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CUYAHOGA COUNTY

HIGHLAND BLUFFS LAKEFRONT RESILIENCE & ACCESS PLAN

SMITHGROUP



June 2023



OFFICE OF
COASTAL
MANAGEMENT
OHIO DEPARTMENT OF NATURAL RESOURCES



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ACKNOWLEDGMENTS

PREPARED FOR:



COUNTY OF CUYAHOGA, OHIO
PUBLIC WORKS

CUYAHOGA COUNTY PLANNING COMMISSION | CITY OF LAKEWOOD

PREPARED BY:



SMITHGROUP

KS ASSOCIATES | CHAGRIN VALLEY ENGINEER | CTL ENGINEERING | ASC GROUP

The participation of the residents and landowners of the 13 properties located along the shoreline, which is the focus of the Highland Bluffs Lakefront Resilience & Access Plan, has been critical to the ideas presented in this document. This group has freely shared their thoughts, preferences and opinions and deserves a great deal of appreciation for their collaborative spirit and willingness to participate in an open exchange of ideas. As this project advances, the information presented in this plan will require further testing and refinement as this document represents a step along the way, not a final recommendation of exactly what will be built in the future. Cuyahoga County and the consultant team wish to express our deep appreciation for the involvement of the 13 landowners, regulatory agency staff, and other participants not otherwise named that have been critical to development of this plan.





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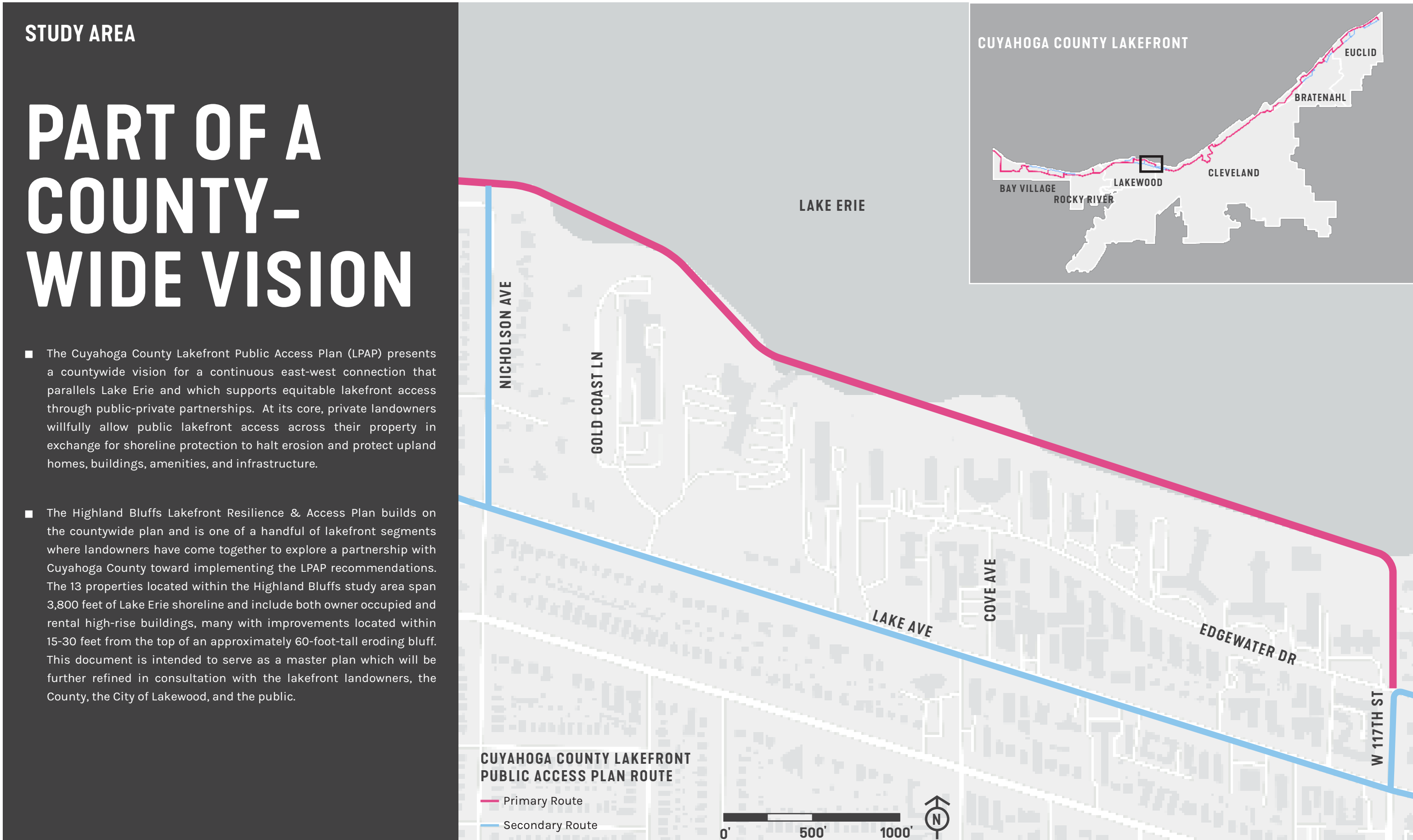
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01 PROJECT CONTEXT

