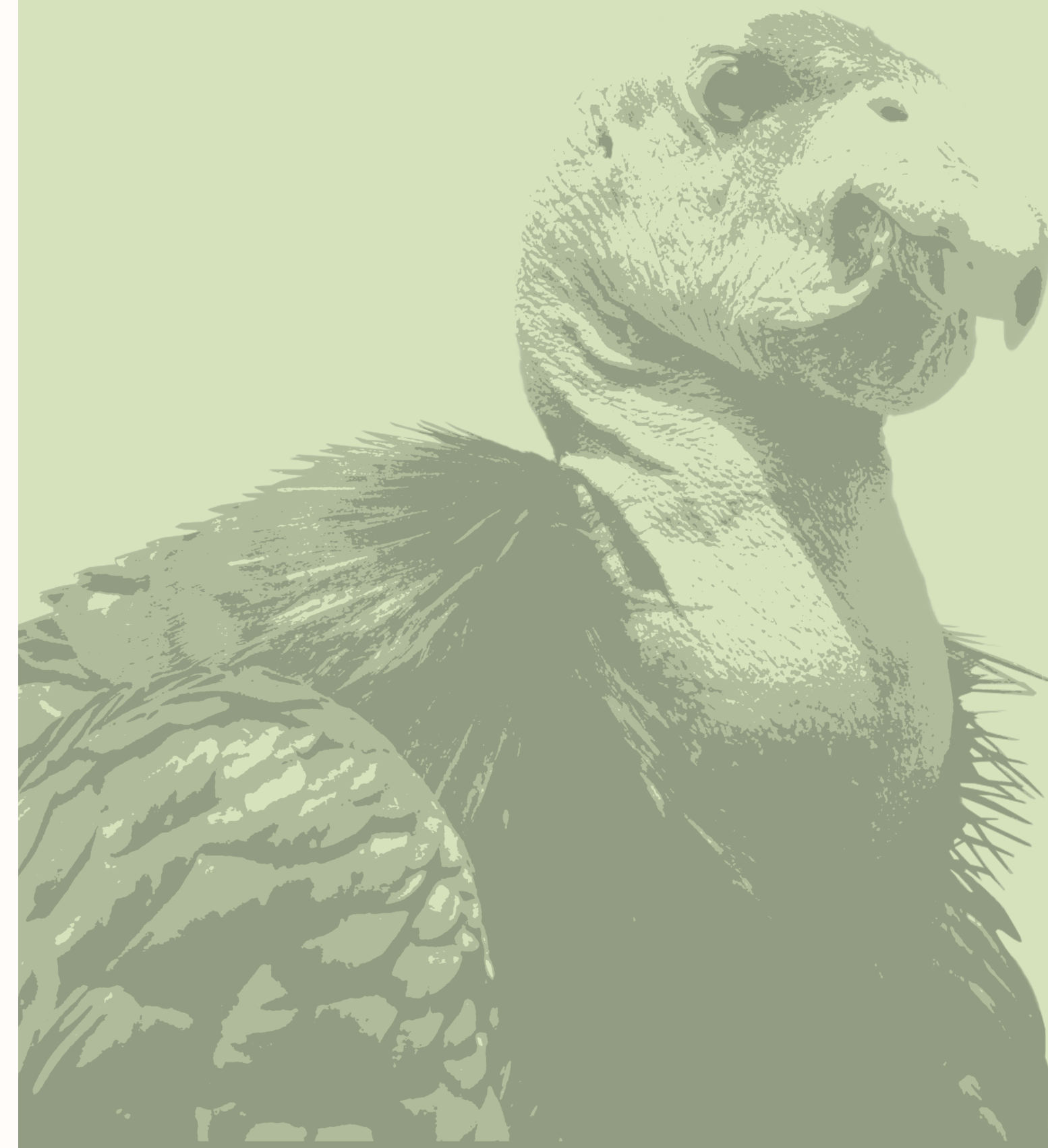
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# APPENDICES

7.0 APPENDIX A | 7.1 APPENDIX B | 7.2 APPENDIX C | 7.3 APPENDIX D



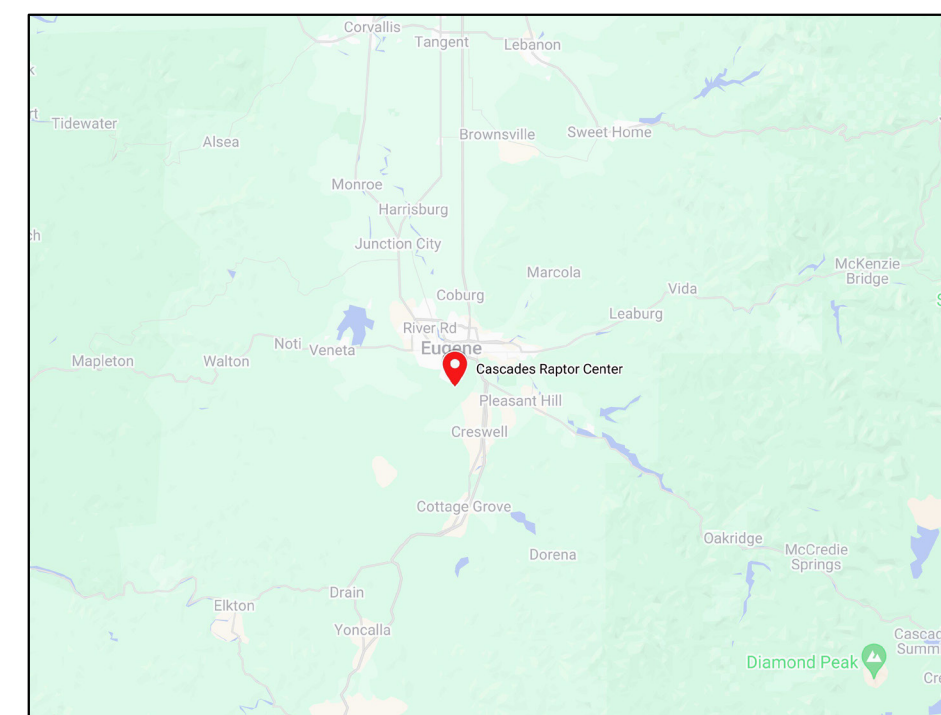
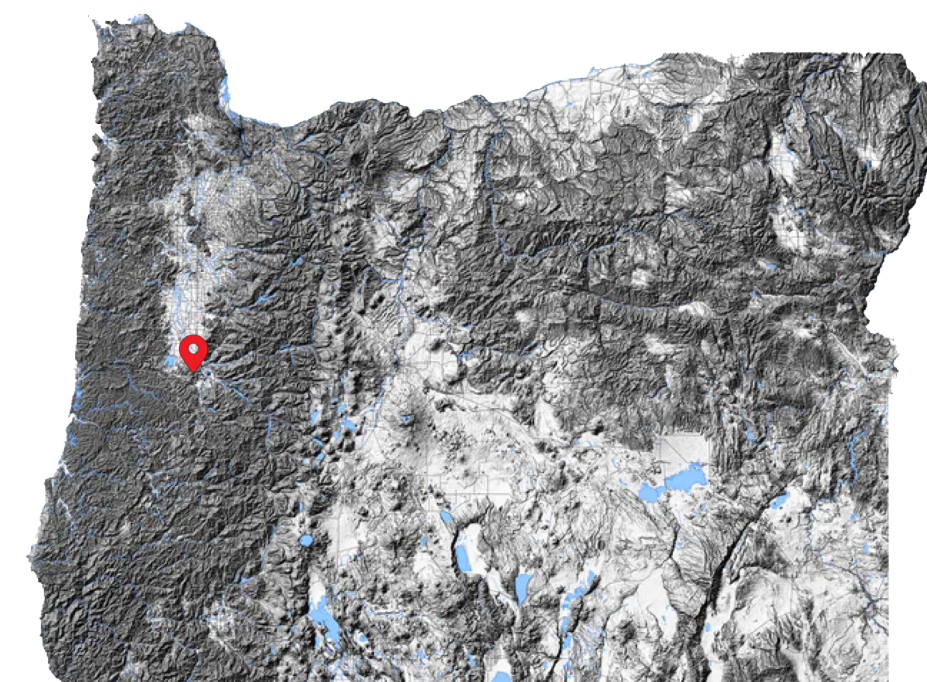
### CAD Documentation - Eagle Aviary Design

Appendix A provides an opportunity to more clearly showcase all my CAD documents that contributed to the design of the eagle aviaries. While samples were included in Chapter 5, section 5.1's "Integrated Habitat Design," some were reduced in size to fit alongside other graphics on the same page or had bits of information removed to balance with the graphics they were overlaid on. While I believe I presented my work effectively in the primary master's project, I also feel these documents would benefit from being presented in their original form and given their own pages.

The following pages contain the CAD plans and sections created for the eagle aviary in addition to the viewing structures, chute bridge, and wooden tree sculptures, and can be referenced back to Chapter 5, section 5.1's "Integrated Habitat Design."

## CASCADES RAPTOR CENTER EAGLE EXHIBIT DESIGN

32275 Fox Hollow Road  
Eugene, OR 97405



## NORTHWEST TREK WILDLIFE PARK BALD EAGLE ENCLOSURE PRECEDENT: EAGLE PASSAGE

11610 TREK DRIVE EAST  
EATONVILLE, WA 98328



KEY TO ABBREVIATIONS	
CL	CENTERLINE
CONN	CONNECT, CONNECTION
CONT	CONTINUOUS
COORD	COORDINATE
DIA	DIAMETER
EA	EACH
EQ	EQUAL, EQUIVALENT
FTG	FOOTING
HORIZ	HORIZONTAL
MFR	MANUFACTURER
PL	PLATE
REQD	REQUIRED



CAPSTONE PROJECT  
Wings of Change  
Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

CASCADES RAPTOR CENTER

Drawn By: JWB

Checked: \_\_\_\_\_

Project #: \_\_\_\_\_

Date: 03/18/2024

PHASE

100% DD

SCALE

NA

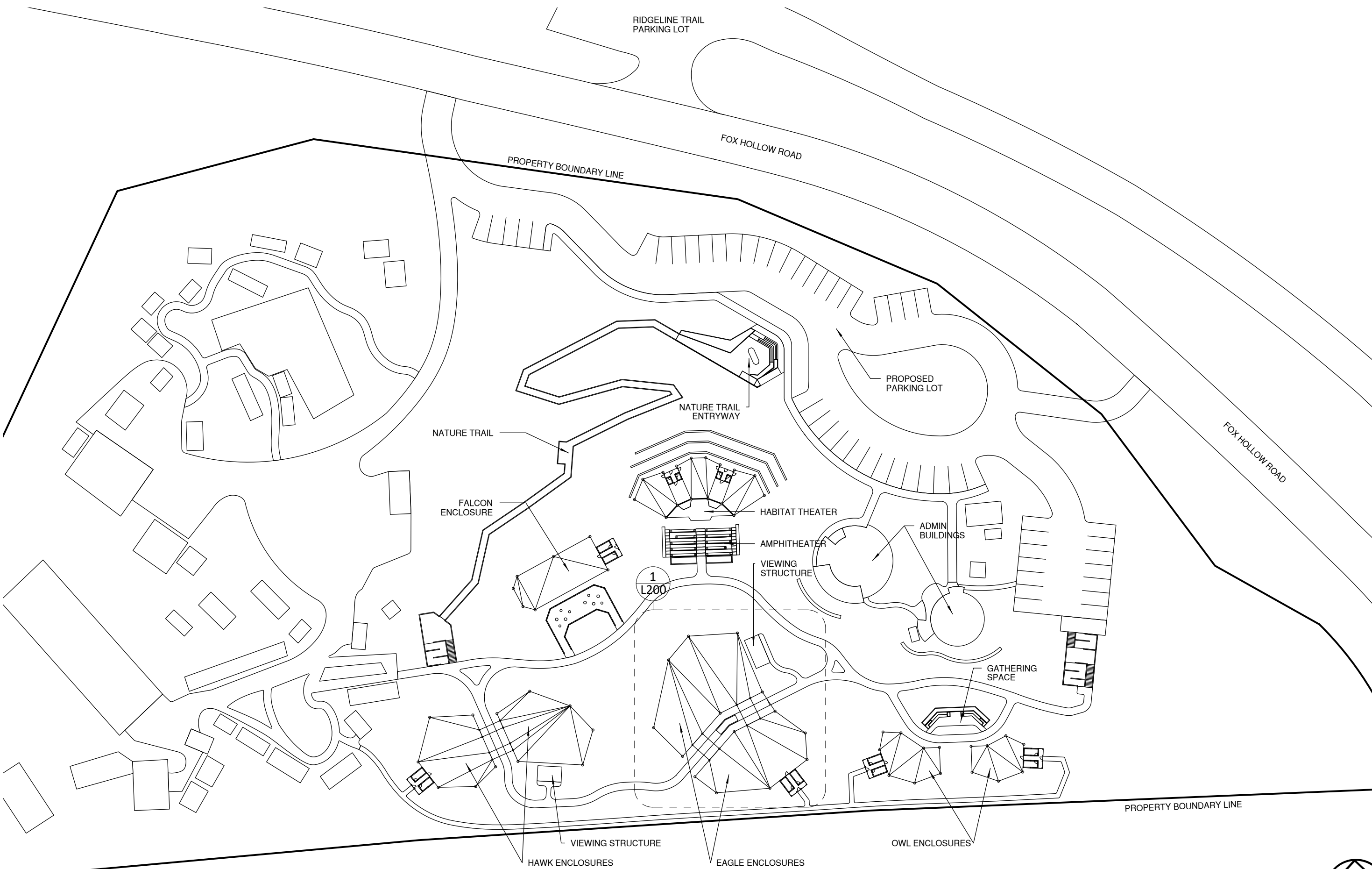
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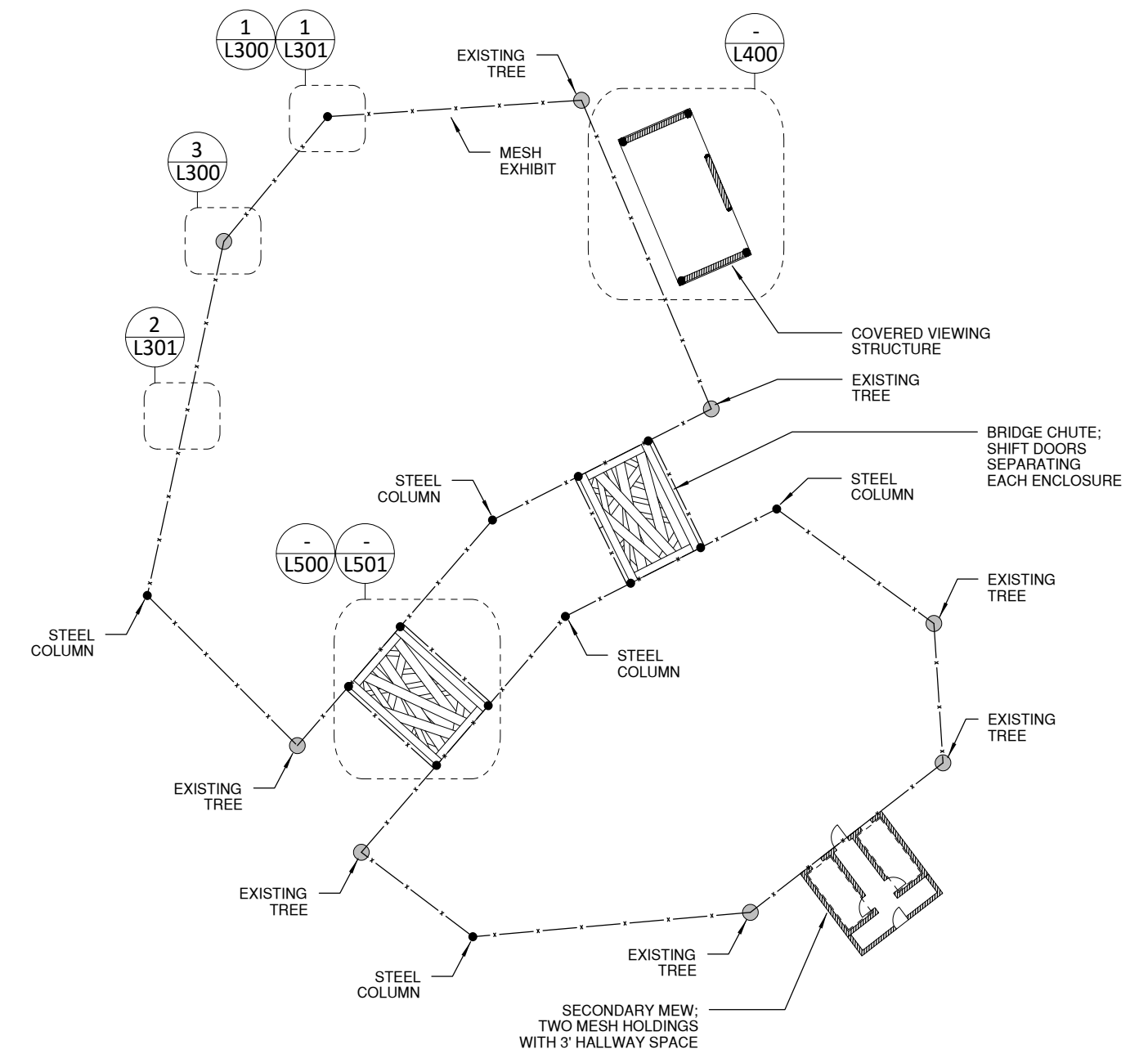
SHEET #

