



Revitalize Beaver Otter Raven Habitat

NCPC Preliminary and Final Submission

01 May 2026

OPDC Project # 2433103
QE Project # 52404680



SMITHSONIAN'S NATIONAL ZOO
& CONSERVATION BIOLOGY INSTITUTE

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EVANS

Project Introduction

Project Name:

Revitalize Beaver Otter Raven Habitat

Location:

Smithsonian Institution

National Zoo and Conservation Biology Institute (NZCBI)

Rock Creek Campus, Washington, DC

Agency and Contact:

Smithsonian Institution

Office of Planning, Design, and Construction (OPDC)

Capital Gallery

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Table of Contents

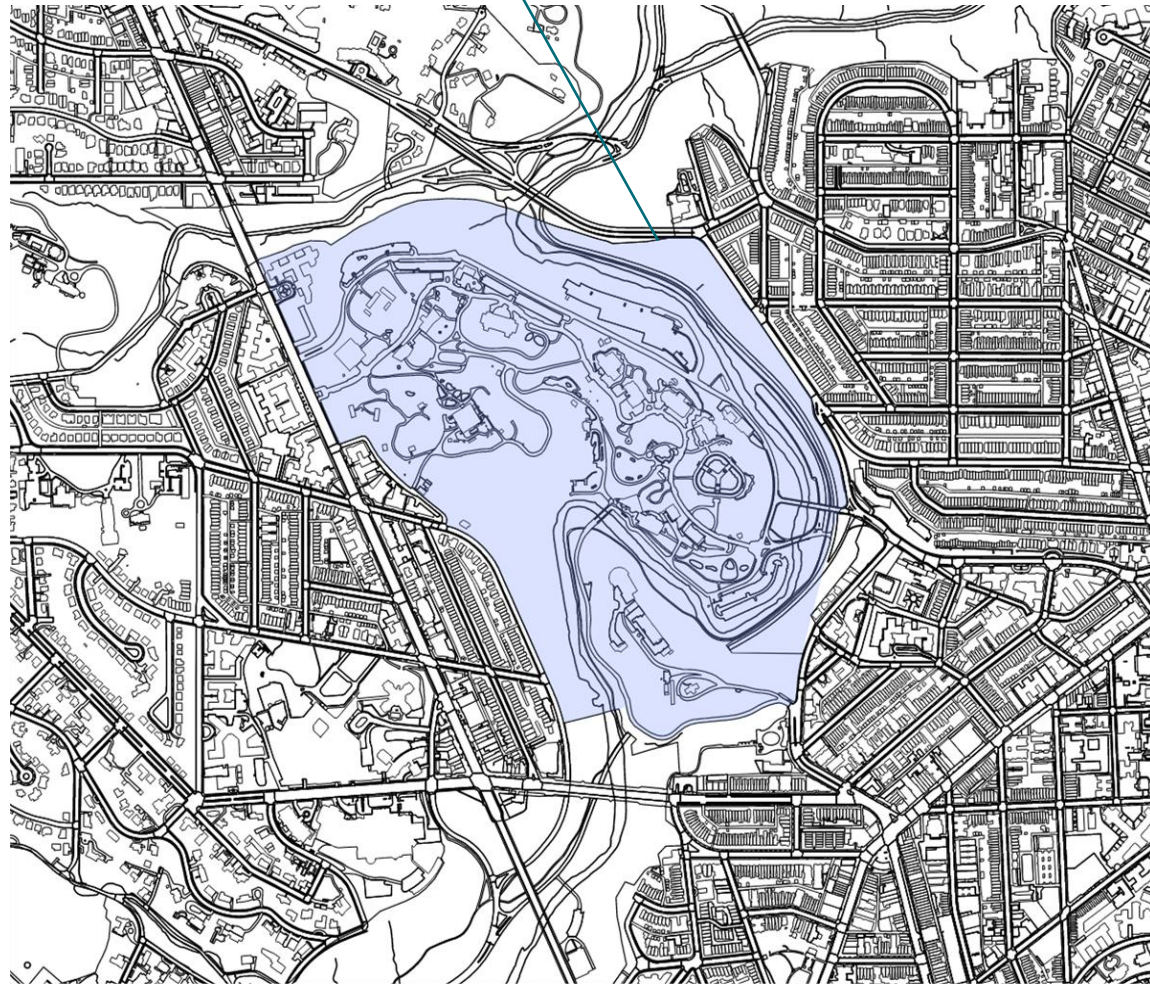
Introduction / Project Report	4	American Trail: Existing Material Palette	40
Project Location	5	Proposed Material Palette	41
Project Scope	6	Wall Cladding Detail	42
Goals and Requirements	7	Fiber Cement Color Samples	43
Project Summary	8	Otter Underwater Viewing Canopy Preferred Approach	44 45
Existing Conditions	10	Proposed Habitat Design	46
Existing Site Plan	11	Demolition Site Plan	47
Site Images	12	Site Plan: Habitat Improvements	48
Failing Faux Rock Examples	22	Habitat Improvements: Otter	49
Faux Rock Demolition Plan	23	Habitat Improvements: Beaver	50
Demolition Building Plans	24		
Existing Site Circulation and Habitat Viewing	27	Additional Site Information	51
Proposed Site Design	28	Grading Plan	52
Initial Grading and Circulation Studies	29	Existing Trees	53
Site Circulation	30	Existing Tree Removal	55
Existing vs Proposed Habitat Viewing	31	Existing Tree Impact Plan	56
Site Plan	33	Tree Inventory	57
Railings	34	Planting Plan	58
		Plant Schedule	60
Proposed Building Design	35	Planting Palette	61
Existing LSS Building	36	Stormwater Management	64
Initial Studies	37		

Introduction/Project Report

Project Location	5
Project Scope	6
Goals and Requirements	7
Project Summary	8

Project Location

NATIONAL ZOOLOGICAL
PARK AND CONSERVATION
BIOLOGY INSTITUTE



VICINITY MAP

NOT TO SCALE

NORTH ROAD
(VEHICLE
ENTRANCE)

OLMSTED
WALK
(PEDESTRIAN
ENTRANCE)

ELEPHANT
OUTPOST

PROJECT
LOCATION



CONTEXT MAP

Project Scope

Built in the 1970s, the Beaver, Otter, and Raven exhibits at the National Zoo are showing signs of aging, with deteriorating faux-rock structures posing safety risks for animals, keepers, and visitors. These exhibits are located on the American Trail, a separate pedestrian and exhibit path visible from Olmsted Walk. These thin concrete shells are cracking and cannot support weight in many areas.

The project consists of a comprehensive renovation including the complete removal of existing faux-rock (rockwork) from the site, architectural re-cladding of the existing Life Support Systems (LSS) and Raven holding buildings, replacement of the life support system (LSS) equipment which has reached its operational life expectancy, revitalization of the Otter and Beaver habitats including complete replacement of the leaking pools, regrading the south path along American Trail to provide accessible visitor walkways, and introduction of new visitor barrier/animal containment site walls with code compliant railings where the existing faux-rock has been removed.

The site work will be executed during a single period of construction to reduce disruptions for both animals and visitors.



Existing faux rock and site wall along Beaver habitat visitor path.

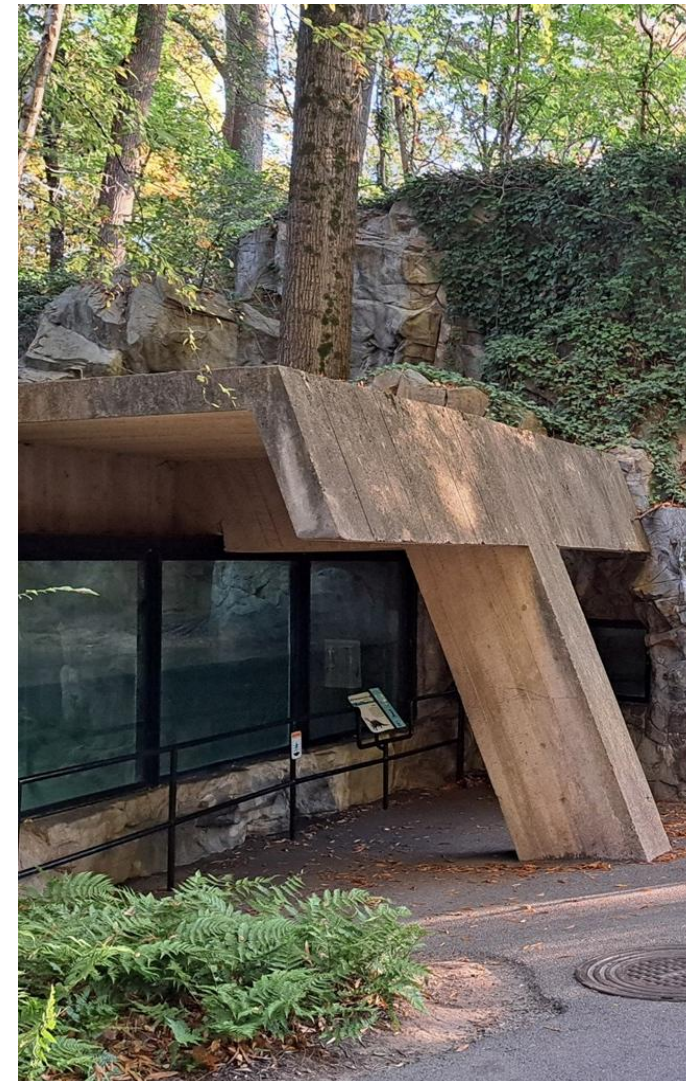
Goals and Requirements

GOALS

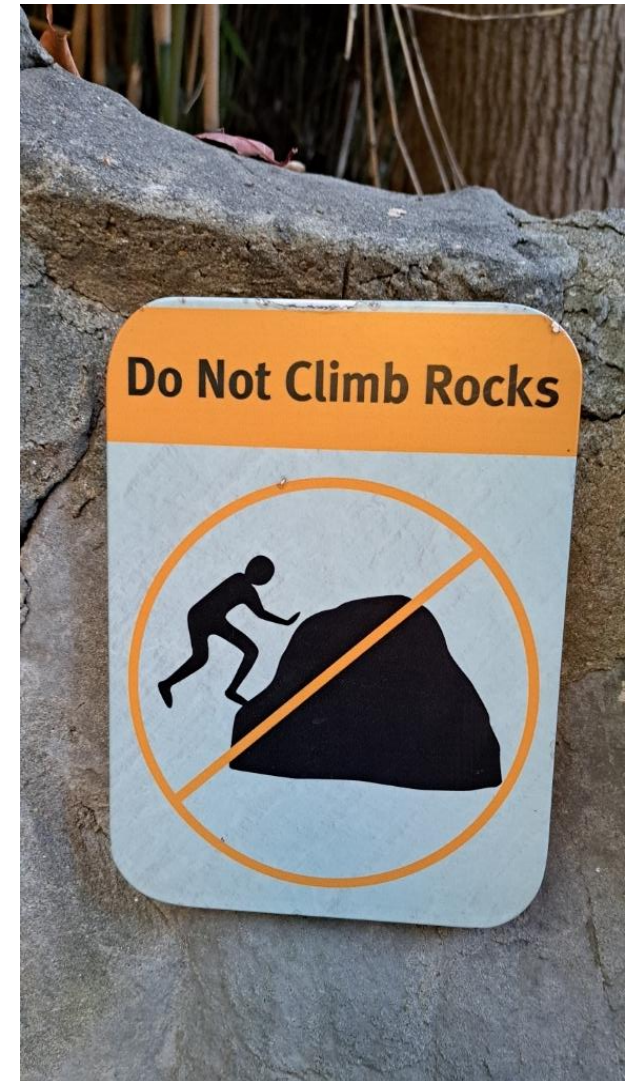
- Improve **caretaker safety** and accessibility through exhibit design improvements.
- Improve **habitats for animals** – informed by Association of Zoos & Aquariums (AZA) standards.
- Improve habitat **viewing experience** for guests.
- Improve existing pathway **accessibility** for guests.

REQUIREMENTS

- Remove and replace all existing rockwork.
- Update metal guardrails and handrails to be code-compliant.
- Stop water-loss through leaks in animal exhibits.
- Replace LSS equipment to provide adequate support for habitat features.
- Clad exposed LSS and Raven buildings to thoughtfully integrate with existing surroundings.



Existing Otter viewing canopy and faux rockwork.



Project Summary

PROJECT COST FUNDING AND SCHEDULE

The project has an estimated construction cost of \$5 million. It will be funded over fiscal years FY2026 and FY2027, with federal and trust funds.

ASSIGNED EMPLOYMENT

Not applicable to this project. The project does not have employees assigned.

TRANSPORTATION MANAGEMENT PROGRAM

Not applicable to this project because the assigned employees are below 500.

MASTER PLAN ALIGNMENT AND ENVIRONMENTAL DOCUMENTATION

This project conforms with the 2008 Master Plan for the National Zoo. In accordance with the National Environmental Policy Act, an Environmental Assessment was prepared for the 2008 Master Plan with a Finding of No Significant Impact. This project concerns modifications to an existing built animal habitat, with no anticipated effects on natural resources.

HISTORIC PRESERVATION DOCUMENTATION

The National Zoological Park Historic District was listed in the DC Inventory of Historic Sites in 1964 and the National Register of Historic Places in 1973.

Originally built as the Beaver Valley exhibit in 1979, the Beaver Otter Raven Habitat is a non-contributing to the National Zoological Park Historic District. A determination of No Adverse Effect on historic resources was submitted to the DC State Historic Preservation Office in April 2026.

The habitat is accessed via American Trail (renovated in 2012), it is not in close proximity to Olmsted Walk and the proposed project will not affect the Walk. There are no contributing buildings, character defining structures or landscape features within or immediately adjacent to the project site. The improvements are contained within the existing exhibit footprint, and there are no known archaeological deposits in the vicinity.

The primary views and experience of the Habitat are from the American Trail. These views will remain unchanged. The removal of the rockwork and replacement with building cladding and fencing maintain the existing setting of the American Trail area.

Project Summary (continued)

STORMWATER MANAGEMENT

The site will undergo improvements to the animal habitats and to the surrounding areas and walkways, with an estimated land disturbance of approximately 15,000 square feet. As such, the project qualifies as major land disturbing activity per the Department of Energy and Environment (DOEE) regulations. To comply, the design incorporates on-site best management practices (BMPs) to achieve the required stormwater retention volume based on a rainfall depth of 1.2 inches (the 90th percentile event).

As part of the coordination process, a Pre-Development Review Meeting (PDRM) was held with DOEE on March 5th, 2026. The site's compacted conditions, steep slopes, and dense tree coverage present notable design challenges. Proposed strategies to address detention and retention requirements include a standard bioretention, two green roof facilities, and tree preservation. Collectively, these traditional approaches achieve approximately 77% of the required stormwater retention volume (SWRv).

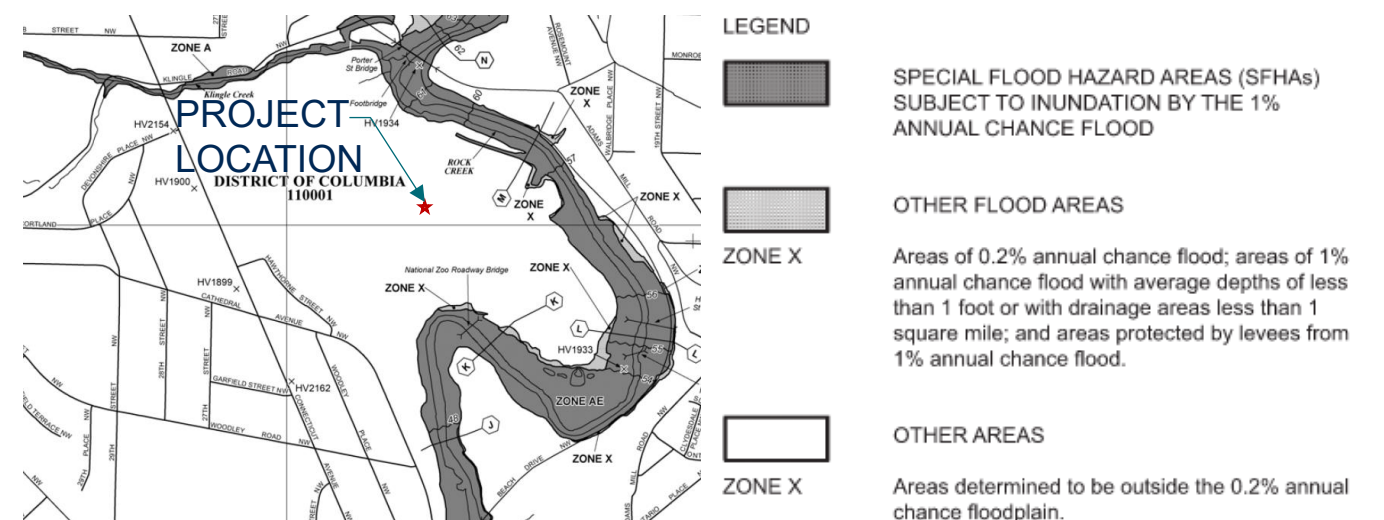
To address the remaining requirements, the design team along with SI presented an alternative approach utilizing the animal habitat pool water treatment system. All pools at NZCBI are subject to intensive treatment and filtration through a LSS system to ensure animal safety and compliance with USDA and AZA standards. These systems operate continuously, with water—including stormwater—being recirculated 24/7.

DOEE indicated that this filtration process is analogous to a rainwater harvesting system, noting that similar approaches have been approved in past projects. Accordingly, the design team will further develop this strategy by modeling the LSS system as a rainwater harvesting tank for SWRv credit providing supporting documentation to DOEE. SI will continue to coordinate with DOEE. Additional details on this approach are provided in the “Additional Site Information” portion of this report.

FLOOD PLAINS MANAGEMENT AND WETLANDS PROTECTION

No Impact on Floodplain or Wetlands

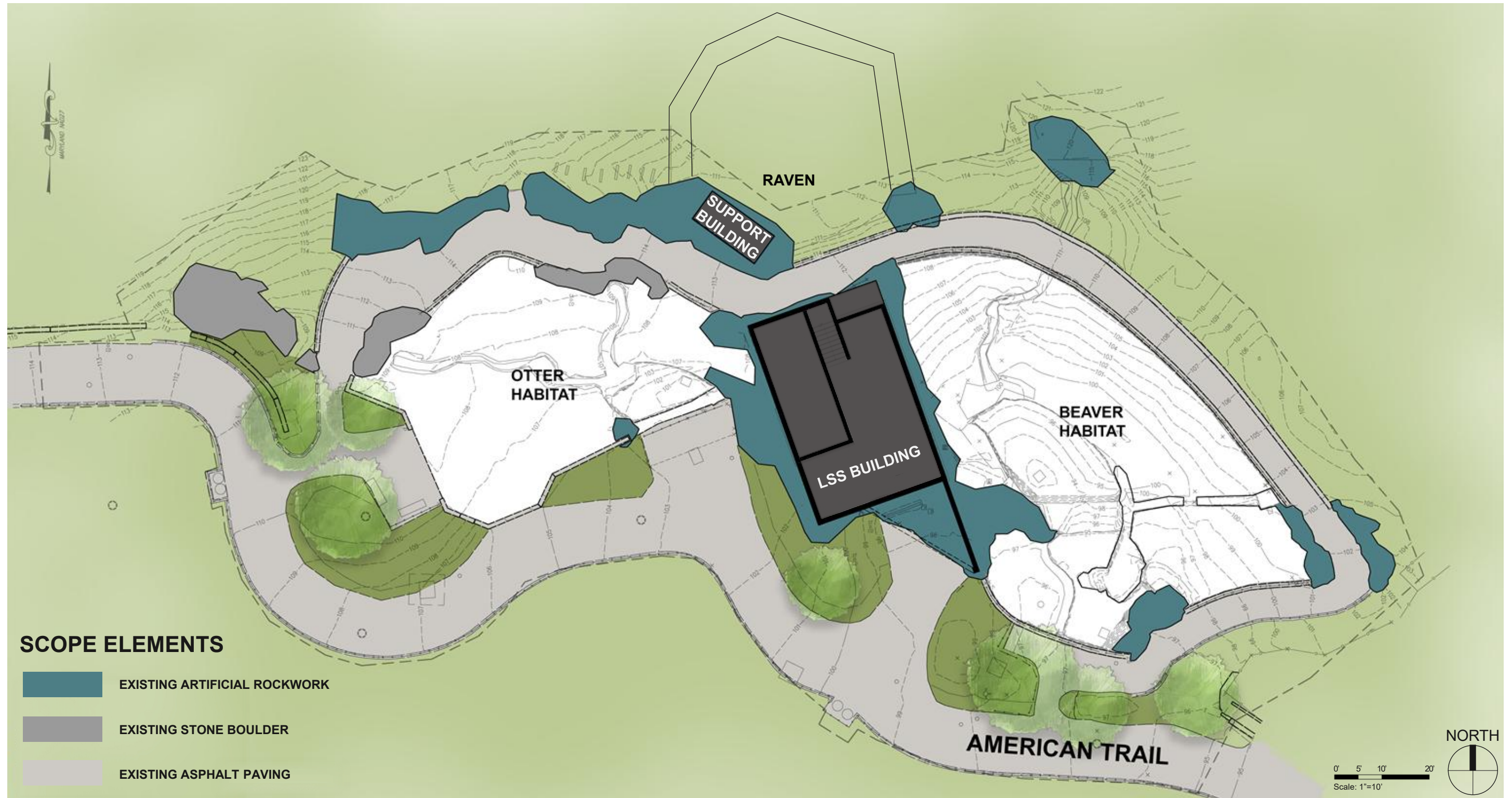
Per FEMA's District of Columbia's Flood Insurance Rate Map (FIRM) panel 1100010016C (effective 9/27/2010), the project area is within Zone X, an area of minimal flood hazard. The project does not impact a wetlands area.