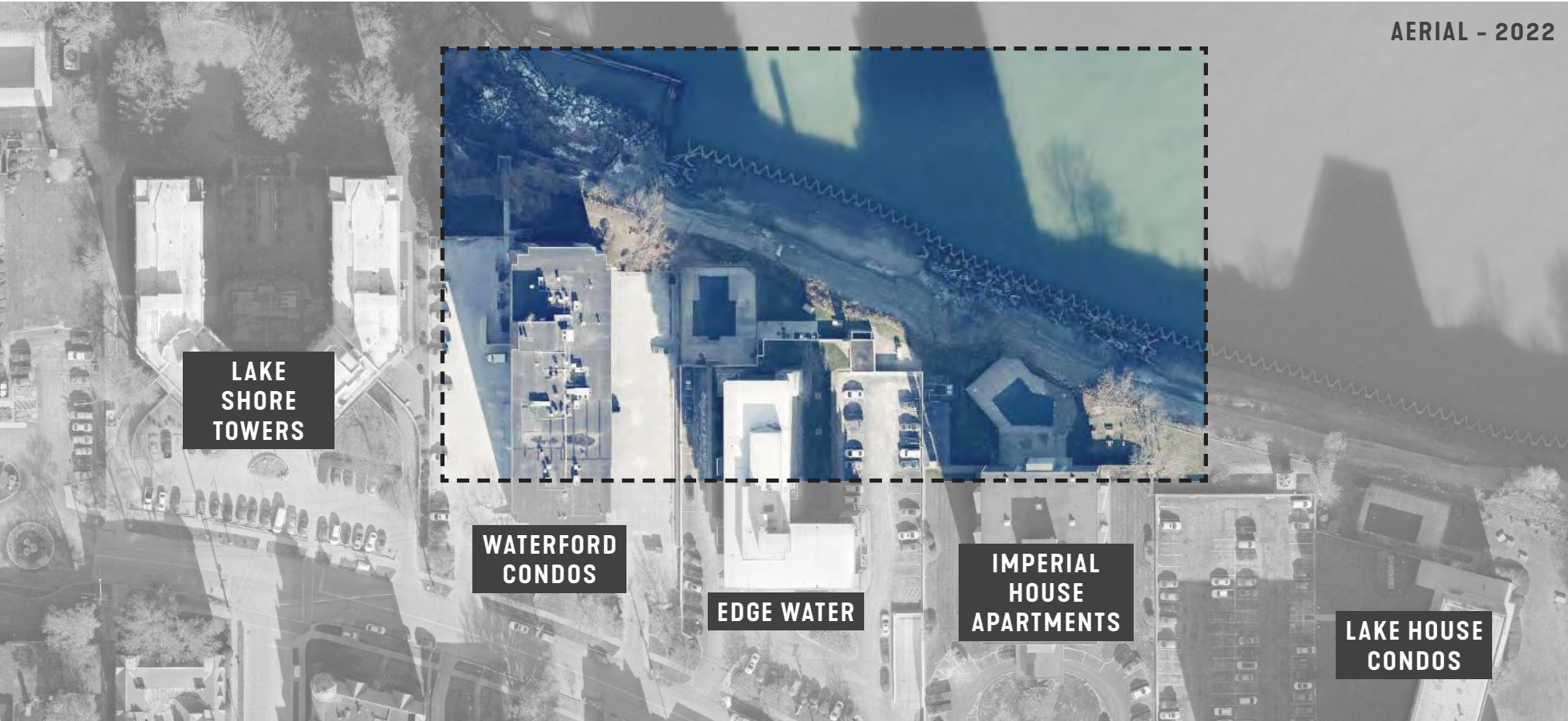




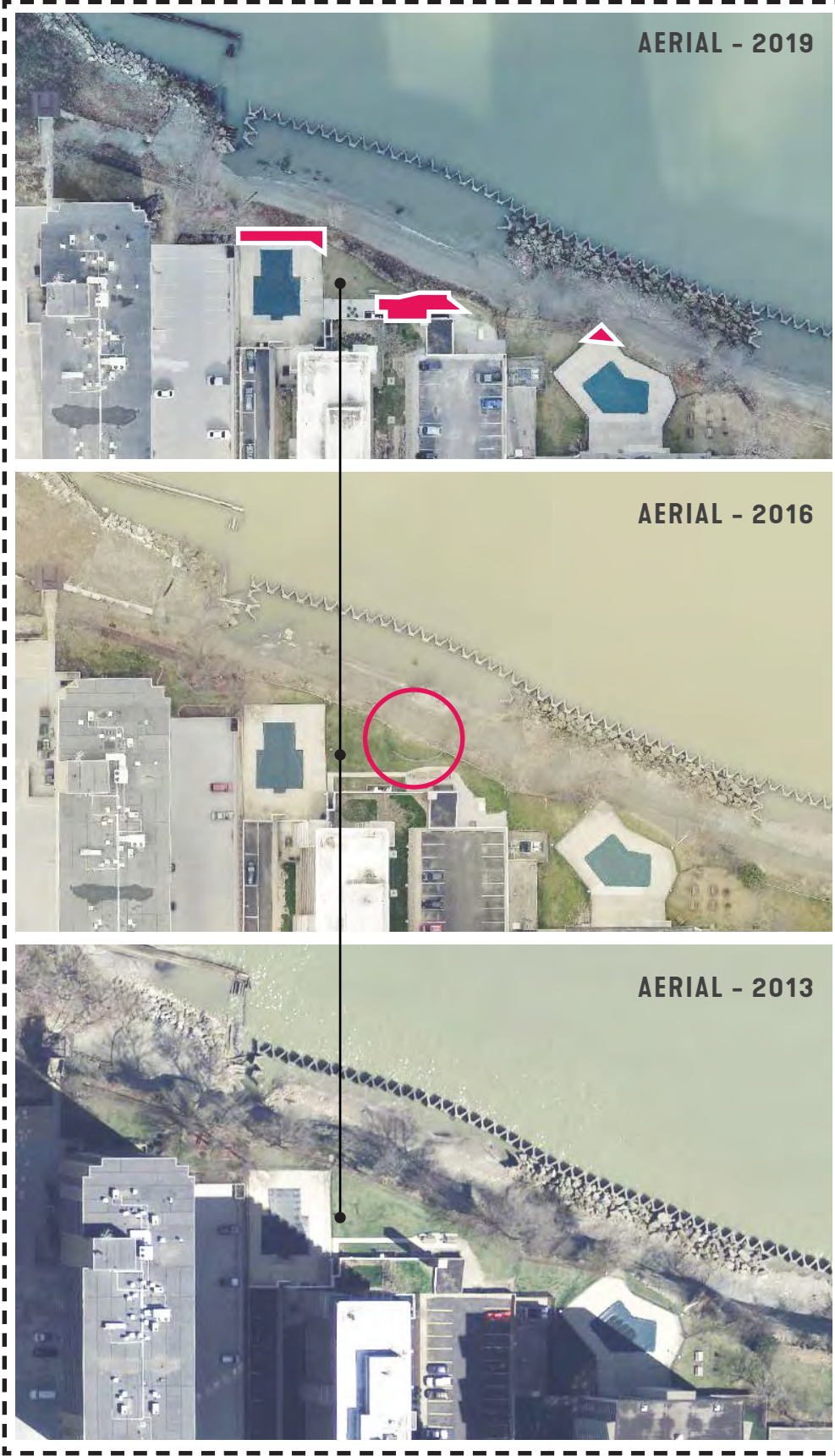
SITE INTRODUCTION

The Highland Bluffs shoreline includes 13 privately owned properties stretching out along 3,800 feet of Lake Erie shoreline and is located in Lakewood Ohio along its eastern boundary with the City of Cleveland. Ownership includes a mix of rental and condo high-rise buildings. Buildings and site improvements, with an approximate assessed value of \$254 million, line the top of the approximately 60-foot-high bluffs with buildings, parking structures, pools, chillers and other mechanical equipment, and other private amenities such as picnic and grilling areas being located within feet of the eroding blufftop.

The bluff and the corresponding erosion generally evolve slowly, but its effects can be seen in comparisons between recent aerial imagery, in the stories shared by residents and landowners, and by the signs of new investments being made to shift blufftop improvements further from harm's way. While the shale bluff is eroding slowly, more significant slumps and localized failures are a very real concern. This has led to the closure of lakefront level resident-serving space particularly along the west side of the project area and multiple attempts by private landowners to address their localized erosion concerns in front of the limited property they own.



Permitted and unpermitted investments at the toe of the bluff are apparent. These include large areas of dumped concrete roughly leveled a few feet above the average lake level, dumped rubble and debris, and the placement of conventional stone revetments and concrete "teeth" know as Great Lakes Armor Units. While these attempts have been somewhat effective in areas, erosion remains active and must be addressed at scale – in a coordinated way across properties as erosion and bluff failures, like key factors such as wind, wave, rain and ice don't respond to property lines. Over the next couple of years, owners have indicated they are likely to spend approximately \$9 million to attempt to solve their erosion issues and protect their property alone. The need for a coordinated effort is clear as residents report segments of bluff being lost at an approximate annual rate of 10-12 inches.



BLUFF EROSION

An on-site evaluation of the existing park shoreline was conducted as part of the master plan. Geotechnical sampling and analysis (coring, durability testing of cores, and on-site examination of bluff faces) found the bluffs are composed of friable shale. Exposed faces along the lakefront are pitted and subject to fracturing from wave impact and freeze/thaw cycles. Repeated exposure to weather and waves and the existing bluff slope has resulted in slope failures. Failures will continue without protection and stabilization.

When the lake water levels are low, a shallow sand beach has historically been present along the bluff toe. The beach was reported to be wide enough that it was sometimes used informally by hikers and walkers. In their current disposition, the bluff faces are susceptible to two types of failure, both of which are actively occurring and will continue far into the future without investment: undermining at the toe of the bluff because of wave action and wetting which results in erosion and spauling of the toe, and slope subsidence because of the near vertical bluff face. Toe armoring and bluff face modifications are needed to preserve the bluffs. These strategies should be implemented to protect users and preserve existing land. The cost of this work is substantial, but the cost of inaction is significantly greater.



SITE CONDITIONS

Lakefront projects are complex. A multitude of factors are involved when considering how to expand equitable public lakefront access while simultaneously balancing private landowner interests and desires with creating a more resilient, adaptable bluff and shoreline. Some of the key factors that influence design decisions are highlighted in this section and inform the alternatives and recommendations outlined in this document.

OUTFALLS

Including large public storm sewers and combined sewer outfalls which are undergoing investment to reduce discharges and protect them from lake impacts as well as smaller private area-draining pipes. Outfalls range in size from 72" to surface-draining 4-6" drainpipes. Managing and cleaning stormwater are key considerations as are factors associated with wastewater.

COASTAL STRUCTURES

Apparent in both the aerial imagery and the State of Ohio's GIS inventory of coastal structures are various fill materials within the lake. The type of material varies from stone to rubble and concrete. Many structures placed along the lakeshore attempting to mitigate erosion need investment due to age and/or the extended period of high lake levels recently experienced on Lake Erie. Structures include both permitted and unpermitted elements with those being located within the boundaries of Submerged Lands Leases generally being the former.

PRIVATE ACCESS

Providing opportunities for lakefront landowners to recover the use and access to the lake that once existed or to gain it for the first time. Other landowners see planned public access points as the solution for gaining access. Accommodation of both perspectives is important.

SUBMERGED LAND LEASES

Representing the agreement between the State of Ohio and private parties that allows for the use of the public waters (lakebed) for private purposes. Leases that generate revenue (e.g. marinas) come with an increased lease rate paid to the state/public while non-revenue producing elements such as shoreline protection come with a nominal cost – typically \$1 annually. Lease requirements are complex, varying with when the structure was built and the purpose of the structure. Generally, structures within identified lease boundaries are permitted by state and federal agencies having jurisdiction.

OWNERSHIP

Including high-rise buildings that are both rental and condominium forms of ownership. This distinction is important as it relates to the complexity of establishing agreements to allow for project advancement. Landowners of rental buildings are typically single or small ownership groups able to make decisions about what is best for their property/investment. Condo associations are represented by boards that represent all owners, meaning agreements with these entities to allow for public access in exchange for shoreline protection involve many more voices. Both groups exist along the project area.

WATER DEPTHS

The greater the depth, the larger a wave can grow. This is one key factor, particularly when considering shoreline resilience measures. As Lake Erie water levels can vary by many feet seasonally and over years, and periods of lake ice that protect shorelines from large northeast winter storms is becoming more of an anomaly than the norm, understanding the coastal conditions is critical to the design of improvements.