L000



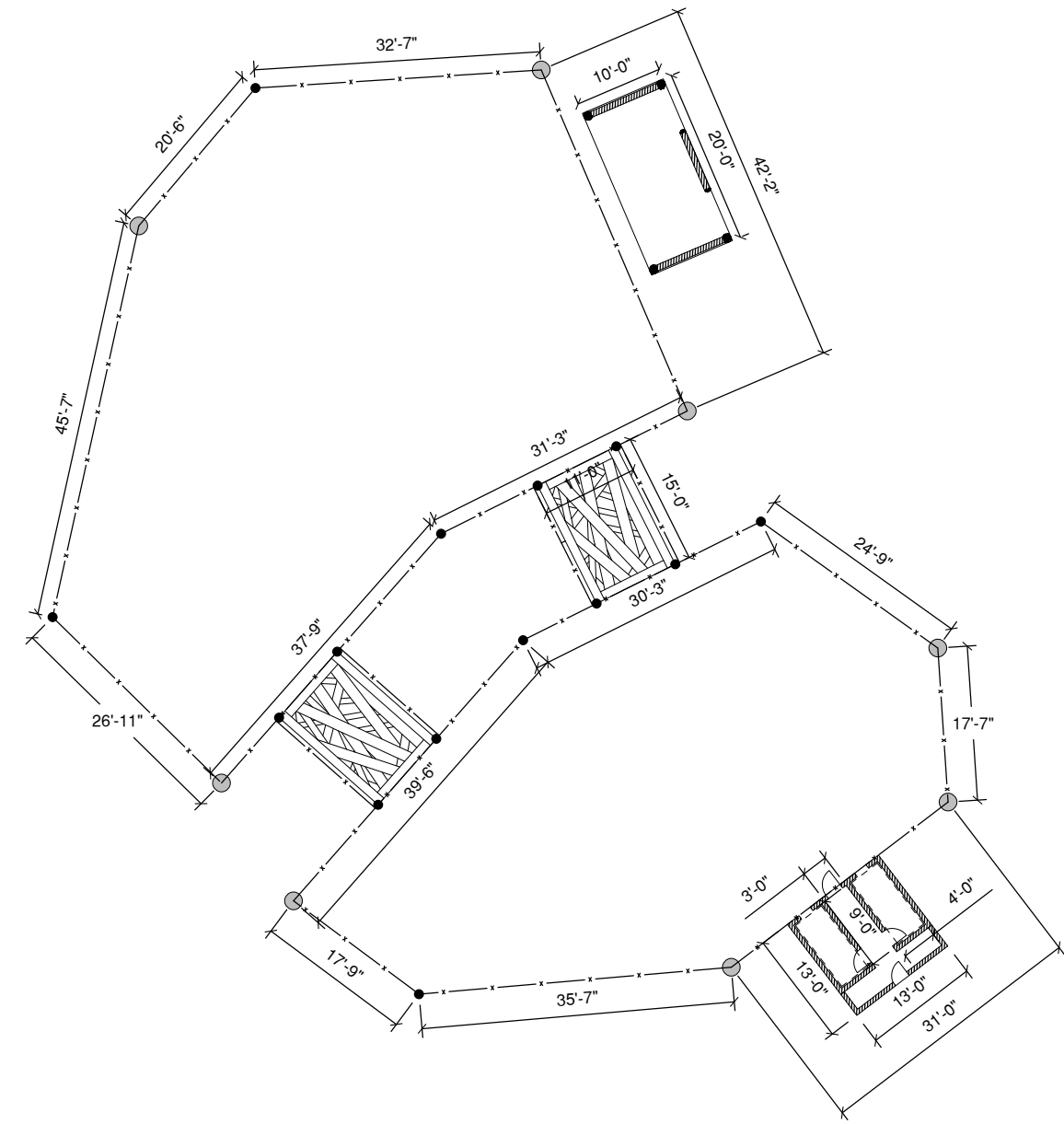


**CASCADES RAPTOR CENTER**  
 DESIGN SITE

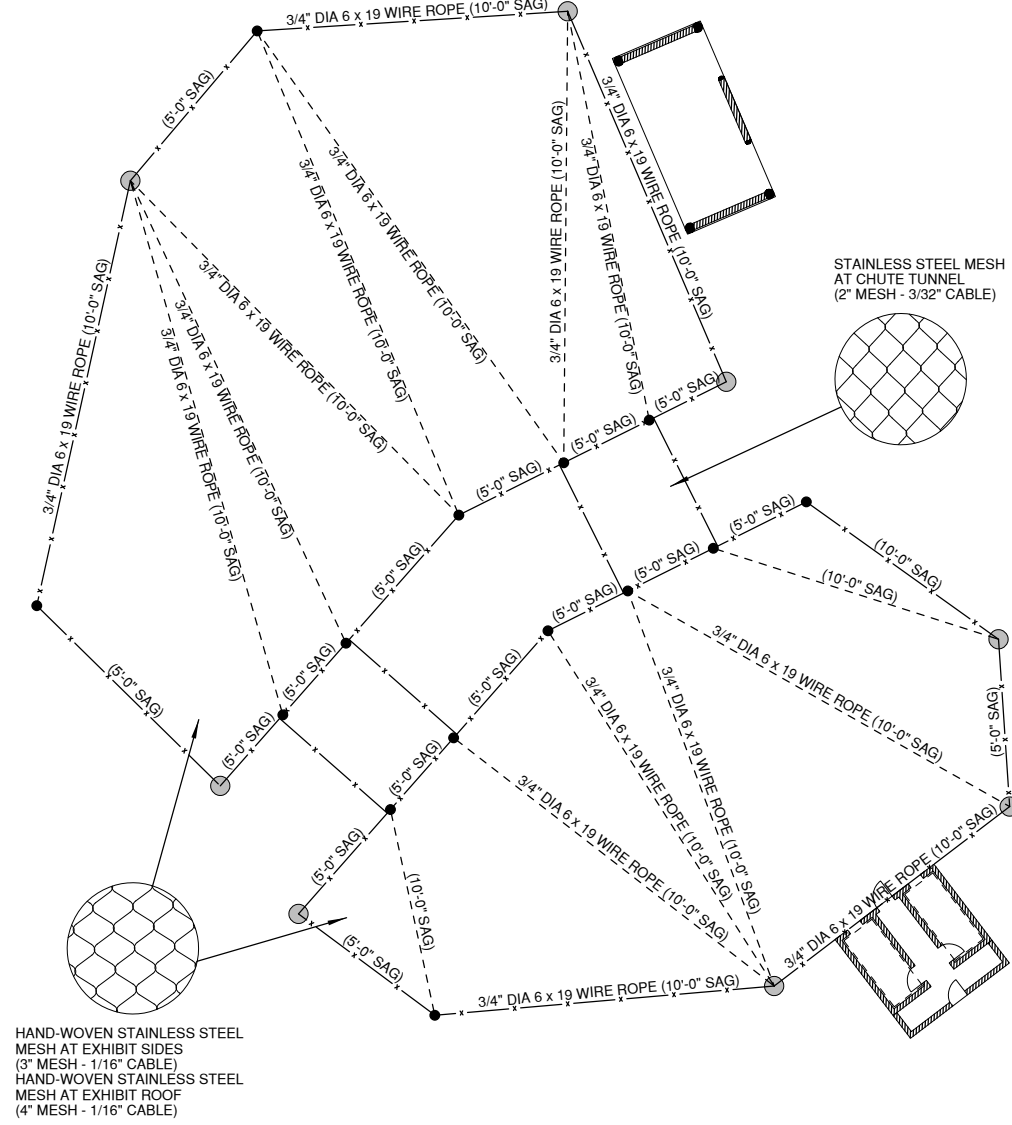


**1 MESH ENCLOSURE**  
 SCALE 1" = 20'

**CASCADES RAPTOR CENTER**  
 EAGLE ENCLOSURE



1 MESH ENCLOSURE FOUNDATION PLAN  
SCALE 1" = 20'



2 MESH ENCLOSURE FRAMING PLAN  
SCALE 1" = 20'

**LEGEND**

**LINE TYPES**

--- MESH ENCLOSURE

--- STEEL CABLES

**MATERIALS**

WOOD WALL

LOG BEAMS

**SYMBOLS**

● STEEL POST

● EXISTING TREE

**UNIVERSITY OF OREGON**

**CASCADES RAPTOR CENTER**

**CAPSTONE PROJECT**  
Wings of Change

Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

**CASCADES RAPTOR CENTER**  
**EAGLE ENCLOSURE**

Drawn By: JWB

Checked: \_\_\_\_\_

Project #: \_\_\_\_\_

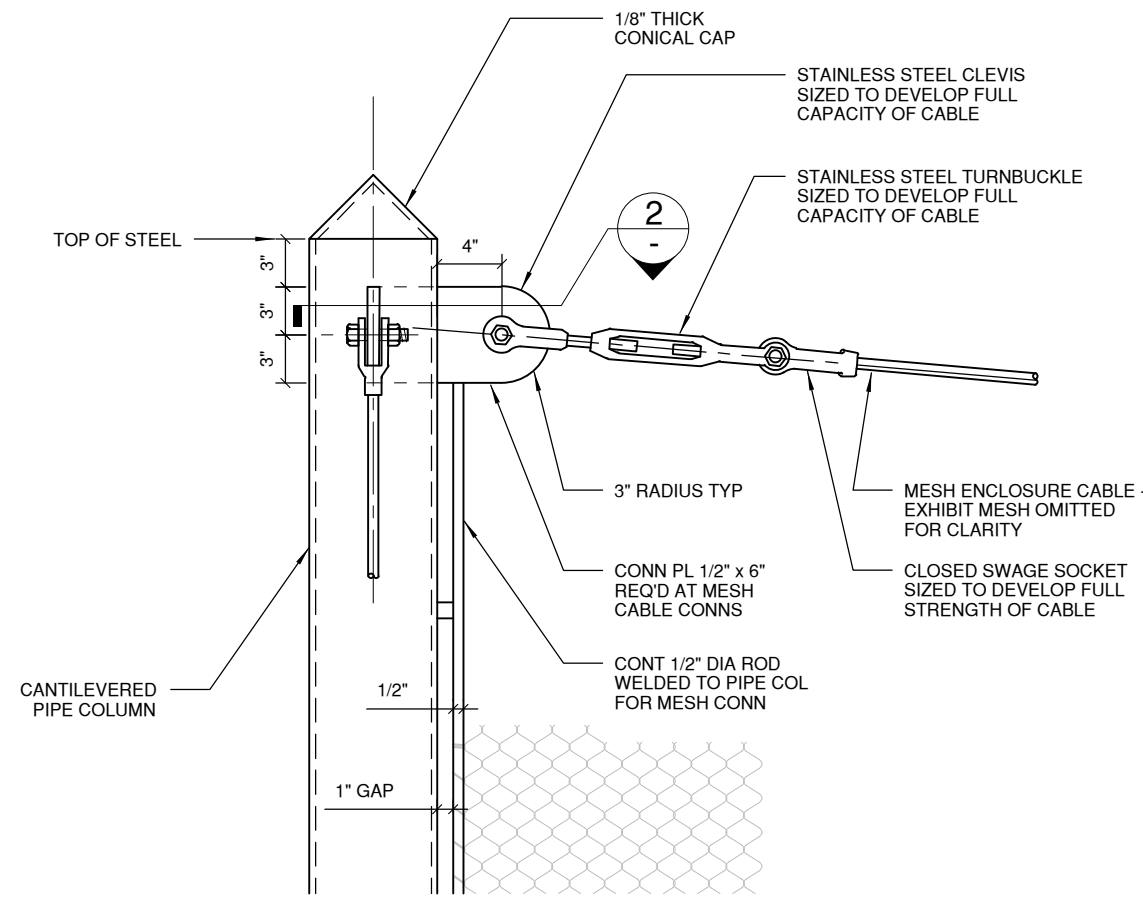
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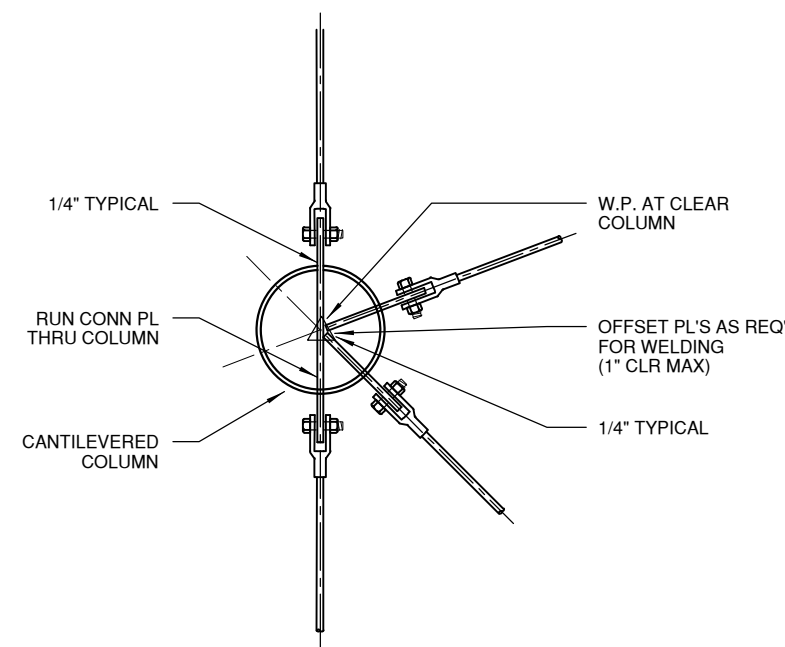
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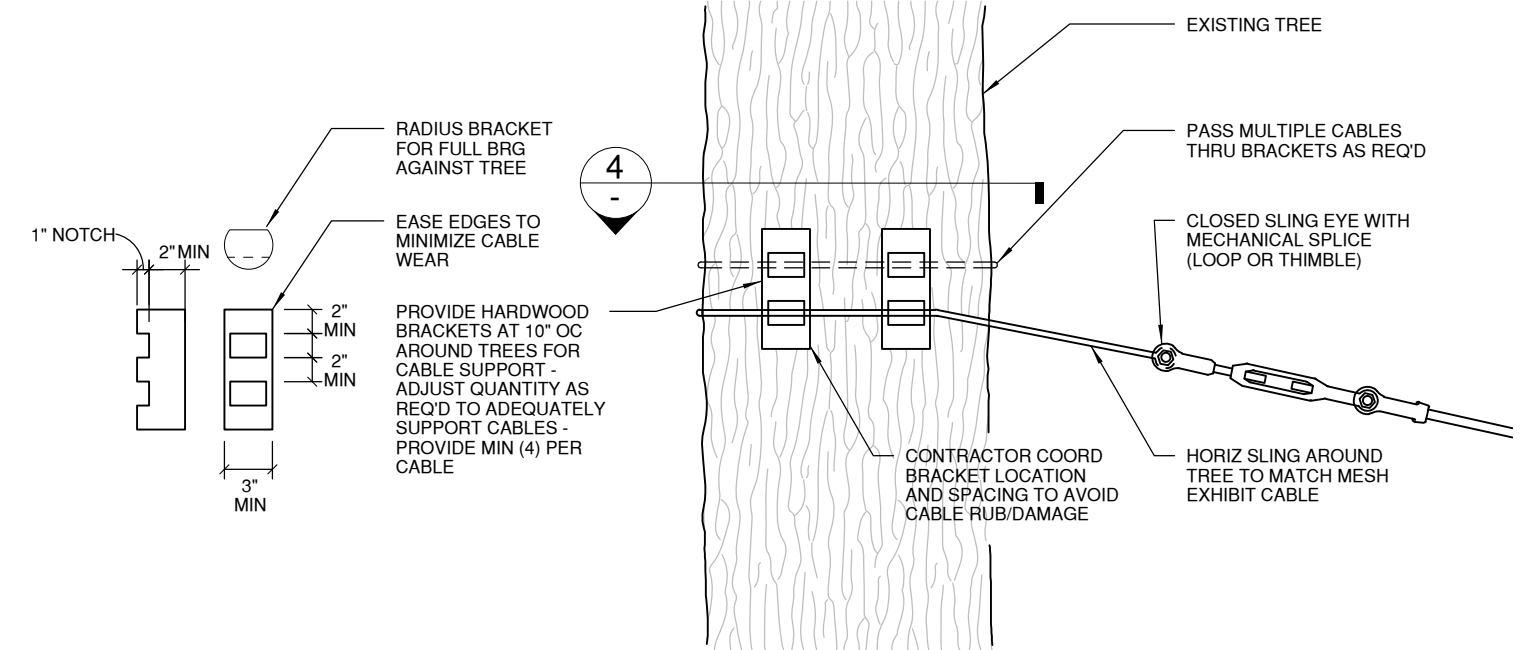
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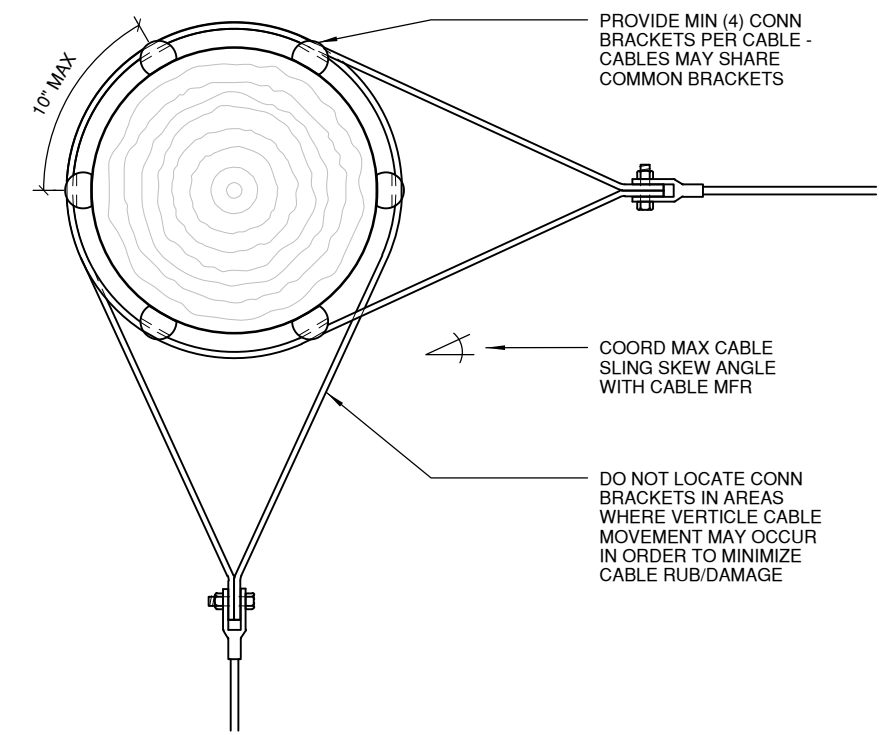
1 STEEL POST CABLE CONNECTION SECTION  
SCALE 1" = 1'



2 STEEL POST CABLE CONNECTION PLAN  
SCALE 1" = 1'



3 EXISTING TREE CABLE CONNECTION SECTION  
SCALE 1" = 1'



4 EXISTING TREE CABLE CONNECTION PLAN  
SCALE 1" = 1'

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**CAPSTONE PROJECT**  
Wings of Change

Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

**CASCADES RAPTOR CENTER**  
**EAGLE ENCLOSURE**

Drawn By: JWB

Checked: \_\_\_\_\_

Project #: \_\_\_\_\_

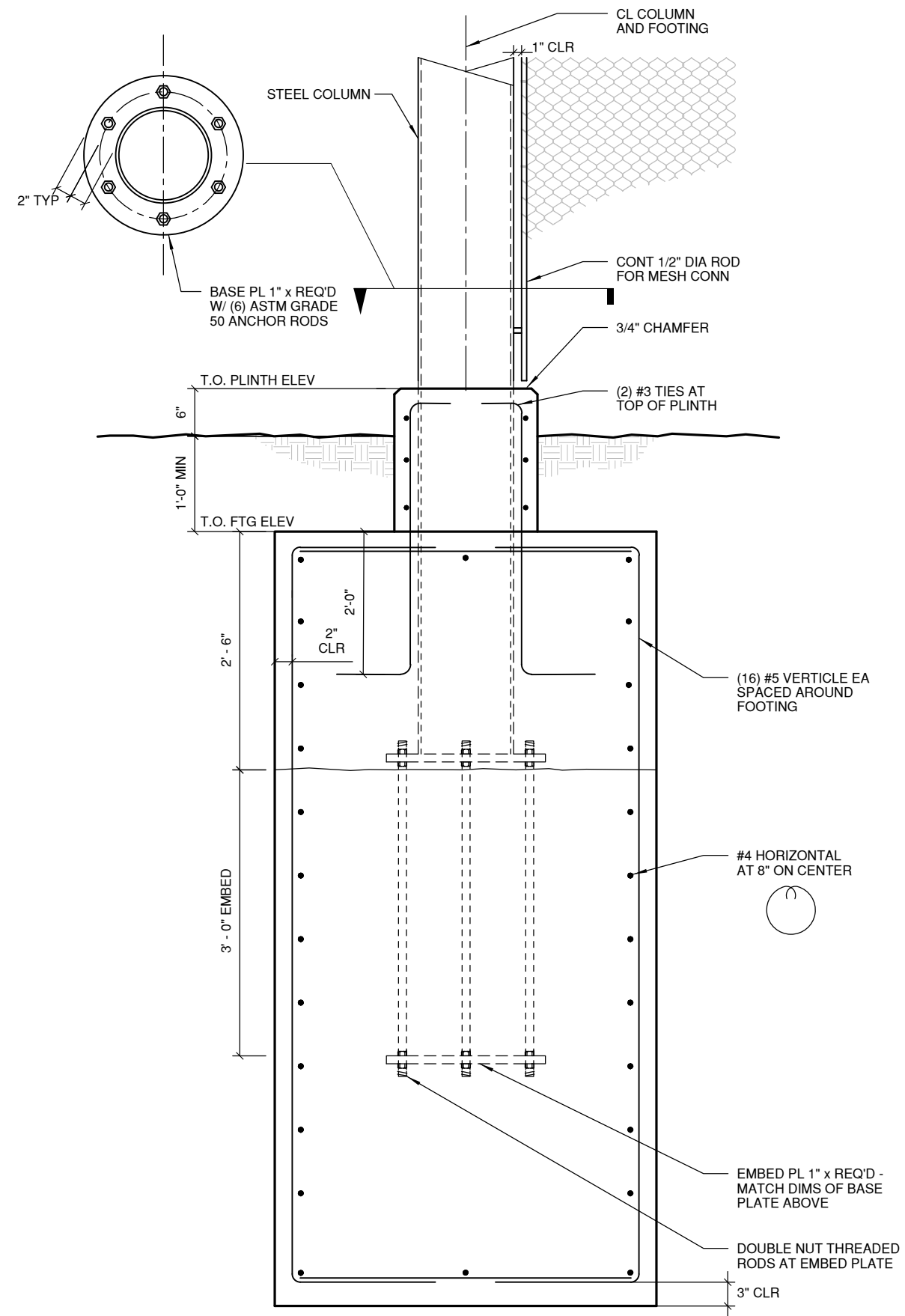
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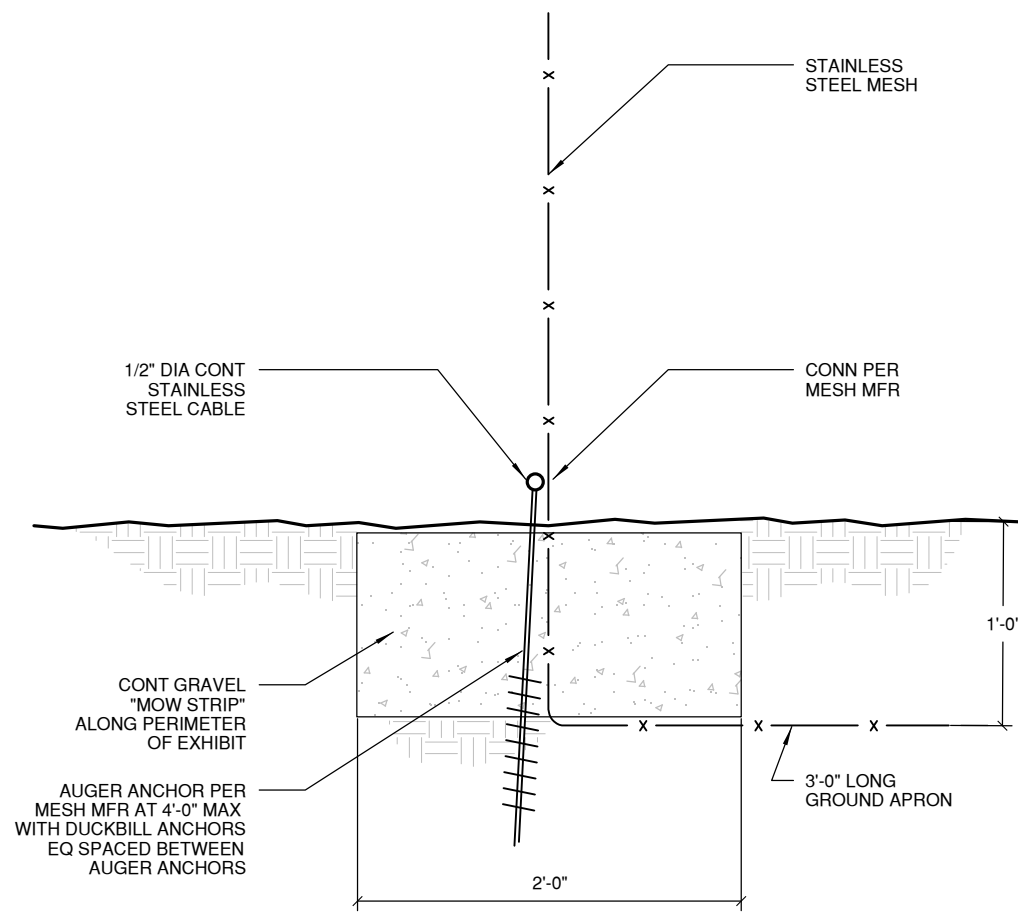
SCALE: 1" = 1'

SHEET TITLE: MESH ENCLOSURE DETAILS

SHEET #: L300



1 STEEL POST FOOTING SECTION  
SCALE 1" = 1"



2 MESH ENCLOSURE FOOTING SECTION  
SCALE 1" = 1"



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Wings of Change  
Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

CASCADES RAPTOR CENTER  
EAGLE ENCLOSURE

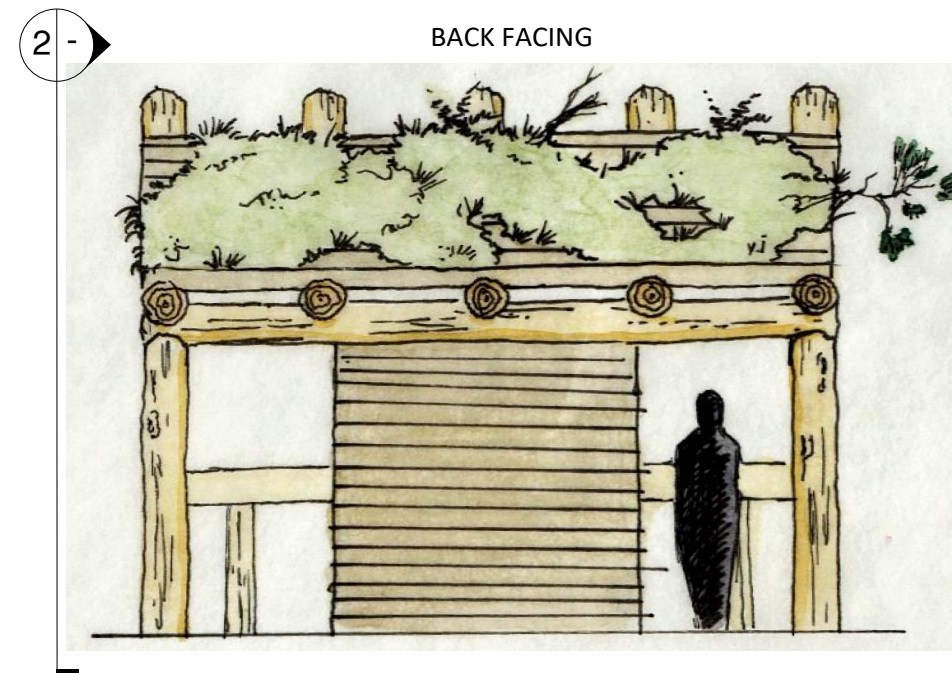
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Project #:  
Date: 03/18/2024

PHASE: 100% DD

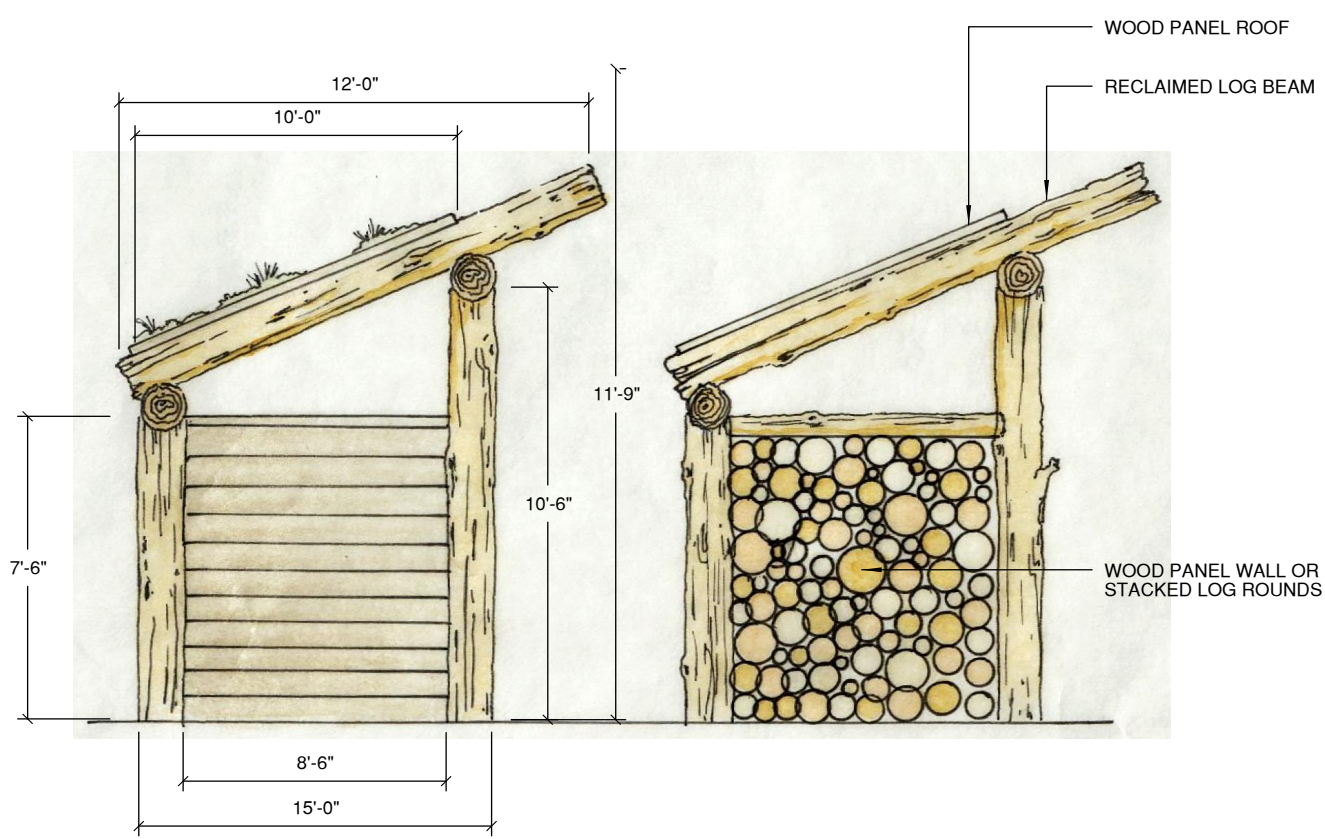
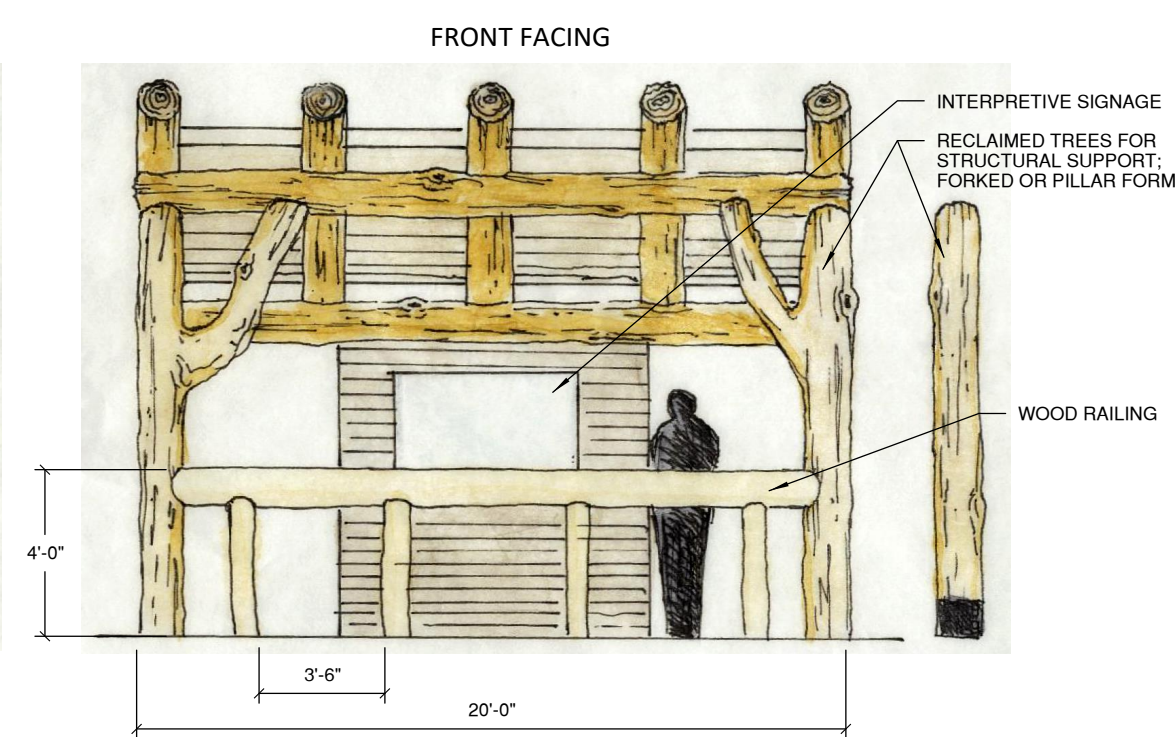
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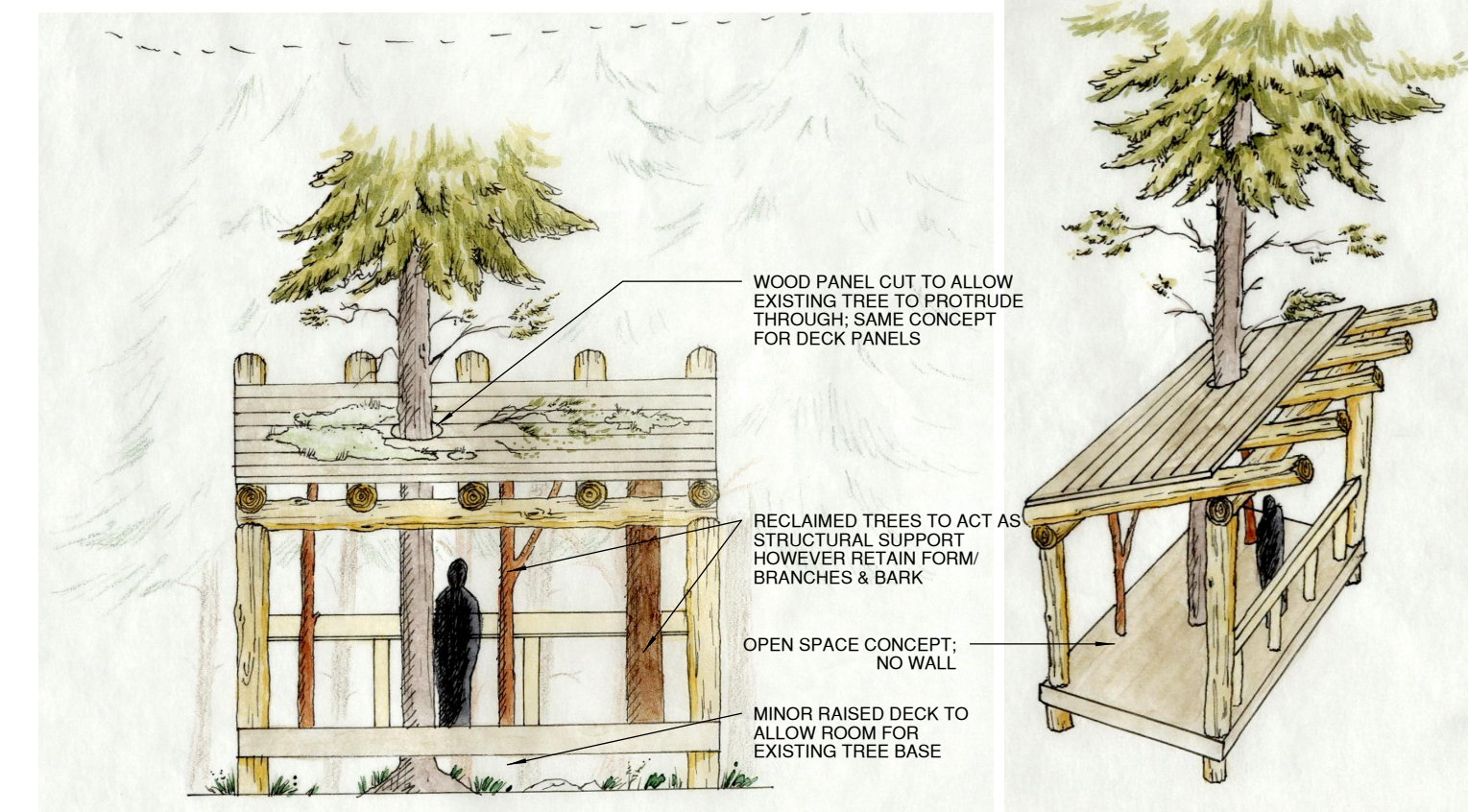
SHEET #: L301



1 COVERED VIEWING SHELTER ELEVATION - DESIGN A  
SCALE (N/A)



2 COVERED VIEWING SHELTER SECTION - DESIGN A  
SCALE (N/A)



1 COVERED VIEWING SHELTER ELEVATION & AXON - DESIGN B  
SCALE (N/A)  
\*DIMENSIONS EQUAL TO DESIGN A



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CAPSTONE PROJECT  
Wings of Change  
Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