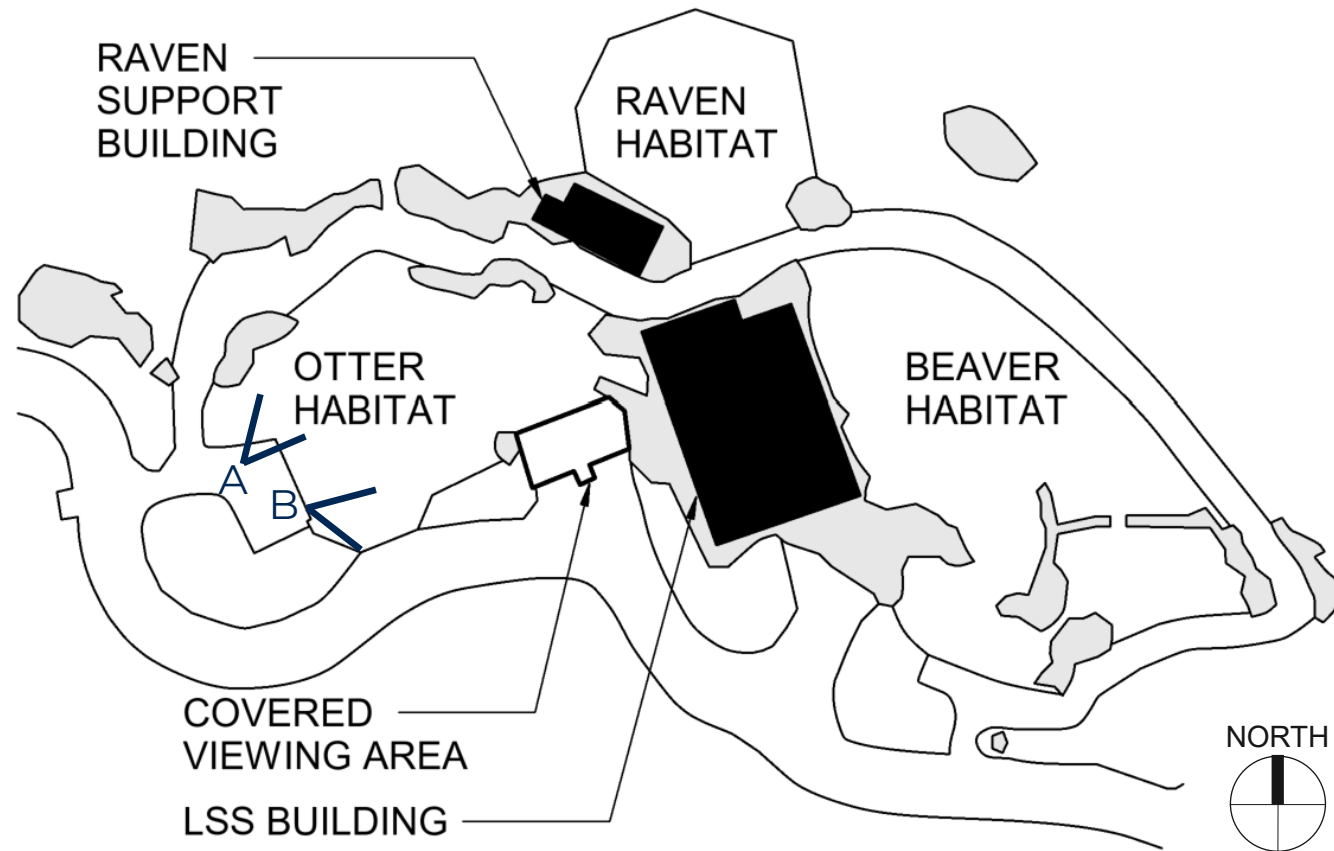
Existing Conditions

Existing Site Plan	11
Site Images	12
Failing Faux Rock Examples	22
Faux Rock Demolition Plan	23
Demolition Building Plans	24
Existing Site Circulation and Habitat Viewing	27

Existing Site Plan



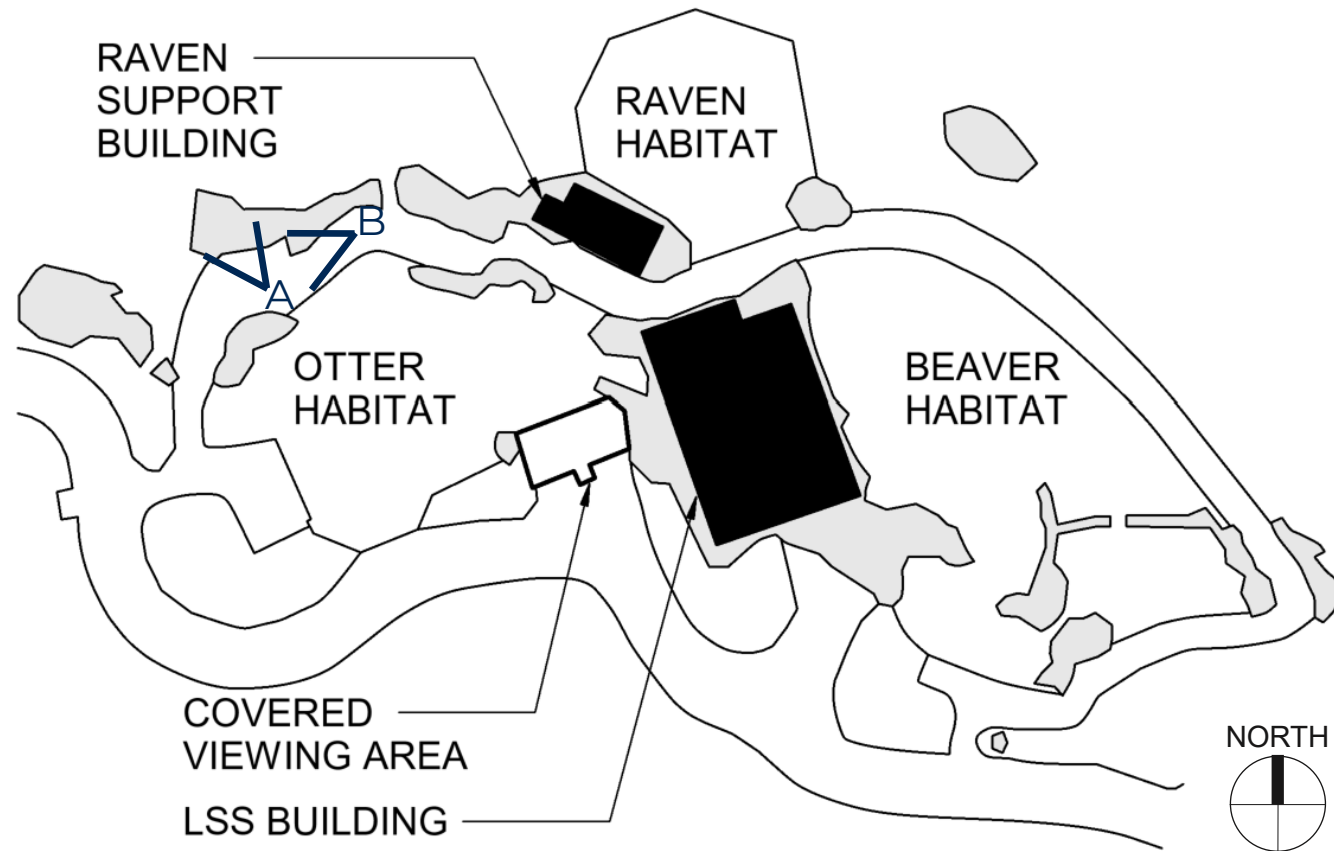
Site Images (1 of 10)



The following series of images follows the visitor experience from the northern entrance to this exhibit tracking clockwise around the site ending at the Otter underwater covered viewing location.



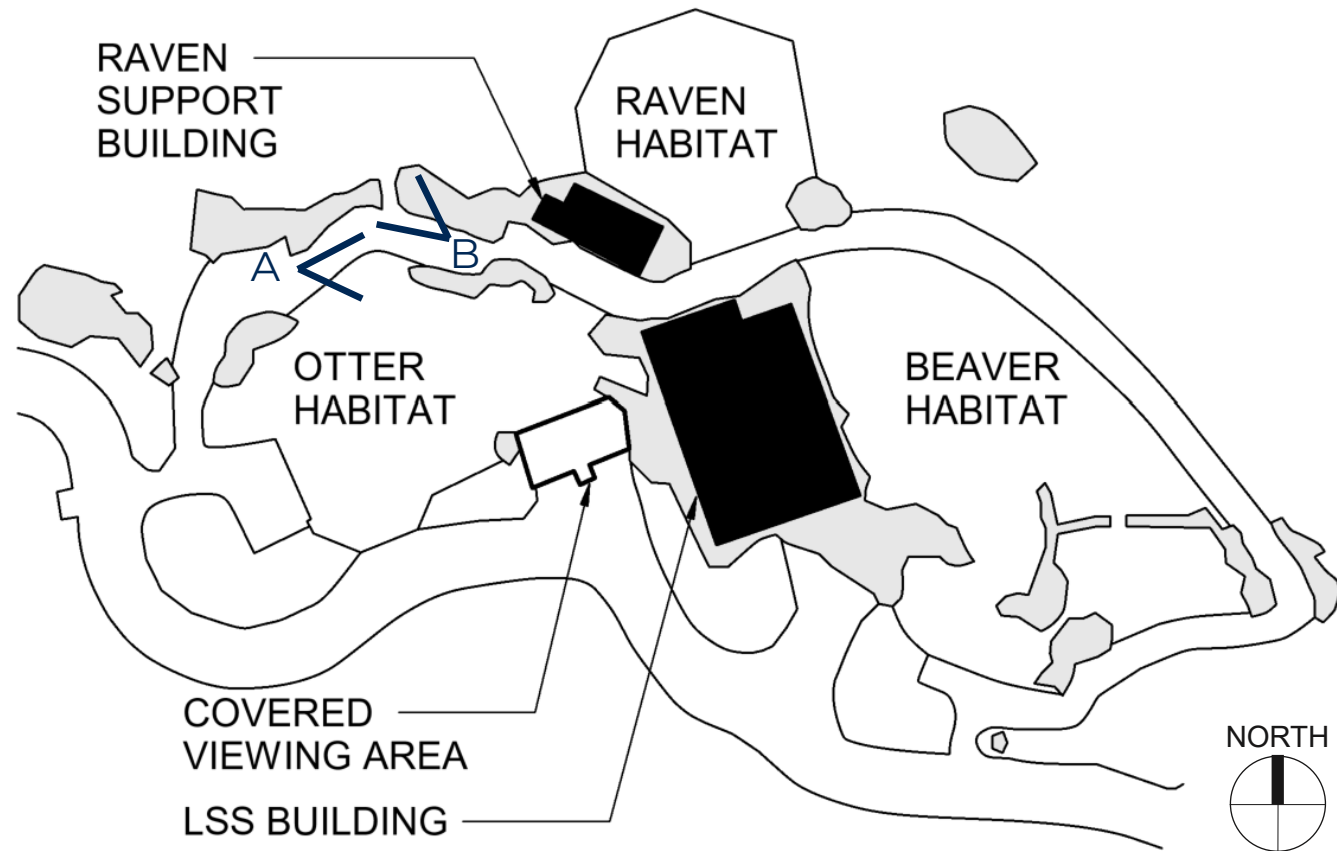
Site Images (2 of 10)



American Trail: Views from the upper trail



Site Images (3 of 10)



American Trail: Views from the upper trail

NATURAL CARDEROCK BOULDERS



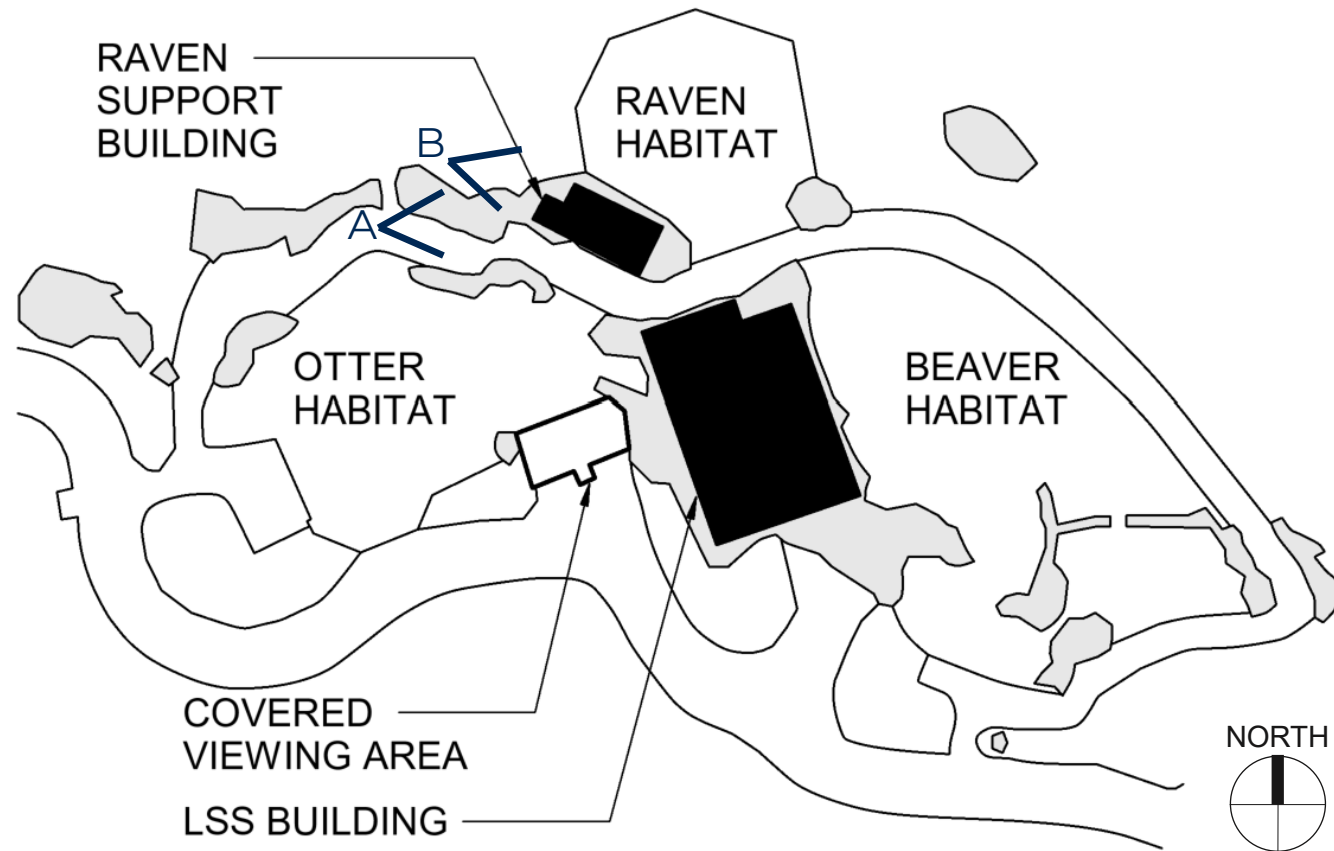
A



B

ARTIFICIAL ROCKWORK

Site Images (4 of 10)

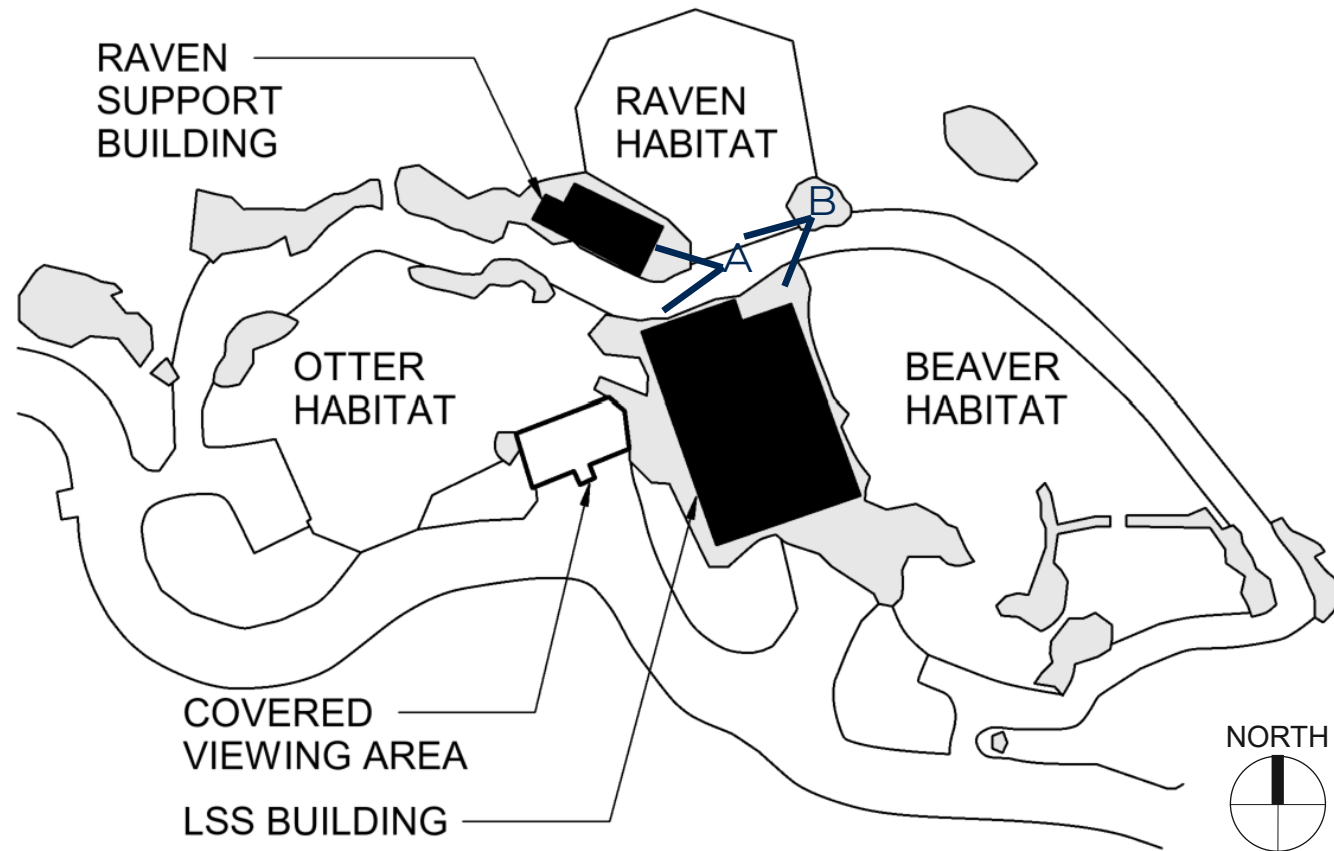


American Trail: Views from the upper trail



RAVEN BUILDING ENCASED IN ARTIFICIAL ROCKWORK

Site Images (5 of 10)

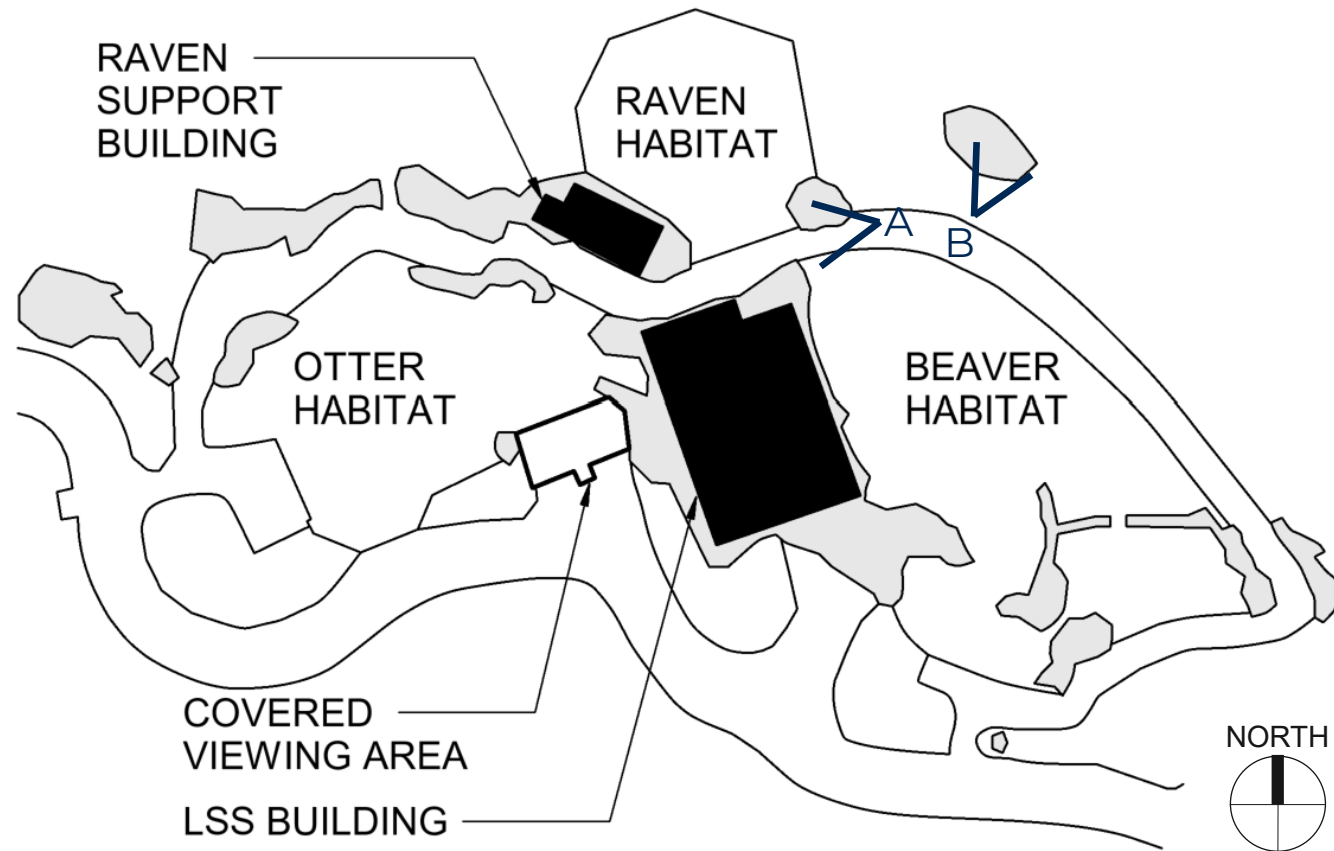


American Trail: Views from the upper trail

RAVEN BUILDING



Site Images (6 of 10)

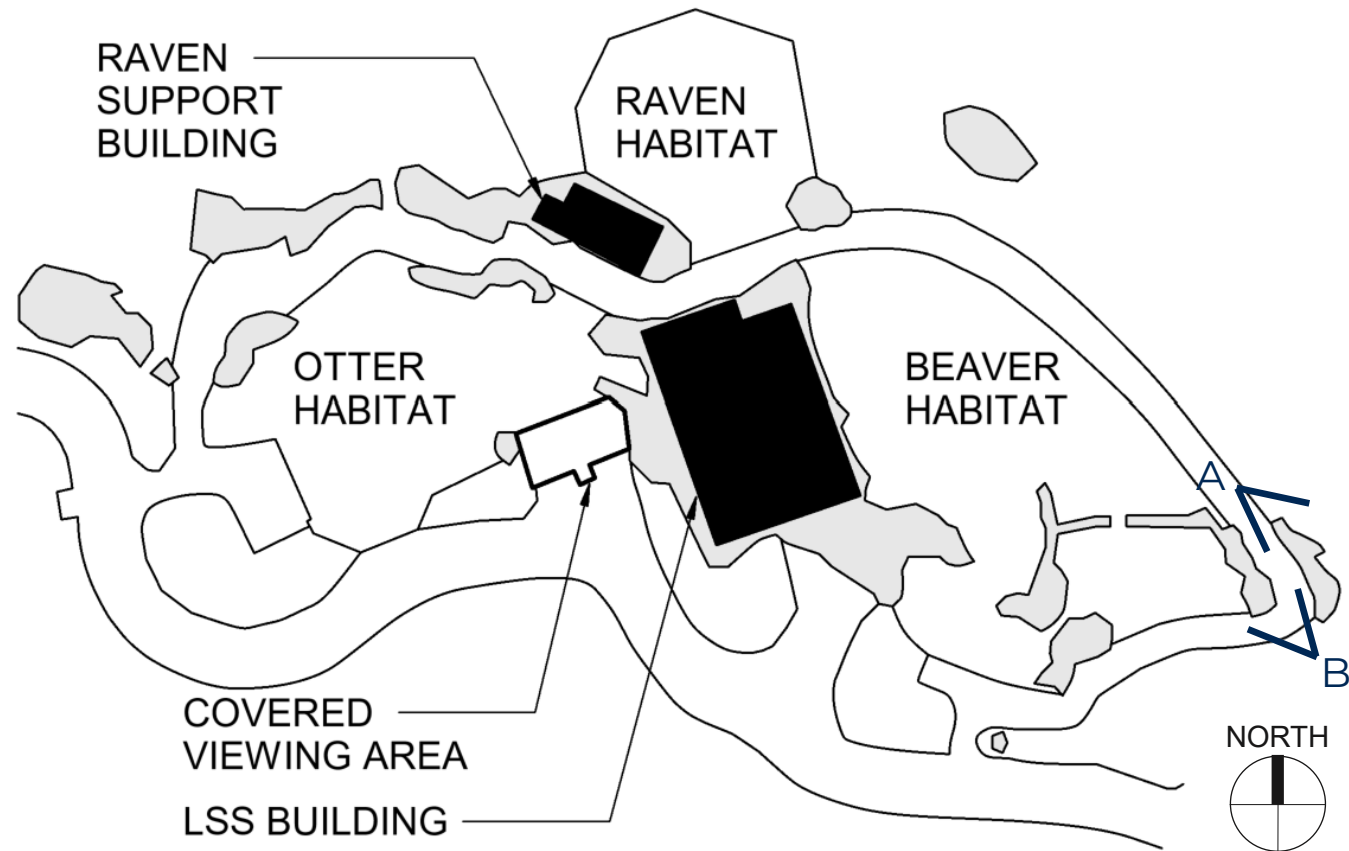


American Trail: Views from the upper trail

RAVEN HABITAT ENCLOSURE



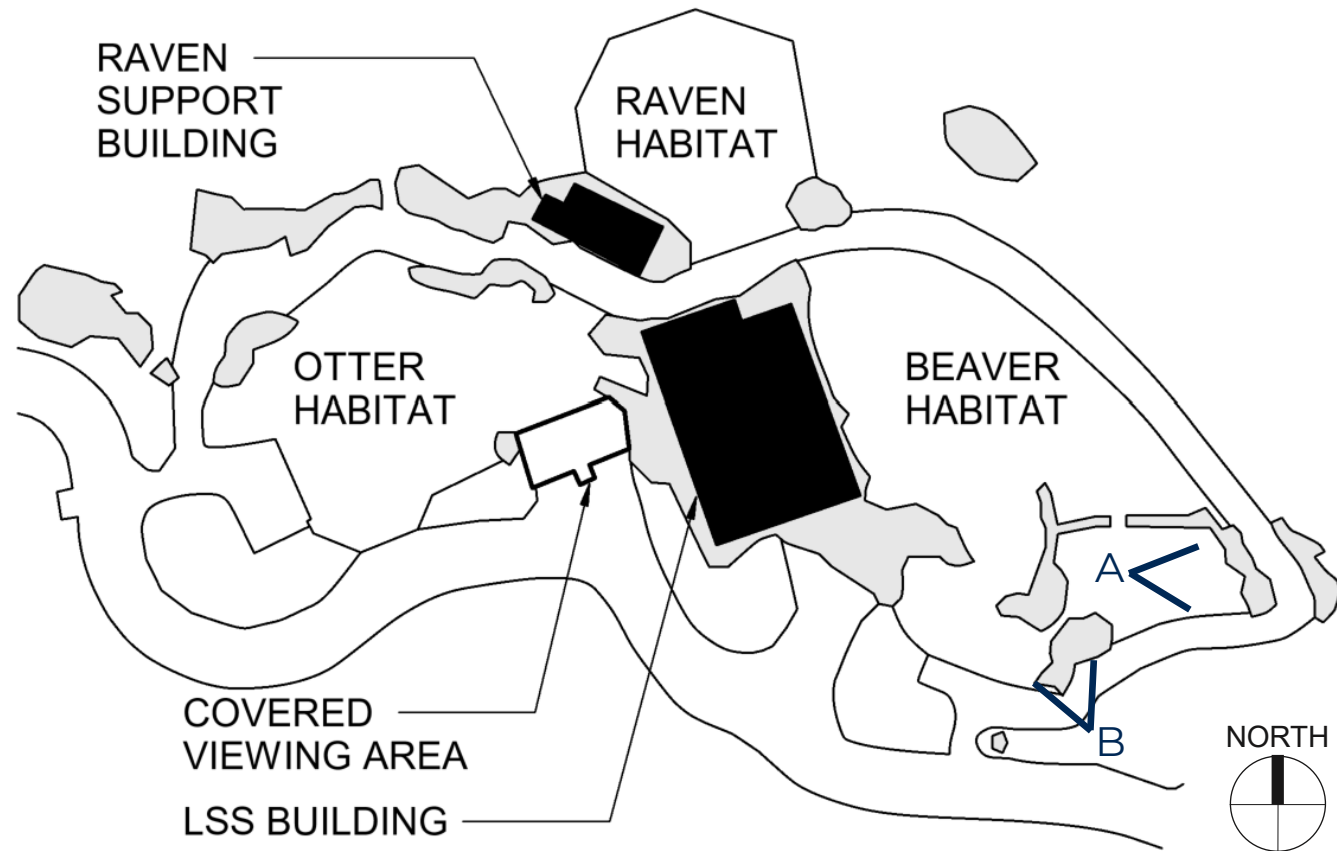
Site Images (7 of 10)