- | | |
|----------------------------|---------------------------------|
| 1 Carlyle on the Lake | 8 Edge Water |
| 2 Winton Place Condominium | 9 Imperial House Apartments |
| 3 The Meridian | 10 Lake House Condominium |
| 4 Marine Towers West Condo | 11 Berkshire Condominium |
| 5 Marine Towers East Condo | 12 Shoreham Apartments |
| 6 Lake Shore Towers | 13 Edgewater Towers Condominium |
| 7 Waterford Condominium | |

02 ALTERNATIVES & STRATEGIES



ALTERNATIVES: PUBLIC LAKEFRONT ACCESS

At its core, this project is about expanding lakefront access and protecting blufftop built improvements from erosion. Achieving both facets are requirements for the project to advance. Therefore, expanding equitable lakefront access comes with the requirement that the public must be able to get to the lakefront trail. Access routes are required to be:

- **Thoughtful:** respecting the privacy and goals of the upland landowner(s);
- **Responsive:** in that they provide opportunities to transition from blufftop to lakefront trail level;
- **Connected:** with logical access points to existing public right-of-ways and multimodal improvements;
- **Distributed:** providing for trail loops that eliminate the needs for out and back conditions or dead-end trails; and
- **Supportive:** offer universal access for all ages and abilities whenever possible.

Experience suggests that while the lakefront trail and improvements will be open to the public, these systems draw significantly from a close area – maybe a 10 minute walk as those are the folks who would access and use daily. This reduces concerns of parking as nearby lakefront access points and destinations like Lakewood Park and Edgewater Park will remain key regional destination for those arriving from great distances by car. Ultimately, the final access routes need further evaluation, more discussion with stakeholders, and legal instruments such as easements to be built. However, the following diagram highlights the preferred routes (based on preliminary discussions) and alternative access points that need further consideration.

WEST PREFERRED 1

Mirroring the corridor of planned City of Lakewood lakefront outfall and utility infrastructure upgrades. Balancing public access with resident use areas at the top and bottom of the bluff will be critical. Visitors to the lakefront restaurant at the northern end of the property would certainly take advantage of this access point.

CENTRAL PREFERRED 2

Along a service drive/walk at the property line between Marine Towers East and Lake Shore Towers. Minor reconfiguration of private parking adjacent to Edgewater Drive would be necessary to create a clear gateway. The sloping land at the north end of the site is slumping in areas allowing investments to address the need for access and bluff stability.

EAST PREFERRED 3

At the eastern edge of the project area, which is also the boundary between the City of Lakewood and City of Cleveland. The trail transition from lake level to top of bluff would connect into the Harborview Drive right-of-way. Residents of this neighborhood have expressed concerns over this connection and the presence of underground and overhead utilities are factors to consider.

WEST ALTERNATIVE

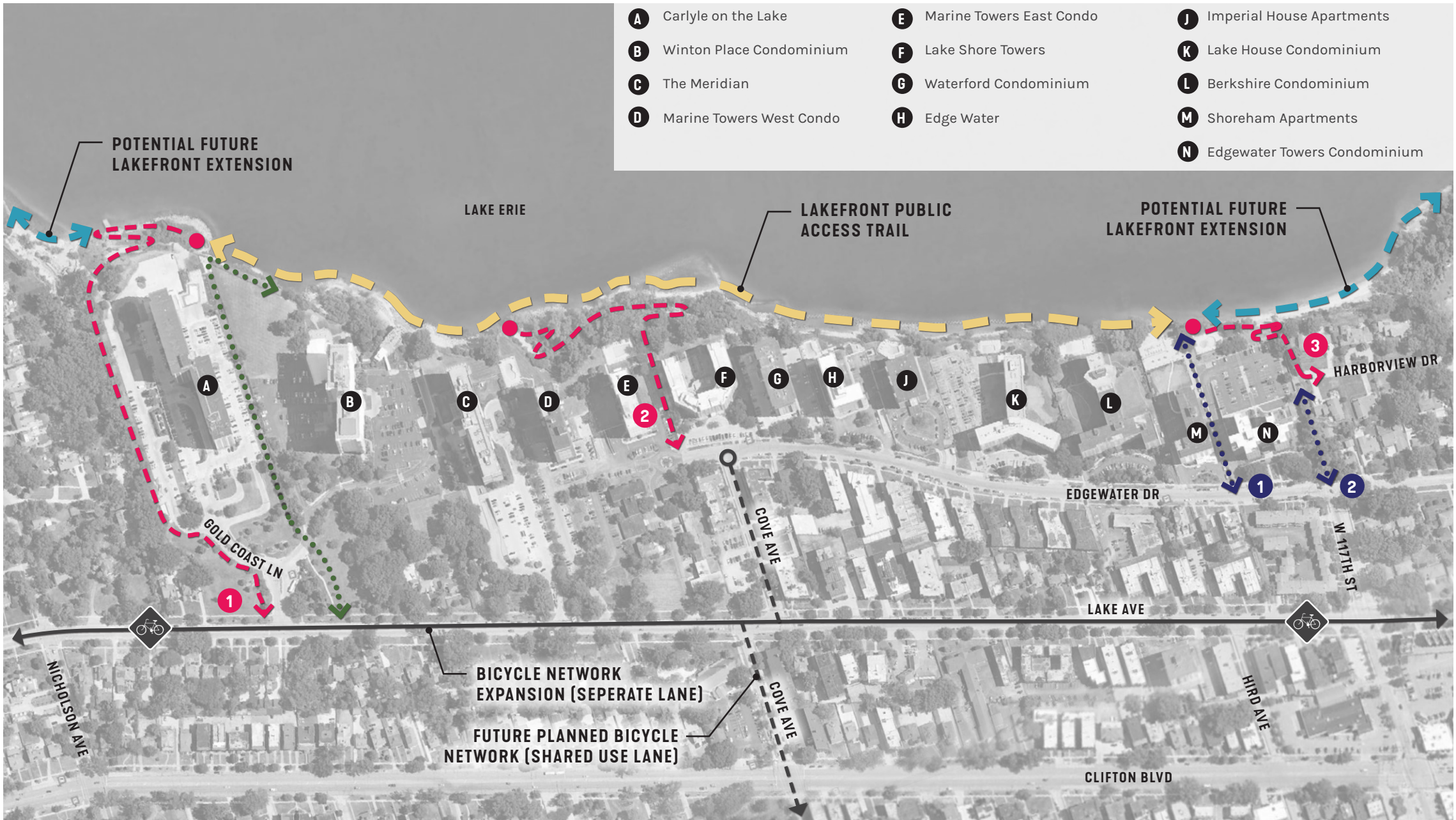
Running along the property line between The Carlyle and Winton Place condominiums and past a bus transit station, this area crosses resident vegetable gardens and the currently underdeveloped open space west of Pier W. Planned recreational investments in this open area and gardens make this route less desirable for landowners.

EAST ALTERNATIVE 1

Reconfiguring the multiple vehicle drive lanes could create space for a multipurpose trail, however, the elevation change between the two buildings is challenging. The probable need to lose some resident parking to create room for the trail is also a concern.