CASCADES RAPTOR CENTER  
EAGLE ENCLOSURE

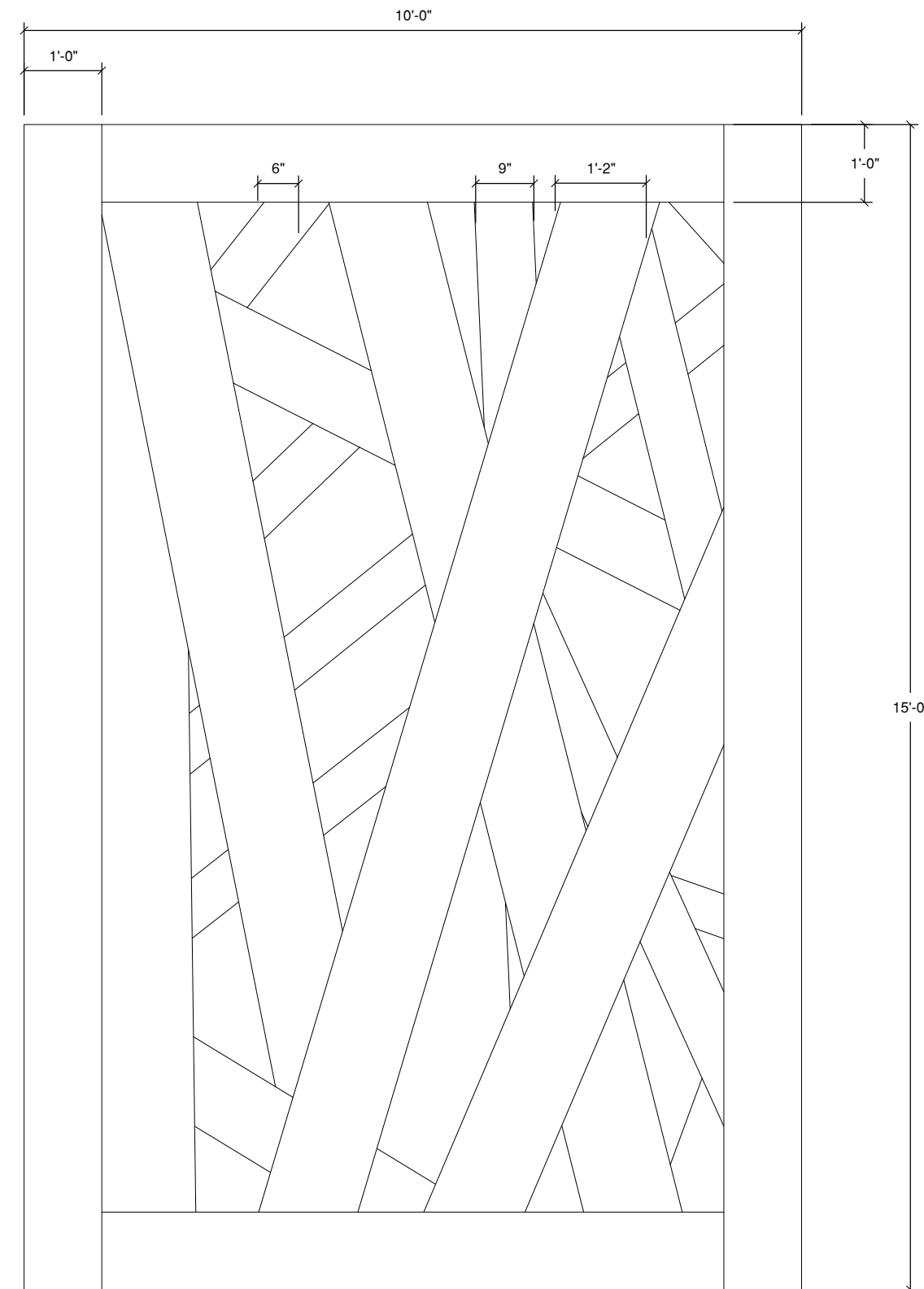
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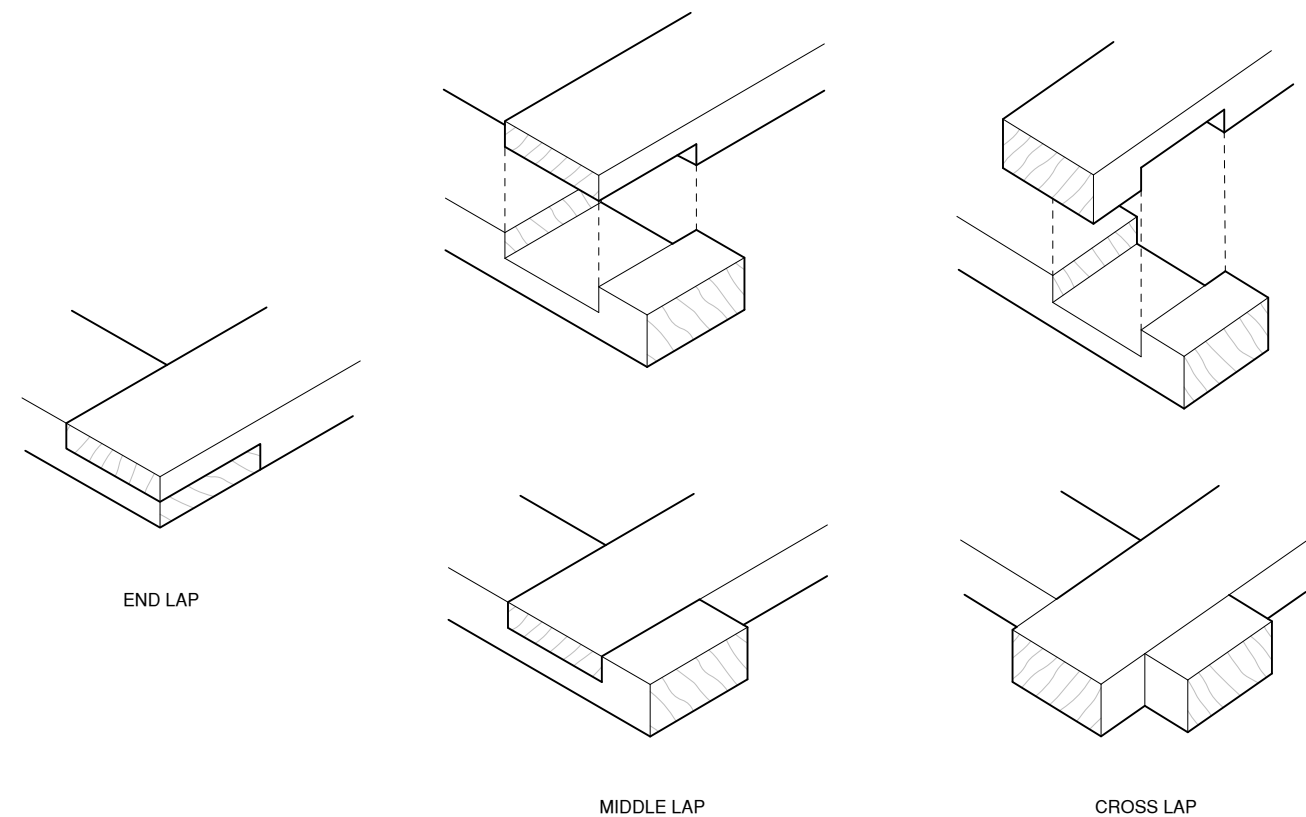
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SHEET TITLE: VIEWING STRUCTURE ANALYSIS

SHEET #: L400



**1** EAGLE CHUTE BRIDGE PLAN  
SCALE 1" = 2'



**WOODEN BEAM CONNECTION**  
METHOD: LAP JOINTS



CASCADES RAPTOR CENTER  
CAPSTONE PROJECT  
Wings of Change  
Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

**CASCADES RAPTOR CENTER**  
**EAGLE ENCLOSURE**

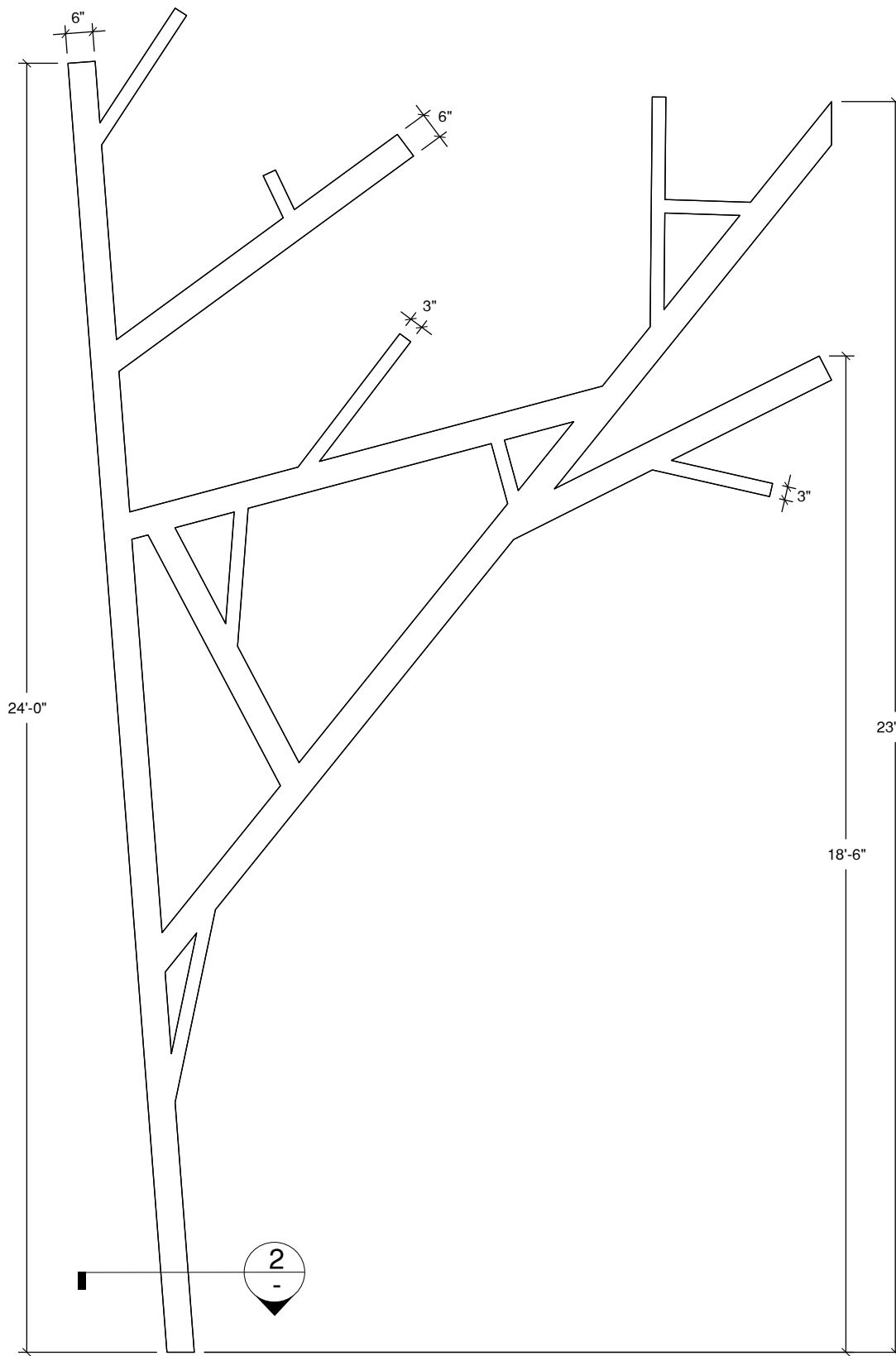
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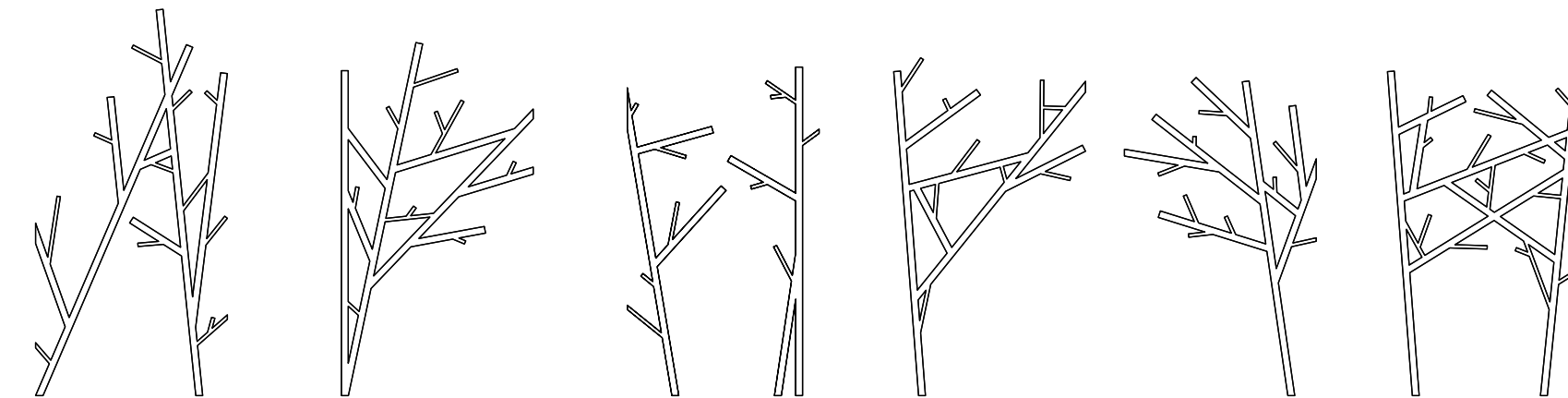
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EAGLE CHUTE BRIDGE

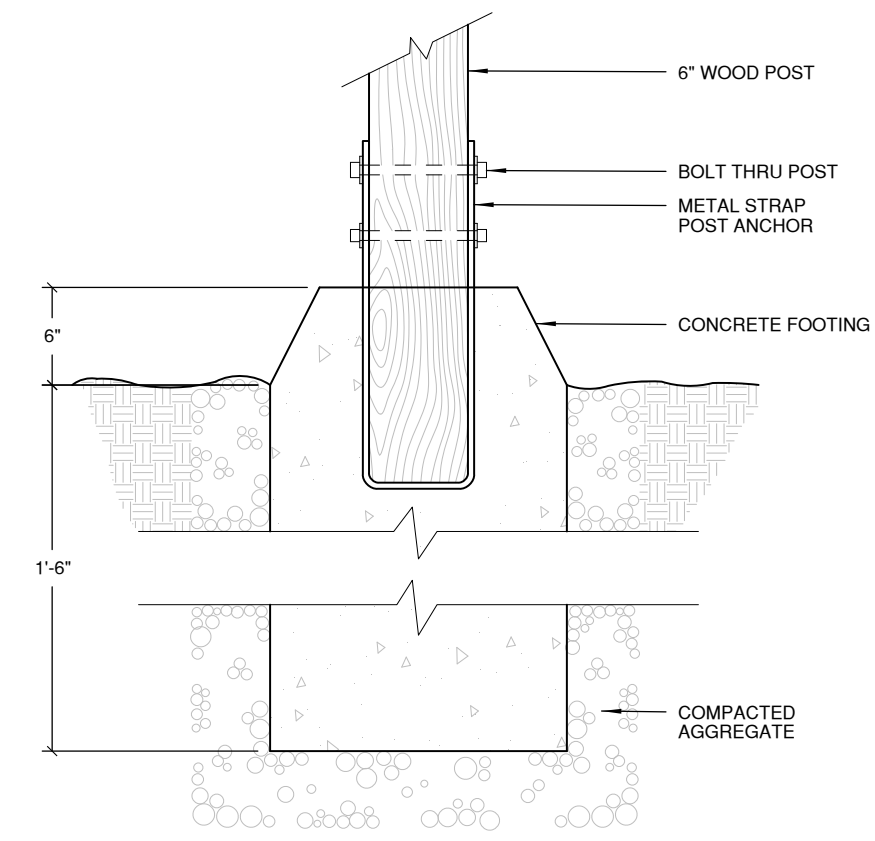
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L500



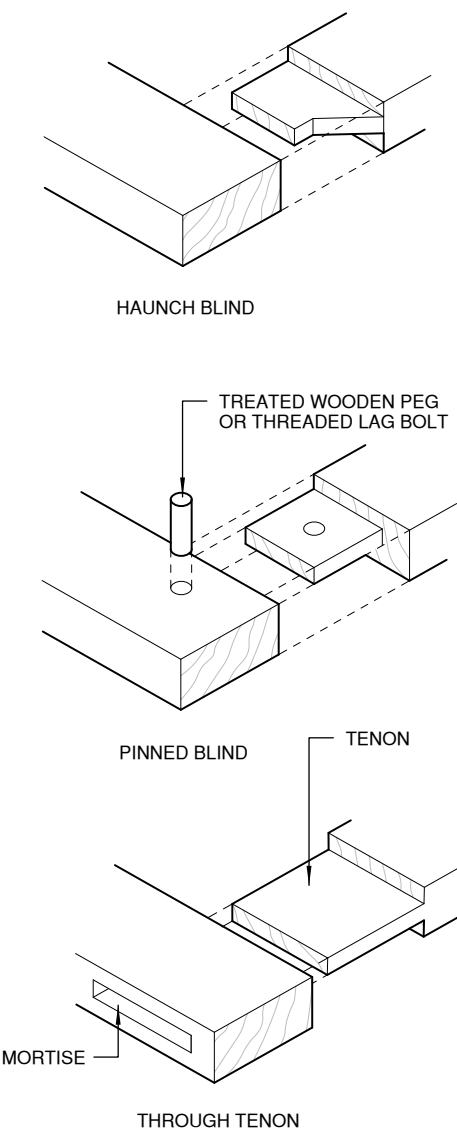
**1** TREE INSTALLATIONS  
SCALE 1" = 3'



VARIOUS INSTALLATIONS IN DESIGN SITE



**2** WOOD POST FOOTING  
SCALE 1" = 1'



**WOODEN BEAM CONNECTION**  
METHOD: MORTISE & TENON JOINTS



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CAPSTONE PROJECT  
Wings of Change  
Prof. Arica Duhrkoop-Galas

JAKE BROTSIS

**CASCADES RAPTOR CENTER**  
**EAGLE ENCLOSURE**

Drawn By: JWB  
Checked:  
Project #:  
Date: 03/18/2024

PHASE  
100% DD

SCALE  
N/A

SHEET TITLE  
TREE INSTALLATIONS

SHEET #  
L501

## Zookeeper Facebook Groups

During my time as a zookeeper, I joined several private Facebook groups for fellow zookeepers around the world, including “Zookreepers” and “You Know You’re A Zookeeper When.” After leaving the field, I joined another group called “Once A Keeper, Always A Keeper,” which is for former zookeepers who have transitioned to other careers. These groups have played a significant role in my development as a young zookeeper and have continued to be useful since I left the field. They have helped me stay up-to-date with the latest news and trends in animal husbandry and have provided a platform to share expertise and knowledge in areas I may be unfamiliar with.

During the design phase of the raptor expansion, I encountered several decision-making obstacles. To overcome these, I reached out to each group to gather opinions about design strategies that would be most effective and applicable to my project. While I considered the majority opinions to guide my decisions, the final proposal was unique and specific to my intentions.

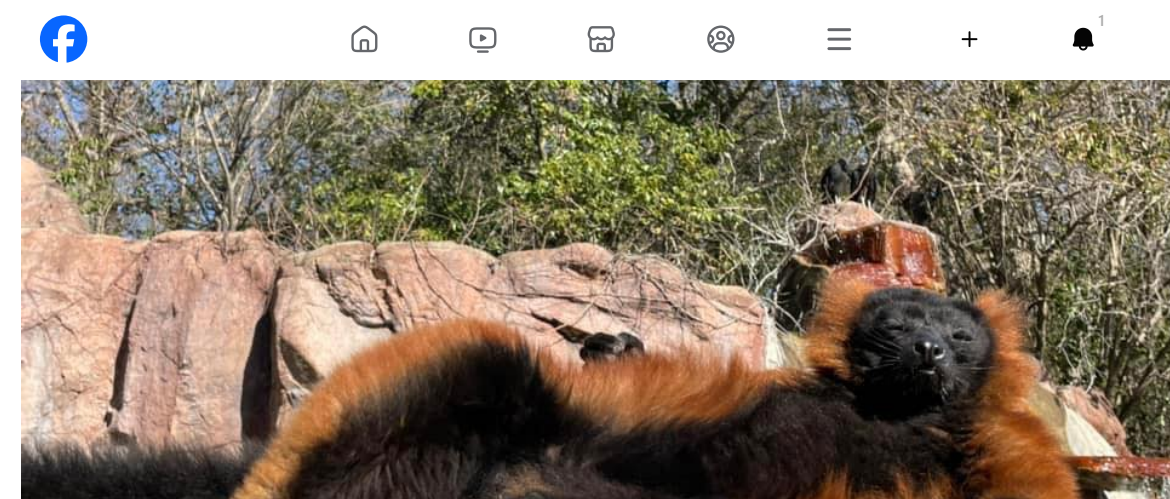
Referencing Chapter 4’s “Sourcing Solutions,” in section 4.0, there is a Facebook logo in my Professional Influence Timeline with an annotation that reads “flex habitat design.” I reached out to the groups with several questions about best practices for designing covered chutes for free-flight raptors. As explained in Chapter 5, section 5.1’s “Flexible Innovations,” flex habitats are common for mammals in zoos but have not been designed for free-flight birds yet. Gathering opinions on the options I proposed was crucial in pushing my designs in the right direction.

On page 143, I detailed my reason for reaching out to the groups and provided several options for each figure. I gathered a total of 56 responses from all groups, with each person responding to both figures.

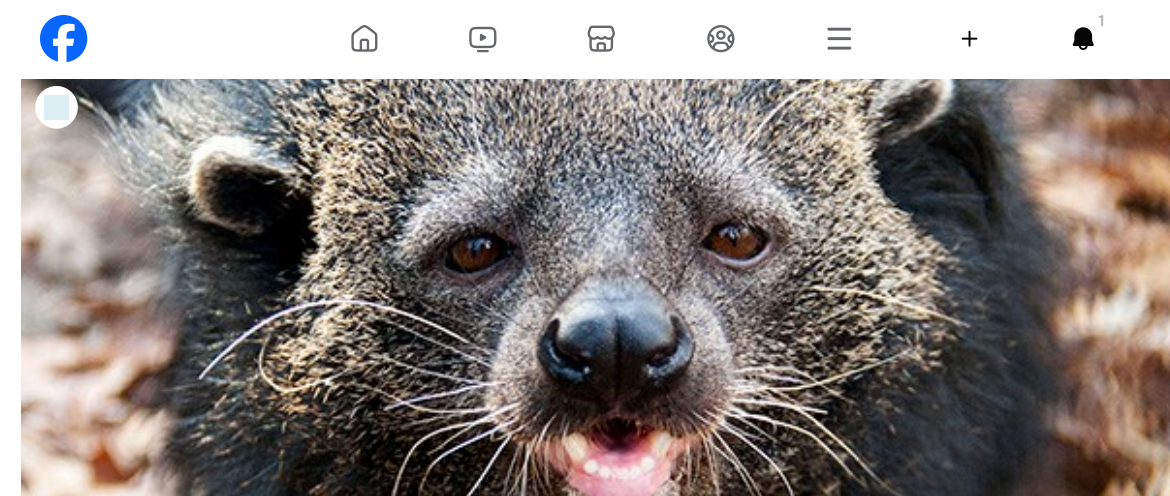
In figure 1, everyone agreed that the horizontal chute was the best option for the chute between each aviary. Reasons against the angled chute included difficulties in cleaning and the challenge birds would face flying upwards in the chute.