American Trail: Views from the upper trail



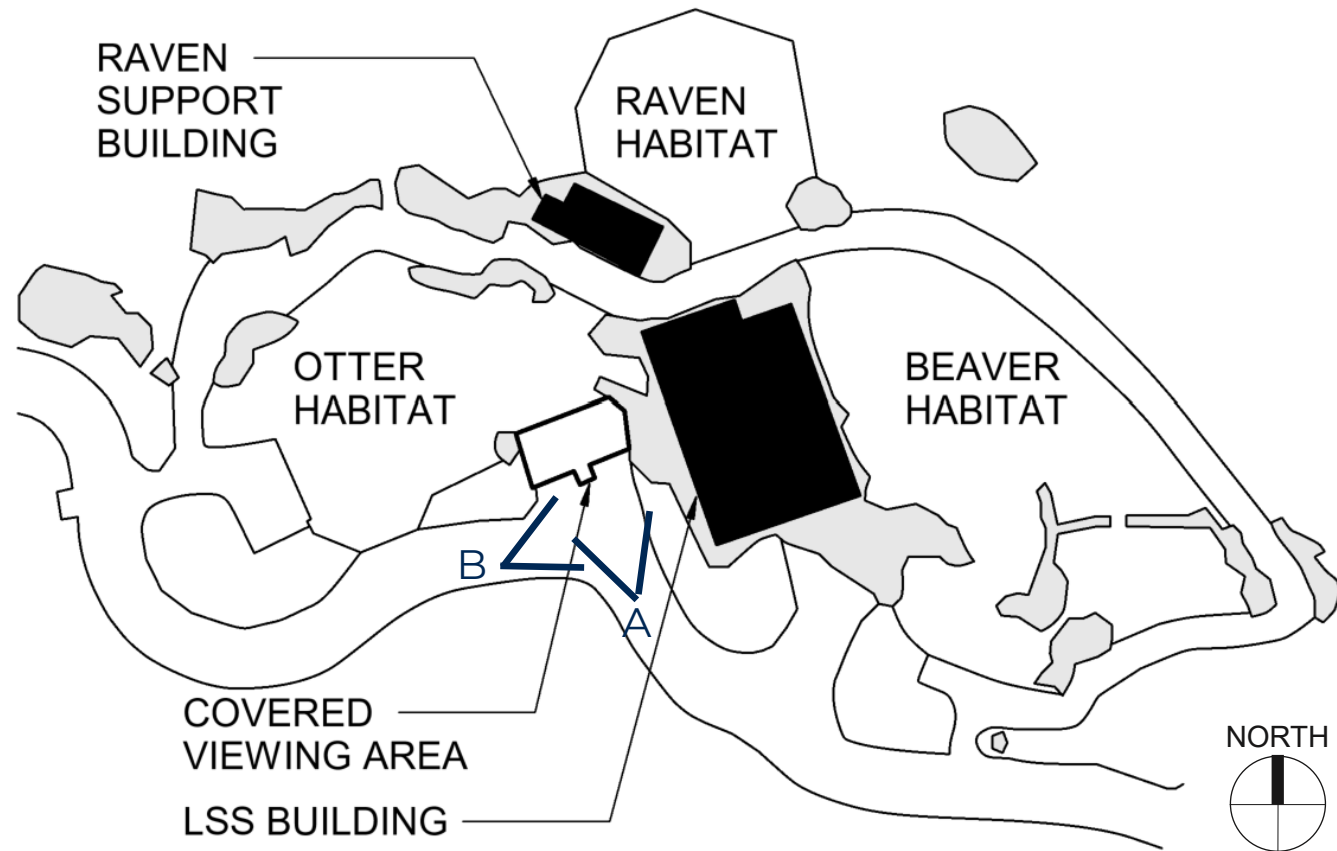
Site Images (8 of 10)



American Trail: Views along the trail



Site Images (9 of 10)

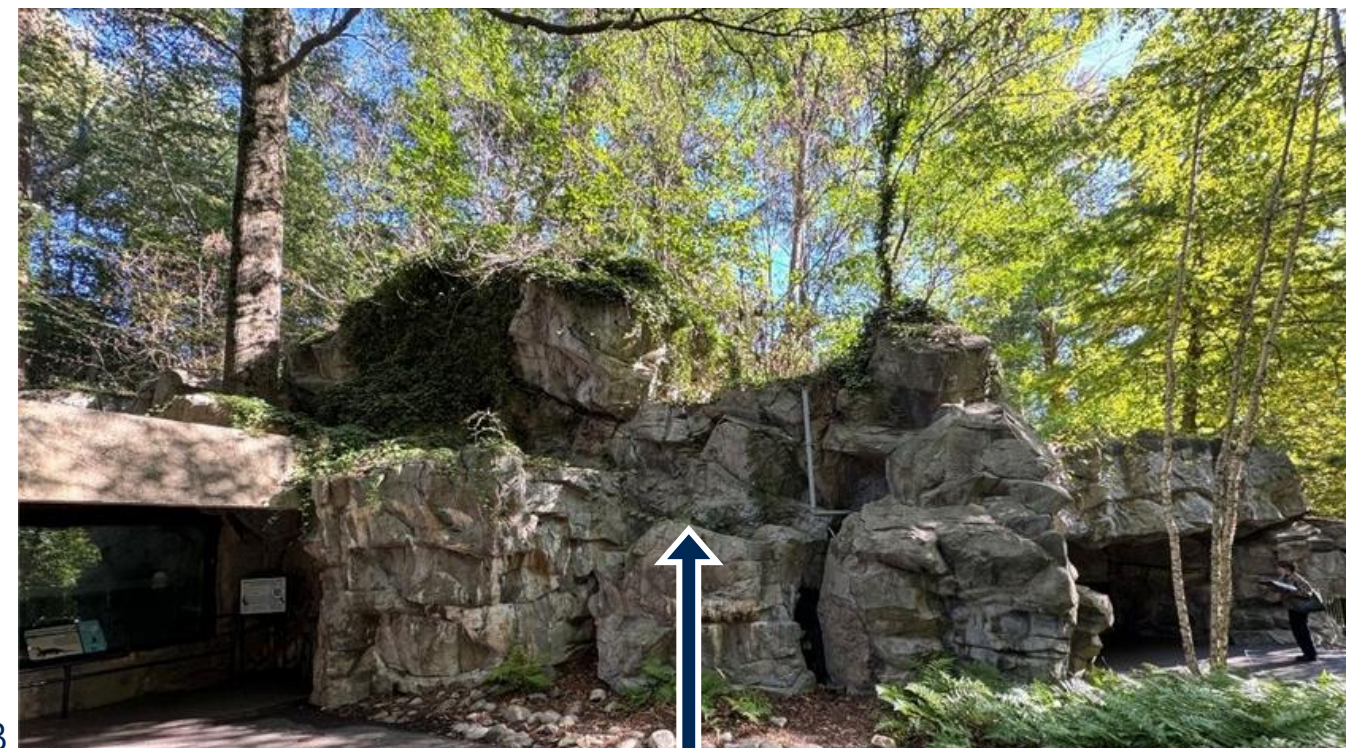


American Trail: Views of LSS Building rockwork and Otter canopy

COVERED OTTER HABITAT VIEWING AREA



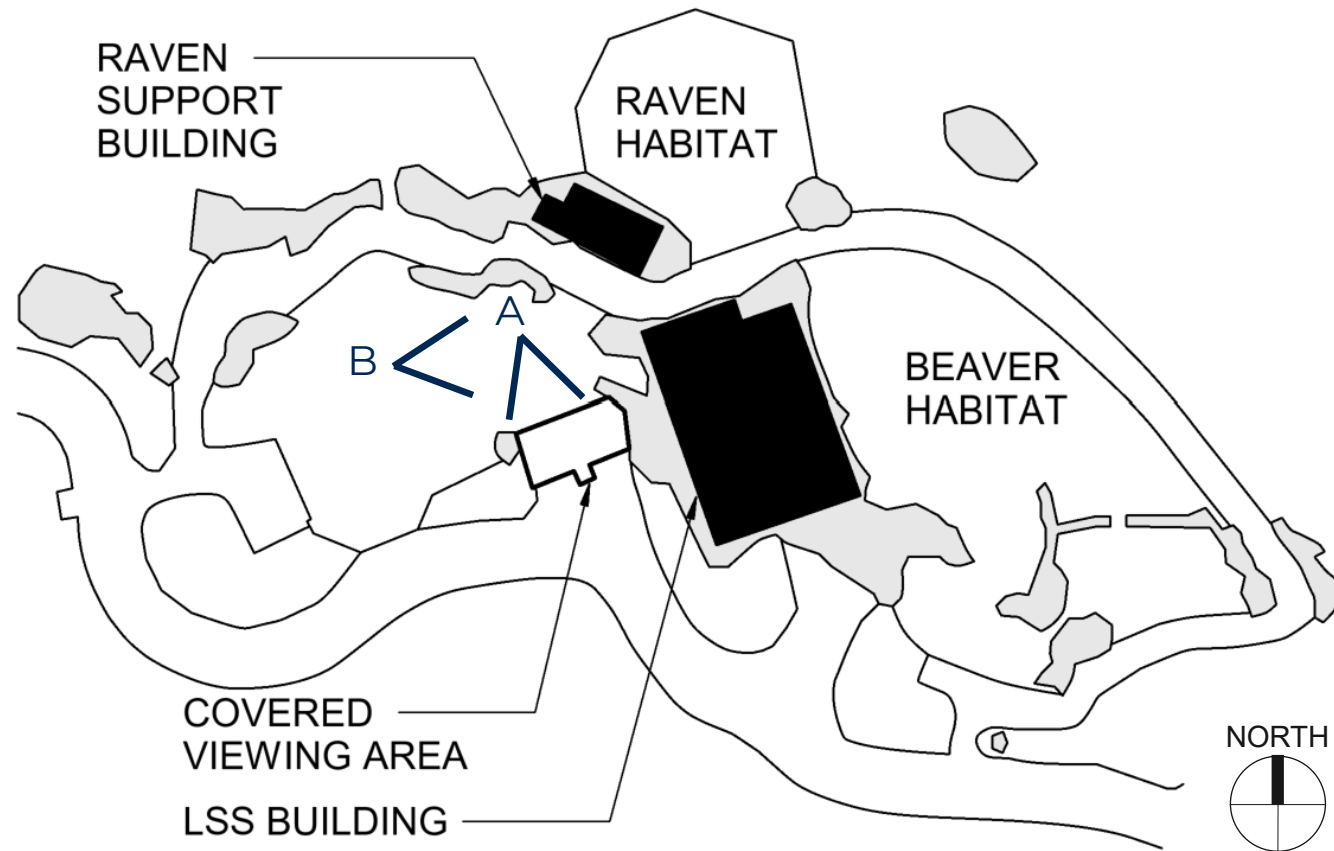
A



B

LSS BUILDING

Site Images (10 of 10)



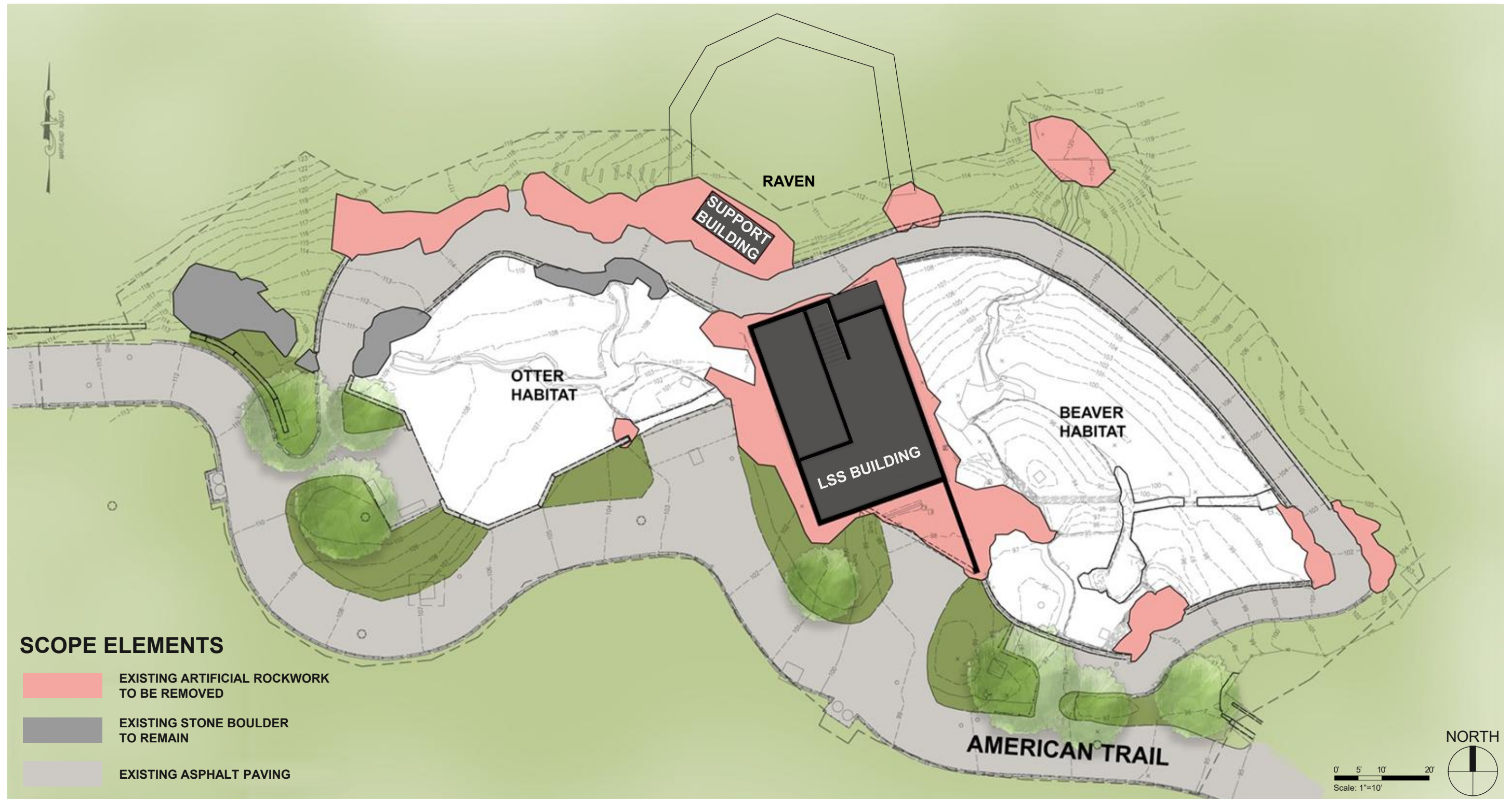
American Trail: Views of rockwork from the Otter habitat



Failing Faux Rock Examples







Faux Rock Demolition Plan

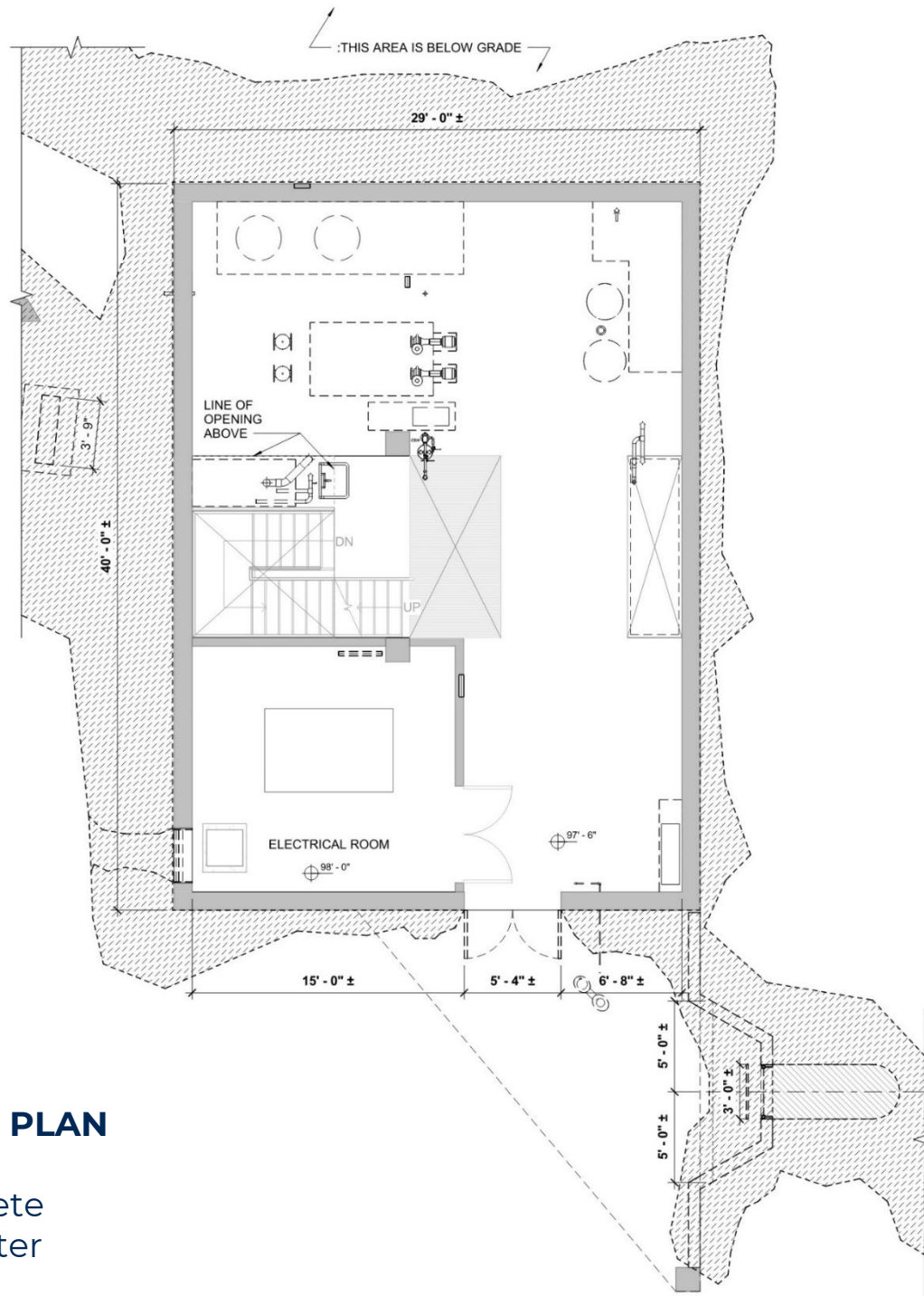


Demolition Plan - LSS Building

LEGEND

-  EXISTING STRUCTURE TO REMAIN
-  ARTIFICIAL ROCKWORK TO BE REMOVED
-  ITEM TO BE REMOVED
-  EXISTING CONCRETE SLAB TO BE REMOVED

0' 2' 4' 8'

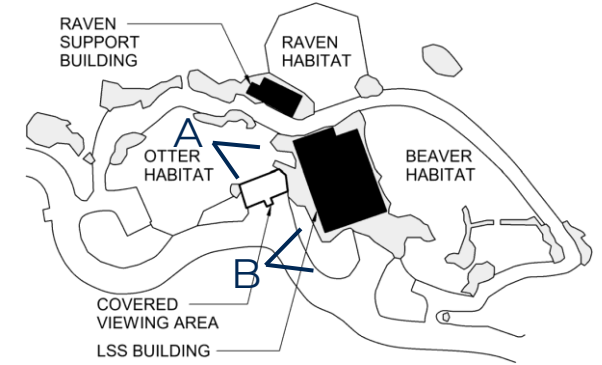


LSS BUILDING – MAIN LEVEL DEMO PLAN

Cast-in-place concrete building exposed after rockwork removal.








A

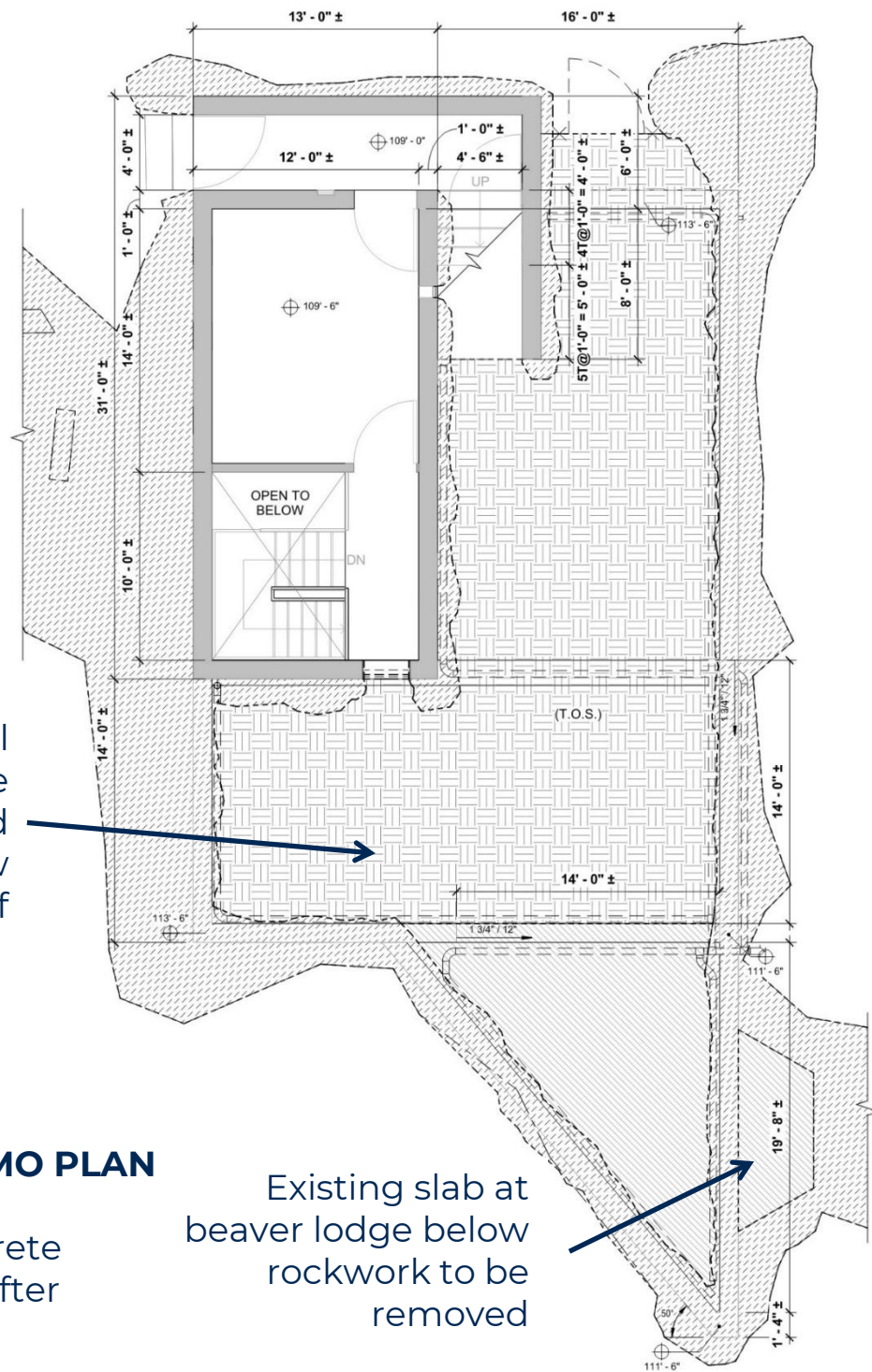
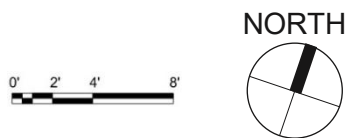


B

Demolition Plan - LSS Building (continued)

LEGEND

-  EXISTING STRUCTURE TO REMAIN
-  ARTIFICIAL ROCKWORK TO BE REMOVED
-  ITEM TO BE REMOVED
-  EXISTING CONCRETE SLAB TO BE REMOVED
-  EXISTING EARTH FILL/GRAVEL TO BE REMOVED



LSS BUILDING - UPPER LEVEL DEMO PLAN

Cast-in-place concrete building exposed after rockwork removal.