EAST ALTERNATIVE 2

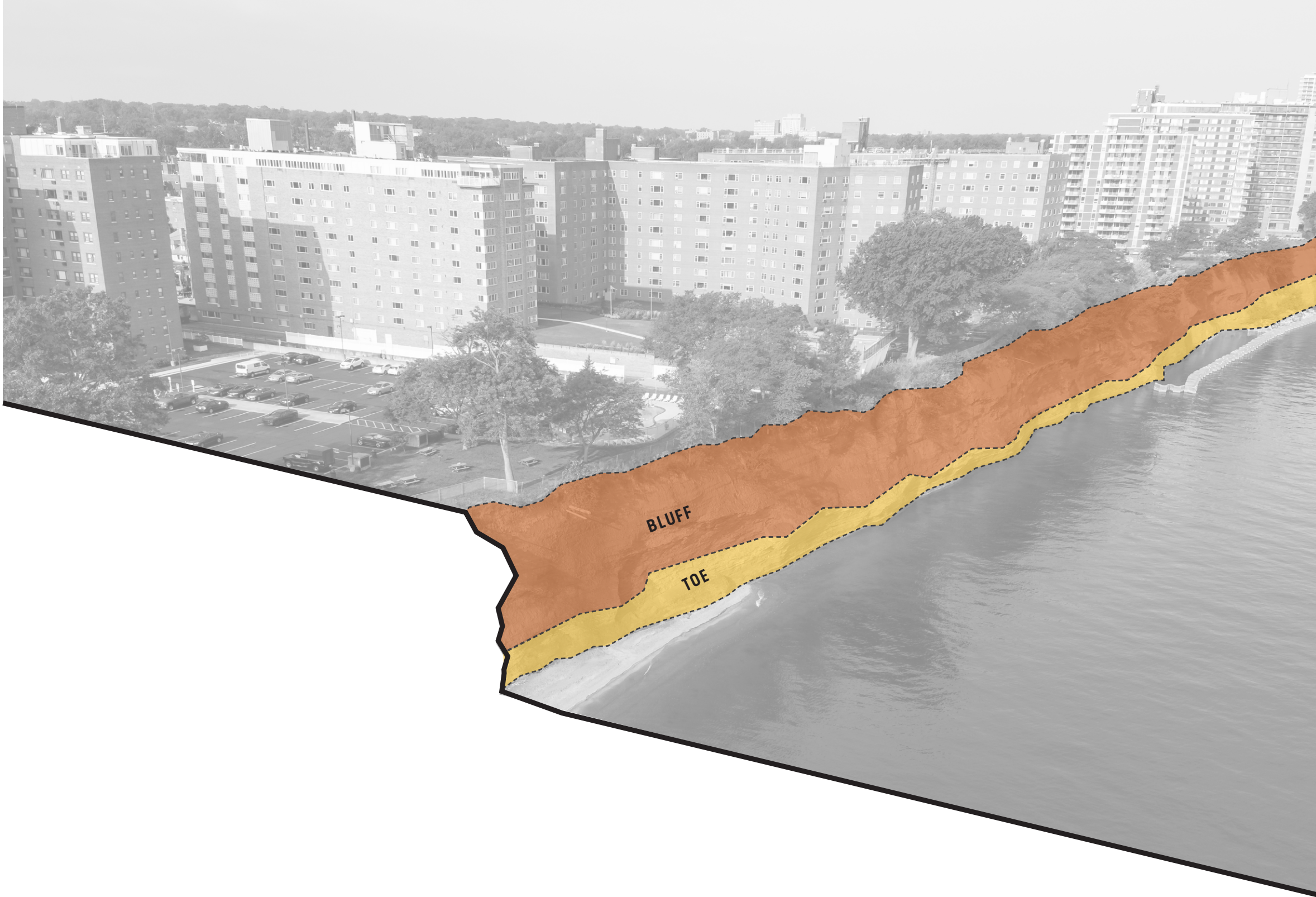
Linking to West 117th Street, which is a key north-south connector, into adjacent neighborhoods and nearby commercial uses. Utilities, the need for easements from multiple off-water landowners, and lower-level vehicular parking garage access on the east side of Edgewater Towers make this route challenging.



ALTERNATIVES: BLUFF AND TOE CONDITIONS

The causes of erosion, which occurs on the bluff itself and along its toe, are described in the Project Context section of this document. Multiple alternative strategies exist for how to mitigate erosion and these are key to protecting blufftop improvements and providing lakefront access and use. A mix and match approach can be used to combine the various bluff and toe strategies to address erosion issues and provide access as illustrated in the upcoming Masterplan Concept section of this document. As the project advances, and based on technical considerations, regulator input, and resident preferences, the approaches will be refined and the vision for the project will be confirmed.

The right side of this page includes diagrams describing the alternative bluff and toe treatments. It includes information on the specific approach (strategy) and when or in what conditions the approach may best be used (application).



BLUFFS

ROCK FALL PROTECTION
Strategy: Remove overhanging and loose portions of the existing shale bluff. Install permanent galvanized wire mesh using fully-grouted 25 mm diameter galvanized steel anchors. Space anchors on a 3 meter x 3 meter grid and install anchors at a depth of 4 to 6 meters (contingent on depth of weathered bluff face).
Application: Where rockfall protection is required for trails, stairs, paths, or occupiable spaces that are located at the bottom of vertical shale bluff faces.

SHOTCRETE CLADDING
Strategy: Remove overhanging and loose portions of the existing shale bluff. Install reinforced shotcrete facing over bluff face. Provide structural connection between reinforced shotcrete facing and 29 mm diameter x 8 meter long, fully-grouted galvanized steel anchors. Space anchors on 2 meter x 2 meter grid.
Application: Where buildings, parking decks, and other significant top-of-bluff structures are threatened by further bluff recession.

RETAINING WALL
Strategy: Install a vertical retaining wall, such as a large format precast concrete modular wall with structural tiebacks. Exact wall typology will be contingent on geotechnical conditions, as well as aesthetic and cost considerations.
Application: Where the location of buildings, parking decks, and other significant structures relative to the existing top-of-bluff do not allow adequate horizontal space to lay back the face of bluff, and the bluff itself is comprised primarily of soil and/or heavily weathered shale and cannot be stabilized using shotcrete facing.

VEGETATED SLOPE
Strategy: Grade existing sloped bluff to a stable 2.5H:1V slope, provide top-soil (if required), and stabilize regraded slopes using deep-rooted native prairie vegetation.
Application: Where bluffs have weathered or slumped to relatively stable angles and vertical stabilization methods are not required to secure vertical bluff faces.

TOE

REVTMENT
Strategy: Provide a continuous, shore-parallel revetment at the base of the vertical shale bluff in order to provide bluff toe protection and mitigate bluff erosion. Leverage revetment crest to support the public lakefront trail.
Application: Where bluff toe protection is required, but no existing lakefills or shore protection measures have established a precedent for in-water coastal structures.

BREAKWATER
Strategy: Create a semi-continuous, shore-parallel breakwater by encapsulating the existing Great Lakes Armor Units that extend from the Waterford Condominium at the west to the Lake House Condominium at the east (approximately 1,000 LF of lakefront). Provide breaks in the breakwater to facilitate water circulation to areas between the bluff and breakwater. Leverage the breakwater crest to support the public lakefront trail; provide bridges at breakwater gaps.
Application: Where bluff toe protection is required and existing lakefills or shore protection measures have established a precedent for in-water coastal structures.

BEACHES AND ASSOCIATED COASTAL STRUCTURES
Strategy: Establish cobble and sand beaches to attenuate wave action and better connect the public lakefront trail and lake. Stabilize beaches using shore-attached groins and detached breakwaters that encapsulate and expand existing lakefills and existing shore protection measures.
Application: Where shallower bluff slopes and wider zones between bluff and lake afford room, and where existing coastal structures can be leveraged and expanded to create stable beach environments.

STRATEGIES:

The project goals are simple – expand equitable lakefront access along the lakefront through public-private partnerships whereby lakefront landowners allow public access across private property in exchange for public investment in shoreline protection measures to mitigate erosion and that preserves existing assets (buildings, amenities, and infrastructure). The strategies for achieving these goals differ across the 3,800 feet of Lake Erie shoreline in response to feedback received from key stakeholders including residents, landowners, and the City of Lakewood. These strategies are organized into four buckets around the level of investment (or achievement) toward ecological enhancements, access and recreational opportunities, mitigating upper bluff and toe erosion, and balancing privacy and access for lakefront landowners with public benefit.

The diagram to the right is intended to illustrate the degree to which the various segments of the lakefront plan outlined in the Masterplan Concept section of this document apply these key strategies toward meeting project goals. Two shoreline segments from the Highland Bluffs project shoreline are superimposed on this example diagram to help explain how it is used later in this document.

SCORING

This exemplifies a shoreline segment where the emphasis of the recommended design is toward investment in mitigating erosion. The design of this segment offers some balance between public and private interests; however, it may not achieve broad aspects important to this strategy (new private access, privacy, shared investment). Ecological enhancements, while important globally, are minimal in this instance.

This exemplifies a shoreline segment where the design is a more balanced integration of strategies, achieving at the highest levels for ecological enhancement, erosion mitigation, and access and recreation. The level of achievement toward balancing public and private interests is less. Reasons for this may be the presence of a blufftop gateway connecting the public trail from blufftop to lake level or other factors such as the lack landowner interest in having dedicated private lakefront access down the bluff.

ENHANCE ECOLOGY AND ENVIRONMENT

- Expand or enhance nearshore habitat
- Clean stormwater through the integration of green infrastructure
- Improve coastal resilience through the use of adaptive shoreline treatments

ENGAGING THE WATER

- Provide continuous public lakefront access
- Maximize accessibility for all ages and abilities
- Integrate opportunities for waterfront recreation

ECOLOGY AND ENVIRONMENT: RESILIENT AND ADAPTIVE DESIGN



The development of shoreline protection and public access can be integrated with improvements that help enhance nearshore health and habitat. Capturing and cleaning stormwater where possible enhances the lake and exemplifies stewardship that is important to lakefront communities. Shoreline solutions that adapt to changing water levels and climate variability are key and offer the ability to self-heal in response to significant storm events.



Emergent zones at the lakeshore provide habitat areas that vary with lake water levels and add ecological variety to the lakeshore.



Off-site and site-adjacent stormwater can be treated in stormwater cells that functionally and visually extend lakeshore pockets and beaches.



Un-groomed cobble and coarse sand beaches are stable but dynamic, changing with the weather and the seasons, collecting driftwood, and demonstrating the beauty of natural lakeshore processes and movements.



Revetments may be used to create stormwater treatment areas. These green infrastructure best practices add ecological complexity to the shoreline.



Stormwater management plays a significant role in water quality. Improvements in the quality of nearshore waters correlates to increased community usage.