In figure 2, the majority of respondents preferred the planar bridge for allowing raptors to move between aviaries. Although the Cascades Raptor Center stated that all their residential raptors were capable of flying, zookeepers from the Facebook groups pointed out that I could not be certain if these birds (or future birds) were strong or weak fliers. A planar bridge would be easiest for all birds. Additionally, raptors might want to inspect the chute before entering it, and a bridge would allow them to get comfortable more quickly compared to other options. Perch hopping was not recommended, as birds might not want to leave the artificial trees once they enter the chute, making it strenuous for both the animals and the trainers.

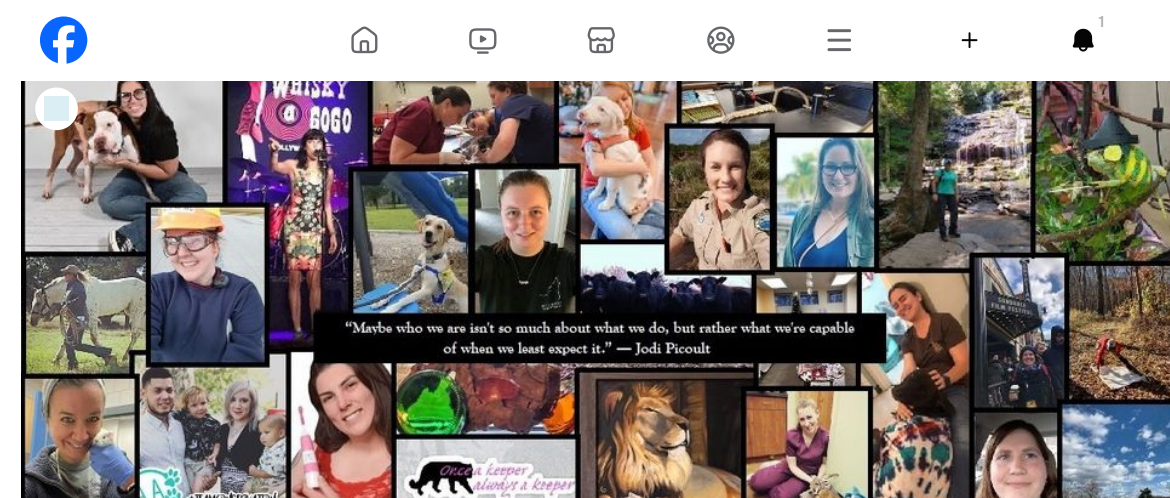
My use of the Facebook groups was strictly for gathering information on the best options and supporting reasons for my design choices. The design of the bridges in my master’s project was entirely my creation and was not influenced by individuals in these groups. I used these groups several other times to answer questions, but nothing was as notable or significant as the flex habitats were, which is why I haven’t included those instances.



**ZOOKreepers**  
Private group · 19.9K members

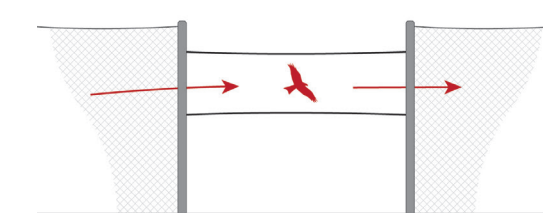


**You know you're a zookeeper when**  
Private group · 21.1K members

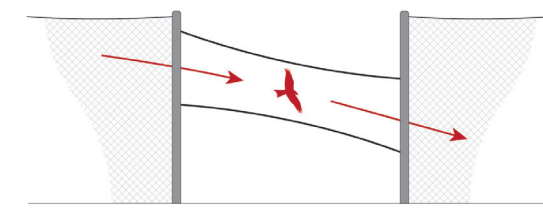


**Once a Keeper, Always a Keeper**  
Private group · 2.0K members

**FIGURE 1**

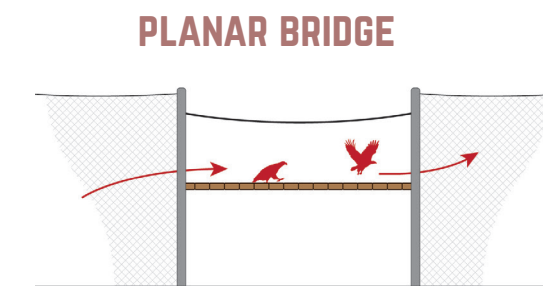


**HORIZONTAL CHUTE**

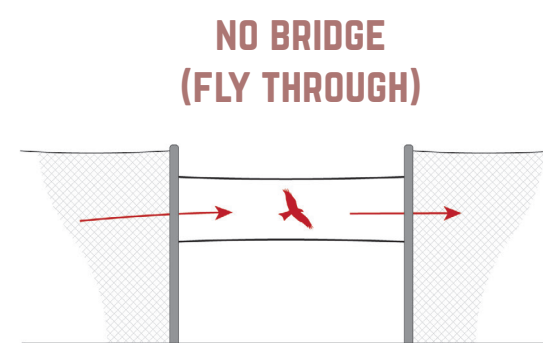


**ANGLED CHUTE**

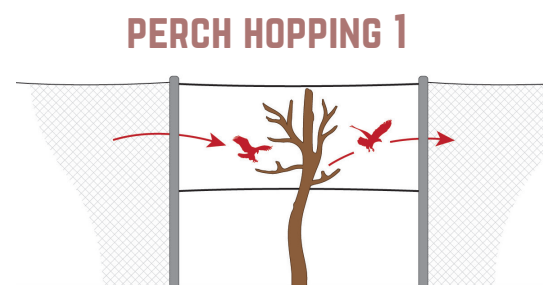
**FIGURE 2**



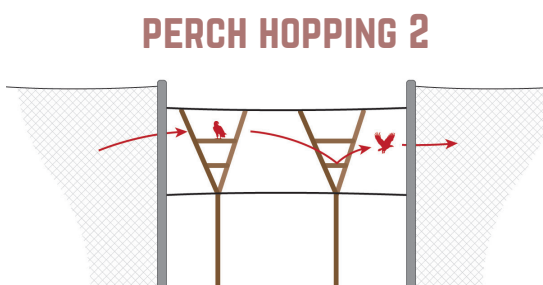
**PLANAR BRIDGE**



**NO BRIDGE  
(FLY THROUGH)**

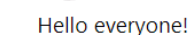


**PERCH HOPPING 1**



**PERCH HOPPING 2**

**Jake Brotsis**  
January 26 · 🌐



Hello everyone!  
I'm looking to get some opinions and feedback on my master's project. My project is focusing on birds of prey and I would greatly appreciate if anyone who had/has experience working with raptors (or this could be applied to most free-flight birds) would be willing to take the time and give me your thoughts. I'll get straight to point of where I'd like your inquiry.

I'm testing the idea of creating rotational habitats for free-flight raptors. To my knowledge, aside from crating raptors and moving them to another habitat, I haven't been able to find any zoos that have rotational habitats for free-flight birds. If you know of any, please tell! A portion of my overall design proposal will be exploring and testing this concept at a local raptor rehabilitation center. I have put together some quick mockups in Adobe to better illustrate my questions.

**Figure 1:** Would it be better to create a horizontal chute or an angled chute? Since these birds are in a confined space, I don't know if it'd be easier for them to fly straight through or fly/glide downward.

**Figure 2:** Would it be better for the chute to have a completely flat surface, like a bridge, for the birds to walk across? Or install momentary landing points for them to fly/hop across? Or nothing at all, just a mesh tunnel, for them to fly straight across? I recognize the size of the chute should be at least the length of their wingspan, plus a couple extra feet on both sides (unless you think it should be larger).

**Figure 3:** As the chute significantly reduces movement, and to prevent birds from flying into the mesh, should I install visual barriers around the chute? Wrapping it in something like burlap. I don't know if I should be thinking about depth perception is for raptors. This could be a temporary installation until the birds become conditioned to flying through the chutes.

Again, I would greatly appreciate anyone's help in my **speculative** design. If there's anything else you'd like to add, you feel I'm not considering, I'm all ears! Thank you for your time!

(I have also posted this in ZooKreepers...I'm casting a wide net to get a lot of feedback 😊).

**56 TOTAL RESPONSES**

**FIGURE 1**

**100% CHOSE HORIZONTAL CHUTE**

**FIGURE 2**

**85% CHOSE PLANAR BRIDGE**

**15% CHOSE PERCH HOPPING**

**0% CHOSE NO BRIDGE ENTIRELY**

## Realm of the Raptors - An Interpretive Story

This master's project was ever-evolving. While I always had a rough idea of what I wanted to accomplish and what I wanted to get out of it, the specifics and my choices were always changing.

As stated in Chapter 6, section 6.0's "Goals Revisited":

"Initially, my focus was evenly split between enclosure design and education, with the environment as the core link. However, as the project evolved, my attention and interest began to shift more towards enclosure design."

Initially, my plan was to create interpretive signage for visitors to provoke thought and care about various issues related to raptors. This included creating graphics and a story for each sign to be featured in the primary master's project. As the project evolved and my interests shifted, I ultimately only had time to reference the signs and their locations on the site plan, as seen on page 117.

However, at the start of the winter term in January 2024, I began to write the story for each interpretive sign addressed in my master's project. I researched how to create an effective interpretive story and the guidelines for balancing text information with graphics, in addition to the preferred amount of text on each sign.

My research suggested the "3-30-3" rule, which reflects how much time, on average, a visitor should spend reading interpretive signs:

- 3 seconds to hook the visitor (theme)
- 30 seconds to review if hooked (sub-themes)
- 3 minutes if very interested (message)

I began to write each sign, creating themes, sub-themes, and a message for each. My intent was to come back later in the winter term, or early spring term, to further synthesize each sign before creating the graphics. However, I both ran out of time and my workload was redirected to other projects higher on my priority list. Nonetheless, I still spent a considerable amount of time researching the information and putting together the skeleton of each sign. It would be a disservice to myself to not include what I had written in this appendix.

Perhaps my interpretive story rough draft will yet become useful in the future or could serve as a jumping-off point for others who may read this appendix.

The following pages contain the (unfinished) signs, without their graphics, that would facilitate the interpretive story for the "Realm of the Raptors" in the Cascades Raptor Center's expansion proposal.

\*\*Depending on the route visitors take into the expansion, these two signs serve as both the welcoming and closing messages to the interpretive story. The welcoming side faces the parking lot and backside to the same sign, the closing side, faces the expansion\*\*

## REALM OF THE RAPTORS MASTERS OF THE SKY

**WELCOME TO THE REALM OF THE RAPTORS, MASTERS OF THE SKY!**

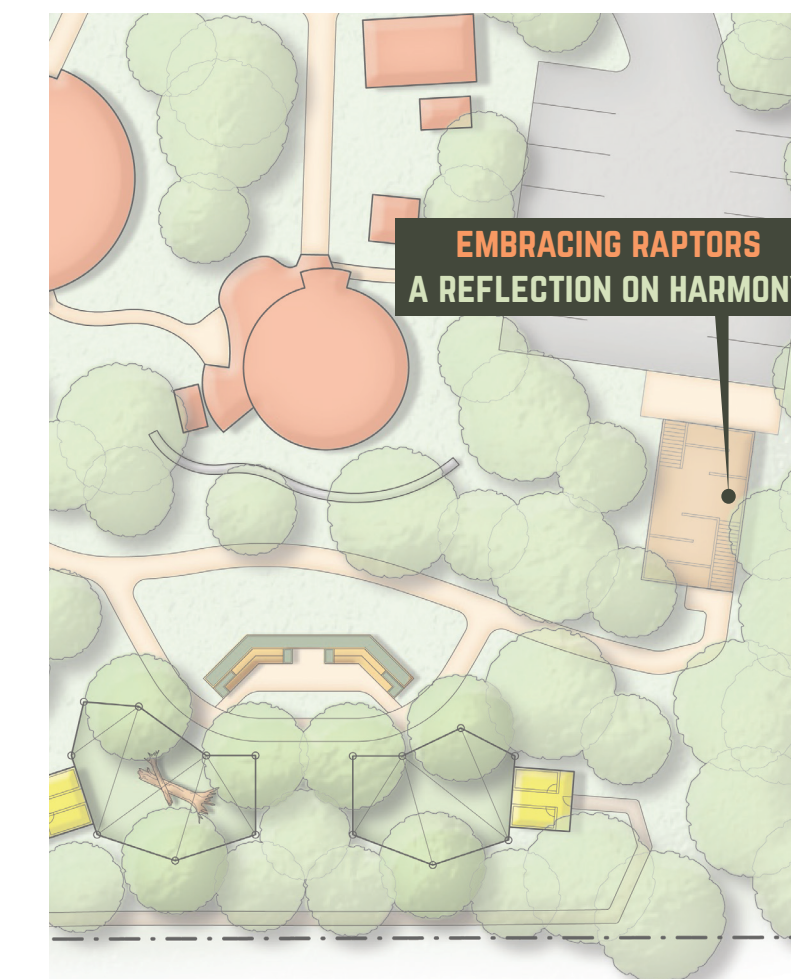
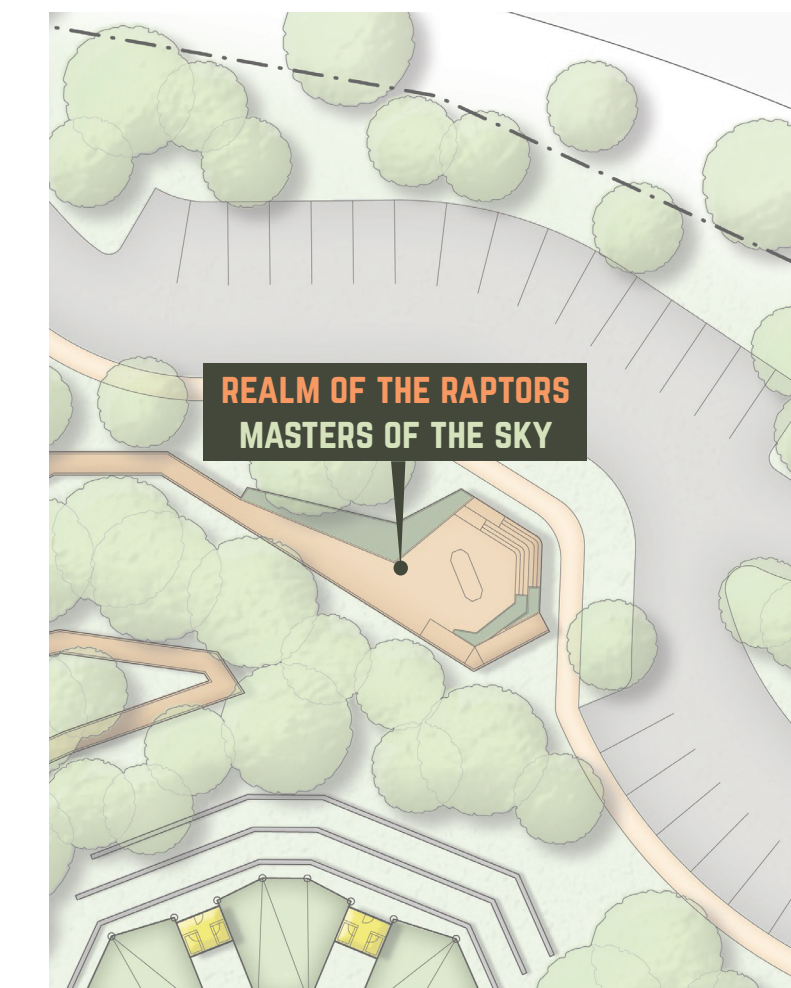
**IN THIS JOURNEY, YOU'LL WITNESS THE INCREDIBLE PROWESS OF THESE EXPERT HUNTERS AND DISCOVER THEIR ESSENTIAL ROLE IN OUR ECOSYSTEM. FROM THEIR POWERFUL TALONS TO AGILE FLIGHT, THESE MASTER HUNTERS PLAY A VITAL ROLE IN MAINTAINING NATURE'S BALANCE.**

**UNCOVER THE CHALLENGES FACED BY THESE MAGNIFICENT CREATURES, EXPLORING PAST AND PRESENT ENVIRONMENTAL IMPACTS THAT JEOPARDIZE THEIR EXISTENCE. WITNESS THEIR RESILIENCE AND LEARN HOW HUMAN ACTIONS CAN MAKE A DIFFERENCE IN ENSURING THE SURVIVAL OF THESE INCREDIBLE BIRDS, ADMIRER AND REVERED FOR CENTURIES AS SYMBOLS OF STRENGTH, FREEDOM, AND COURAGE IN VARIOUS HUMAN CULTURES.**

**ENJOY THESE BIRDS AND ALLOW THE REALM OF THE RAPTORS TO INSPIRE A DEEPER CONNECTION TO THE WONDERS OF THE SKY.**

## EMBRACING RAPTORS A REFLECTION ON HARMONY

**AS YOU CONCLUDE YOUR JOURNEY THROUGH THE REALM OF THE RAPTORS, WE INVITE YOU TO REFLECT ON THE ENDURING LESSONS FROM THESE MAJESTIC BIRDS. LET THEIR RESILIENCE INSPIRE COMPASSION, FOSTERING A DEEPER CONNECTION TO THE WONDERS OF THE SKY AND THE DELICATE BALANCE OF NATURE. IN OUR COLLECTIVE ACTIONS, WE HOLD THE POWER TO PROTECT AND PRESERVE THE REALM OF RAPTORS, ENSURING A HARMONIOUS COEXISTENCE WITH THESE EXTRAORDINARY ANIMALS. EMBRACE THE CALL TO EMPATHY AND CONSERVATION, FOR IN UNDERSTANDING AND APPRECIATING THE CHALLENGES FACED BY OUR BIRDS OF PREY, WE EMBARK ON A SHARED JOURNEY TOWARDS A SUSTAINABLE FUTURE FOR ALL.**



## GUARDIANS OF THE SKY RAPTORS' VITAL DUTY

SITTING ATOP THE FOOD CHAIN, AS APEX PREDATORS, RAPTORS SERVE SEVERAL ECOLOGICAL ROLES IN SUSTAINING HEALTHY ECOSYSTEMS. FROM REGULATING PREY POPULATIONS TO CONTROLLING DISEASES AND ACTING AS ENVIRONMENTAL INDICATORS, RAPTORS DEMONSTRATE THEIR CRUCIAL NECESSITY IN PREVENTING ECOLOGICAL IMBALANCES.

### INDICATOR SPECIES

- AS INDICATOR SPECIES, PLAY A VITAL ROLE IN MONITORING ECOSYSTEM HEALTH. THEY ARE PARTICULARLY SENSITIVE TO ENVIRONMENTAL CHANGES AND THEIR BEHAVIORS CAN REFLECT THE DELICATE EQUILIBRIUM OF NATURE. THE POTENTIAL DISAPPEARANCE OF RAPTORS COULD LEAD TO ENVIRONMENTAL PROBLEMS SUCH AS PREY COLLAPSE. ADDITIONALLY, SERVING AS ECOLOGICAL BAROMETERS, RAPTORS ACT AS AN EARLY WARNING SYSTEM FOR CHEMICAL AND POLLUTANT LEVELS.