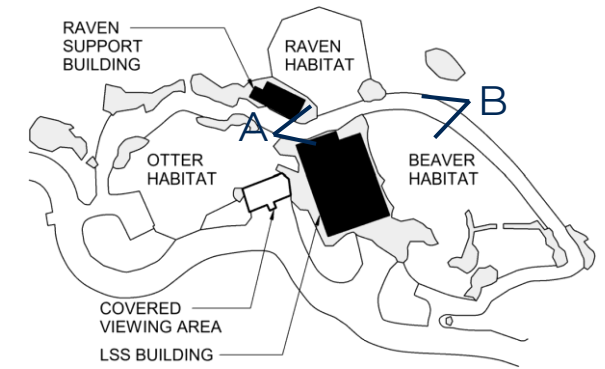
Existing slab at beaver lodge below rockwork to be removed



A







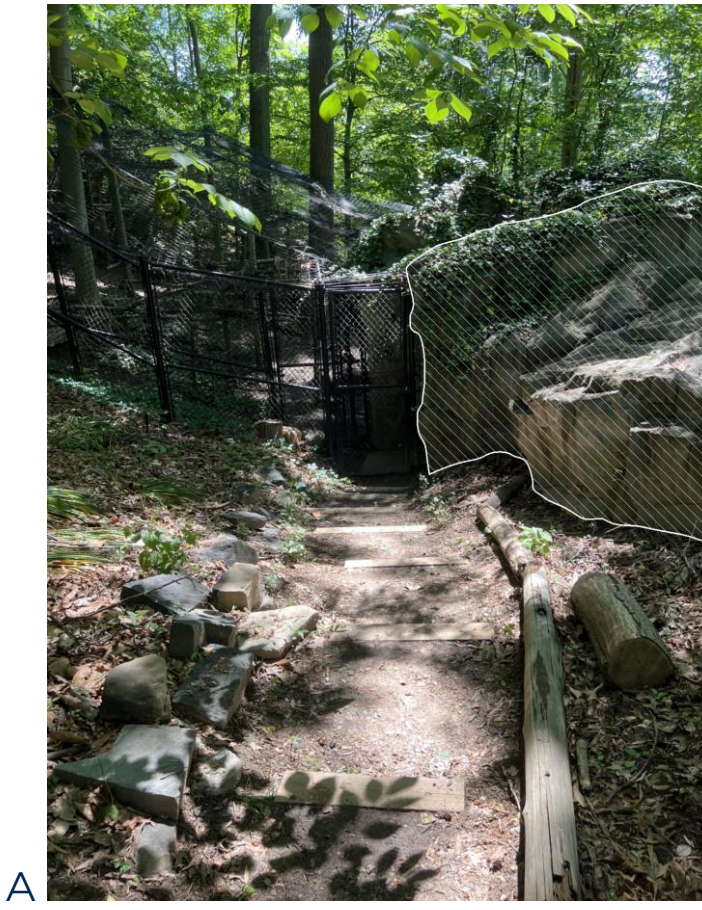
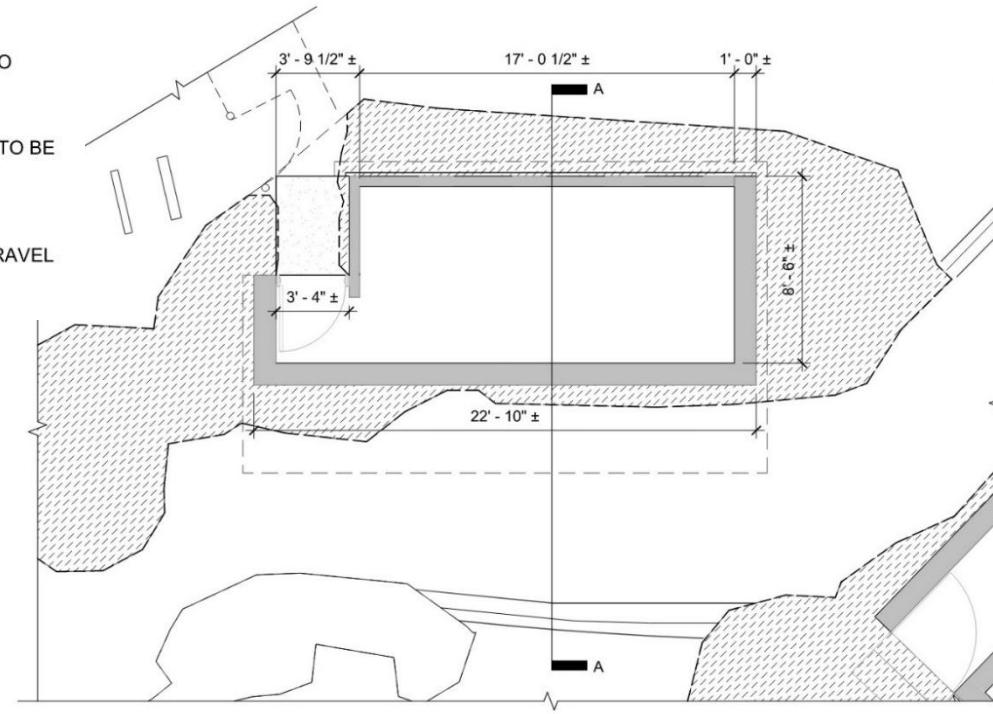
B



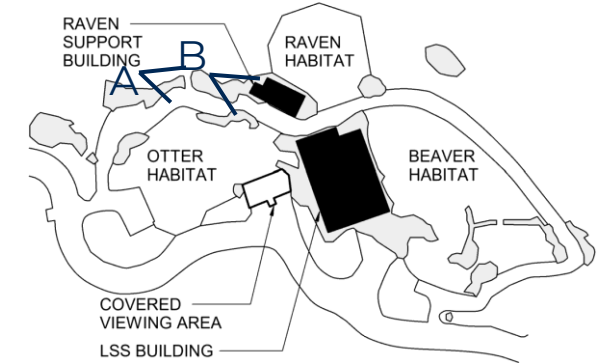
Demolition Plan - Raven

LEGEND

-  EXISTING STRUCTURE TO REMAIN
-  ARTIFICIAL ROCKWORK TO BE REMOVED
-  ITEM TO BE REMOVED
-  EXISTING EARTH FILL/GRAVEL TO REMAIN

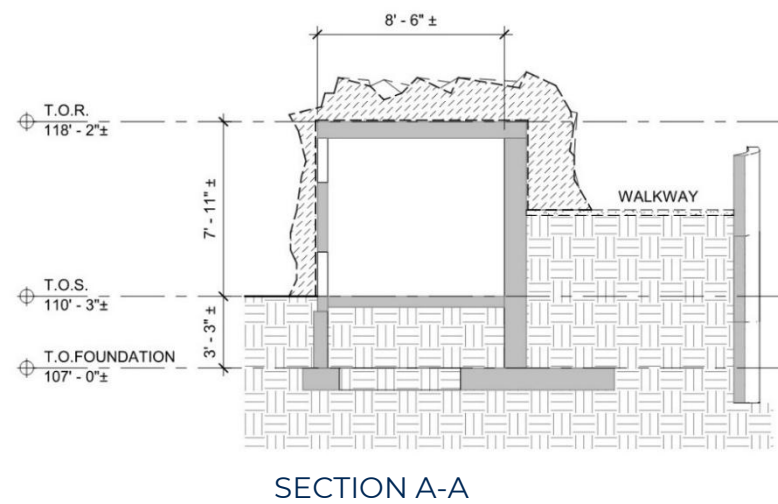


A



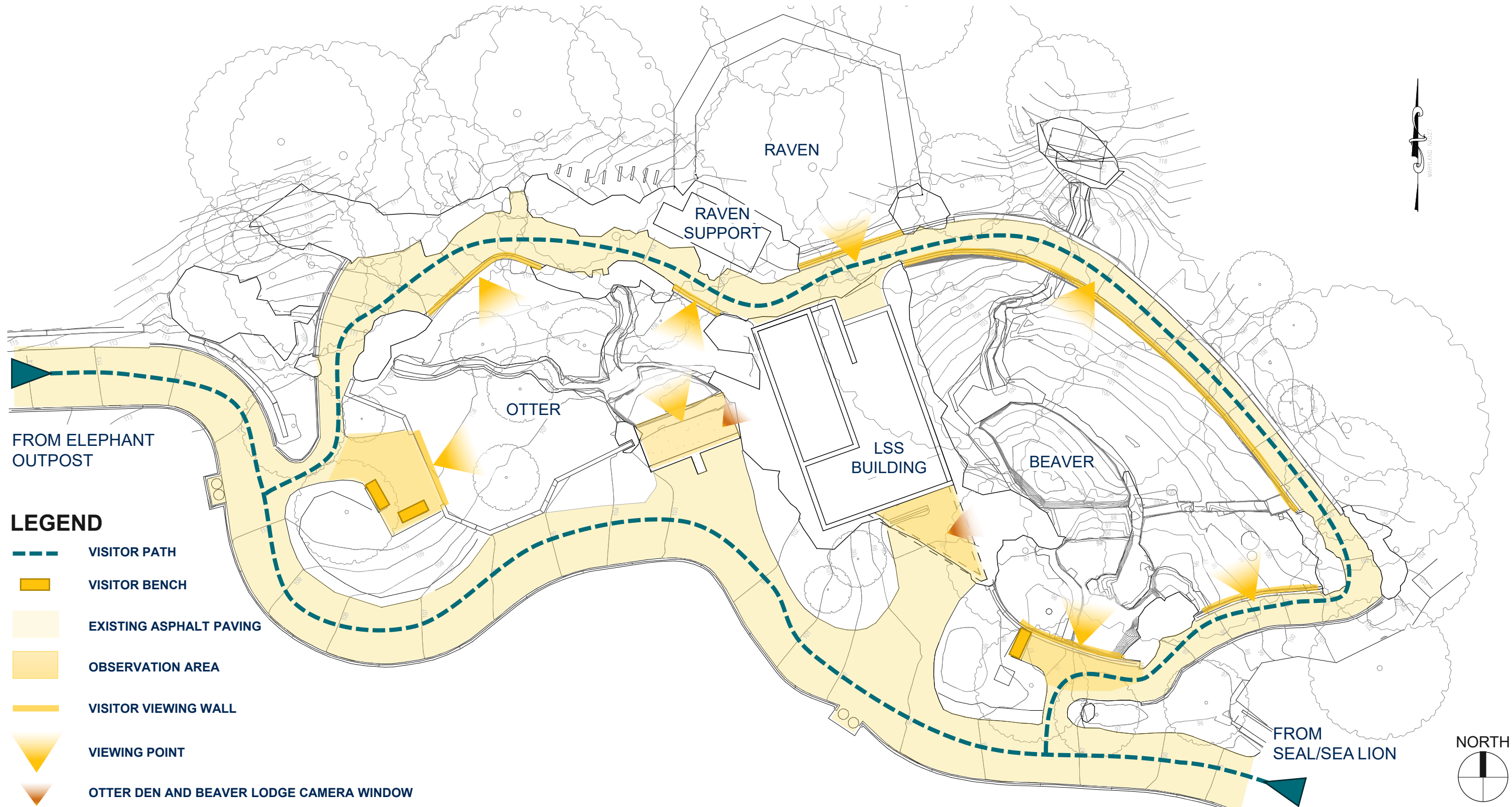
RAVEN SUPPORT – DEMO PLAN & SECTION

Cast-in-place concrete building exposed after rockwork removal.



B

Existing Circulation and Habitat Viewing



Proposed Site Design

Initial Grading and Circulation Studies	29
Site Circulation	30
Existing vs Proposed Habitat Viewing	31
Site Plan	33
Railings	34

Initial Grading and Circulation Studies

ACCESSIBLE VISITOR WALKWAYS

During the scope refinement phase of the project, multiple options for creating accessible routes were explored. The steep elevation changes both in the north-south and east-west cross sections of the valley required regrading that would significantly impact the existing walkways. Retaining walls, visitor barriers, and animal containment needed to be demolished and re-built to respond to the new grades.

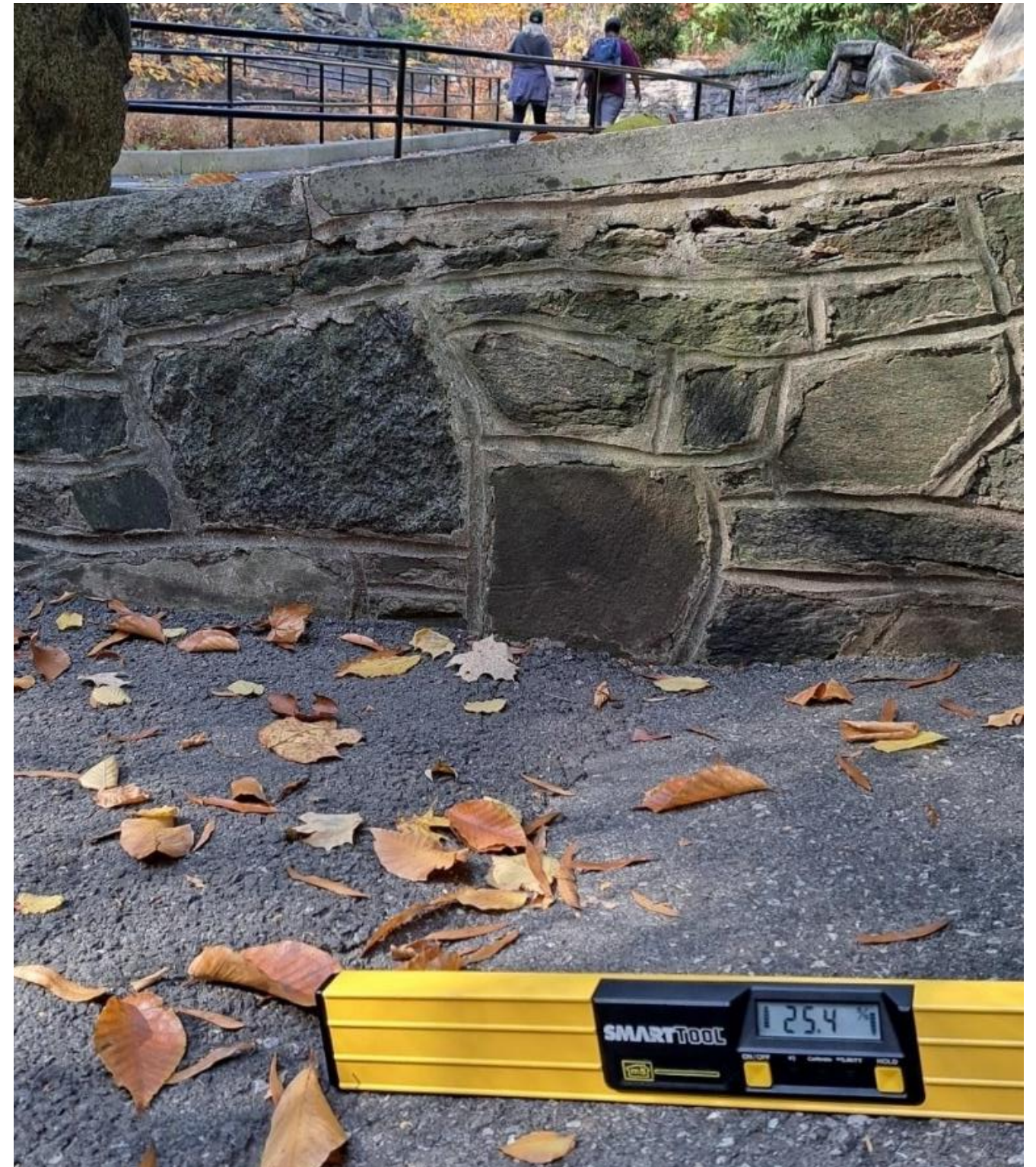
Two long stretches along the upper path at Otter (west) and at Beaver (east) are currently not ADA accessible. Achieving a fully accessible path presented significant challenges that were carefully evaluated.

PROPOSED SITE UPGRADES

The Raven exhibit is currently unoccupied and will remain unoccupied. The non-accessible upper path will be closed to the public and serve keeper access purposes only. New gates on the east and west ends of the lower path will control access beyond those points. Accessibility upgrades will be focused on the areas open to the public.

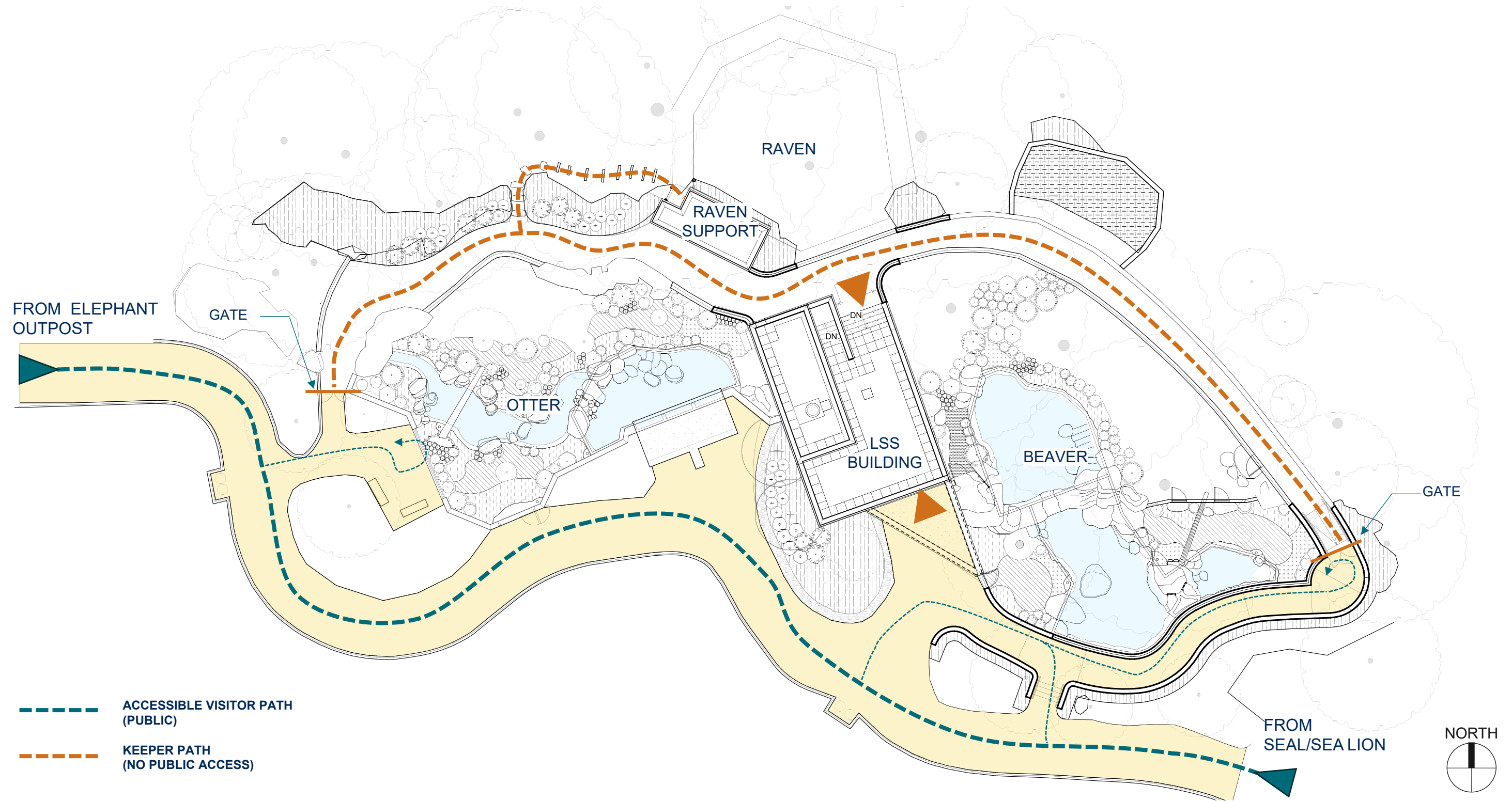
This update will alter the visitor experience. While Otter and Beaver public viewing from the upper path would be eliminated, new opportunities for viewing will be added along the lower path. The removal of faux-rock and regrading at Beaver will allow for a more continuous, open viewing accessible to all visitors. A new turn-around of approximately 10-foot radius will provide another landing zone for visitors to stop and observe the newly improved introduction area. At Otter, a new window will increase viewing opportunities, and a new training wall will allow for demos and engagement with the keepers, thus enhancing the overall guest experience.

The subsequent images illustrate the proposed new circulation routes, visitor viewing opportunities, and landscape updates in more detail.

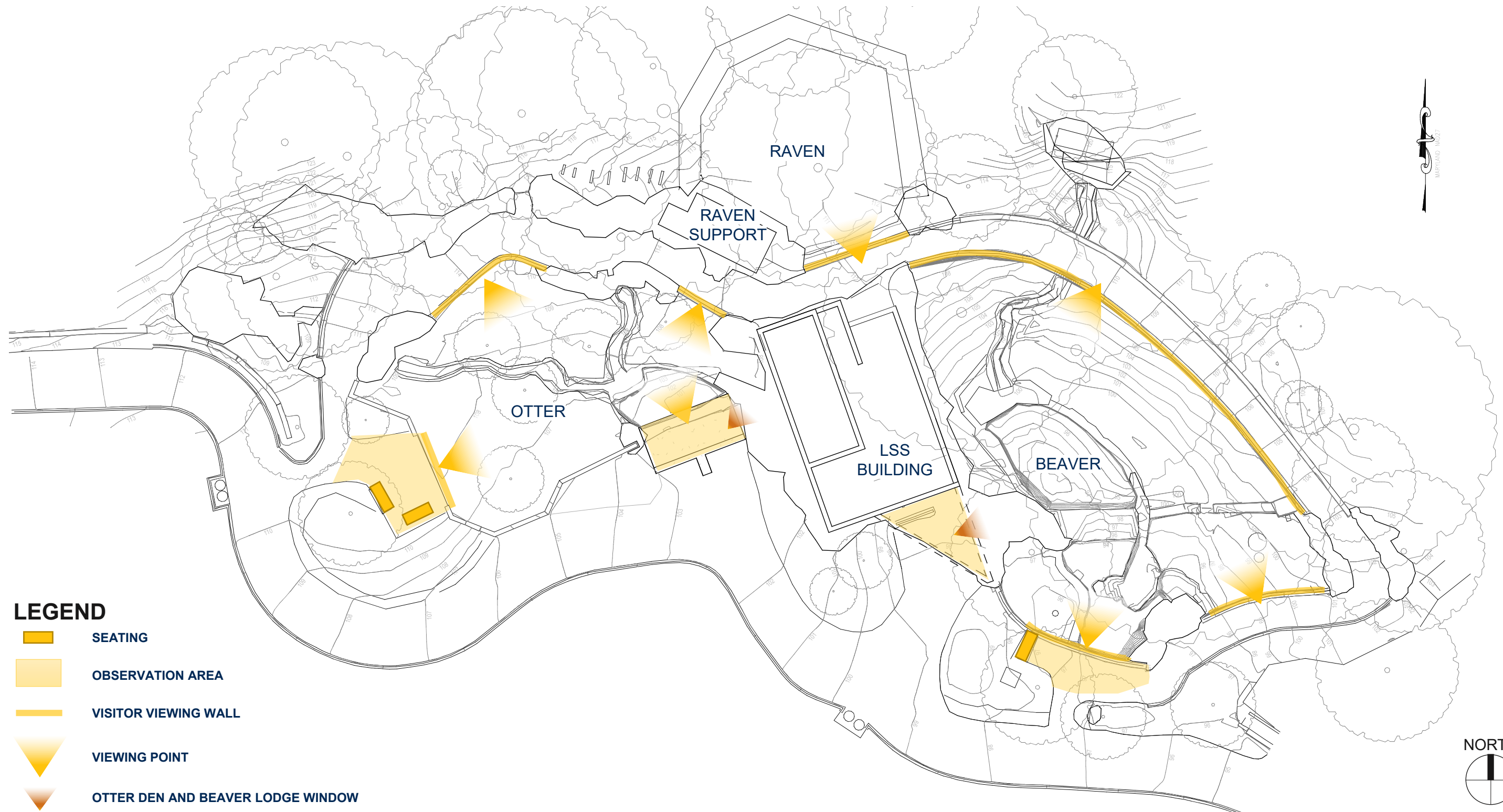


Demonstration of area of upper path with a steep slope of approximately 25%.