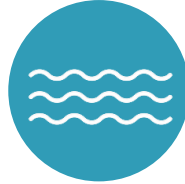
MITIGATING BLUFF EROSION

- Protect the bluff toe and face from undercutting and further erosion
- Remove unpermitted fill and debris from along the lakefront
- Preserve existing buildings, improvements and infrastructure

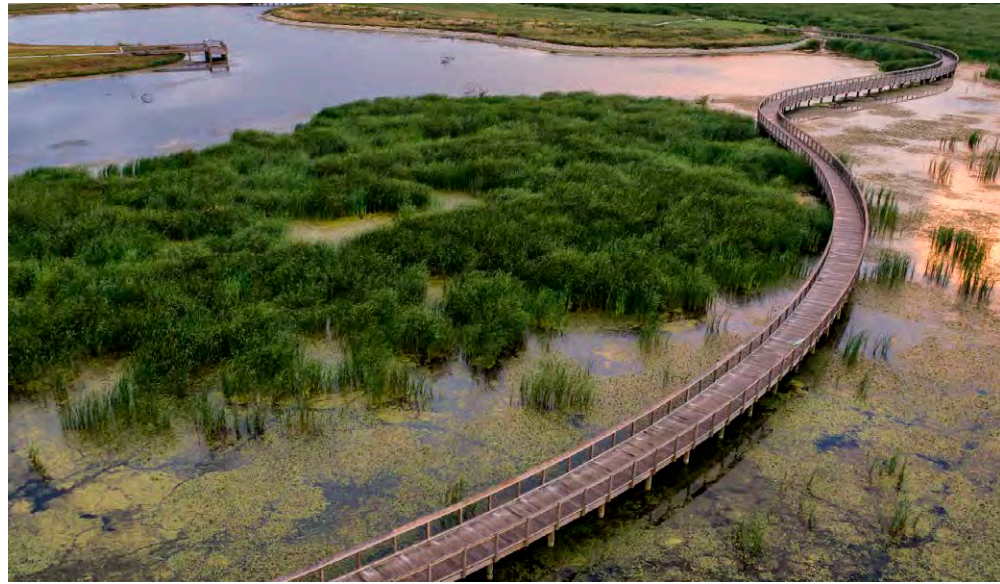
BALANCING PUBLIC AND PRIVATE INTERESTS

- Provide for new lakefront access for private landowners where desired
- Employ strategies that support public access while respecting landowner privacy
- (Re)Direct public and private investments in improvements for mutual benefit

ENGAGING THE WATER



Expanding recreational opportunities, making the lakefront accessible to persons of all ages, economic means, and abilities, and providing continuous lakefront access that visitors can integrate into daily rhythms are at the heart of this strategy. Casting cobble into the lake, launching a paddle board, and watching the sunset are new opportunities for this stretch of shoreline and bolster the value of this project in the community's eyes.



Boardwalks and bridges afford access to sensitive coast ecological zones, providing educational opportunities, birding and viewing opportunities, and more immediate connections to restored lake-adjacent wetlands and emergent habitats.



Stormwater green infrastructure and restored habitat areas can be co-located with public spaces to provide opportunities for interpretation and education.

ACCESS: BALANCING PUBLIC AND PRIVATE INTERESTS



The inclusion of dedicated private access, the relationship between public access and privacy for lakefront residents and leveraging public and private investment toward mutual gain are aspects that relate to this specific strategy. Continued dialog with lakefront landowners will be critical to maintaining their support for future project implementation.



Piers and accessible coastal structure provide opportunities for the public to get 'on the water' in ways that lake adjacent public access does not. Piers provide opportunities for fishing and viewing and, if large enough, gathering and community events.



While pathways and revetments are necessarily located high above Lake Erie's typical water level, stepped revetments and accessible lakeshore edges provide opportunities for direct lake access.



MITIGATING BLUFF EROSION



Prioritizing investments to mitigate shoreline erosion along the face and toe of the bluff is important, particularly where no buffer to accommodate further blufftop recession exists. Removing debris and attempts to halt the erosion benefits the environment and offers opportunities to reuse materials in ways that affect change at scale. Preserving buildings, amenities and infrastructure assets is at the heart of the project.



Gunite applied to the face of the bluff.



Where required, retaining structures may be utilized to stabilize bluffs without impacting existing top-of-bluff improvements.



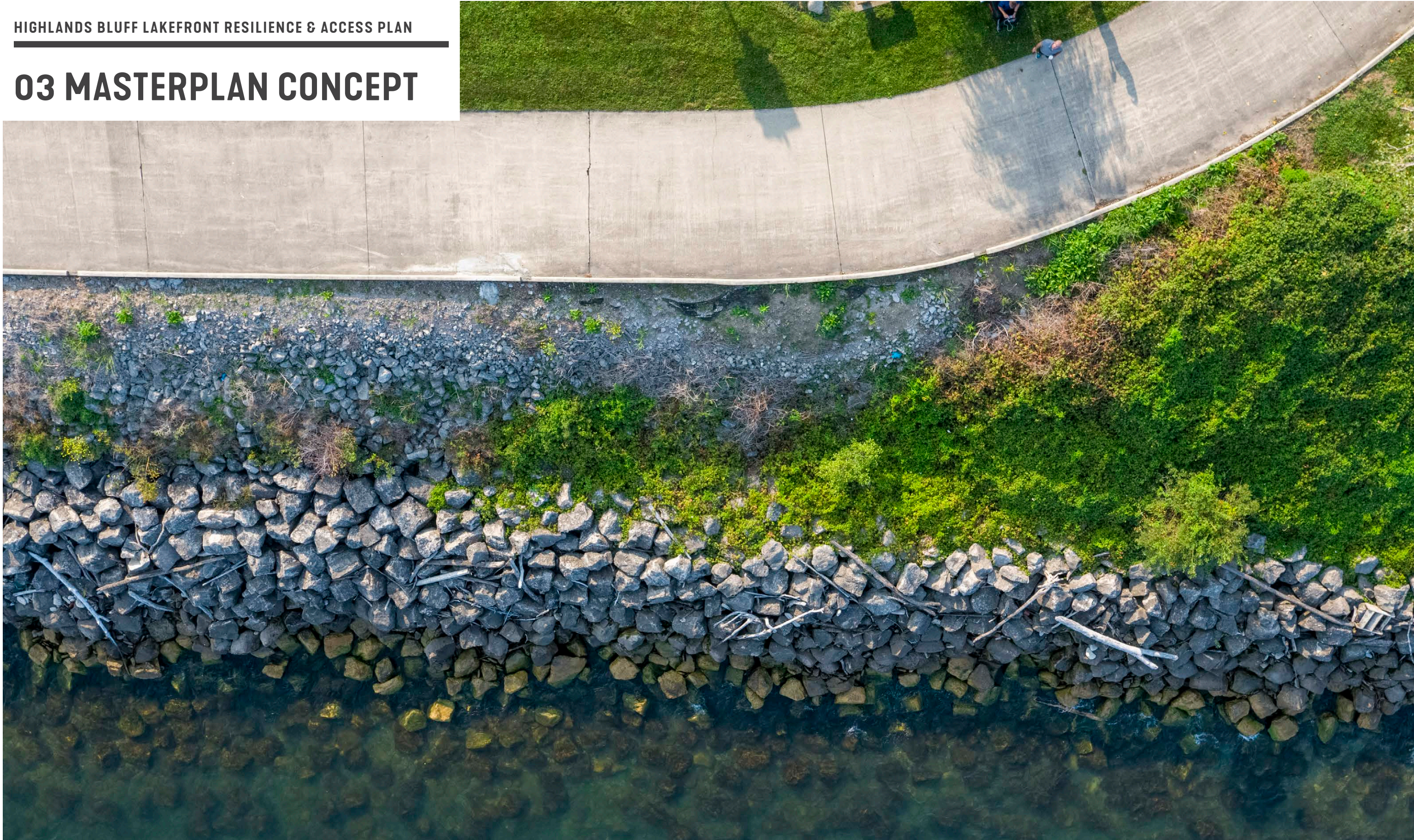
Bluff toe protection (revetment) mitigates wave erosion at base of the bluff, preventing undermining of the bluff face and resulting slides and collapses.