### POPULATION REGULATION

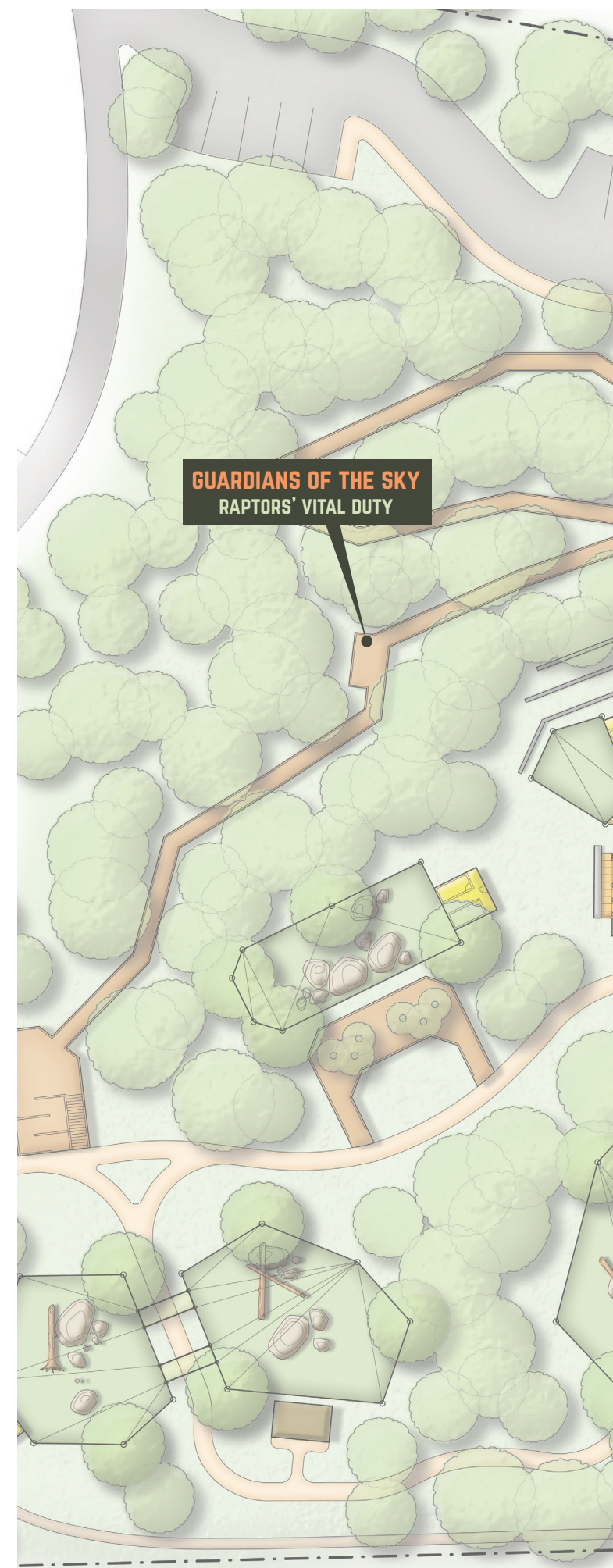
- RAPTORS PLAY A VITAL ROLE IN REGULATING PREY SPECIES' POPULATIONS, CONTRIBUTING TO ECOLOGICAL SERVICES THROUGH SCAVENGING AND PREVENTING THE SPREAD OF DISEASES.

### RODENT CONTROL

- RAPTORS SIGNIFICANTLY IMPACT RODENT POPULATIONS, SHOWCASING EFFECTIVENESS COMPARED TO RODENTICIDES. THEIR CONTRIBUTION TO AGRICULTURAL AND ENVIRONMENTAL HEALTH IS INVALUABLE.

### SCAVENGERS & NUTRIENT CYCLING

- SPECIALIST SCAVENGERS LIKE VULTURES FULFILL A CRITICAL ROLE IN NUTRIENT CYCLING AND DISEASE CONTROL. THEIR ACIDIC GUT SECRETIONS AID IN LIMITING THE SPREAD OF DISEASE ASSOCIATED WITH CARRION.



## SKY SCULPTORS UNVEILING RAPTOR ATTRIBUTES

FROM BINOCULAR VISION AND POWERFUL BEAKS TO DIVERSE HUNTING TECHNIQUES, THESE BIRDS ARE TRUE SCULPTORS OF THE SKY. UNCOVER THEIR SIGNATURE CHARACTERISTICS AND UNIQUE ABILITIES, A MESMERIZING SHOWCASE OF THE ARTISTRY INHERENT IN THESE MAGNIFICENT CREATURES.

### ANATOMY

- TO BE EFFECTIVE HUNTING, RAPTOR HAVE ADAPTED KEEN EYESIGHT TO SPOT PREY FROM GREAT DISTANCES. SOME, LIKE EAGLES AND FALCONS, SEE UP TO EIGHT TIMES GREATER THAN HUMANS. STRONG BEAKS AND TALONS ARE USED TO GRIP, TEAR, AND CONSUME THEIR PREY.

### SPECIALIZED TRAITS

- RAPTORS SHOWCASE REMARKABLE ABILITIES SUCH AS INCREDIBLE SPEEDS DURING FLIGHT, AS SEEN IN THE PEREGRINE FALCON REACHING UP TO 200 MPH WHEN DIVING. WHILE OTHERS, LIKE THE OWL, HAVE SPECIALIZED FEATHERS FOR SILENT FLIGHT AND CAN ROTATE THEIR HEADS UP TO 270 DEGREES.

### VERSATILE HUNTING TECHNIQUES

- HUNTING TECHNIQUES CAN RANGE BASED ON SPECIES AND ENVIRONMENT. SOME SOAR AND SCAN THE GROUND FOR MOVEMENT, LIKE EAGLES AND VULTURES. OTHERS, LIKE HAWKS AND OWLS, PERCH AND WAIT FOR PREY, AND SOME, LIKE FALCONS AND HARRIERS, CHASE PREY IN THE AIR OR ON THE GROUND.

### COMMUNICATION

- VARIOUS VOCALIZATIONS SUCH AS SCREECHES, WHISTLES, HOOTS, AND CHIRPS COMMUNICATE PRESENCE, MOOD, INTENTIONS, AND WARNINGS. BODY LANGUAGE INCLUDES POSTURES, GESTURES, EYE CONTACT, AND FACIAL EXPRESSIONS, CAN INDICATE DOMINANCE, SUBMISSION, AGGRESSION, AFFECTION, OR CURIOSITY.

### NESTING & MATING RITUALS

- FORMING LASTING BONDS, RAPTOR MATE FOR LIFE OR SEVERAL SEASONS. COURTSHIP DISPLAYS INVOLVE AERIAL ACROBATICS, GIFT-GIVING, AND DUETS. THESE SKILLED ARCHITECTS CONSTRUCT NESTS ON HIGH REACHES LIKE TREES, CLIFFS, OR BUILDINGS, USING MATERIALS SUCH AS WOOD DEBRIS, FEATHERS, FUR, OR BONES. INCUBATION LASTS FOR SEVERAL WEEKS, WITH PARENTS TAKING TURNS FEEDING AND PROTECTING THEIR YOUNG UNTIL THEY ARE READY TO FLEDGE AND BECOME INDEPENDENT.



## FALCONRY'S LEGACY

### ANCIENT BONDS WITH RAPTORS

FALCONRY, A TIME-HONORED PRACTICE FOSTERING A PROFOUND PARTNERSHIP BETWEEN HUMANS AND RAPTORS, SPANS OVER 4,000 YEARS. FROM ITS ORIGINS AS A MEANS OF OBTAINING FOOD, IT HAS EVOLVED INTO A MEANINGFUL TRADITION ASSOCIATED WITH CAMARADERIE. DELVE INTO THE DEMANDING TECHNIQUES THAT BUILD A PROFOUND BOND BETWEEN FALCONERS AND THESE MAGNIFICENT BIRDS.

THE EXACT ORIGINS OF FALCONRY ARE UNCERTAIN, BUT IS BELIEVED TO HAVE ORIGINATED IN CENTRAL ASIA AND THE IRANIAN PLATEAU. SPREADING THROUGH CULTURAL AND TRADE CONNECTIONS TO VARIOUS REGIONS, THE PRACTICE WAS UTILIZED IN EAST ASIA, NORTH AFRICA, EUROPE, AND EVENTUALLY, IN THE 16TH CENTURY AD, TO A SIGNIFICANT PART OF THE WORLD.

ORIGINALLY A MEANS OF OBTAINING FOOD, FALCONRY HAS ACQUIRED OTHER VALUES OVER TIME AND HAS BEEN INTEGRATED INTO COMMUNITIES AS A SOCIAL AND RECREATIONAL PRACTICE AND AS A WAY OF RECONNECTING WITH NATURE. TODAY, FALCONRY IS PRACTICED BY PEOPLE OF ALL AGES IN MANY COUNTRIES, TRANSMITTED FROM GENERATION TO GENERATION. THE MODERN PRACTICE OF FALCONRY FOCUSES ON SAFEGUARDING RAPTORS, HABITATS, CONSERVATION AGENCIES, AS WELL AS THE PRACTICE ITSELF.

THIS REWARDING PRACTICE, REQUIRING EXCEPTIONAL PATIENCE, SKILL, AND AN IN-DEPTH UNDERSTANDING OF A RAPTOR'S BEHAVIOR, BEGINS THE MOMENT THE BIRD BECOMES A PARTICIPANT. THE FALCONER, WITH UNWAVERING DEDICATION, METICULOUSLY GAINS THE BIRD'S TRUST, FOSTERING A BOND OF PROFOUND RESPECT AND UNDERSTANDING. BUILDING TRUST EMERGES AS A CRITICAL ASPECT OF FALCONRY TRAINING, WHERE THE RAPTOR LEARNS TO TRUST THE FALCONER AND FEELS AT EASE IN THEIR PRESENCE. THE FALCONER, PATIENT AND GENTLE, ALLOWS THE BIRD TO APPROACH ON ITS TERMS, CREATING A BOND THAT ENABLES EFFECTIVE COLLABORATION. LEVERAGING THE RAPTOR'S INNATE INSTINCTS, CAREFULLY CRAFTED TRAINING TECHNIQUES UNFOLD TO ESTABLISH A SYMBIOTIC PARTNERSHIP.



## CLIMATE SHIFTS

### RAPTORS FACING THE WINDS

IN AN EVER-EVOLVING WORLD, RESEARCHERS HAVE BEGUN TO INVESTIGATE HOW CLIMATE CHANGE IS RESHAPING RAPTOR PHYSIOLOGY AND THEIR HABITATS, MIGRATION PATTERNS, AND POSING CHALLENGES FOR NESTLINGS. JOIN US IN UNDERSTANDING THE PRESSING ISSUES FACED BY THESE MAJESTIC BIRDS IN THE ERA OF CLIMATE SHIFTS.

#### WINTER FOOD SUPPLY

CLIMATE CHANGE IS RESHAPING THE WEST COAST ECOSYSTEM, IMPACTING THE FOOD SUPPLY FOR WINTERING BALD EAGLES. WARMING TEMPERATURES ACCELERATE SALMON CARCASS DECOMPOSITION, REDUCING THE AVAILABILITY OF A CRUCIAL FOOD SOURCE. ADDITIONALLY, THE ACCELERATION OF SNOW PEAK MELT HAS RISEN WATER LEVELS AND STREAM TURBULENCE. THIS DIMINISHES SALMON CARCASS AVAILABILITY ON STREAM BANKS, CAUSING A NOTABLE DECLINE IN THE FOOD SUPPLY FOR BALD EAGLES.

#### ALTERED MIGRATION TIMES

CLIMATE CHANGE HAS ALTERED THE MIGRATION TIMES OF VARIOUS BIRDS OF PREY, SUCH AS EAGLES AND HAWKS. THE DURATION BETWEEN SPRING AND FALL MIGRATION HAS INCREASED BY UP TO 30 DAYS SINCE THE EARLY 1970'S, RESULTING IN THESE SPECIES SPENDING MORE TIME IN THEIR SUMMER GROUNDS. THIS SHIFT BRINGS CHALLENGES, INCLUDING POTENTIAL EXPOSURE TO ADVERSE WEATHER CONDITIONS IF THEY ARRIVE TOO EARLY IN THE SPRING OR DEPART TOO LATE IN THE FALL. ADDITIONALLY, EARLIER MIGRATION CONTRIBUTES TO PREMATURE BREEDING, EGG LAYING, AND CHICK HATCHING, INCREASING THE RISK OF NEST FAILURE DUE TO FOOD SCARCITY CAUSED BY INCLEMENT WEATHER.

#### CHANGES IN BEHAVIOR

RED-TAILED HAWKS HAVE UNDERGONE ALTERATIONS IN RESPONSE TO CLIMATE CHANGE. A GROWING NUMBER OPT NOT TO MIGRATE OR MIGRATE SHORTER DISTANCES, LEADING TO A SHIFT IN THEIR WINTER RANGE. THIS CHANGE MAY DISTURB ECOLOGICAL BALANCES, IMPACTING PREDATOR-PREY RELATIONSHIPS IN THEIR SUMMER TERRITORIES AND CAUSING PREY OVERPOPULATION IN THEIR TRADITIONAL WINTER TERRITORIES.

#### NESTING VULNERABILITY

INCREASED HEAVY RAINFALL DUE TO CLIMATE CHANGE, POSES A THREAT TO RAPTOR NESTLINGS. VULNERABLE TO RAIN WHEN THEIR PARENTS ARE HUNTING, NESTLINGS MAY LOSE VITAL INSULATION, BECOMING HYPOTHERMIC AND FACING MORTALITY. AS HEAVY RAINFALL FREQUENCIES RISE, THE SURVIVAL OF THESE BIRDS, HANGS IN THE BALANCE.





## ECO-WATCH

### TAKING FLIGHT FOR RAPTOR CONSERVATION

BECOMING STEWARDS OF THE SKIES REQUIRES COLLECTIVE EFFORT. EXPLORE THE WAYS YOU CAN ACTIVELY PARTICIPATE IN RAPTOR CONSERVATION, FROM RESPONSIBLE WASTE MANAGEMENT TO SUPPORTING ORGANIZATIONS DEDICATED TO SAFEGUARDING THESE MAJESTIC BIRDS. EVERY ACTION TAKEN IS A STEP TOWARD PRESERVING THEIR HABITATS AND ENSURING A HARMONIOUS COEXISTENCE WITH THE NATURAL WORLD.

#### ECO-FRIENDLY DISPOSAL

- PROPER WASTE DISPOSAL IS VITAL FOR RAPTOR CONSERVATION. EVEN BIODEGRADABLE ITEMS, WHEN DISCARDED IMPROPERLY, CAN ATTRACT PREY ANIMALS TO ROADS, LEADING TO COLLISIONS WITH BIRDS OF PREY LIKE RED-TAILED HAWKS AND OWLS. RESPONSIBLE WASTE MANAGEMENT HELPS MAINTAIN A SAFE ENVIRONMENT FOR RAPTORS.

#### NATIVE PLANT ADVOCACY

- URBANIZATION POSES CHALLENGES TO RAPTORS, AND PLANTING NATIVE SPECIES IN GARDENS CAN MAKE A SIGNIFICANT IMPACT. NATIVE PLANTS ATTRACT PREY ANIMALS, REDUCE THE NEED FOR HARMFUL PESTICIDES, AND CONTRIBUTE TO HEALTHIER ECOSYSTEMS. SUPPORTING BIODIVERSITY THROUGH NATIVE PLANTS IS A STEP TOWARD ENSURING RAPTOR HABITATS THRIVE.

#### SUSTAINABLE PEST MANAGEMENT

- TOXIC PESTICIDES AND RODENT TRAPS CAN HARM RAPTORS THROUGH THE FOOD CHAIN, AS INSECTS CONSUME THE POISON, SMALL RAPTORS EAT THE CONTAMINATED INSECTS, AND THE CYCLE CONTINUES. OPTING FOR NON-TOXIC SOLUTIONS ALLOWS RAPTORS TO FULFILL THEIR NATURAL ECOLOGICAL ROLE AS PEST CONTROLLERS, PREVENTING THE UNINTENDED CONSEQUENCES OF HARMFUL CHEMICALS. AVOIDING THE USE OF RAT POISON SUPPORTS THE NATURAL HUNTING SKILLS OF RAPTORS, PROVIDING A SIMPLE AND HUMANE WAY TO MANAGE RODENT POPULATIONS SUSTAINABLY.

#### SAFE AMMO, SAFE RAPTORS

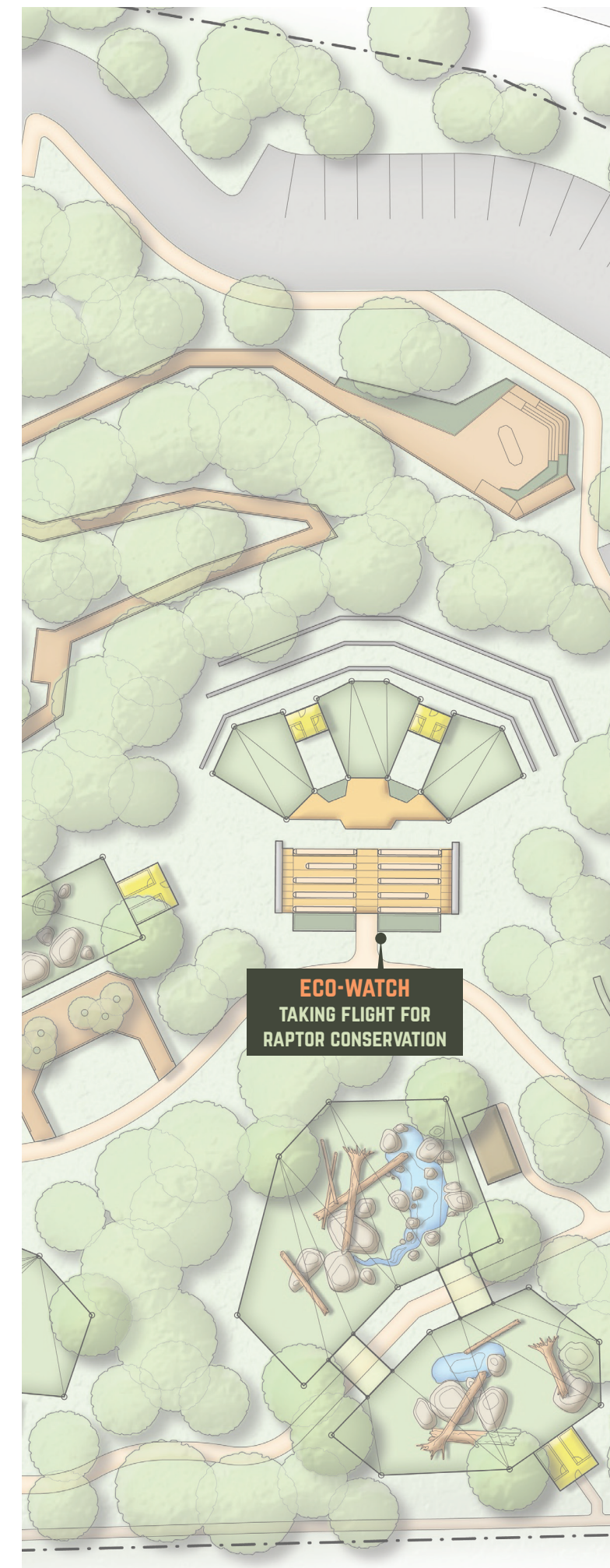
- LEAD, COMMONLY USED IN HUNTING AMMUNITION AND FISHING TACKLE, POSES A THREAT TO RAPTORS. SWITCHING TO COPPER-MADE BULLETS AND TACKLE HELPS SAFEGUARD EAGLES AND OTHER SCAVENGERS FROM LEAD POISONING. RESPONSIBLE CHOICES IN SPORTING GEAR CONTRIBUTE TO THE WELL-BEING OF OUR NATIVE RAPTORS.

#### CARBON FOOTPRINT CONSCIOUSNESS

- MINDFUL DAILY CHOICES CAN SIGNIFICANTLY REDUCE YOUR CARBON FOOTPRINT, BENEFITING NOT ONLY THE ENVIRONMENT BUT ALSO RAPTORS. SIMPLE ACTIONS LIKE USING ENERGY-EFFICIENT APPLIANCES, CARPOOLING, REDUCING SINGLE-USE PLASTICS, AND SUPPORTING RENEWABLE ENERGY INITIATIVES CONTRIBUTE TO A SUSTAINABLE FUTURE FOR BOTH HUMANS AND BIRDS OF PREY. YOUR CONSCIOUS DECISIONS TODAY SHAPE A HEALTHIER TOMORROW FOR THE SKIES WE ALL SHARE.