Site Circulation



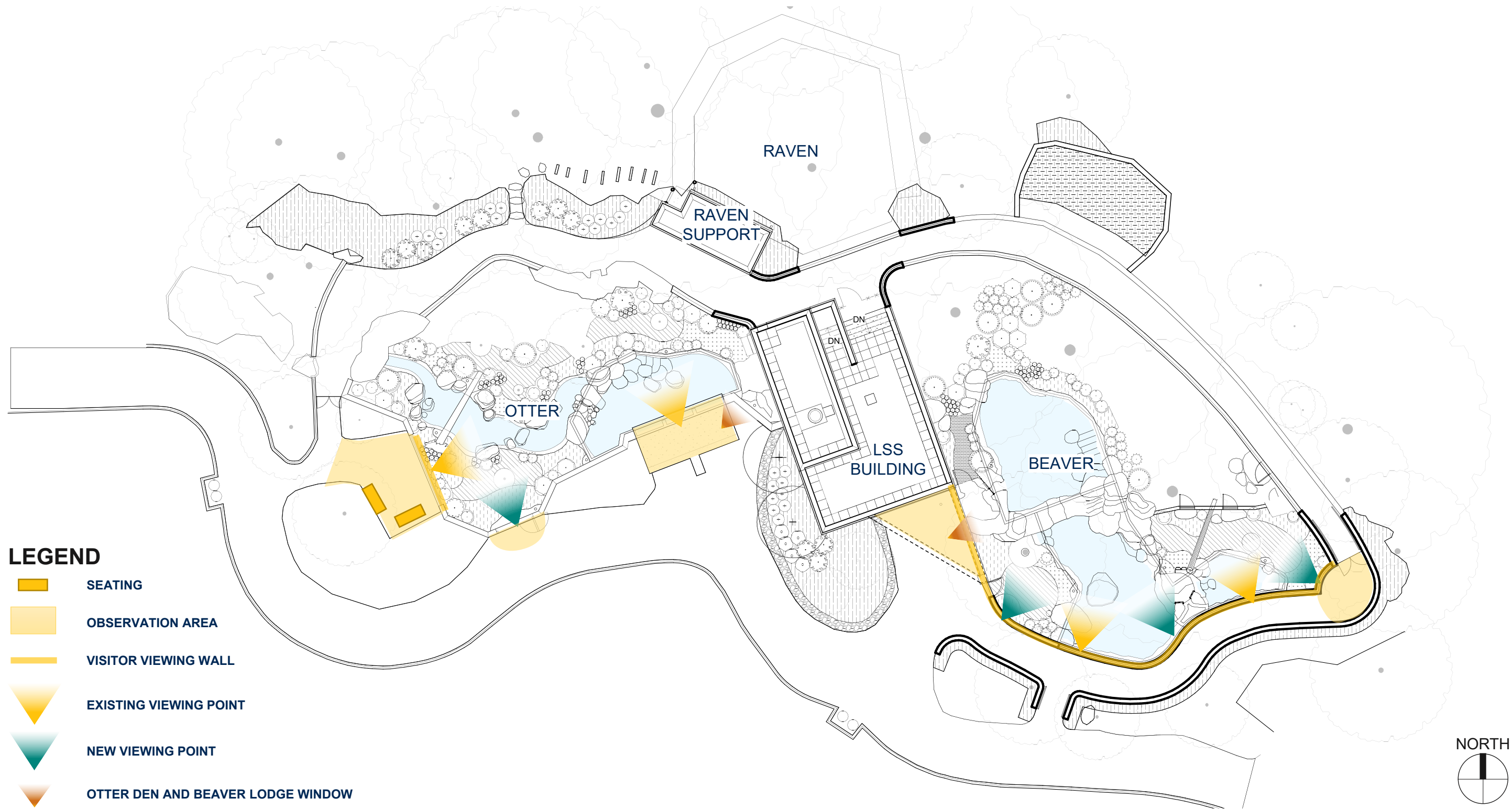
Existing Habitat Viewing



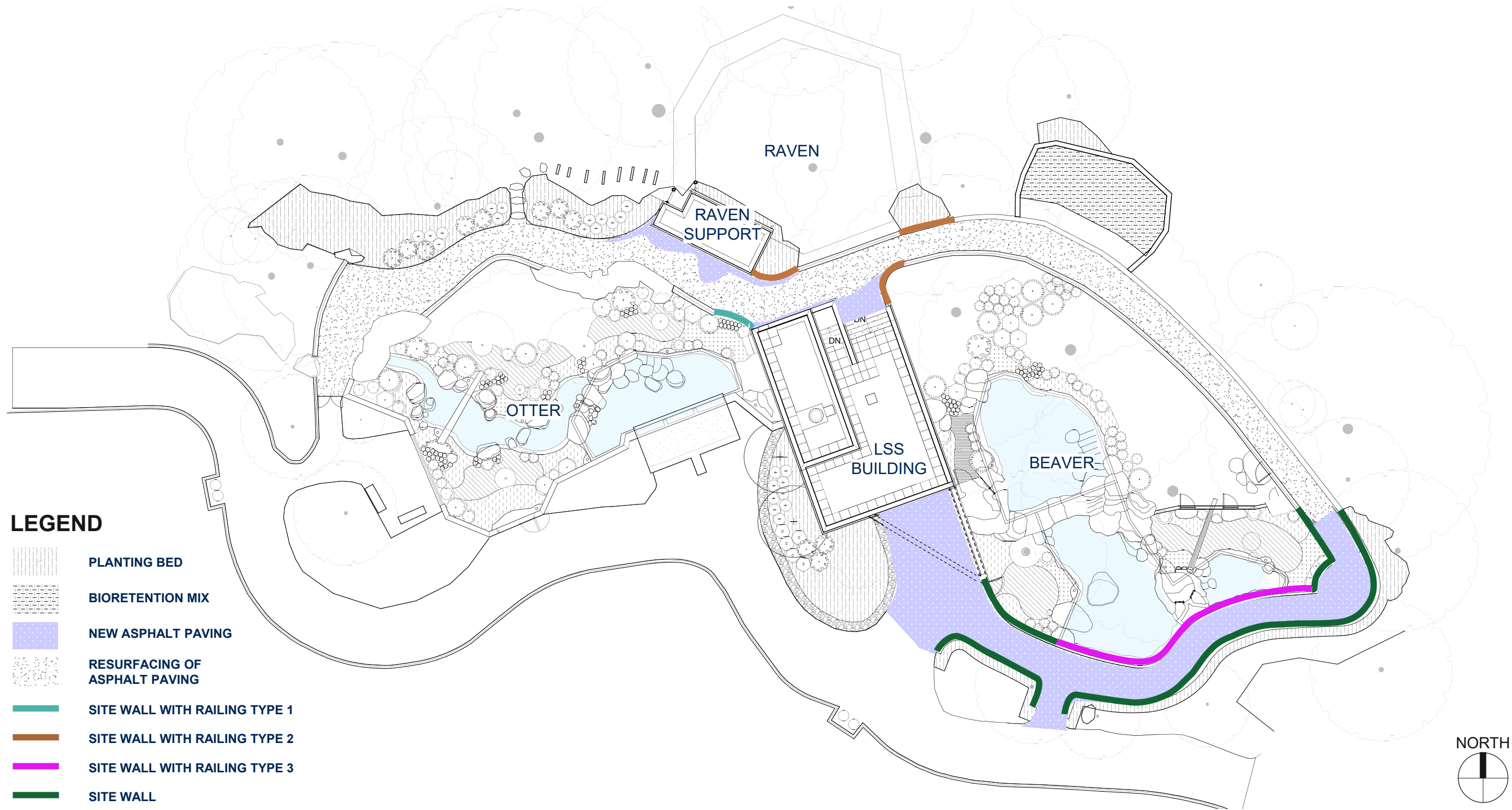
LEGEND

-  SEATING
-  OBSERVATION AREA
-  VISITOR VIEWING WALL
-  VIEWING POINT
-  OTTER DEN AND BEAVER LODGE WINDOW

Proposed Habitat



Site Plan

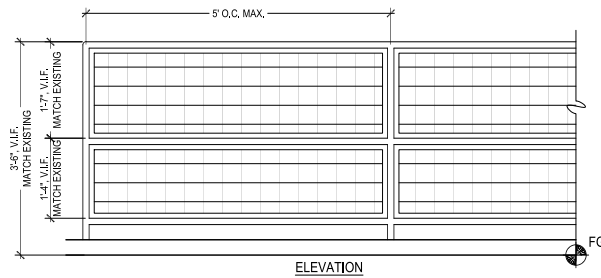


Railings



SITE WALL WITH RAILING TYPE 1

The proposed rail infill in the non-public zone will match existing tube and mesh rail.



REFERENCE IMAGE FOR PROPOSED RAILING TYPE 1: Existing stone clad retaining wall with steel mesh netting guardrail at Otter

SITE WALL

The proposed retaining walls will be designed to match existing stone clad walls on site. Top of wall elevations will vary depending on animal containment and visitor barrier requirements.

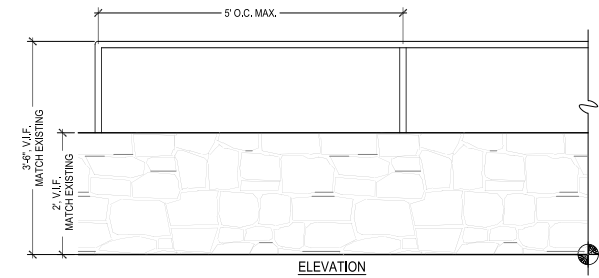


REFERENCE IMAGE FOR PROPOSED SITE WALL: Existing stone clad retaining wall



SITE WALL WITH RAILING TYPE 2

The proposed rail infill in the non-public zone will match the existing stone clad walls and steel tube rails.

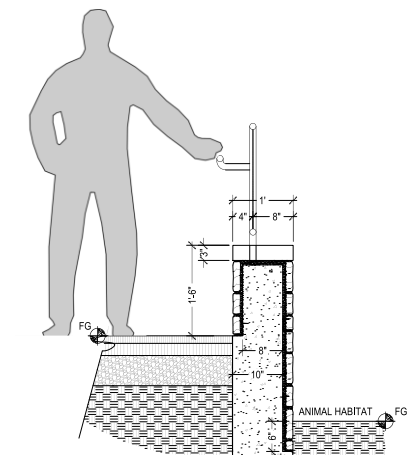
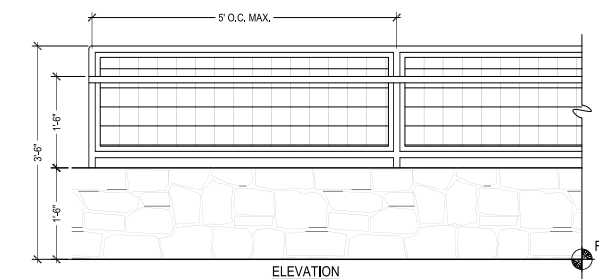


REFERENCE IMAGE FOR PROPOSED RAILING TYPE 2: Existing stone clad retaining wall with steel tube handrail at beaver



SITE WALL WITH RAILING TYPE 3

The proposed visitor rail at Beaver introduces a new design that meets animal containment requirements while drawing from the site's existing rail vocabulary. Welded wire mesh panels are set between painted black steel posts, to preserve visibility while discouraging visitor trespass. An integrated handrail enhances usability and comfort, exceeding ADA baseline provisions for sloped walkways.



Proposed Building Design

Existing LSS Building	36
Initial Studies	37
American Trail: Existing Material Palette	40
Proposed Material Palette	41
Wall Cladding Detail	42
Fiber Cement Color Samples	43
Otter Underwater Viewing Canopy	44
Preferred Approach	45

Existing LSS Building

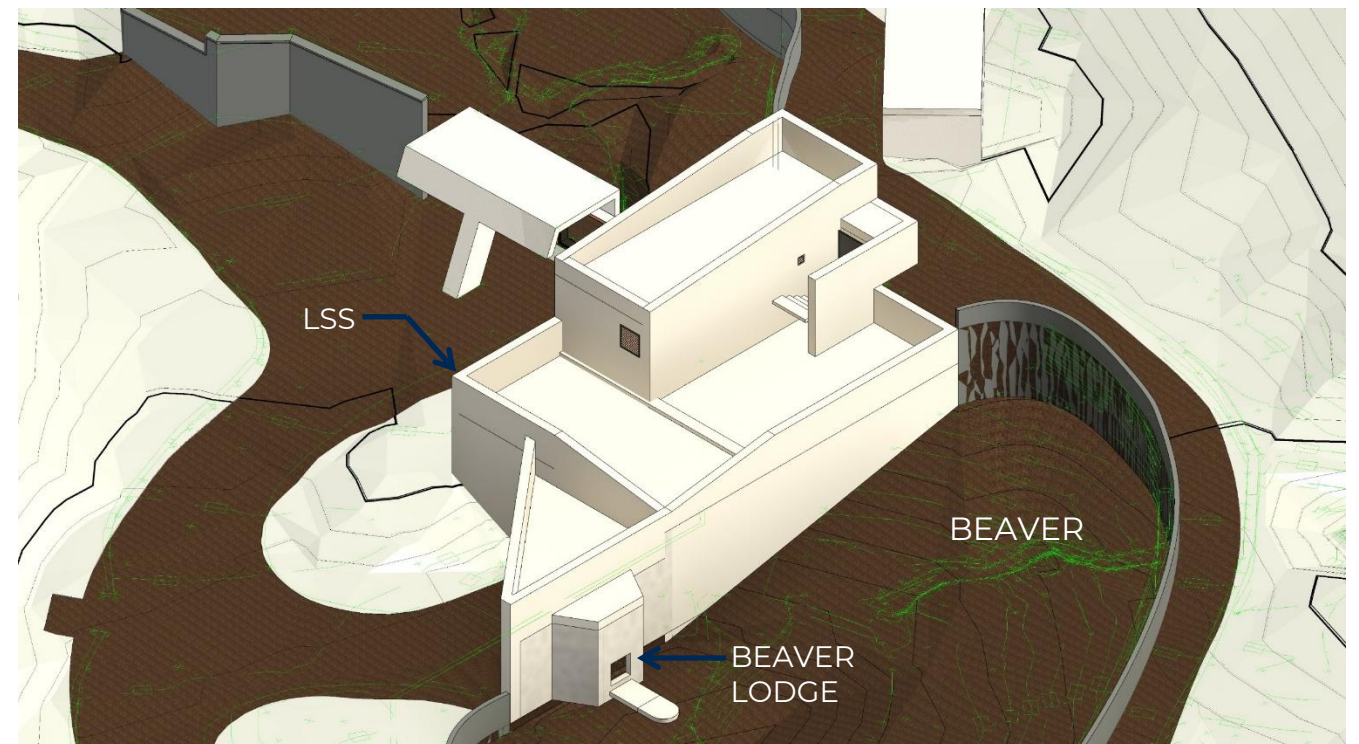
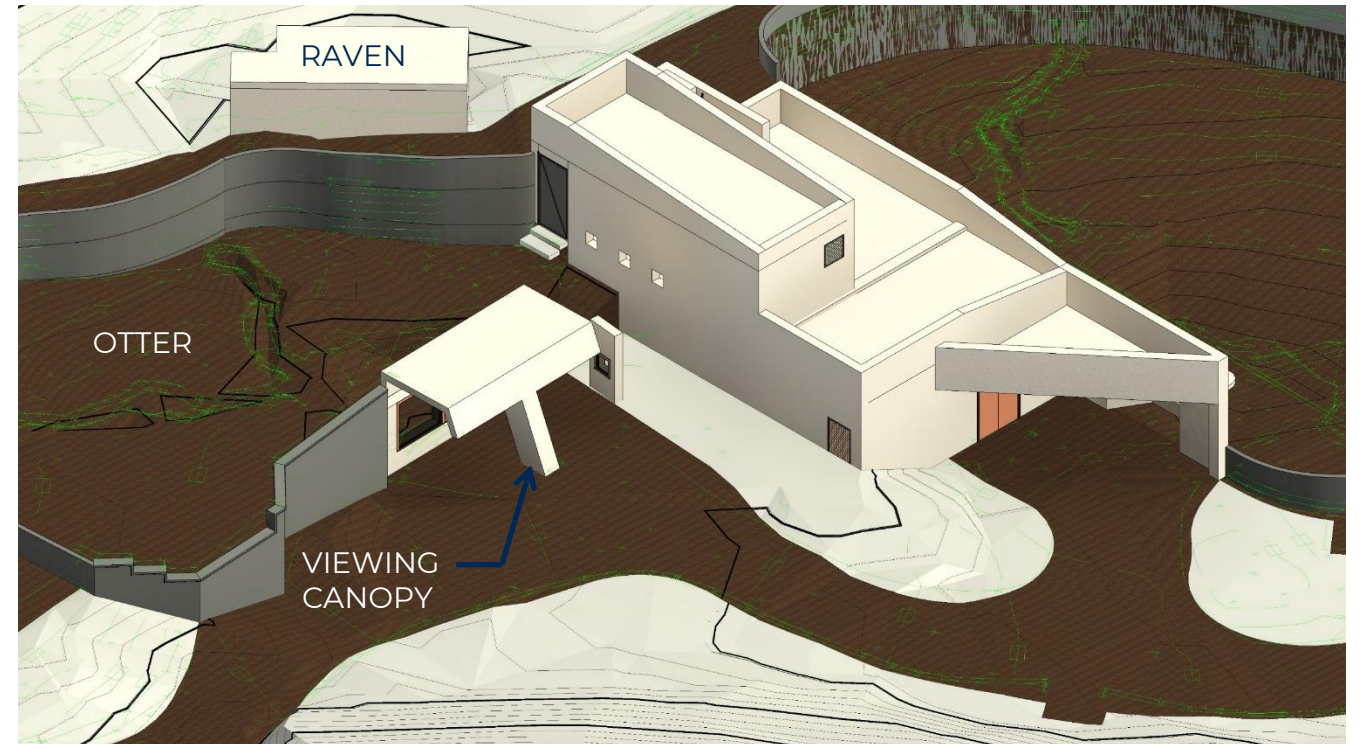
ARCHITECTURAL MODIFICATIONS

The existing LSS building is a three-story cast-in-place structure fully encased in artificial rockwork. The faux-rock blends the building with the adjacent landscape and habitats, disguising its presence from the public. The roofs are covered in two to four feet of earth fill, which has led to the unintended growth of invasive species. The wild vegetation further camouflages the building, blending it into its surroundings.

Due to the need to remove all failing faux-rock from the site, an architectural approach for cladding the exposed building is required. *(The 3D model views to the right showcase the existing LSS building once the rockwork has been removed.)* Initial scope refinement studies explored three options with varying levels of intervention.

Concept Zero minimized work to essential repairs, applying a parged concrete finish over rough surfaces to create a smooth, finished look. Concept One introduced new architectural cladding for the existing structures, including a stone wainscot, fiber cement panels, and salvaged wood over the canopies. Concept Two resulted in the most transformative intervention, demolishing the concrete viewing canopy and the overhang above the entrance, replacing them with new canopy structures. The images that follow provide a closer look at these early design options.

After careful consideration, the scope outlined in Concept One was selected for further development. The Preferred Approach (as seen on page 45) refines material selections and massing strategies, building upon the foundation established by the original studies.



Initial Studies – Cladding Concept Zero



1. REPLACE DAMAGED FIBER CEMENT BOARD

2. EXISTING CONCRETE CANOPY TO REMAIN

3. EXTENDED FAÇADE AT RAVEN, PARGED

4. PARGED EXTERIOR WALLS OF LSS BUILDING

5. EXTENDED PLANTING BED

6. NEW INTEGRATED LODGE LIVE FEED

7. EXTENDED SITE WALL

8. EXISTING GREEN ROOF



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Initial Studies – Cladding Concept One



1. REPLACE DAMAGED FIBER CEMENT BOARD

2. EXISTING CONCRETE CANOPY, CLAD WITH THERMALLY-MODIFIED WOOD

3. EXTENDED FAÇADE AT RAVEN, FIBER CEMENT CLADDING

4. EXTERIOR ELEMENTS WITH FIBER CEMENT CLADDING

5. STONE VENEER

6. DEMO CMU INFILL WALL, CREATE VIEWING AREA WITH VISITOR BARRIER

7. EXTENDED WALL

8. EXISTING GREEN ROOF, CLAD WITH THERMALLY-MODIFIED WOOD

9. EXISTING COLUMN, CONCRETE FINISHING

10. POWDERED METAL COPING, TYP



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Initial Studies – Cladding Concept Two



1. EXISTING WALL REMOVED OF ALL FIBER BOARD, REPLACED WITH STONE VENEER BLENDED WITH PARGED CONCRETE

2. NEW STANDING SEAM METAL ROOF WITH STRUCTURAL COLUMNS CLAD WITH WOOD (SEE STRUCTURAL) – NEW ACRYLIC WINDOW

3. NEW ACRYLIC WINDOW
4. EXTENDED FAÇADE AT RAVEN, THERMALLY-MODIFIED WOOD CLADDING

5. THERMALLY MODIFIED WOOD CLADDING
6. STONE VENEER

7. POWDERED ALUMINUM COPING, TYP
8. NEW FRP DOOR

9. SEATING FROM SALVAGED ON-SITE TIMBER
10. LOW IMPACT INCLUSIVE PLAY AREA

11. EXTEND VISITOR AREA, MATCH EXISTING ASPHALT
12. MESH RAILING WITH KEEPER ACCESS GATE

13. THERMALLY-MODIFIED WOOD SCREENING

14. TEXTURED AND COLORED CONCRETE HALF-WALL WITH BEAVER LODGE VIEWING

15. EXTEND SITE WALL TO NEW COLUMN



American Trail – Existing Material Palette

METAL COPING
Copper



CONCRETE
Parged Exterior



VENEER STONE
Bucks County
70% Southern Ledge stone
30% Dressed Fieldstone



FIBER CEMENT BOARD
Hardie Trim (12 in. x 1 in.)
1" reveal



Seal and Sea Lion (SSL) LSS Building



Seal and Sea Lion Café



Otter Barrier and Viewing

For consistency with other American Trail exhibits, the installation of similar architectural cladding on the LSS Building improves the relationship of the exhibit buildings in this thematic area. The American Trail buildings and site elements use four key materials to maintain visual continuity: vertical fiber cement boards with a one-inch reveal, matching the detailing executed in the SSL buildings; Bucks County stone veneer, consistent with the material used throughout the retaining walls and as the buildings' wainscot; copper coping to accentuate building edges; parged concrete finish in less public areas. The subsequent images showcase how these materials and details could be extended further along American Trail, providing a cohesive architectural and site language.

Proposed Material Palette



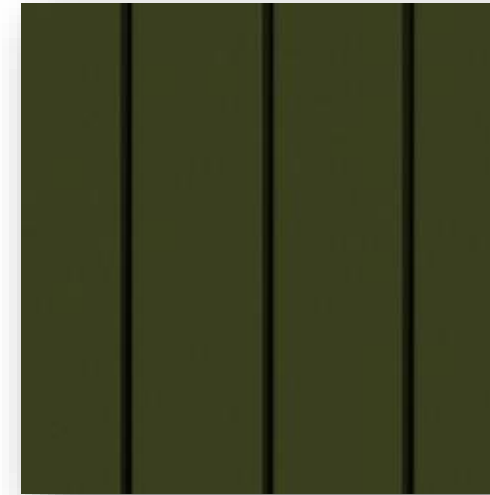
STONE VENEER

Bucks County
70% Southern LedgeStone
30% Dressed Fieldstone
(as new building wainscot)



STONE VENEER

Champlain Stone 1763 Granite
(for new infill site walls to match existing)



FIBER CEMENT BOARD

Hardie Trim, 12" wide
Color: Mountain Sage



METAL COPING

Copper

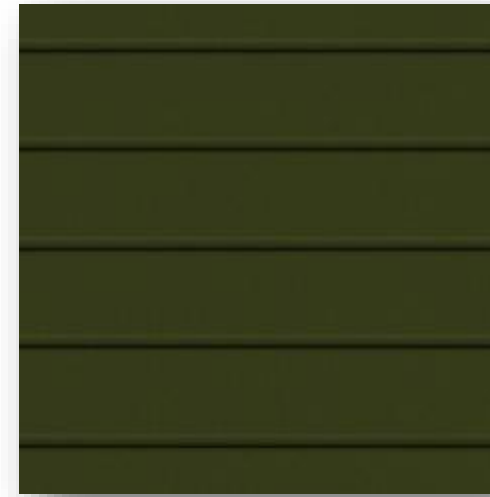


LOUVERS



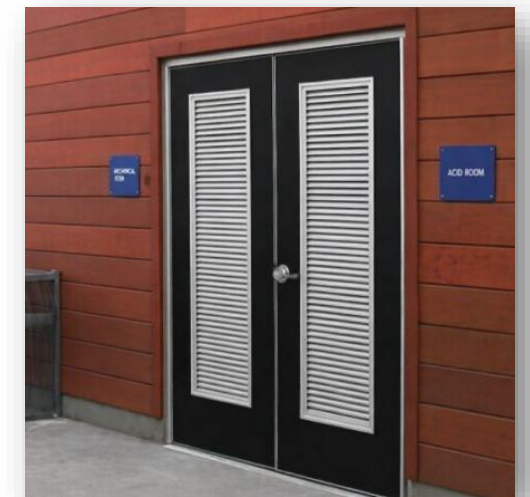
CONCRETE

Parged Exterior



FIBER CEMENT BOARD

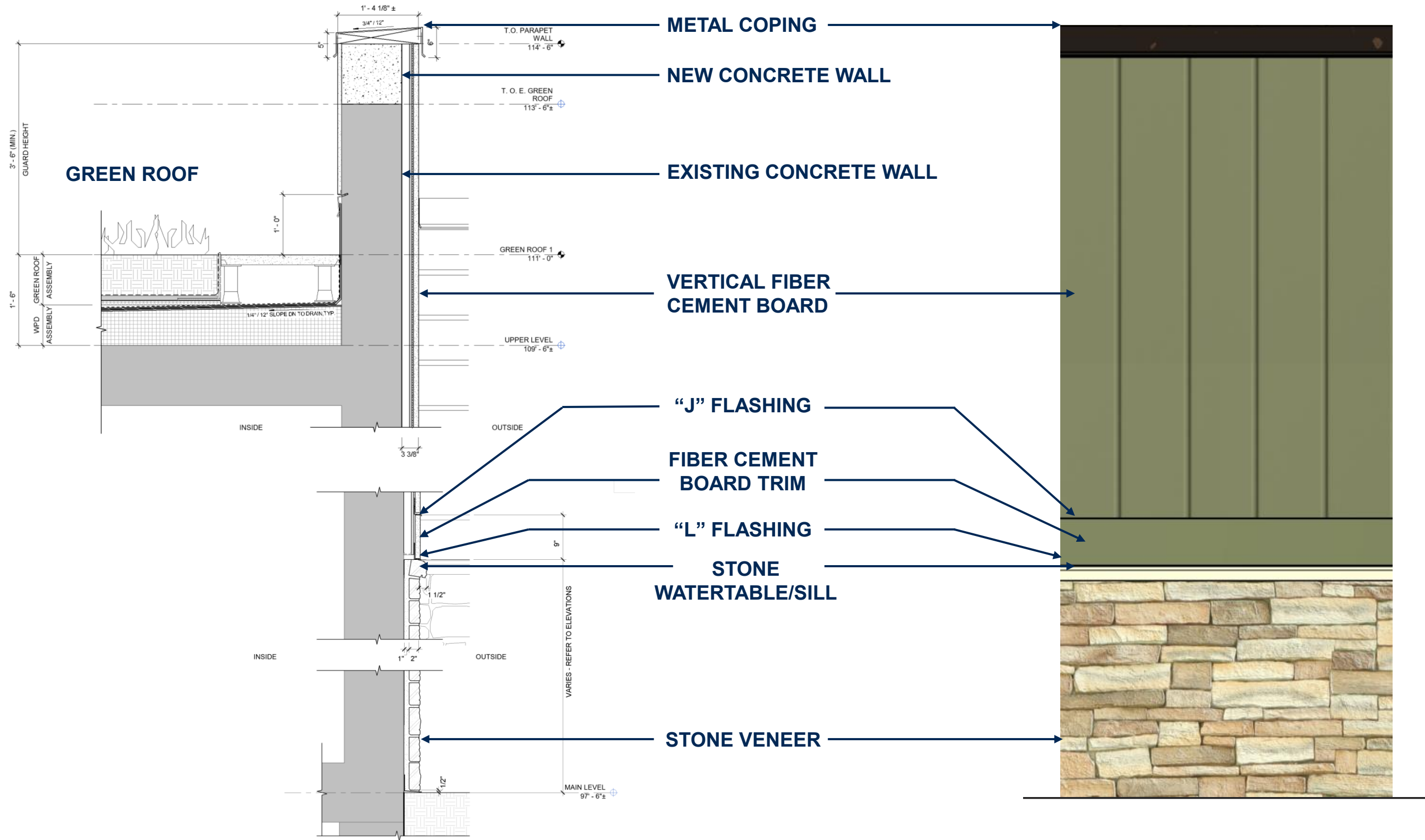
Hardie Artisan Siding, 9" wide
Color: Mountain Sage
(at entrance overhang)