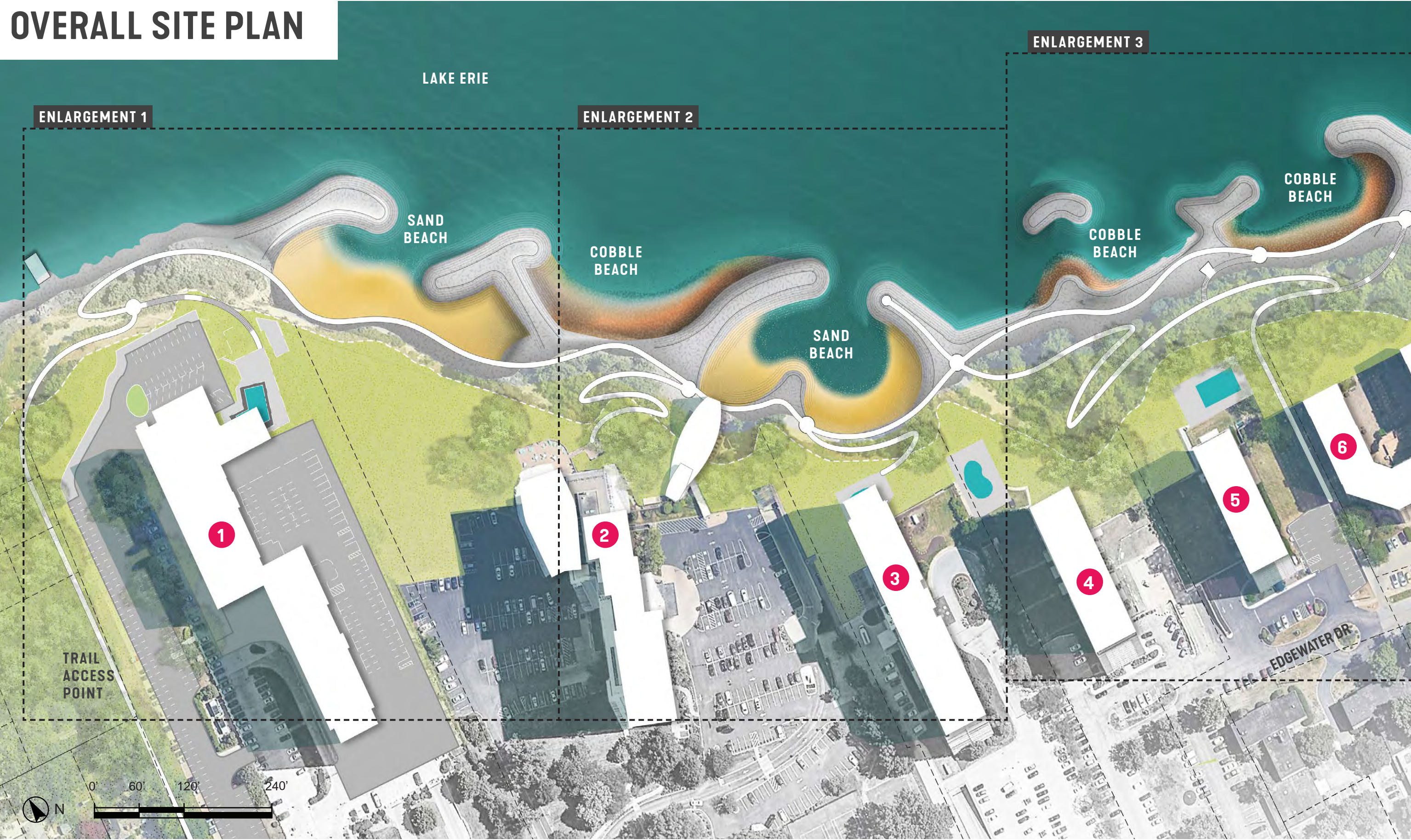
Bluffs may be stabilized with deep-rooted native vegetation that provides habitat benefits and improves visual connections between top-of-bluff areas and the lake. These restored and stabilized bluffs are not incompatible with public access; they may be shaped and locally retained to provide fully-accessible pathways despite their steepness and height.