#### WINGS OF SUPPORT

- SUPPORTING RAPTOR-FOCUSED ORGANIZATIONS THROUGH MEMBERSHIPS, DONATIONS, VOLUNTEERING, AND PARTICIPATION IN EDUCATIONAL PROGRAMS IS CRUCIAL FOR RAPTOR CONSERVATION. THESE ORGANIZATIONS PLAY A PIVOTAL ROLE IN RESEARCH, REHABILITATION, AND AWARENESS, CONTRIBUTING TO THE PROTECTION AND RESTORATION OF BIRDS OF PREY AND THEIR HABITATS.



## SILENT KILLERS

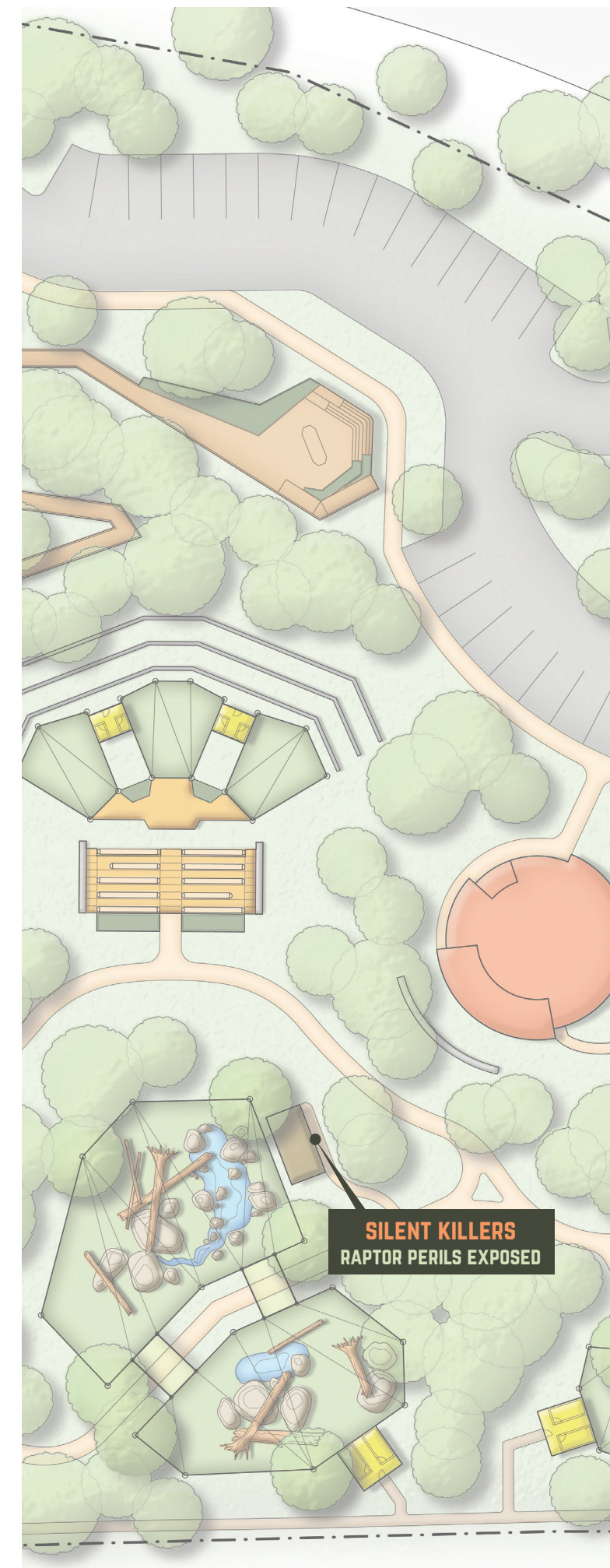
### RAPTOR PERILS EXPOSED

EXPLORE THE HISTORICAL CHALLENGES FACED BY BIRDS OF PREY AS WE UNVEIL THE DETRIMENTAL IMPACT OF CHEMICAL CONTAMINANTS, SUCH AS DDT, AND WITNESS THE REMARKABLE RECOVERY STORIES OF SPECIES LIKE PEREGRINE FALCONS AND BALD EAGLES.

DECADES AGO, THE WIDESPREAD USE OF PESTICIDES, NOTABLY DDT, SENT SHOCKWAVES THROUGH THE AVIAN WORLD. THIN EGGSHELLS IMPERILED PEREGRINE FALCONS AND BALD EAGLES, LEADING TO A STAGGERING POPULATION DECLINE. THE 1940'S AND 1950'S WITNESSED DDT'S INADVERTENT IMPACT, AS FALCONS FED ON CONTAMINATED PREY, ELEVATING DDT CONCENTRATIONS IN THEIR BODIES. THE CONSEQUENCE WAS DEVASTATING—FRAIL EGGSHELLS, NEST FAILURES, AND A 90% DECLINE IN PEREGRINE FALCON POPULATIONS.

DDT IS A CHEMICAL COMPOUND INITIALLY DEVELOPED AS AN INSECTICIDE. ITS TOXICITY AND STABILITY MAKE IT PERSIST IN THE ENVIRONMENT FOR EXTENDED PERIODS, YET IT EASILY DISSOLVES IN FATTY SUBSTANCES, LEADING TO ACCUMULATION IN ANIMAL FAT. BIOACCUMULATION IS THE PROCESS THROUGH WHICH THESE TOXIC SUBSTANCES TRAVEL THROUGH THE FOOD CHAIN, BECOMING HIGHLY CONCENTRATED IN PREDATORS AT THE TOP, POSING A SIGNIFICANT THREAT TO BIRDS OF PREY.

IN THE FACE OF CRISIS, CONSERVATION EFFORTS EMERGED. SCIENTIFIC FINDINGS LED TO A BAN ON DDT, AND CAPTIVE BREEDING PROGRAMS PLAYED A PIVOTAL ROLE IN RESTORING FALCON POPULATIONS. THE REMARKABLE RECOVERY SAW PEREGRINE FALCONS, ONCE ON THE BRINK, NOW FLOURISHING WITH OVER 2,100 INDIVIDUALS ACROSS THEIR RANGE. SIMILARLY, BALD EAGLES FACED A PERILOUS DECLINE, DWINDLING TO 417 NESTING PAIRS BY 1963. YET, DEDICATED CONSERVATION EFFORTS SPURRED THEIR RECOVERY AND RESILIENCY.



## MYTHICAL WINGS

### RAPTORS' SYMBOLIC ASCENSION

LEARN ABOUT THE CULTURAL SIGNIFICANCE OF BIRDS OF PREY ACROSS DIVERSE MYTHOLOGIES, FOLKLORE, AND SYMBOLISM, UNCOVERING THE PROFOUND CONNECTIONS BETWEEN THESE MAGNIFICENT CREATURES AND HUMAN BELIEFS THROUGHOUT HISTORY.

#### SPIRITUAL REPRESENTATION

BIRDS OF PREY HAVE BEEN VENERATED AND RESPECTED IN VARIOUS CULTURES, EACH SPECIES HOLDING UNIQUE SIGNIFICANCE. FOR INSTANCE, SOME TRIBES IN THE SOUTH OF AUSTRALIA BELIEVE THAT EACH MAN IS REPRESENTED BY A BAT AND EACH WOMAN BY AN OWL, HIGHLIGHTING THE MYSTICAL CONNECTION BETWEEN HUMANS AND THESE BIRDS.

#### MYTHOLOGICAL ASSOCIATION

BIRDS OF PREY HOLD SIGNIFICANT REPRESENTATION IN THE MYTHOLOGIES AND FOLKLORE OF DIVERSE CULTURES. IN ANCIENT EGYPT, THE FALCON WAS ASSOCIATED WITH HORUS, THE GOD OF THE SKY, WHILE IN ANCIENT GREECE, THE EAGLE SYMBOLIZED ZEUS, THE KING OF THE GODS. NATIVE AMERICAN CULTURES REVERED THE HAWK FOR ITS ASSOCIATIONS WITH VISION, LEADERSHIP, AND SPIRITUALITY.

#### SYMBOLISM & SYMBOLIC ROLES

HAWKS, IN PARTICULAR, HAVE PLAYED SIGNIFICANT ROLES IN HUMAN SYMBOLISM. LINKED WITH POWER, FREEDOM, AND NOBILITY, HAWKS ARE SEEN AS MESSENGERS BETWEEN HUMANS AND THE SPIRIT WORLD IN NATIVE AMERICAN CULTURES. THE HAWK'S ABILITY TO SOAR HIGH, SWOOP DOWN FOR PREY, AND SEE FROM GREAT DISTANCES SYMBOLIZES FORESIGHT AND VICTORY. IN MANY CULTURES, THE HAWK IS ALSO REGARDED AS A SYMBOL OF FREEDOM AND INDEPENDENCE, REPRESENTING THE ABILITY TO RISE ABOVE LIFE'S CHALLENGES.

#### LITERATURE & MEDIA INFLUENCE

BIRDS OF PREY HAVE CARVED A NOTABLE PRESENCE IN LITERATURE, ART, AND SYMBOLISM, SERVING AS MOTIFS, METAPHORS, OR ALLEGORIES. IN J.R.R. TOLKIEN'S 'THE LORD OF THE RINGS,' EAGLES ALLY WITH THE FORCES OF GOOD, HIGHLIGHTING THEIR MYTHOLOGICAL SIGNIFICANCE. SIMILARLY, IN J.K. ROWLING'S 'HARRY POTTER' SERIES, OWLS PLAY THE ROLE OF MESSENGERS AND COMPANIONS FOR WIZARDS AND WITCHES, EXEMPLIFYING THE ENDURING INSPIRATION THESE BIRDS PROVIDE IN MODERN LITERATURE AND ENTERTAINMENT.



\*\*CUT FOR SPACE: Additional, work-in-progress, signs that were created but removed due to lack of space in the expansion proposal.\*\*

## PERSECUTION SHADOWS

### A RAPTOR'S STRUGGLE

PERSECUTION, ARISING FROM FEAR, HATRED, AND SUPERSTITION, MANIFESTED AS DELIBERATE HARM TO BIRDS OF PREY. FROM THE 16TH TO THE 20TH CENTURY, INCIDENTS OF POISONING AND SHOOTING WERE DRIVEN BY CONCERNS OVER LIVESTOCK ATTACKS AND COMPETITION FOR SMALL GAME. DURING THE HEIGHT OF PERSECUTION BETWEEN 1850 AND 1900, BOUNTIES INCENTIVIZED THE KILLING OF BIRDS OF PREY TO PROTECT DOMESTIC FARM ANIMALS. THIS DISTURBING PRACTICE PERSISTED UNTIL 1960, INVOLVING SHOOTING EAGLES OUT OF THE SKY USING SMALL PLANES AND HELICOPTERS IN THE AMERICAN SOUTHWEST, RESULTING IN THE DEATH OF MORE THAN 2,000 EAGLES.

### SAFEGUARDING RAPTORS

TODAY, COMPREHENSIVE LEGAL PROTECTIONS SAFEGUARD OUR FEATHERED FRIENDS. LAWS SUCH AS THE FEDERAL MIGRATORY BIRD TREATY ACT, THE BALD AND GOLDEN EAGLE PROTECTION ACT, THE LACEY ACT, THE AIRBORNE HUNTING ACT, AND THE CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FLORA AND FAUNA MAKE IT ILLEGAL TO CAPTURE, POISON, KILL, HARM, DISTURB NESTS, TRADE, OR POSSESS RAPTORS. THESE LEGAL MEASURES REFLECT A COMMITMENT TO PRESERVING AND ENSURING THE WELL-BEING OF BIRDS OF PREY FOR GENERATIONS TO COME.

## HABITAT DILEMMA

### RAPTORS' ALTERED REALM

MODERN AGRICULTURAL PRACTICES MAKE THE ENVIRONMENT CONSISTENT, LEADING TO REDUCED PLANT AND HABITAT DIVERSITY. THIS TRANSFORMATION AFFECTS BOTH PREDATORS AND PREY IN ADAPTING TO DIMINISHING TREES AND EXPANDING AGRICULTURAL FIELDS. ALTHOUGH RAPTORS THAT HUNT IN OPEN AREAS HAVE ADAPTED TO THIS CHANGING LANDSCAPE, THEIR COUNTERPARTS DWELLING IN FORESTS FACE GREATER CHALLENGES IN ADJUSTING TO THE TRANSFORMED ENVIRONMENT.

HABITAT FRAGMENTATION HEIGHTENS THE ISSUE, CREATING SMALL, ISOLATED SPACES THAT HINDER FEEDING, NESTING, AND MATE-FINDING. AGRICULTURE, FORESTRY, AND POLLUTION CONTRIBUTE TO ENVIRONMENTAL DEGRADATION, DECREASING PREY POPULATIONS AND INFLUENCING A RAPTOR'S TERRITORY SIZE. SCARCE PREY FORCES RAPTORS TO EXPAND TERRITORIES, INCREASING COMPETITION AND, IN SOME CASES, LEADS TO STARVATION.

HABITAT LOSS, DRIVEN BY HUMAN ACTIVITIES SUCH AS AGRICULTURE, URBANIZATION, LOGGING, AND MINING, STANDS AS A SIGNIFICANT THREAT TO RAPTORS UNABLE TO ADAPT. THE BROADER SPECTRUM OF ENVIRONMENTAL DEGRADATION NOT ONLY DIMINISHES PREY POPULATIONS BUT ALSO RESHAPES THE INTRICATE DYNAMICS OF TERRITORIES, COMPETITION, AND HUMAN INTERFERENCE.

## Presentation Script

### Slide 1 – Title Page

Good afternoon, everyone. Thank you all for being here today. Your presence and support mean the world to me.

### Slide 2 – TOC

Wings of Change has been a labor of love and I'm excited to show you all how I have merged my passion for animal care with the principles of landscape architecture.

So, without further ado, let's get started.

### Slide 3 – NESTING PREPARATIONS

### Slide 4 – About Me

Prior to enrolling in this MLA program, I was formerly a zookeeper, working at a variety of zoos nationwide and forging meaningful relationships with a range of animals from alligators to rhinos.

During my time as a zookeeper, I developed a deep interest in designing enclosures and master planning zoos, drawn to the challenge of recreating ecologically and culturally significant environments within the zoo setting. It was this interest that ultimately drove me to transition from zookeeping to landscape architecture. No longer working with the animals, but for them.

### Slide 5 – Setting the Standard

Before proceeding, let's clarify some terms used throughout this presentation.

Whenever I mention the word “zoo”, I will be referring to AZA-accredited zoos, where I've gained the majority of my 15 years of experience.

AZA is an accreditation organization ensuring high standards in animal care, conservation, and education. Less than 10% of the roughly 2,800 animal exhibitors nationwide are AZA-accredited. While there are other accreditation and federal groups that provide animal wellness standards, I have chosen to focus on AZA due to my familiarity and trust in them.

### Slide 6 – Comparing Missions

Second, lets clarify the difference between zoos and wildlife rehabilitation centers.

Zoos play a vital role in public education and conservation, actively participating in research initiatives to manage threatened populations around the world. Animals are cared for by trained professionals and receive daily enrichment activities for a healthy existence in permanent homes.

Wildlife rehabilitation centers provide critical care for injured or orphaned local wildlife, preparing them for release back into the wild. They focus predominantly on medical treatment and rehabilitation.

Both institutes share a mission of conservation and education, often collaborating with one another to improve biodiversity and safeguard species.

### Slide 7 – Vocabulary

In this presentation, I'll be using certain terms that are relevant to understanding the context of my project. While I won't define each term here, I've done my best to clarify each term within its relevant context.

### Slide 8 – FLEDGLING FOUNDATIONS

### Slide 9 – Cascades Raptor Center

The Cascades Raptor Center, nestled in Spencer Butte Park in south Eugene on Fox Hollow Road, has been a beacon of conservation and education since its founding in 1987. Officially incorporated in 1990 and relocated to its current 8-acre site, the center promotes environmental stewardship and the preservation of the natural world. Serving as Oregon's sole raptor-exclusive wildlife center, it provides vital resources for avian medical treatment and community support, having treated over 7,200 sick and injured raptors since its establishment.

### Slide 10 – Structure & Circulation

Spread across 3.7 acres are the core elements of the nature center, including a wildlife hospital, a gift shop, educational spaces, and enclosures for both residential and rehabilitating raptors. Rehabilitating raptors are kept out of public view to preserve their wild nature.

Visitor parking is minimal, with a small lot located nearest the animal hospital. Overflow parking is available across Fox Hollow Road in the Ridgeline Trail parking lot. Two winding trail systems provide circulation for visitors to view the birds. On the east side of the property are two yurts designated exclusively for administration and staff.

### Slide 11 – Animal Inventory

The raptor center houses a diverse collection of more than 30 residential raptors. Residential raptors refer to the birds that permanently reside at the center. Offering one of the largest North American raptor collections in the Pacific Northwest, each raptor enclosure, often referred to as a 'mew,' is constructed from natural materials and designed to meet the needs of all species. These birds actively participate in weekly training sessions and interact with people in public encounters on and off property.

### Slide 12 – Educational Programs

The raptor center also offers several on-site educational programs to teach visitors about their raptors. Guests can learn about each animal's natural history and personal story through hand-crafted identification plaques. Interactive experiences include an outdoor classroom adjacent to the parking lot, an amphitheater by the gift shop, and spots designated for trainer talks with the birds.

### Slide 13 – Collaboration

In the winter of 2023, Mark Eischeid introduced me to Melissa Green, the Creative Engagement Designer at the Cascades Raptor Center. Our discussions about potential projects led to a meeting with Julie Collins, the Executive Director. Together, we explored the raptor center's plans to expand in the upcoming future.

Julie provided me with an extensive list of all the project items the raptor center is planning to undertake in their expansion. This expansion reflects the center's commitment to enhancing their facilities and their role in wildlife rehabilitation and public education. I selected several primary projects that piqued my interest most. These chosen projects held the potential to not only further bird of prey husbandry but also create engaging programming for future visitors. Additionally, I outlined several secondary projects for potential inclusion, subject to available time and space.

### Slide 14 – Design Boundary

Acquired in 2017 for future expansion, the 4-acre parcel between the primary nature center and administrative yurts, saw expansion plans halted by COVID-19. Despite this setback, this provided an opportunity for me to merge my concepts gained from my experience working in zoos with solutions proposed by local partners.

### Slide 15 – Design Boundary (cont.)

Visiting each office, I gained approval from Dougherty Landscape Architects, PIVOT Architecture, and KPFF Engineers to incorporate their parking lot proposal into my design. After replicating and modifying their parking lot, I officially defined the boundary of my canvas.

### Slide 16 – Evaluation Takeaways

After several visits to the raptor center, I gathered valuable takeaways to help inform the basis of my design intentions, further structuring my project goals.

First, it was important to retain the site's natural character and preserve as much habitat as possible for the local wildlife. Second, to continue building with natural materials, as evident by the raptor mews.

Additionally, I wanted to understand the standards of raptor mews compared to zoo aviaries and how that would influence my proposed designs.

In terms of spatiality, I wanted to rethink circulation that was accessible for all visitors and provided efficient movement for staff. I also wanted to address the spatial organization of raptor enclosures.

And finally, I began considering what kind of interpretive signage would be most effective in this expansion. I also wanted to explore how zoos have reimaged animal shows and how those ideas could be actualized in a new amphitheater.

### Slide 17 – ASCENDING ASPIRATIONS

### Slide 18 – Key Inquiries

My decision to construct new raptor enclosures was primarily driven by my curiosity about the standards used in designing raptor mews, especially when compared to aviaries in zoos.

Approaching this subject, I reflected on the advancements zoos have made in animal representation. For much of history, enclosures lacked references to the animals' natural habitats. Yet, as attitudes began to focus on conservation, animal husbandry, and embracing a biophilic connection to nature, zoos began reflecting highly detailed, representations of their animal's natural habitats. Today, thoughtfully designed enclosures serve as powerful communicators, effectively conveying messages to the public, promoting empathy, and shaping attitudes towards wildlife and nature as a whole.