FIBER REINFORCED POLYMER (FRP) DOORS & FRAMES

Special-Lite
SL-17 Pebble Grain Hybrid FRP Door

Wall Cladding Detail



Fiber Cement Color Samples

Preferred



Mountain Sage



Countryslane Red



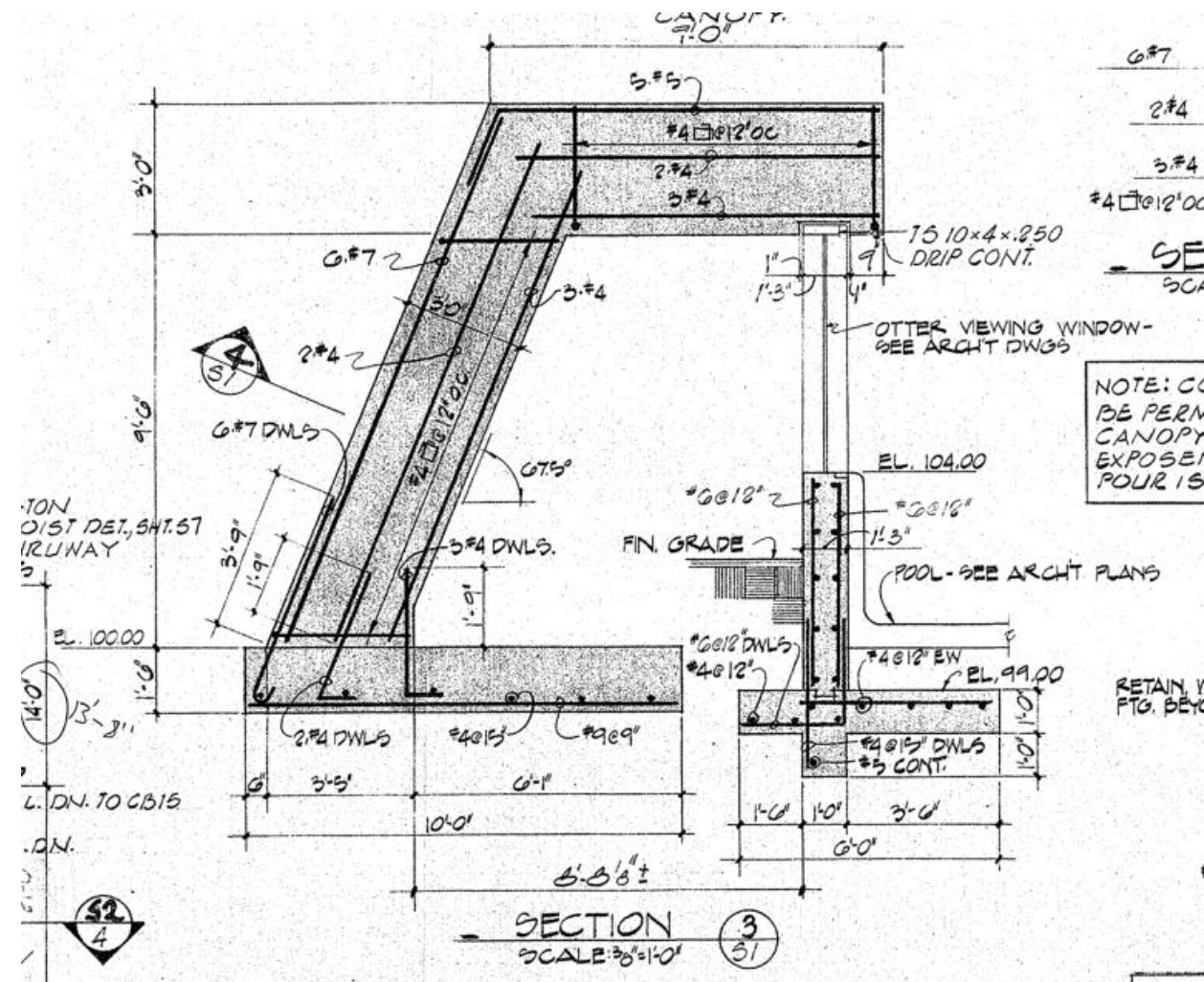
Rich Espresso

Three standard fiber cement panel colors were evaluated as potential alternatives for the cladding. Of the options, Mountain Sage is the recommended choice due to its neutral undertone and its compatibility with the existing Seal and Sea Lion gray (a.k.a. “Heather”) color palette. The green hue evokes the lush plantings of the surrounding landscape, while also creating a harmonious contrast to the proposed copper coping and stone veneers.

The images to the right illustrate the color studies applied to earlier massing iterations. The selected massing approach establishes consistent horizontal datums at 42 inches above both green roofs for safety. The preferred approach is illustrated on subsequent slides.



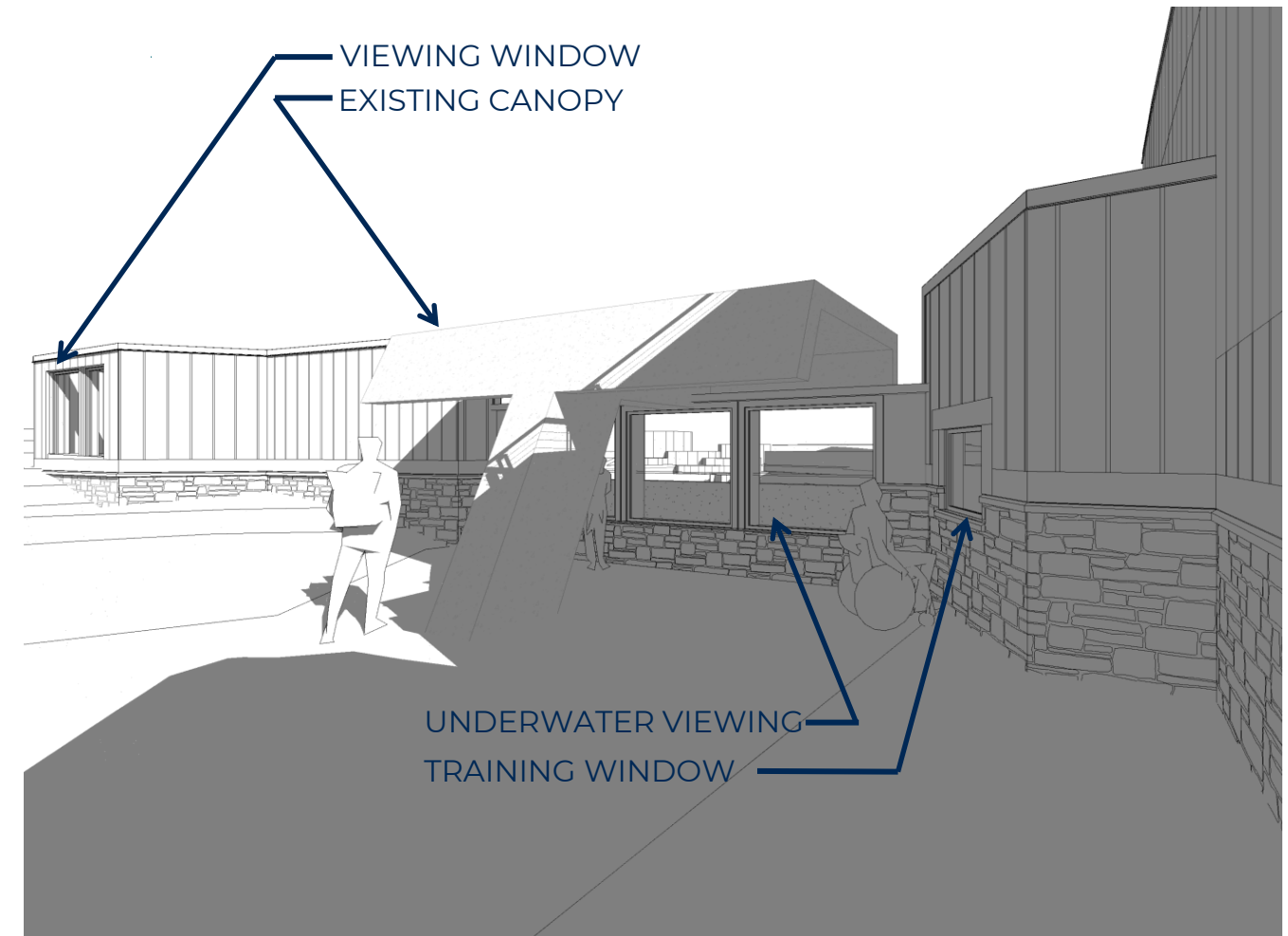
Otter – Underwater Viewing Canopy



STRUCTURAL DETAIL

Existing Otter viewing concrete canopy. The structure provides support for the viewing glass and pool.

Source: 1977 Beaver Valley construction drawings, Smithsonian



PROPOSED DESIGN

The existing concrete Otter viewing canopy will remain, while the original window glazing will be replaced to improve visibility and performance. New barrier walls clad with veneer stone and fiber cement vertical panels will ensure continuity of animal containment. A new training window will invite visitors to engage with the animal keepers as they feed and use activities to care for the otters.

Preferred Approach

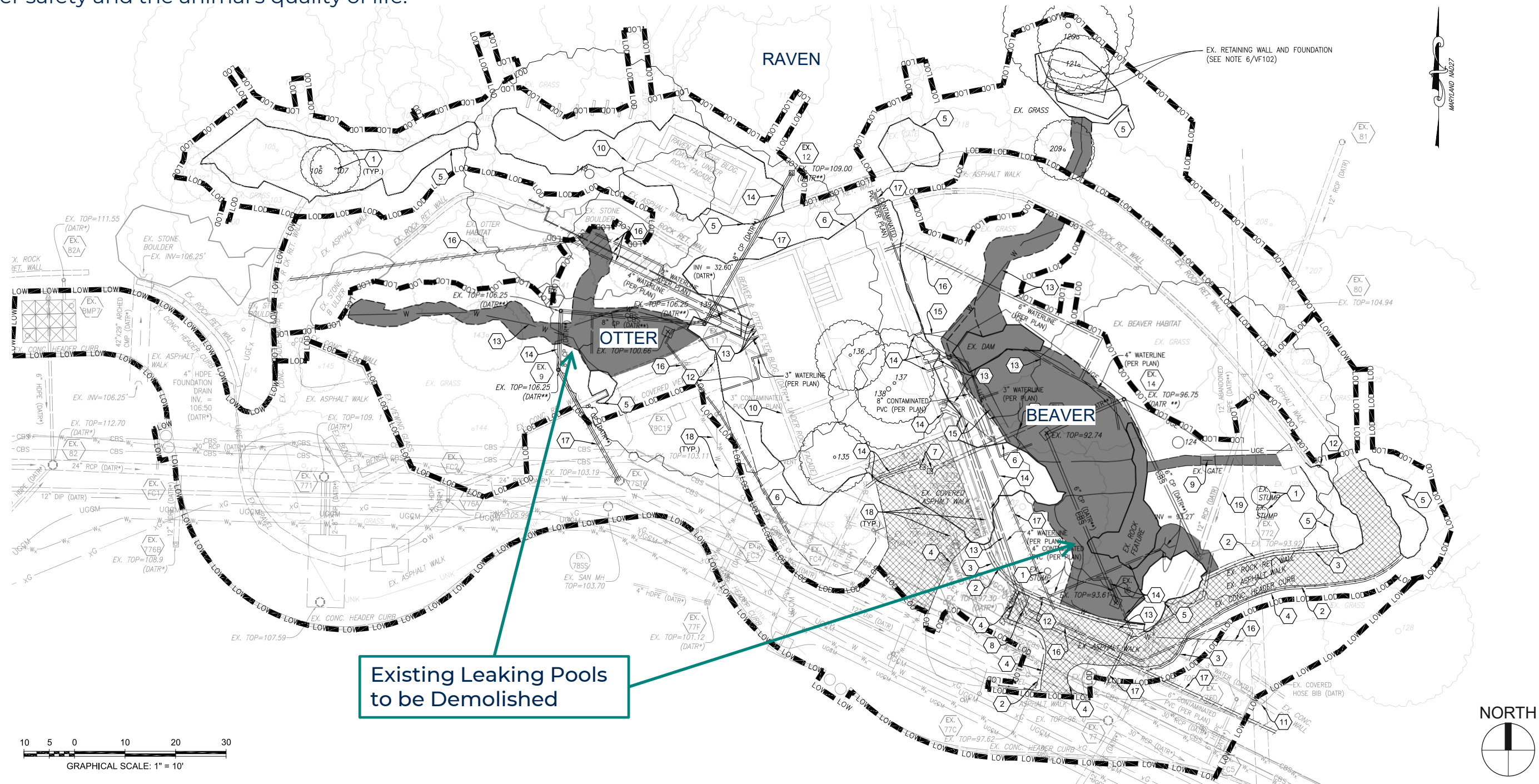


Proposed Habitat Design

Demolition Site Plan	47
Site Plan: Habitat Improvements	48
Habitat Improvements: Otter	49
Habitat Improvements: Beaver	50

Demolition Site Plan

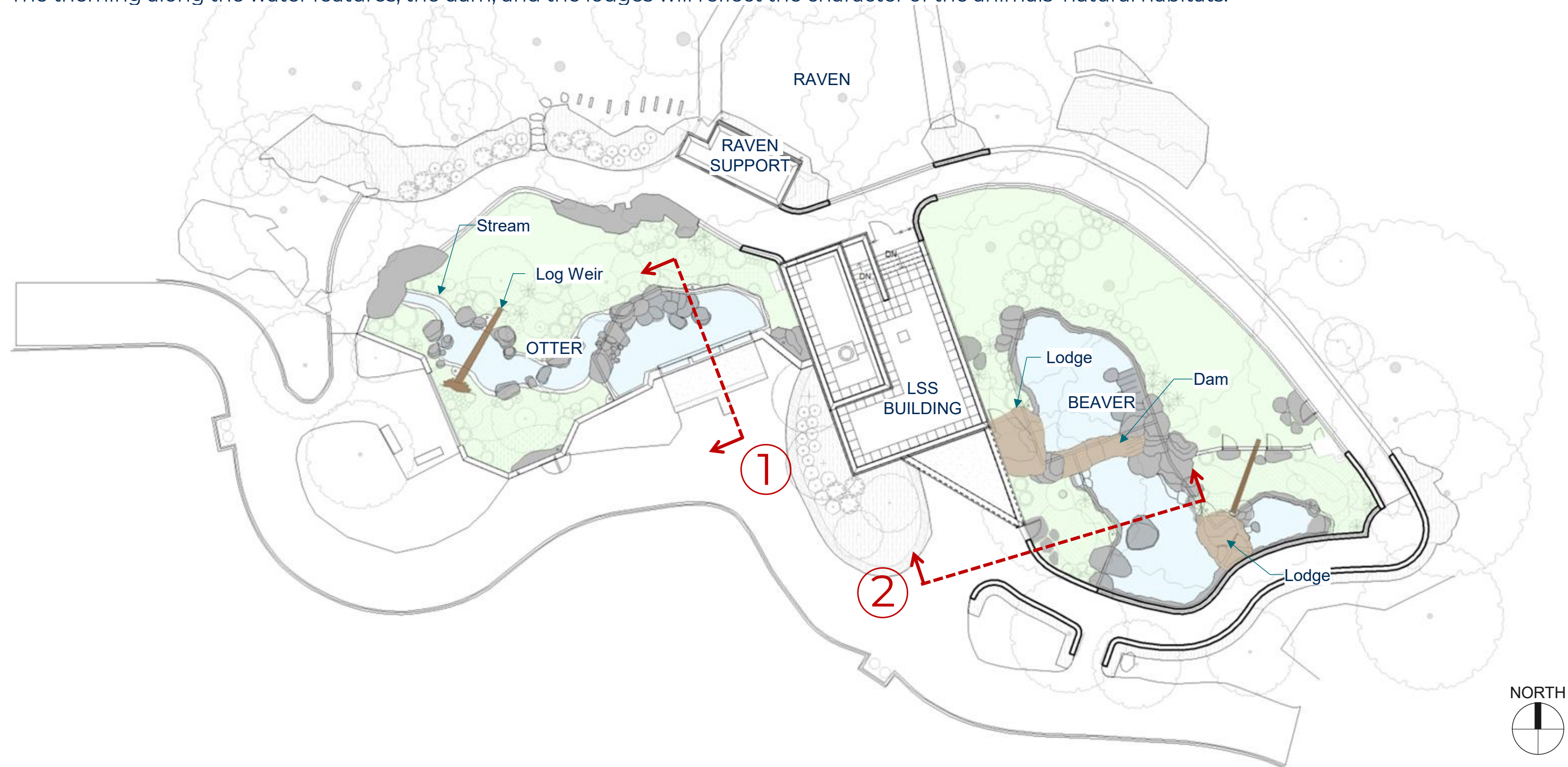
The existing pools in both habitats are leaking and need to be replaced. The new pools will be enlarged to meet current animal care standards including recommended water surface areas. The replacement of the pools create opportunities for reimagining the habitats in ways that will support greater keeper safety and the animal's quality of life.



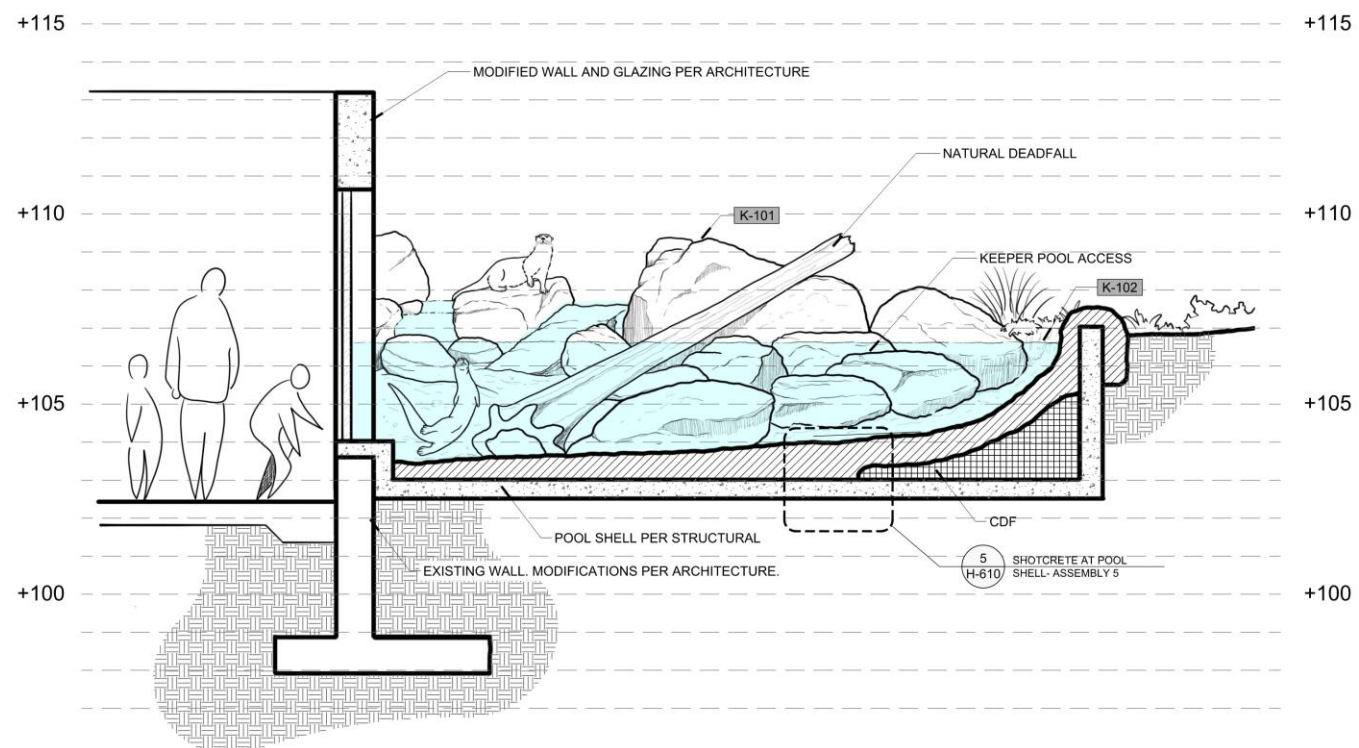
Existing Leaking Pools to be Demolished

Site Plan - Habitat Improvements

At Otter, a new stream with a log weir and natural deadfall will encourage the animals to swim, slide, and play in groups. At Beaver, an improved introduction area with an additional pool, a small Beaver lodge, and land shift will create more areas for animal enrichment and enhanced visitor viewing. The theming along the water features, the dam, and the lodges will reflect the character of the animals' natural habitats.