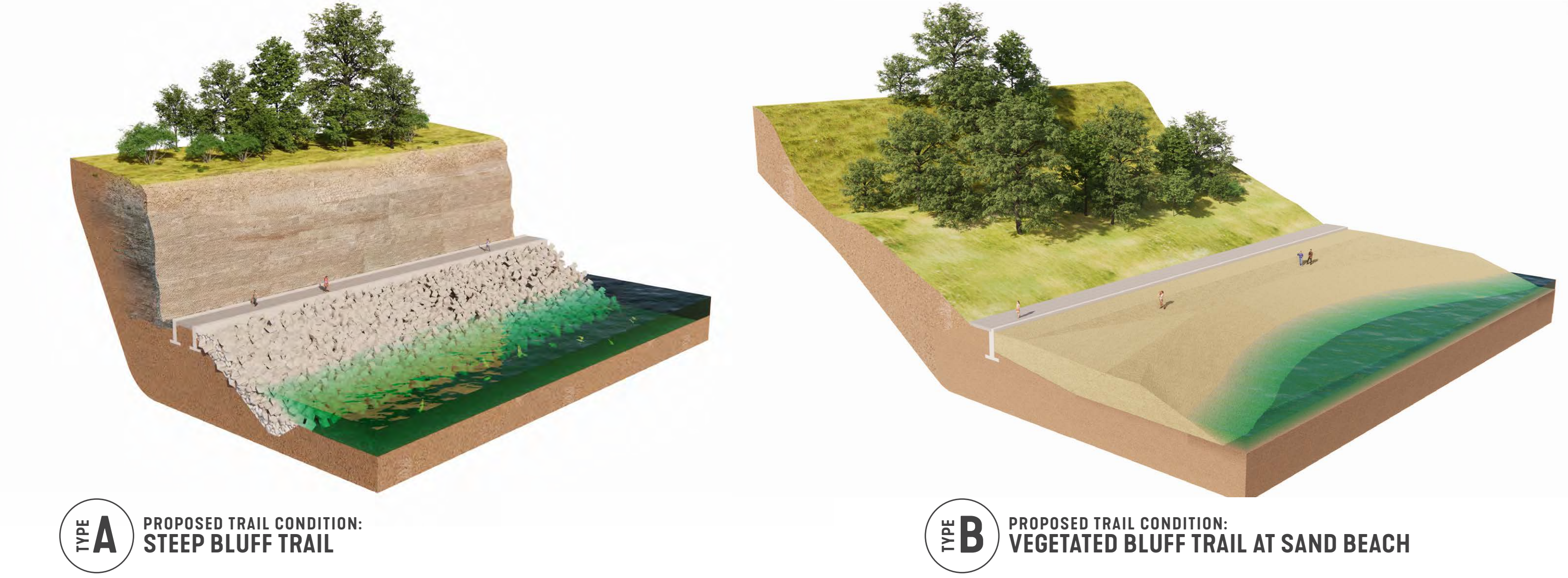
HIGHLANDS BLUFF LAKEFRONT RESILIENCE & ACCESS PLAN

03 MASTERPLAN CONCEPT



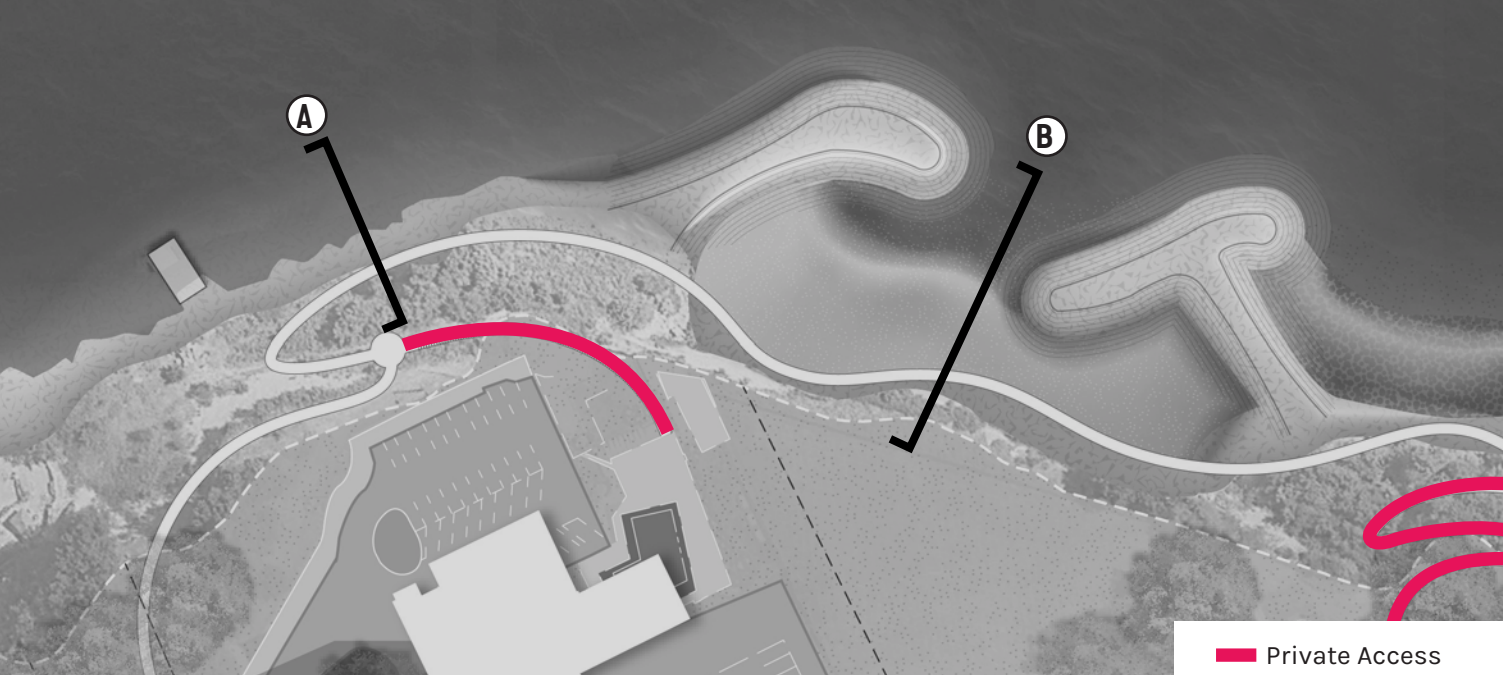
OVERALL SITE PLAN

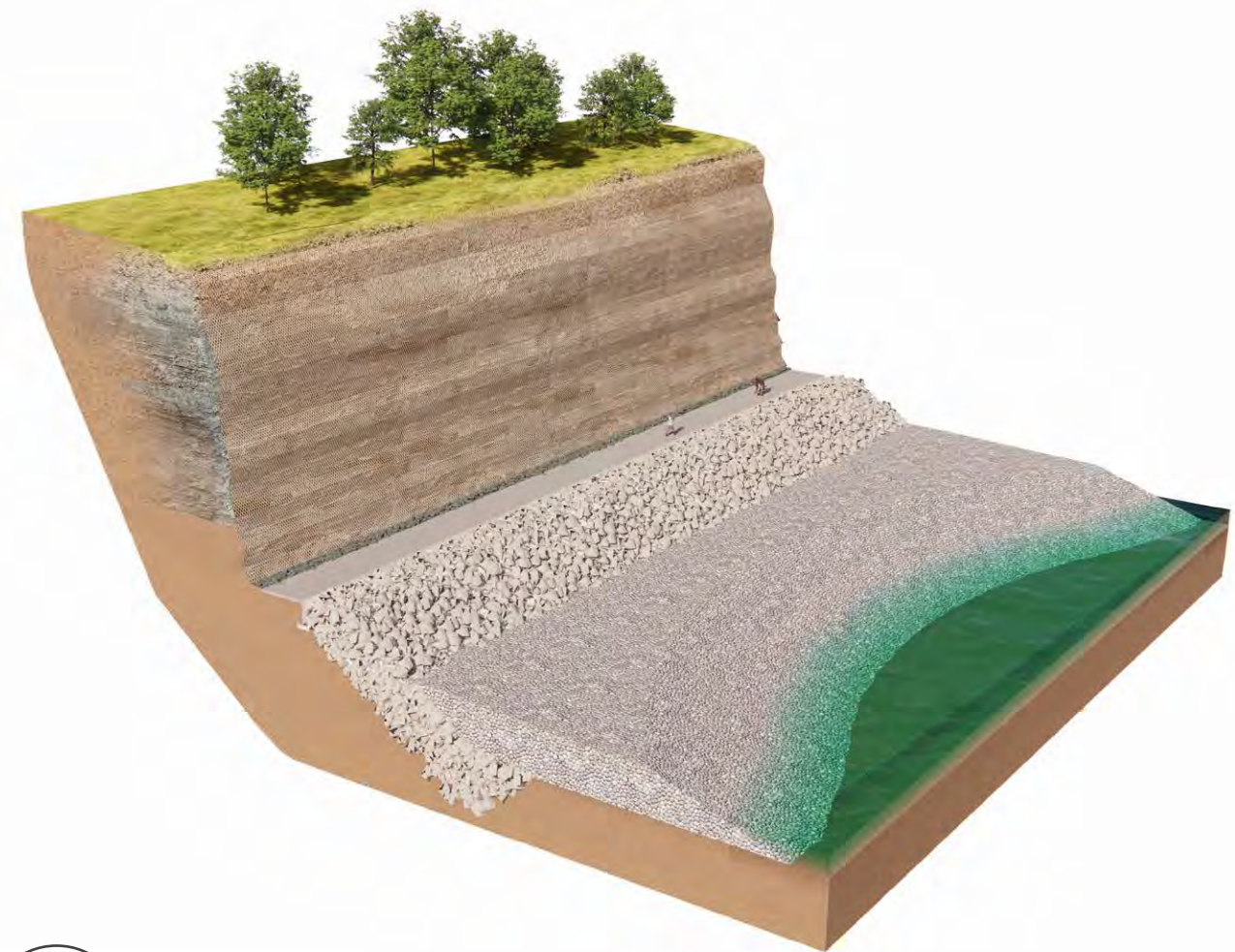




A | STEEP BLUFF TRAIL
Where the public lakefront trail parallels the base of the vertical shale bluff, the trail will be situated at elevation 685, approximately 12 feet above the average lake water level. The trail and the base of the bluff will be protected with stone revetment. Overhanging portions of the bluff and loose areas of the bluff face will be removed, and galvanized wire mesh will be permanently affixed to the face of the bluff to mitigate risks associated with rockfall.

B | VEGETATED BLUFF TRAIL AT SAND BEACH
At select locations at the west half of the project area, the combination of less steep vegetated bluff and existing shore protection measures combine to create a unique opportunity. Here, the combination of a re-graded and stabilized vegetated bluff and expanded/enhanced shore protection features, such as groins that expand existing lakefill, will allow for the creation of stable coarse sand beaches and trail segments that are much lower and closer to lake level than they are elsewhere. The depth of these beaches and the relatively protected bays created by the enclosing stone groins will reduce the need for stone protection at the base of the bluff and create useable, albeit natural and un-groomed, coarse sand beaches. Similar to the more shallow vegetated bluff elsewhere at the west half of the project area, the bluff itself will be stabilized with native prairie vegetation that stabilizes soils, improves habitat value, and enhances top-of-bluff views.