### Slide 19 – Key Inquires (cont.)

If zoos have come to recognize that well-designed enclosures can effectively communicate the essence of both the animals and their natural habitats, then it was crucial for me to understand the rationale behind raptor mews in rehabilitation centers. Understanding this could inform my exploration of how their design approach could be translated into my enclosure proposals.

### Slide 20 – Raptor Mews

To effectively care for injured raptors brought in to rehabilitation centers, three factors were identified that shape the design and function of mews: understanding raptor natural history, integrating this knowledge into interior furnishings, and incorporating these practices into each stage of the rehabilitation process.

### Slide 21 – Raptor Mews (cont.)

Understanding each species' natural history and habitat requirements is vital for designing mews that meet multispecies needs. Patients rely on the same adaptations in human care as they do in the wild, so reflecting their natural habitats aids in recovering species-specific behaviors.

### Slide 22 – Raptor Mews (cont.)

For security and repeated use, mews should be constructed using weatherproofed natural materials. Furnishings should prioritize the animal's well-being, offering choices for comfort and safety. Raptor foot health is a constant concern, so providing a variety of perching options and substrates is essential to safeguard their delicate footpads.

### Slide 23 – Raptor Mews (cont.)

With an understanding of the design criteria behind constructing raptor mews, next we can see how mews function in the rehabilitation process. Patients progress through three types of mews: holding, behavioral training, and flight conditioning mews. Each of these stages is specifically tailored to support the raptors' recovery and prepare them for their eventual release back into the wild.

In cases where rerelease is not possible, options for long-term care include permanent residency at the rehab center as residential raptors or relocation to other facilities such as zoos.

## Slide 24 – Ongoing Exploration

Upon reflection, it became evident that while there are established housing standards for mews aiding in the recovery of temporary raptors, there became a lack of consistent criteria for permanent, resident raptors. Despite extensive research, I found limited information regarding housing standards for raptors intended to reside permanently in rehab centers.

This prompted a critical question: Why is there a gap in standardized housing for resident raptors? Unlike those relocated to zoos, resident raptors at rehab centers appear to lack enclosures reflecting their natural habitat. While there are well-documented standards for mews designed for rehabilitating raptors, the absence of a shift in housing standards for resident birds requires further investigation. This discussion prompts consideration for developing a new enclosure format for resident raptors, one that continues to prioritize the animal’s wellness while providing educational value.

## Slide 25 – Research Question

In light of these observations, I formulated my research question to explore potential solutions in my design proposal. This question aims to investigate how principles from zoo design can be adapted to the Cascades Raptor Center.

## Slide 26 – Concept Framework

Informed by the selected project goals and design intentions, I developed a conceptual framework centered around enclosure design and education. These two pillars form a symbiotic relationship, where advancements in one area naturally complement the other. Aligning with current zoo design principles, we can create naturalistic living conditions for resident raptors while fostering impactful educational experiences that contribute to a more informed understanding of these animals in human care. The synergy between enclosure design and education is essential for creating an effective strategy that aligns with the goals outlined in CRC’s expansion proposal.

## Slide 27 – SOARING SOLUTIONS

### Slide 28 – Design Development

Transitioning into design development, I received invaluable feedback from a diverse range of experts,

### Slide 29 – Design Development (cont.)

including landscape architects, engineers, and zoo professionals in various roles from both local and national backgrounds.

### Slide 30 – Design Development (cont.)

Engaging with these individuals not only provided practical solutions

### Slide 31 – Design Development (cont.)

but also developed personal connections for future collaboration within the intersecting fields of design and zoology.

### Slide 32 – Design Development (cont.)

Throughout the design process, I remained guided by my project goals and design intentions, aiming to implement optimal solutions while testing and refining concepts.

### Slide 33 – Design Development (cont.)

The objectives included designing enclosures that met the habitat requirements of the selected raptor species.

### Slide 34 – Design Development (cont.)

Additionally, careful consideration was given to visitor circulation, placement of interpretive programs, and minimizing the impact of construction on the existing landscape.

### Slide 35 – Design Development (cont.)

These efforts culminated in a speculative blueprint with expanded attention to animal wellness and visitor experience, while maintaining ecological integrity.

## Slide 36 – Slope Analysis

As you can see, the majority of the expansion occurs on the south side of the site. Slope analysis revealed that building on the hillside would necessitate significant grading, presenting a challenge to maintaining the site’s character. Multiple analyses, limited to a maximum 5% grading, determined that the hilltop offers optimal opportunities for expansion with the least amount of environmental impact.

### Slide 37 – Slope Analysis (cont.)

Instead, the base of the hillside would serve as an entry point for visitors, led by an elevated boardwalk winding through the forest, showcasing its natural beauty. This trail serves a dual purpose by creating and preserving habitats for local wildlife while offering educational opportunities that align with the center’s mission in promoting appreciation for the natural world.

The boardwalk leading to the raptor aviaries gradually reveals glimpses of the birds amidst the forest soundscape, creating a ‘hide and reveal’ experience enhancing visitor anticipation.

## Slide 38 – Site Design Analysis

Following the trend seen in zoos, where enclosures are grouped into thematic zones, I’ve organized the expansion around the phylogeny of raptors. Categorized by accipiters, which are eagles and hawks, falcons, and owls, this framework allows for flexible rotation of raptors within their designated aviaries. Additionally, each group features a secondary holding, serving various functions such as providing nightly quarters and trainer access into the aviaries. Lastly, this framework further improves guest navigation, providing clearer wayfinding to their desired bird encounters.

### Slide 39 – Site Design Analysis (cont.)

Adjacent to most aviaries are secondary trails leading to viewing platforms, offering new viewing experiences for guests. These platforms range from covered shelters to open gathering spaces, each featuring interpretive signage and interactives.

## Slide 40 – Site Design Circulation

In January 2024, Eugene experienced a severe ice storm, impacting the raptor center. While all raptors remained unharmed, swift efforts were made to recover the displaced raptors that lost their mews. The loss of these mews presented an opportunity, in the midst of the design process, to seamlessly attach the existing property to my proposal, without disrupting its current infrastructure.

### Slide 41 – Site Design Circulation (cont.)

I established two types of pathways: one for visitors and the other for staff. Visitor paths offer a more spacious and fluid experience, allowing visitors to explore the area at their own pace. A dedicated path for trainers to and from the secondary holdings, ensures the streamline movement of animal husbandry and maintenance related tasks. Each pathway ensures functionality without impeding on the other.

## Slide 42 – LANDING INSIGHTS

### Slide 43 – Conceptual Framework

Now, let’s dive deeper into the conceptual framework guiding my design decisions. Initially defined as enclosure design and education, these developed into: Integrated Habitat Design and Interpretive Engagement. These concepts represent the cornerstone of my approach to expanding both the raptors’ living conditions and the visitors’ experience. Let’s first begin with integrating habitat design’s part one: habitat planning.

### Slide 44 – Caring Capacity

To determine enclosure sizes, I consulted the Minimum Standards of Wildlife Rehabilitation manual, which categorizes housing guidelines into three activity groups based on bird size and flight styles. I used the Unlimited Activity parameters as the baseline, with the intent to expand further. Given the constraints of limited building space, I chose to focus on raptors with greater spatial requirements instead of maximizing the number of aviaries.

## Slide 45 – Scaling Configuration

Establishing suitable aviary heights involved navigating variations in height recommendations across different organizations. In the end, I selected heights based on a median range derived from these standards and the birds’ natural flight elevations. Taller aviaries were designed for high-flying raptors like eagles and falcons, while those for low-flying species like owls and hawks were kept at slightly lower heights.

### Slide 46 – Species Selection

The decision to organize aviaries by raptor phylogeny serves several purposes. It allows each aviary to be optimized to meet the requirements of that particular group, instead of catering to all species. Trainers can choose to permanently display specific species or rotate them periodically with other species at the center. Lastly, educational signage accompanying each group’s aviary provides comprehensive information, minimizing the need for frequent signage changes if birds rotate.

### Slide 47 – Avian Architecture Intro

Moving into Avian Architecture, the aviary template has seen a variety of forms, evolving throughout the history of zoos. Today, this template can not only house birds, but are often used to display big cats and primates.

When selecting the structure and appearance of the aviaries at CRC, it was important for me to find a precedent that fit within the natural landscape of Spencer’s Butte and would allow me to visit firsthand.

### Slide 48 – Northwest Trek

Northwest Trek Wildlife Park near Eatonville, Washington, spans 723 acres and is overseen by Metro Parks Tacoma. Focused solely on North American wildlife, it features a guided tram tour through a 435-acre free-roam area for ungulate species and a self-guided walking tour, encountering the remainder of their animal collection.

## Slide 49 – Northwest Trek (cont.)

In 2019, Northwest Trek introduced Eagle Passage, a bald eagle aviary mimicking the rainforests of Mount Rainier. Eagle Passage’s outstanding design earned it top honors in the AZA’s National Exhibit Award category in 2021.

### Slide 50 – Baldie Blueprint

I took my aviaries’ inspiration from Northwest Trek’s Eagle Passage for several reasons. Firstly, it resourcefully utilizes living trees, attaching the aviary’s mesh and cables to a unique block-and-collar system, which does not impact the tree’s health, offering a design solution harmonious with nature.

### Slide 51 – Baldie Blueprint (cont.)

Secondly, disguising stability poles with an artificial bark coating increases the immersive appeal while hand-woven, “invisible” mesh netting ensures both viewing clarity and bird security.

### Slide 52 – Baldie Blueprint (cont.)

Lastly, the successful transition of their bald eagles from former raptor rehab centers to Eagle Passage highlights the potential role of my proposed aviaries for CRC’s resident raptors.

### Slide 53 – Site Application

Utilizing Eagle Passage’s blueprint as a guide, I enlarged each aviary based on suitable conifers adjacent to their construction locations, keeping in mind, spatial comfort for the raptors while considering trainer accessibility.

### Slide 54 – Site Application (cont.)

Additional steel posts were disguised with a bark-like coating for immersion and mesh sizing was determined based on raptor size and visitor viewing location. Varied mesh sizes ensure unobstructed viewing for visitors while maintaining security for the birds and structural integrity for the aviaries themselves.

## Slide 55 – Land. Immersion Concept Overview

Finally we arrive to landscape immersion. The earliest example of landscape immersion originated in the early 20th century with Tierpark Hagenbeck Zoo’s innovative enclosure layout. Enclosures replicated habitats native to the animals’ natural environment, and were separated by those in the foreground, creating the illusion that visitors were observing the animals coexisting in a single habitat. This concept later extended into the visitor space, unifying the simulated habitat, and thus defining what is landscape immersion.

## Slide 56 – Land. Immersion Concept Overview (cont.)

This practice not only prioritizes animal wellness by recreating their natural environments but can also elicit emotional responses that lead to improved cognitive outcomes. To further align with this concept, I used living and reclaimed trees from the expansion as the primary construction material for built structures, extending the immersive aesthetic.

## Slide 57 – Guiding Principles

I curated my own set of guidelines, taken from landscape immersion principles, to shape decisions for both animal and human spaces. My goal was to create impactful first impressions connecting visitors to the authentic ambiance of the raptors’ habitats in Spencer Butte’s mixed hardwood forest.

## Slide 58 – Guiding Principles (cont.)

First, selecting a habitat model serves as the foundation for replicating features from the ideal landscape within the enclosure. This approach ensures that the simulated habitat is respectfully represented while meeting the animal’s husbandry requirements.

## Slide 59 – Guiding Principles (cont.)

Second, to create a seamless transition between the human and animal spaces, the habitat blends continuously on all sides of the aviary, making the visitor space an extension of the animals’ home, alluding to the shared environment sensation.

## Slide 60 – Guiding Principles (cont.)

Additionally, the site layout was also guided by other principles to improve both visitor and animal experiences. Cross-viewing is reduced to prevent the animals from feeling surrounded by people.

## Slide 61 – Guiding Principles (cont.)

Viewing platforms are located along secondary pathways and situated at eye-level with aviaries.

## Slide 62 – Guiding Principles (cont.)

Lastly, using the “borrowed landscapes” concept, viewing structures are placed so that visitors can spot other raptors in the backdrop, creating an experience true to nature.

## Slide 63 – Guiding Principles (cont.)

Utilizing both reclaimed and living trees in the architectural framework, each viewing structure seamlessly blends human and animal spaces, by extending the visual boundaries of the aviary and merging with the backdrop to form, what appears as, a cohesive forest.

## Slide 64 – Flexible Innovations

To push the concept of landscape immersion further, zoos have begun designing flex enclosures. Short for flexible, flex enclosures assist in the controlled animal movement between enclosures via a chute network, operated through animal training. While these enclosures are common for mammals, my proposal explores their application for free-flight raptors.

## Slide 65 – Flexible Innovations (cont.)

Flex enclosures promote physical exercise, alleviate boredom, and expand the visitor experience by showcasing more active animals exhibiting behaviors similarly seen in migration, hunting, or territorial exploration. While no enclosure can fully replicate the space and environmental complexity animals experience in the wild, this managed “time share” concept aims to increase both within the limitations of the site.

## Slide 66 – Flexible Innovations (cont.)

As visitors approach these flex enclosures, they’ll encounter these wooden sculptures mimicking the character of various forest typologies in the Pacific Northwest. Securely fastened to the chute bridges, these sculptures serve as both visual barriers for the raptors and points of fascination for visitors.

## Slide 67 – Flexible Innovations (cont.)

As visitors move between each habitat, they experience the feeling of walking through a forested holloway. The brachiating beams of each chute bridge, create the impression of looking into the tree canopy. These designs not only enrich the visitor experience but also highlight the significant role trees play in supporting biodiversity.

## Slide 68 – Interp. Engagement

And finally, we arrive to interpretive engagement. Interpretive programs are designed to generate connections with wildlife by going beyond facts, instilling deeper meanings to potentially shape visitor attitudes. At the raptor center, interpretive programming will be vital for educating and engaging visitors.

## Slide 69 – Interp. Engagement (cont.)

This engagement focuses on two core components:

First, static interpretation, including signage, offers foundational knowledge about birds of prey through compelling visuals that elicit passive responses to the immediate experience.

## Slide 70 – Interp. Engagement (cont.)

Second, dynamic interpretation featuring raptor shows, offers educative entertainment, creating emotionally engaging experiences that leave lasting impressions on visitors.

## Slide 71 – Interp. Engagement (cont.)

Combining both static and dynamic interpretive programs enables the raptor center to offer diverse educational experiences tailored to various learning styles. These initiatives aim to deepen visitors’ appreciation for raptors; advocating for raptor conservation and environmental stewardship.

## Slide 72 – Static Interpretation

A series of interpretive displays have been installed along the visitors’ pathway. Titled “Realm of the Raptors”, these static interpretive signs evoke consideration about a variety of issues related to raptors, ranging from environmental impacts to their ecological and cultural significance. The goal is to instill an emotional response that lingers during their visit. These signs elevate the overall guest experience, providing meaningful takeaways that supplement their visit.

## Slide 73 – Dynamic Interpretation

Historically, zoos have incorporated animal shows to offer visitors up-close interactions. Typically, these shows involve moving animals out of their enclosures or keeping a separate collection solely for show purposes. Recently, the emergence of habitat theaters have begun to gain traction, serving as the intersection between animal enclosures and amphitheaters. The inspiration behind habitat theaters stems from the idea that observing animals behaving naturally in their simulated environment can be a form of entertainment in itself.

## Slide 74 – Dynamic Interpretation (cont.)

My proposal, the Cascadia Habitat Theater, looks to integrate the traditional bird show format with the habitat theater concept. Graded into the existing landscape, this theater seats up to 100 visitors providing a panoramic view of the Spencer Butte Forest. To further capture that feeling of place in the landscape, the aviary habitats appear to emerge into the staging area, creating a unified experience for the visitors. Secondary holdings, linking each aviary, allow trainers to rotate different raptors based on show themes. Beyond its role as a venue for raptor shows, the Cascadia Habitat Theater serves as a secondary outdoor classroom, expanding the educational offerings of the raptor center.

## Slide 75 – Dynamic Interpretation (cont.)

Through dynamic interpretation, the habitat theater engages, inspires, and motivates audiences, demonstrating the power of entertainment as a vehicle for education. As a dynamic platform for educating all age groups, the Cascadia Habitat Theater utilizes raptor encounters to encourage environmental action in the Pacific Northwest.

## Slide 76 – PERCHED REFLECTIONS

### Slide 77 – Goals Revisited

As we come to the end, let’s briefly revisit how my design solutions align with the initial goals.

Initially, my focus was evenly split between enclosure design and education, with the environment as the core link. However, as the project evolved, my attention and interest began to shift more towards enclosure design. Despite this shift, my designs remained committed to creating enriching experiences that offer educational value, all while respecting and enhancing the natural environment on the site. Through these initiatives, I’ve aimed to create a deeper connection between humans and nature, ultimately contributing to the mission of the Cascades Raptor Center.

### Slide 78 – Next Steps

While this proposal addresses the goals that resonate most with my interests, it represents merely the first phase of the raptor center’s ambitious expansion plans.

In future phases, CRC could explore ways to integrate their remaining project goals into the existing, now vacant, conditions of the site.

Numerous opportunities remain for creative solutions including future collaborations. I encourage the students entering their final year to take on these projects, offering your own innovative ideas towards CRC’s eventual expansion.

### Slide 79 – Future Opportunities

Before we conclude, I’d like to touch upon other zoo design strategies that were not addressed in this project. If I had more time, I would have liked to have explored the following:

### Slide 80 – Future Opportunities (cont.)

Artificial rockwork allows zoos to go even further to recreate accurate displays of animals’ natural habitats. These hand-crafted works of art not only expand the possibilities of enclosure design but also greatly enhance that feeling of being transported to the animal’s natural environment.

## Slide 81 – Future Opportunities (cont.)

Cultural landscape immersion integrates cultural elements into both animal and human environments, providing valuable opportunities for multicultural education. By authentically capturing the essence of a real location and exploring engaging themes, stronger connections can be forged with audiences.

## Slide 82 – Future Opportunities (cont.)

Simply put, I was hoping to take this project as an opportunity to do more hand drawn renders. Renders such as these onscreen, are part of what inspired me to enter landscape architecture and are still the preferred approach for visualizing animal habitats in zoo LA firms.

Though these elements remained unexplored in this project, I’m excited to dive deeper into these and refine the skills gained during my master’s project as I begin my new career with Studio Hanson Roberts this summer!

## Slide 83 – Zoo Design Niche

Studio Hanson Roberts is a landscape architecture firm specializing in designing zoos and aquariums, with projects spanning across the globe. Their work is driven by a passion for engaging people with the natural world and fostering a thriving coexistence with wildlife.

## Slide 84 – Zoo Design Niche (cont.)

For everyone here, I encourage you all to explore the incredible work zoo design firms are doing. They play a crucial role in shaping modern zoos and aquariums, improving visitor perceptions, and promoting conservation efforts. There’s so much more I wish I could talk about related to zoo design that I unfortunately do not have the time to disclose, but I believe everyone will find the zoo & aquarium design niche to be creatively engaging and impactful, not only for the animals, but the generations of people who will experience your work.

## Slide 85 – Acknowledgements

And speaking of work, I would like to acknowledge the incredible support and guidance I received throughout my work on this project.

(Acknowledging support was spoken spontaneously)

#### **Slide 86 – Closing Remarks**

On a personal note, this project has been more than just an academic endeavor for me. It has been a transformative journey. As a kid, I spent hours playing a computer game called Zoo Tycoon and always dreamt of building zoos when I grew up. When I couldn't see a path to designing zoos, I chose the next best thing, becoming a zookeeper.

To be here now, merging my passion for animals with my enthusiasm for design, is truly a dream come true. The relationships I've built with animals and now the opportunity to design spaces that enrich their lives means so much to me. This project, and my time in school, have been pivotal in making this dream a reality and I am deeply grateful for the support I've received and the friendships I've made.

Thank you all for being here today and for sharing in this journey with me.

#### **Slide 87 – Works Cited**

**Total Runtime: 30-33 minutes**