Habitat Improvements - Otter



Section 1 – Underwater Viewing and Pool

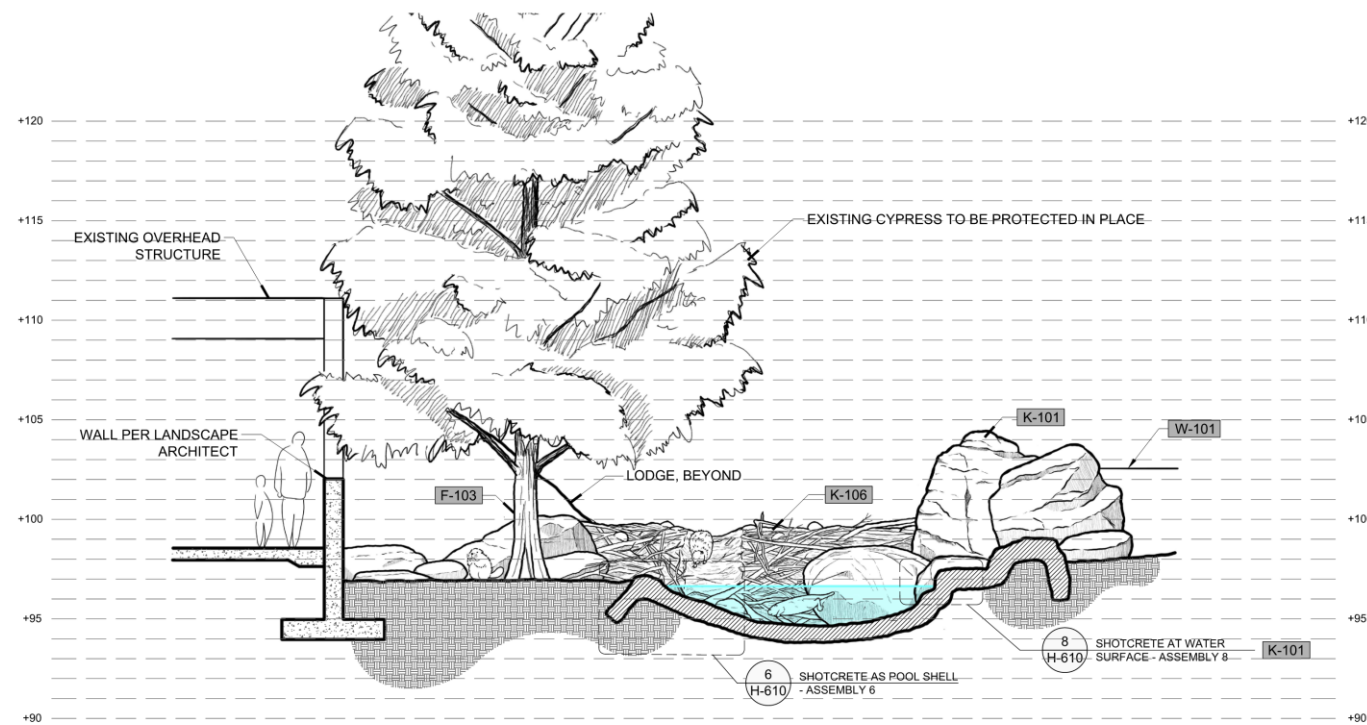


Character of Otter Log Weir



Character of Otter Pool Stream

Habitat Improvements - Beaver



Section 2 – Beaver Viewing, Pool and Dam



Character of Beaver Lodge



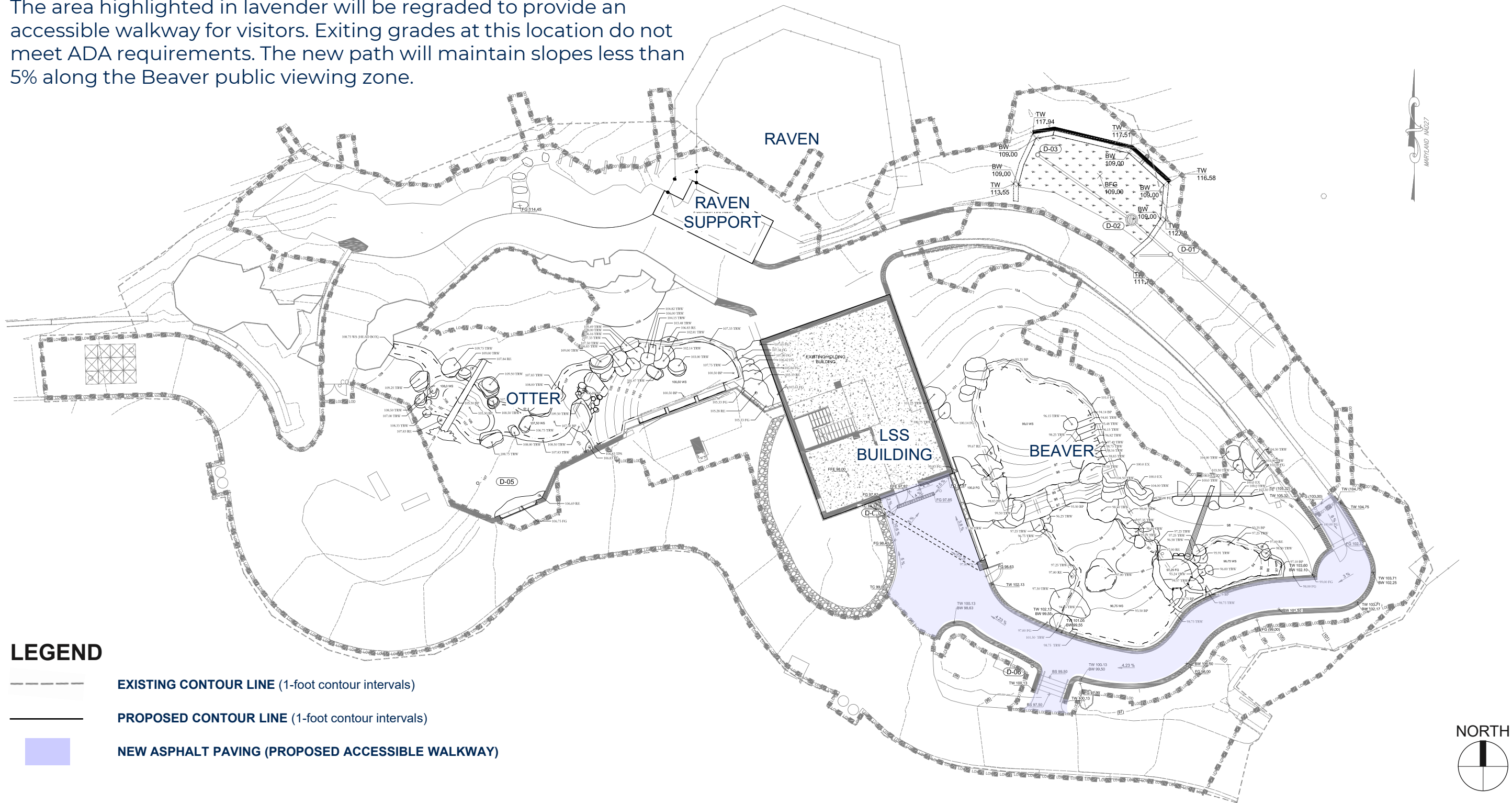
Character of Beaver Dam

Additional Site Information

Grading Plan	52
Existing Trees	53
Existing Tree Removal	55
Existing Tree Impact Plan	56
Tree Inventory	57
Planting Plan	58
Plant Schedule	60
Planting Palette	61
Stormwater Management	64

Grading Plan

The area highlighted in lavender will be regraded to provide an accessible walkway for visitors. Existing grades at this location do not meet ADA requirements. The new path will maintain slopes less than 5% along the Beaver public viewing zone.



Existing Trees

TREE PRESERVATION AND REPLACEMENT

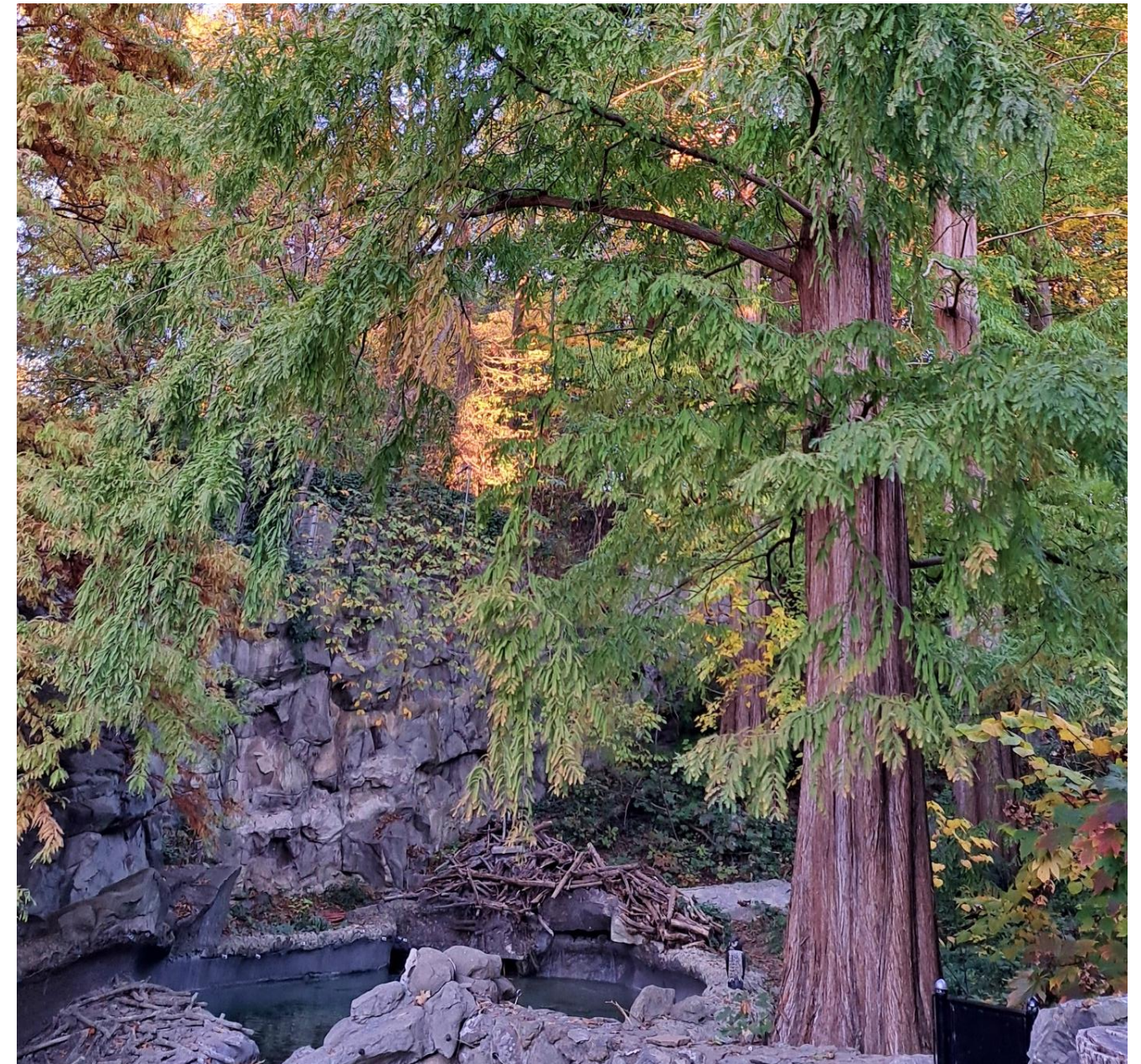
American Trail and the Beaver, Otter, and Raven exhibits are defined by their heavily wooded environment.

BEAVER HABITAT

Maintaining this environment was a priority but safety issues for animal, staff, and visitors needed to be addressed. The project priorities require 11 trees to be replaced and two installed as part of the renewal. Much of the apparent “beaver area” is inaccessible to the animals, allowing mature Dawn Redwoods and Hydrangeas (safely situated beyond low stone walls and shotcrete pool-edges) to thrive. Existing trees lend shade, seasonal color, and a strong sense of character. These significant Dawn Redwoods and Baldcypress will be preserved through construction with appropriate protection measures.

OTTER HABITAT

West of the LSS building, the Otter exhibit is a lively, shaded place framed by Sweetbay Magnolias and a Riverbirch that will be protected during construction. A prominent Willow Oak towers over the Otter pool near the keeper access point. While visually striking, this tree has contributed to unsafe conditions for animal care staff. Exposed roots disrupt circulation, and water pooling in these areas creates hazardous ice during winter months, particularly near the pool and the holding doors. Although preservation of the Willow Oak (#139) was carefully evaluated, its position (confined between the building, pool, and faux-rock structures slated for demolition) renders its survival unfeasible. To ensure staff safety for daily operations and avoid further complications from construction impacts, its removal has been deemed essential.



Dawn Redwoods at Beaver Habitat

Existing Trees (continued)

SITE FEATURES

The demolition of deteriorating faux rock features across the exhibits will also require removal of several smaller, invasive trees. Above the LSS building, the existing green roof has become dominated by volunteer growth, including three Siberian elms and one Black walnut (#138). These trees pose structural concerns due to their weight and potential impact on roof waterproofing. As part of installing a new, functional green roof system, these species (including the invasive, vine-covered Siberian elms, one of which exhibits poor structure) will be removed.

On the northern portion of the site, where a faux-rock stream structure currently exists, additional volunteer species have established themselves. Two Tree-of-heaven specimens, heavily infested with spotted lanternflies, and a poorly formed White Mulberry will be removed as part of the faux-rock demolition work. A small Tulip Poplar will also be taken out to accommodate a new bioretention area for on-site stormwater management. Similarly, two small American hollies located within the faux-rock along the west side of the upper walkway, must be removed to facilitate required construction in this constrained area.

In summary, the trees identified for removal within the construction zones are predominantly opportunistic or invasive species located in areas where deteriorated faux-rock exhibit elements must be demolished to address safety concerns. Removed trees will be replaced with native species of comparable size and ecological value. Two Dura Heat River Birches are proposed for installation south of the LSS building, while any additional required replacement trees will be distributed elsewhere across the campus.



LSS building with volunteer trees growing on existing green roof

Existing Tree Removal



#106, 107: AMERICAN HOLLY

These trees to be removed are located within the construction zone, embedded in the faux-rock features to be demolished.



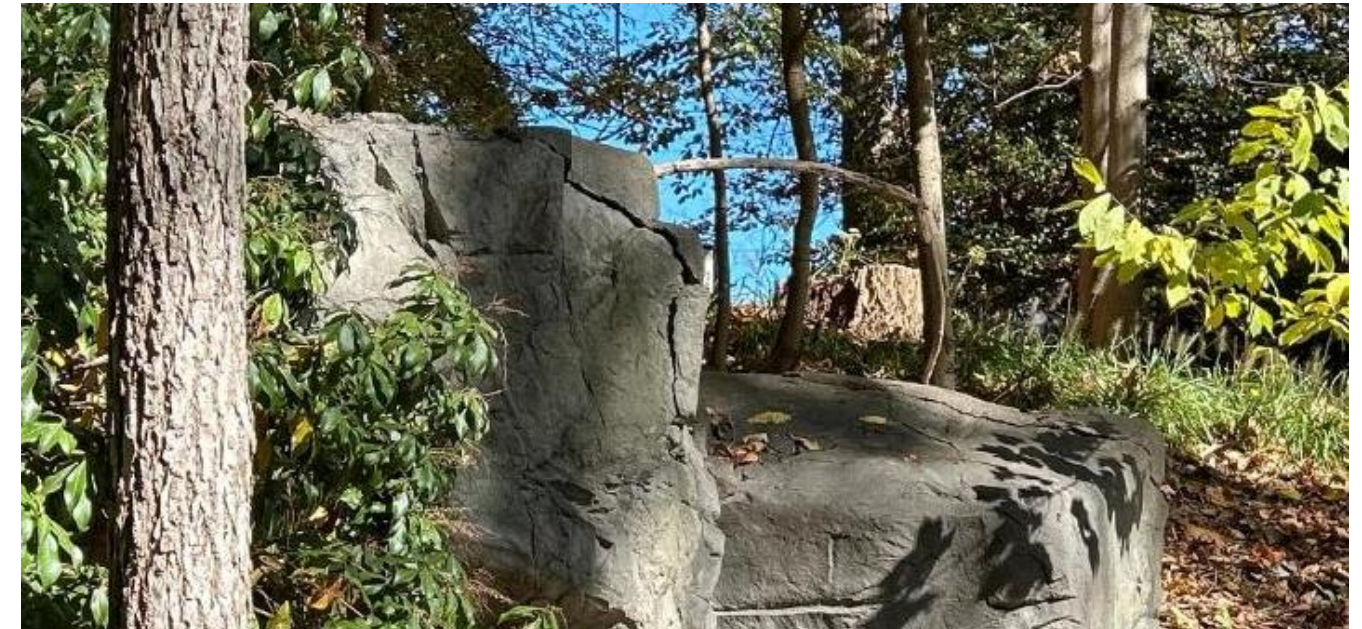
#139: WILLOW OAK

The exposed roots pose safety hazards for keepers. The tree is located between exhibit features to be demolished which renders its preservation unfeasible.



#135, 136, 137: SIBERIAN ELM; #138: BLACK WALNUT

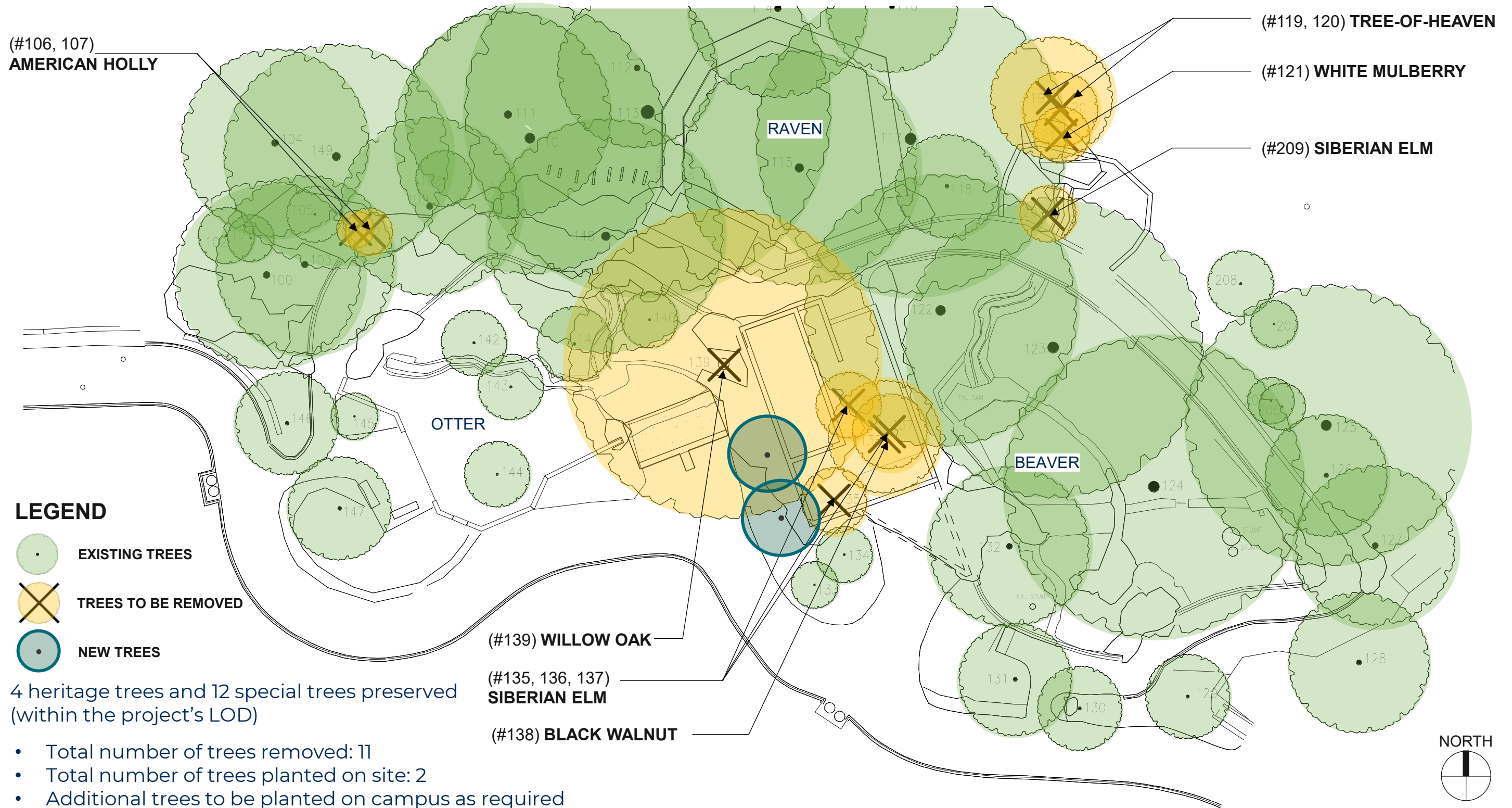
These invasive and/or volunteer trees are located on the existing LSS building's green roof which will be replaced with a new green roof.



#119, 120: TREE-OF-HEAVEN; #121: WHITE MULBERRY

These invasive and/or volunteer species are located within failing faux-rock features to be demolished. Some are poorly formed and infested with spotted lanternflies.

Existing Tree Impact Plan



Tree Inventory

Tree #	Botanical Name	Common Name	Size (DBH)	Critical Root Zone (CRZ)	Species Rating	Condition%	Action	Notes
100	<i>Taxodium distichum</i>	Baldcypress	20"	20'	85%	81%		No tag
101	<i>Ilex opaca</i>	American holly	6"	8'	85%	84%		Tag #2556
102	<i>Ilex opaca</i>	American holly	5"	8'	85%	81%		Tag #2555
103	<i>Taxodium distichum</i>	Baldcypress	19"	19'	85%	81%		Tag #2557; Near wall
104	<i>Fagus grandifolia</i>	American beech	20"	20'	85%	78%		Tag #2547; On steep hill; girdling root
105	<i>Ilex opaca</i>	American holly	6"	8'	85%	81%		Tag #2550; Multi-trunk (5",3",2")
106	<i>Ilex opaca</i>	American holly	4"	8'	85%	81%		Tag #2552; On rocks
107	<i>Ilex opaca</i>	American holly	5"	8'	85%	78%		No tag (possibly #2551)
108	<i>Acer saccharum</i>	Sugar maple	6"	8'	85%	78%		No tag
109	<i>Acer saccharum</i>	Sugar maple	19"	19'	85%	78%		No tag
110	<i>Liriodendron tulipifera</i>	Tulip-poplar	29"	29'	80%	72%		Minor deadwood, Little canopy; No tag
111	<i>Liriodendron tulipifera</i>	Tulip-poplar	22"	22'	80%	78%		Little canopy: No tag
112	<i>Quercus rubra</i>	Northern red oak	17"	17'	85%	72%		Little canopy at top; Minor deadwood; No tag
113	<i>Liriodendron tulipifera</i>	Tulip-poplar	39"	39'	80%	81%		Broken limb in canopy; Strings embedded in trunk
114	<i>Liriodendron tulipifera</i>	Tulip-poplar	19"	19'	80%	84%		Tag #2532
115	<i>Liriodendron tulipifera</i>	Tulip-poplar	25"	25'	80%	0%		Estimated DBH: Within eagle enclosure; Major deadwood at top; Thinner canopy
116	<i>Acer platanoides</i>	Norway maple	14"	14'	70%	81%		Tag #2527
117	<i>Quercus rubra</i>	Northern red oak	33"	33'	85%	81%		No tag; Next to fence
118	<i>Fagus grandifolia</i>	American beech	11"	11'	85%	84%		Tag #2506
119	<i>Ailanthus altissima</i>	Tree-of-heaven	13"	20'	25%	75%		Spotted Lanternfly on trunk; No tag
120	<i>Ailanthus altissima</i>	Tree-of-heaven	8"	12'	25%	72%		Spotted Lanternfly on trunk; No tag
121	<i>Morus alba</i>	White mulberry	6"	9'	30%	59%		Leaning; Poor form
122	<i>Metasequoia glyptostroboides</i>	Dawn redwood	29"	44'	85%	81%		Good form and structure; No tag
123	<i>Metasequoia glyptostroboides</i>	Dawn redwood	32"	48'	85%	84%		Tag #2834; Vines 10%
124	<i>Metasequoia glyptostroboides</i>	Dawn redwood	32"	48'	85%	87%		Tag #2432; Specimen; Near walls
125	<i>Nyssa sylvatica</i>	Blackgum	30"	45'	85%	78%		Good form and structure; No tag
126	<i>Acer platanoides</i>	Norway maple	13"	20'	30%	75%		Tag #2324; Adjacent to path
127	<i>Acer platanoides</i>	Norway maple	17"	26'	30%	75%		Next to stones
128	<i>Metasequoia glyptostroboides</i>	Dawn redwood	15"	23'	85%	81%		Estimated DBH: Within wolf enclosure
129	<i>Betula nigra</i>	River birch	9"	14'	80%	81%		No tag; Multi-trunk (7",6",3")
130	<i>Betula nigra</i>	River birch	9"	14'	80%	78%		No tag; Multi-trunk (6",6",5")
131	<i>Betula nigra</i>	River birch	12"	18'	80%	81%		No tag; Multi-trunk (8",7",6")
132	<i>Taxodium distichum</i>	Baldcypress	17"	25'	85%	81%		Tag buried in trunk
133	<i>Betula nigra</i>	River birch	5"	8'	80%	81%		No tag; Multi-trunk (3",3",3")
134	<i>Betula nigra</i>	River birch	6"	9'	80%	84%		No tag; Multi-trunk (4"3",3")
135	<i>Ulmus pumila</i>	Siberian elm	7"	11'	40%	68%		Poor form and structure
136	<i>Ulmus pumila</i>	Siberian elm	7"	11'	40%	66%		On top of structure; Vines 25%
137	<i>Ulmus pumila</i>	Siberian elm	8"	12'	40%	63%		On top of structure; Vines 30%
138	<i>Juglans nigra</i>	Black walnut	12"	18'	80%	72%		On top of structure; Vines 10%
139	<i>Quercus phellos</i>	Willow oak	33"	50'	80%	84%		Specimen: Next to Otter enclosure wall
140	<i>Magnolia virginiana</i>	Sweetbay magnolia	6"	9'	85%	78%		Good form and structure
141	<i>Magnolia virginiana</i>	Sweetbay magnolia	8"	12'	85%	81%		Good form and structure
142	<i>Magnolia virginiana</i>	Sweetbay magnolia	7"	11'	85%	82%		Tag #2419; Good form and structure
143	<i>Magnolia virginiana</i>	Sweetbay magnolia	7"	11'	85%	78%		Good form and structure
144	<i>Betula nigra</i>	River birch	7"	11'	80%	72%		Multi-trunk (6",3",3")
145	<i>Chionanthus virginicus</i>	Fringetree	5"	8'	85%	75%		Multi-trunk (3",2",2",2",2"); Broken leader
146	<i>Betula nigra</i>	River birch	11"	17'	80%	78%		Multi-trunk (8",5",5",4",3")
147	<i>Betula nigra</i>	River birch	11"	17'	80%	81%		Multi-trunk (7",6",6")
148	<i>Quercus phellos</i>	Willow oak	25"	38'	80%	78%		Good form and structure
149	<i>Fagus grandifolia</i>	American beech	24"	36'	85%	75%		Narrow form
205	<i>Ilex opaca</i>	American holly	5"	8'	85%	81%		Near path
206	<i>Morus rubra</i>	Red mulberry	5"	8'	40%	78%		Near path
207	<i>Morus rubra</i>	Red mulberry	5"	8'	40%	75%		
208	<i>Liriodendron tulipifera</i>	Tulip-poplar	7"	11'	80%	72%		Curved lower trunk
209	<i>Ulmus pumila</i>	Siberian elm	6"	9'	40%	72%		Next to water channel

LEGEND

TREES TO BE REMOVED


Note, while most trees are part of the NZCBI campus' living collection, those without tags are volunteer and not part of the tree collection.

Planting Plan - Otter

PLANT SCHEDULE

SYMBOL CODE BOTANICAL / COMMON NAME

TREES

 BN BETULA NIGRA 'DURA HEAT' / DURA HEAT RIVER BIRCH

SHRUBS

 CR CORNUS SERICEA / RED TWIG DOGWOOD

 DL DIERVILLA LONICERA / BUSH HONEYSUCKLE

 FG FOTHERGILLA GARDENII / DWARF FOTHERGILLA

 IV ITEA VIRGINICA / VIRGINIA SWEETSPIRE

 JE JUNCUS EFFUSUS / SOFT RUSH


 LB LINDERA BENZOIN / SPICEBUSH


 MR MITCHELLA REPENS / PARTRIDGEBERRY


 CS CORNUS SERICEA 'FLAVIRAMEA' / YELLOW TWIG DOGWOOD

 MP MORELLA PENNSYLVANICA / NORTHERN BAYBERRY


GROUND COVERS

 CG CAREX GRAYI / GRAY'S SEDGE


 CW CAREX WOODII / PRETTY SEDGE

 EV ELYMUS VIRGINICUS / VIRGINIA WILD RYE

GROUND COVER MIX

 CAREX PENNSYLVANICA / PENNSYLVANIA SEDGE
 DRYOPTERIS ERYTHROSORA 'BRILLIANCE' / BRILLIANCE AUTUMN FERN
 ELYMUS HYSTRIX / BOTTLEBRUSH GRASS
 THELYPTERIS NOVEBORACENSIS / NEW YORK FERN
 HEUCHERA VILLOSA 'AUTUMN BRIDE' / AUTUMN BRIDE HAIRY ALUMROOT

BIORETENTION MIX

 CAREX STRICTA / TUSsock SEDGE
 CHELONE GLABRA / WHITE TURTLEHEAD
 JUNCUS EFFUSUS / SOFT RUSH
 OSMUNDASTRUM CINNAMOMEUM / CINNAMON FERN
 ELYMUS HYSTRIX / BOTTLEBRUSH GRASS




Planting Plan - Beaver

PLANT SCHEDULE

SYMBOL CODE BOTANICAL / COMMON NAME

TREES

 BN BETULA NIGRA 'DURA HEAT' / DURA HEAT RIVER BIRCH

SHRUBS

 CR CORNUS SERICEA / RED TWIG DOGWOOD

 DL DIERVILLA LONICERA / BUSH HONEYSUCKLE

 FG FOTHERGILLA GARDENII / DWARF FOTHERGILLA

 IV ITEA VIRGINICA / VIRGINIA SWEETSPIRE

 JE JUNCUS EFFUSUS / SOFT RUSH


 LB LINDERA BENZOIN / SPICEBUSH


 MR MITCHELLA REPENS / PARTRIDGEBERRY


 CS CORNUS SERICEA 'FLAVIRAMEA' / YELLOW TWIG DOGWOOD

 MP MORELLA PENNSYLVANICA / NORTHERN BAYBERRY


GROUND COVERS

 CG CAREX GRAYI / GRAY'S SEDGE


 CW CAREX WOODII / PRETTY SEDGE

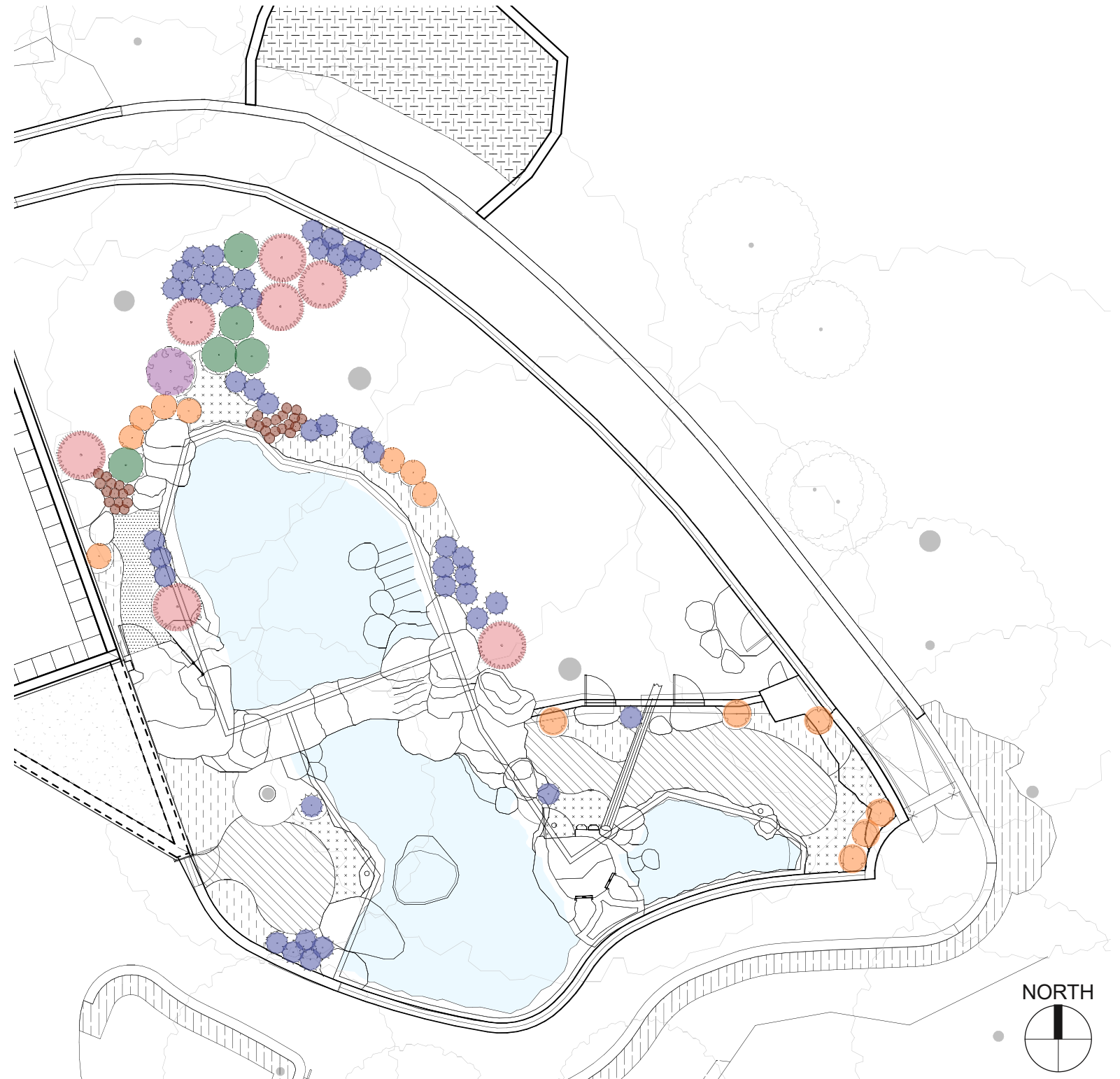
 EV ELYMUS VIRGINICUS / VIRGINIA WILD RYE

GROUND COVER MIX

 CAREX PENNSYLVANICA / PENNSYLVANIA SEDGE
 DRYOPTERIS ERYTHROSORA 'BRILLIANCE' / BRILLIANCE AUTUMN FERN
 ELYMUS HYSTRIX / BOTTLEBRUSH GRASS
 THELYPTERIS NOVEBORACENSIS / NEW YORK FERN
 HEUCHERA VILLOSA 'AUTUMN BRIDE' / AUTUMN BRIDE HAIRY ALUMROOT

BIORETENTION MIX

 CAREX STRICTA / TUSOCK SEDGE
 CHELONE GLABRA / WHITE TURTLEHEAD
 JUNCUS EFFUSUS / SOFT RUSH
 OSMUNDASTRUM CINNAMOMEUM / CINNAMON FERN
 ELYMUS HYSTRIX / BOTTLEBRUSH GRASS




Plant Schedule





PLANT SCHEDULE

SYMBOL CODE BOTANICAL / COMMON NAME


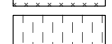

TREES

	BN	BETULA NIGRA 'DURA HEAT' / DURA HEAT RIVER BIRCH
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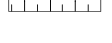



SHRUBS

	CR	CORNUS SERICEA / RED TWIG DOGWOOD
	DL	DIERVILLA LONICERA / BUSH HONEYSUCKLE
	FG	FOTHERGILLA GARDENII / DWARF FOTHERGILLA
	IV	ITEA VIRGINICA / VIRGINIA SWEETSPIRE
	JE	JUNCUS EFFUSUS / SOFT RUSH
	LB	LINDERA BENZOIN / SPICEBUSH
	MR	MITCHELLA REPENS / PARTRIDGEBERRY
	CS	CORNUS SERICEA 'FLAVIRAMEA' / YELLOW TWIG DOGWOOD
	MP	MORELLA PENNSYLVANICA / NORTHERN BAYBERRY

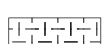
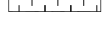



GROUND COVERS

	CG	CAREX GRAYI / GRAY'S SEDGE
	CW	CAREX WOODII / PRETTY SEDGE
	EV	ELYMUS VIRGINICUS / VIRGINIA WILD RYE

GROUND COVER MIX

	CAREX PENNSYLVANICA / PENNSYLVANIA SEDGE
	DRYOPTERIS ERYTHROSORA 'BRILLIANCE' / BRILLIANCE AUTUMN FERN
	ELYMUS HYSTRIX / BOTTLEBRUSH GRASS
	THELYPTERIS NOVEBORACENSIS / NEW YORK FERN
	HEUCHERA VILLOSA 'AUTUMN BRIDE' / AUTUMN BRIDE HAIRY ALUMROOT

BIORETENTION MIX

	CAREX STRICTA / TUSOCK SEDGE
	CHELONE GLABRA / WHITE TURTLEHEAD
	JUNCUS EFFUSUS / SOFT RUSH
	OSMUNDASTRUM CINNAMOMEUM / CINNAMON FERN
	ELYMUS HYSTRIX / BOTTLEBRUSH GRASS

PLANT SCHEDULE BEAVER

CODE	QTY	BOTANICAL / COMMON NAME	CONT	SIZE	SPACING	REMARKS
SHRUBS						
CR	7	CORNUS SERICEA / RED TWIG DOGWOOD	5 GAL	36" O.A.	60" o.c.	
DL	14	DIERVILLA LONICERA / BUSH HONEYSUCKLE	3 GAL	18" O.A.	30" o.c.	FULL TO EDGE OF POT
IV	5	ITEA VIRGINICA / VIRGINIA SWEETSPIRE	3 GAL	30" O.A.	48" o.c.	
JE	44	JUNCUS EFFUSUS / SOFT RUSH	3 GAL	18" HT., FULL TO EDGE OF POT	30" o.c.	
LB	1	LINDERA BENZOIN / SPICEBUSH	5 GAL	30" O.A.	60" o.c.	
MR	31	MITCHELLA REPENS / PARTRIDGEBERRY	1 GAL	FULL TO EDGE OF POT	12" o.c.	FULL TO EDGE OF POT
GROUND COVERS						
CG	34	CAREX GRAYI / GRAY'S SEDGE	1 GAL	FULL TO EDGE OF POT	24" o.c.	FULL TO EDGE OF POT
CW	55	CAREX WOODII / PRETTY SEDGE	1 GAL	FULL TO EDGE OF POT	24" o.c.	
EV	51	ELYMUS VIRGINICUS / VIRGINIA WILD RYE	1 GAL	FULL TO EDGE OF POT	30" o.c.	

PLANT SCHEDULE OTTER

CODE	QTY	BOTANICAL / COMMON NAME	CONT	SIZE	SPACING	REMARKS
SHRUBS						
CR	3	CORNUS SERICEA / RED TWIG DOGWOOD	5 GAL	36" O.A.	60" o.c.	
DL	24	DIERVILLA LONICERA / BUSH HONEYSUCKLE	3 GAL	18" O.A.	30" o.c.	FULL TO EDGE OF POT
FG	3	FOTHERGILLA GARDENII / DWARF FOTHERGILLA	5 GAL	18" O.A.	48" o.c.	FULL TO EDGE OF POT
IV	6	ITEA VIRGINICA / VIRGINIA SWEETSPIRE	3 GAL	30" O.A.	48" o.c.	
JE	22	JUNCUS EFFUSUS / SOFT RUSH	3 GAL	18" HT., FULL TO EDGE OF POT	30" o.c.	
LB	2	LINDERA BENZOIN / SPICEBUSH	5 GAL	30" O.A.	60" o.c.	
MR	65	MITCHELLA REPENS / PARTRIDGEBERRY	1 GAL	FULL TO EDGE OF POT	12" o.c.	FULL TO EDGE OF POT
GROUND COVERS						
CG	26	CAREX GRAYI / GRAY'S SEDGE	1 GAL	FULL TO EDGE OF POT	24" o.c.	FULL TO EDGE OF POT
CW	65	CAREX WOODII / PRETTY SEDGE	1 GAL	FULL TO EDGE OF POT	24" o.c.	
EV	46	ELYMUS VIRGINICUS / VIRGINIA WILD RYE	1 GAL	FULL TO EDGE OF POT	30" o.c.	

PLANT SCHEDULE SITE

CODE	QTY	UNIT	BOTANICAL / COMMON NAME	SIZE	TYPE	SPACING	
TREES							
TBN	2	ea	Betula nigra `Dura Heat` / Dura Heat River Birch	10' Ht.	B&B	As Shown	
SHRUBS							
CF	5	ea	Itea virginica 'Little Henry' / Dwarf Virginia Sweetspire	3 gal.	Cont.	As Shown	
LB	11	ea	Lindera benzoin / Spicebush	5 gal.	Cont.	As Shown	
MP	23	ea	Morella Pennsylvanica / Northern Bayberry	2 gal.	Cont.	As Shown	
GROUND COVER MIX							
CP	144	ea	Carex pensylvanica / Pennsylvania Sedge	1 Qt.	Pot	18" O.C.	20% @ 18" o.c.
DB	217	ea	Dryopteris erythrosora 'Brilliance' / Brilliance Autumn Fern	1 Qt.	Pot	18" O.C.	30% @ 18" o.c.
CHA	144	ea	Elymus hystrix / Bottlebrush Grass	1 Qt.	Pot	18" O.C.	20% @ 18" o.c.
HA	60	ea	Heuchera villosa 'Autumn Bride' / Autumn Bride Hairly Alumroot	1 Qt.	Pot	24" O.C.	15% @ 24" o.c.
TN	107	ea	Thelypteris noveboracensis / New York Fern	1 Qt.	Pot	18" O.C.	15% @ 18" o.c.
BIORETENTION MIX							
CV	45	ea	Carex stricta / Tussock Sedge	1 Qt.	Pot	18" O.C.	25% @ 18" o.c.
CG	18	ea	Chelone glabra / White Turtlehead	1 Qt.	Pot	18" O.C.	10% @ 18" o.c.
EH	18	ea	Elymus hystrix / Bottlebrush Grass	1 Qt.	Pot	18" O.C.	10% @ 18" o.c.
JE	54	ea	Juncus effusus / Soft Rush	1 Qt.	Pot	18" O.C.	30% @ 18" o.c.
AP2	101	ea	Osmundastrum cinnamomeum / Cinnamon Fern	1 Qt.	Pot	12" O.C.	25% @ 12" o.c.

Habitat Planting Palette

All plantings within the NZCBI are coordinated and reviewed with Animal Care, Horticulture, and Integrated Pest Management team for animal safety and maintenance requirements. Plants to be incorporated within the habitats will prioritize native, non-toxic species that safely accommodate the natural behaviors of the resident beavers, otters, and ravens. Red Twig Dogwood (*Cornus sericea*) provides safe structural elements and natural forage. Plant selections have been made based on character, native status, support of pollinators, appropriateness for animals and alignment with the NCPC Pollinator Best Practices. Virginia Sweetspire (*Itea virginica*) offers necessary nectar for native bees and butterflies while remaining non-toxic. Additionally, planting Soft Rush (*Juncus effusus*) along the aquatic margins establishes a resilient water transition zone.

SHRUBS



JUNCUS EFFUSUS
SOFT RUSH



CORNUS SERICEA
RED TWIG DOGWOOD



DIERVILLA LONICERA
BUSH HONEYSUCKLE



FOTHERGILLA GARDENII
DWARF FOTHERGILLA



MITCHELLA REPENS
PARTRIDGEBERRY



ITEA VIRGINICA
VIRGINIA SWEETSPIRE



LINDERA BENZOIN
SPICEBUSH

GROUND COVERS



CAREX GRAYI
GRAY'S SEDGE



CAREX WOODII
PRETTY SEDGE



ELYMUS VIRGINICUS
VIRGINIA WILD RYE

Site Planting Palette

The landscaping establishes a resilient perimeter using native, deer-resistant plants that offer ecological value for pollinators. Spicebush serves as a foundational shrub, providing aromatic foliage that naturally deters deer while supporting local pollinators. To create a robust, layered ecological buffer, the design incorporates a bioretention mix featuring White Turtlehead, Soft Rush, and Cinnamon Fern. Supplementing this area with diverse, moisture-tolerant groundcovers like New York Fern adds visual interest and essential habitat structure without attracting local deer populations.

TREES



BETULA NIGRA 'DURA HEAT'
DURA HEAT RIVER BIRCH

SHRUBS



CORNUS SERICEA FLAVIRAMEA
YELLOW TWIG DOGWOOD



MORELLA PENNSYLVANICA
NORTHERN BAYBERRY



LINDERA BENZOIN
SPICEBUSH

Site Planting Palette (continued)

GROUND COVERS



THELYPTERIS NOVEBORACENSIS
NEW YORK FERN



CAREX PENNSYLVANICA
PENNSYLVANIA SEDG



HEUCHERA VILLOSA 'AUTUMN BRIDE'
AUTUMN BRIDE HAIRY ALUMROOT



DRYOPTERIS ERYTHROSORA
'BRILLIANCE'
BRILLIANCE AUTUMN FERN



ELYMUS HYSTRIX
BOTTLEBRUSH GRASS

BIORETENTION MIX



CAREX STRICTA
TUSSOCK SEDGE



CHELONE GLABRA
WHITE TURTLEHEAD



ELYMUS HYSTRIX
BOTTLEBRUSH GRASS



JUNCUS EFFUSUS
SOFT RUSH



OSMUNDASTRUM CINNAMOMEUM
CINNAMON FERN

Stormwater Management Compliance

STORMWATER MANAGEMENT COMPLIANCE SUMMARY

The retention requirement is fulfilled through the installation of the following BMPs: (2) Green Roofs, (1) Bioretention, and (2) Rainwater Harvesting Systems as well as through the preservation of (4) Heritage Trees, (12) Special Trees, and (11) Small Trees.

- PARCEL SWR_v REQUIRED: 926 CF
- PARCEL SWR_v PROVIDED: 1,040 CF (112.3% of the requirement met on site)

The proposed habitat pools function as the contributing drainage areas to the proposed LSS systems which act as rainwater harvesting systems for SWM credit. Per the preliminary design review meeting conducted with DOEE on 03/05/2026, the proposed LSS systems shall be modeled as rainwater harvesting tanks for SWR_v purposes.

STORMWATER MANAGEMENT PLAN NOTES

PRE-DEVELOPMENT PROJECT AREA TABULATIONS

COMPACTED COVER:	6,278 SF
COMPACTED COVER (UTILITY; SWM-EXEMPT):	455 SF
IMPERVIOUS COVER:	8,319 SF
BMP LAND COVER:	0 SF
TOTAL AREA:	15,052 SF

POST-DEVELOPMENT PROJECT AREA TABULATIONS

COMPACTED COVER:	6,579 SF
COMPACTED COVER (UTILITY; SWM-EXEMPT):	455 SF
IMPERVIOUS COVER:	7,073 SF
BMP LAND COVER:	945 SF
TOTAL AREA:	15,052 SF

BMP COMPLIANCE SUMMARY:

GREEN ROOFS

GREEN ROOF 1

175 SF AREA

255 SF CONTRIBUTING DRAINAGE AREA SYSTEM AT 9" DEPTH

SWR_v = 54 CF

GREEN ROOF 2

380 SF AREA

390 SF CONTRIBUTING DRAINAGE AREA SYSTEM AT 9" DEPTH

SWR_v = 104 CF

RAINWATER HARVESTING

RAINWATER HARVESTING SYSTEM 1

127 CF VOLUME

625 SF CONTRIBUTING DRAINAGE AREA

SWR_v = 84 CF

RAINWATER HARVESTING SYSTEM 1

147 CF VOLUME

1,053 SF CONTRIBUTING DRAINAGE AREA

SWR_v = 52 CF

BIORETENTION

390 SF AREA

2,914 SF CONTRIBUTING DRAINAGE AREA

MEDIA AT 3' DEPTH

SWR_v = 156 CF

TREE PRESERVATIONS

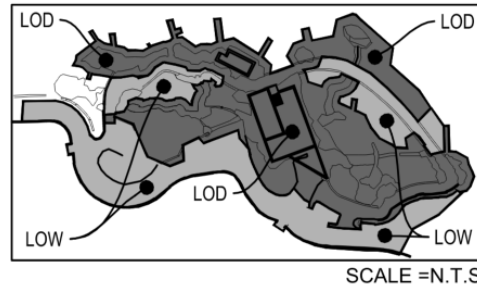
3 HERITAGE TREES PRESERVED (SWR_v PER (1) HERITAGE TREE PRESERVED = 40 CF)

12 SPECIAL TREES PRESERVED (SWR_v PER (1) SPECIAL TREE PRESERVED = 30 CF)

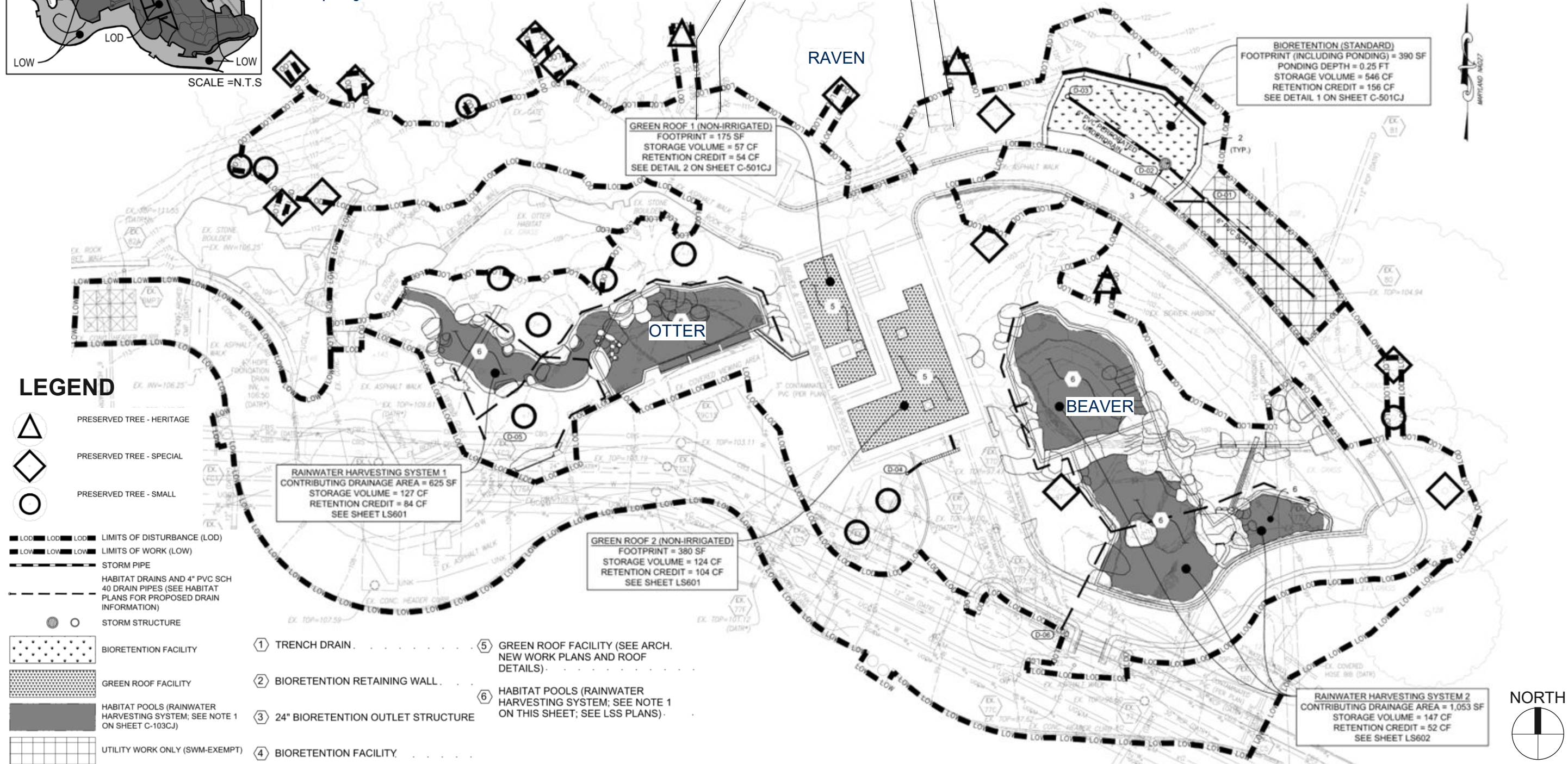
11 SMALL TREES PRESERVED (SWR_v PER (1) SMALL TREE PRESERVED = 10 CF)

SWR_v = 590 CF

Stormwater Management Plan



Below is a summary of the currently proposed strategies to address SWM requirements for this project site.





SMITHSONIAN'S NATIONAL ZOO
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QUINN
EVANS