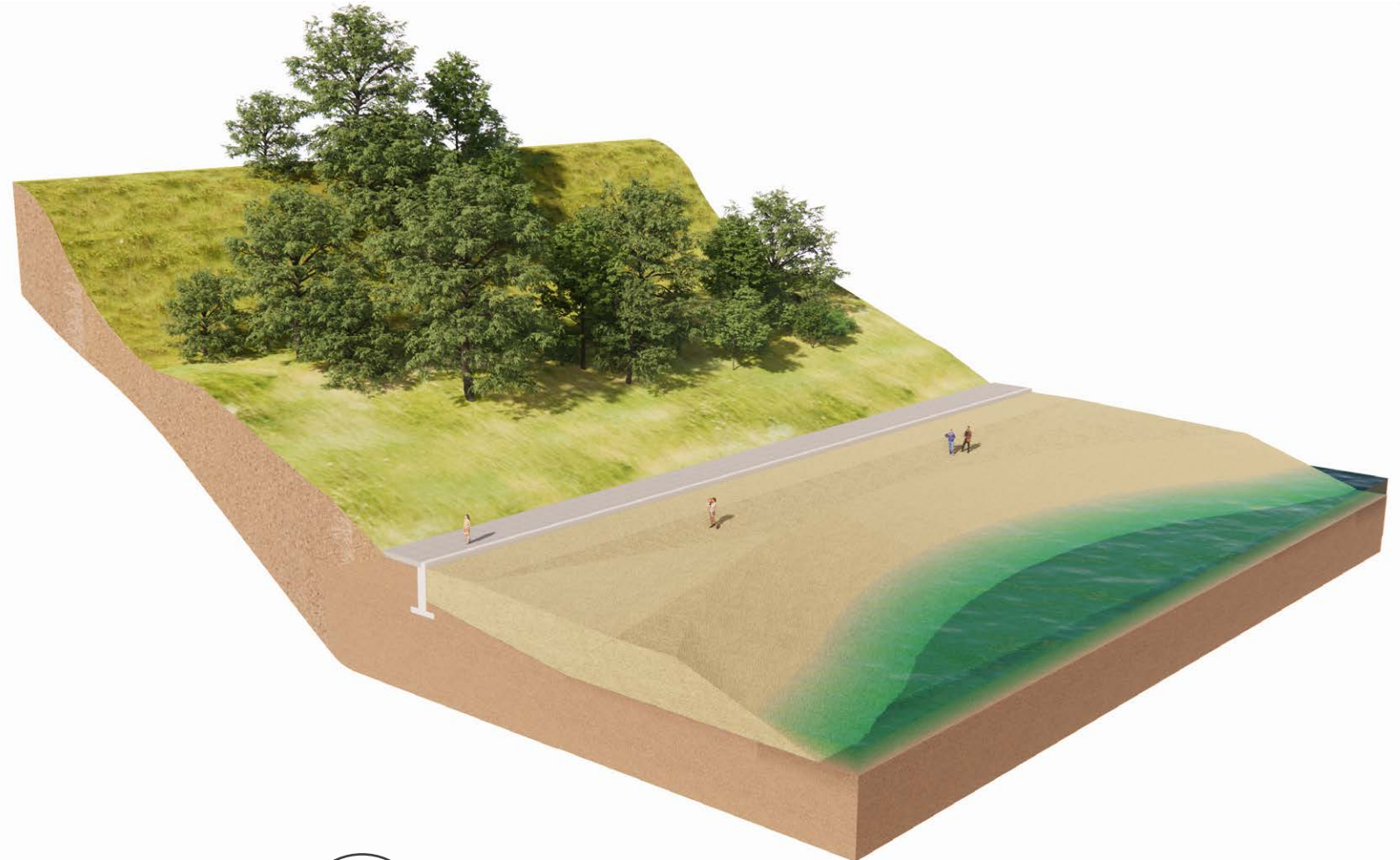




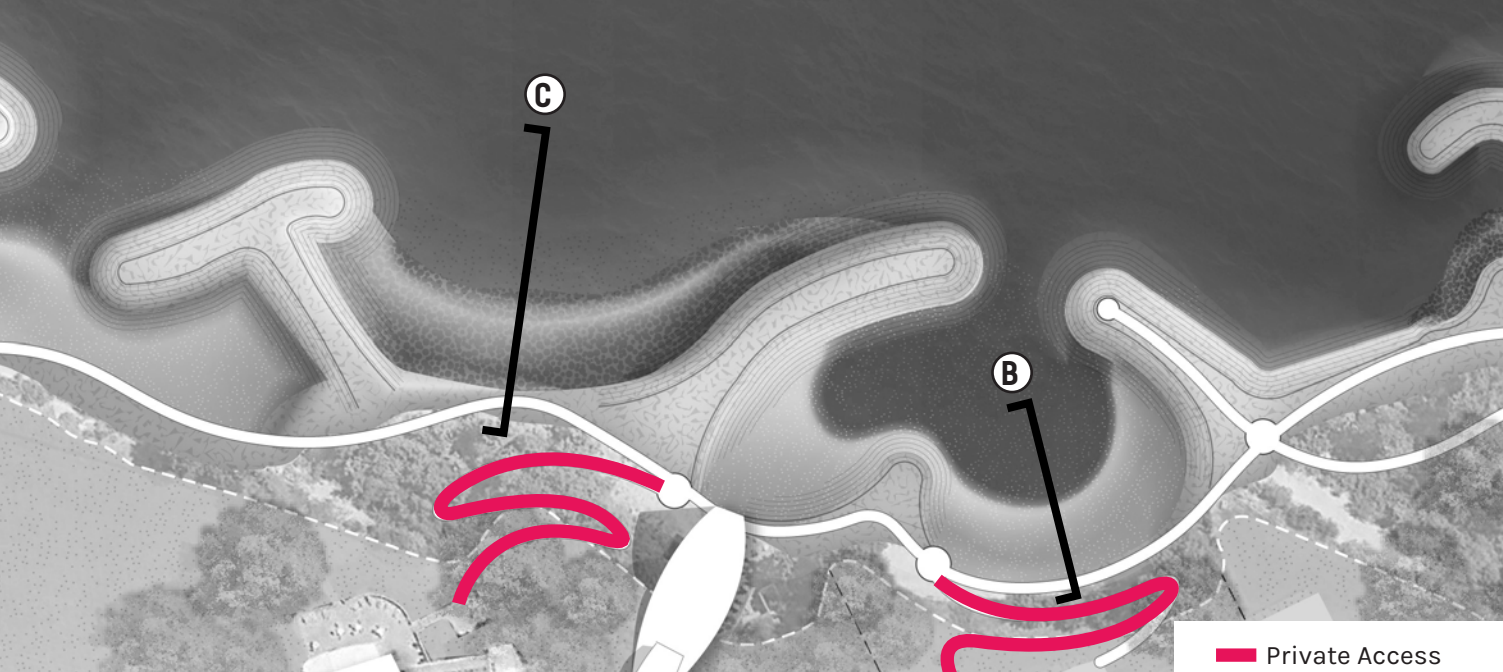
TYPE C PROPOSED TRAIL CONDITION:
STEEP BLUFF TRAIL AT COBBLE BEACH

C | STEEP BLUFF TRAIL AT COBBLE BEACH

Much of the west half of the project area includes steep, vertical shale bluffs that meet the shoreline at locations bookended by existing shore protection measures such as revetments, seawalls, and groins. The plan proposes to expand upon and enhance these existing shore protection measures to create cobble beach zones at the base of the vertical bluff on the west half of the project area. Because these cobble beaches will help mitigate wave energy, the trail and associated revetment will be lower and more directly connected to the lake at these locations, enhancing the trail user's experience and allowing for informal water access despite the constraints posed by the vertical shale bluff. Landward of the trail, overhanging portions of the bluff and loose areas of the bluff face will be removed, and galvanized wire mesh will be permanently affixed to the face of the bluff to mitigate risks associated with rockfall. trail user's experience.

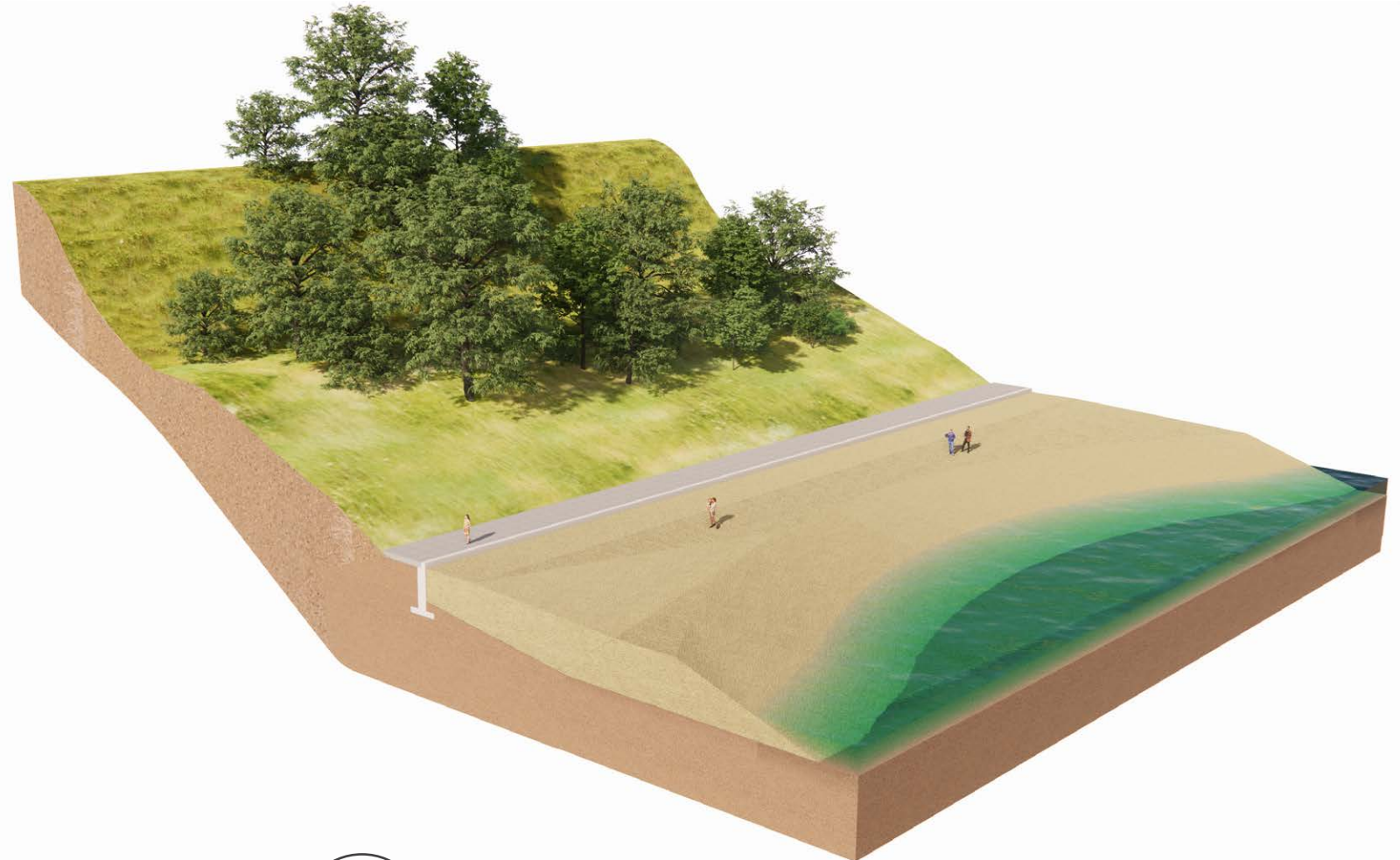


TYPE B PROPOSED TRAIL CONDITION:
VEGETATED BLUFF TRAIL AT SAND BEACH





TYPE D PROPOSED TRAIL CONDITION: VEGETATED BLUFF TRAIL

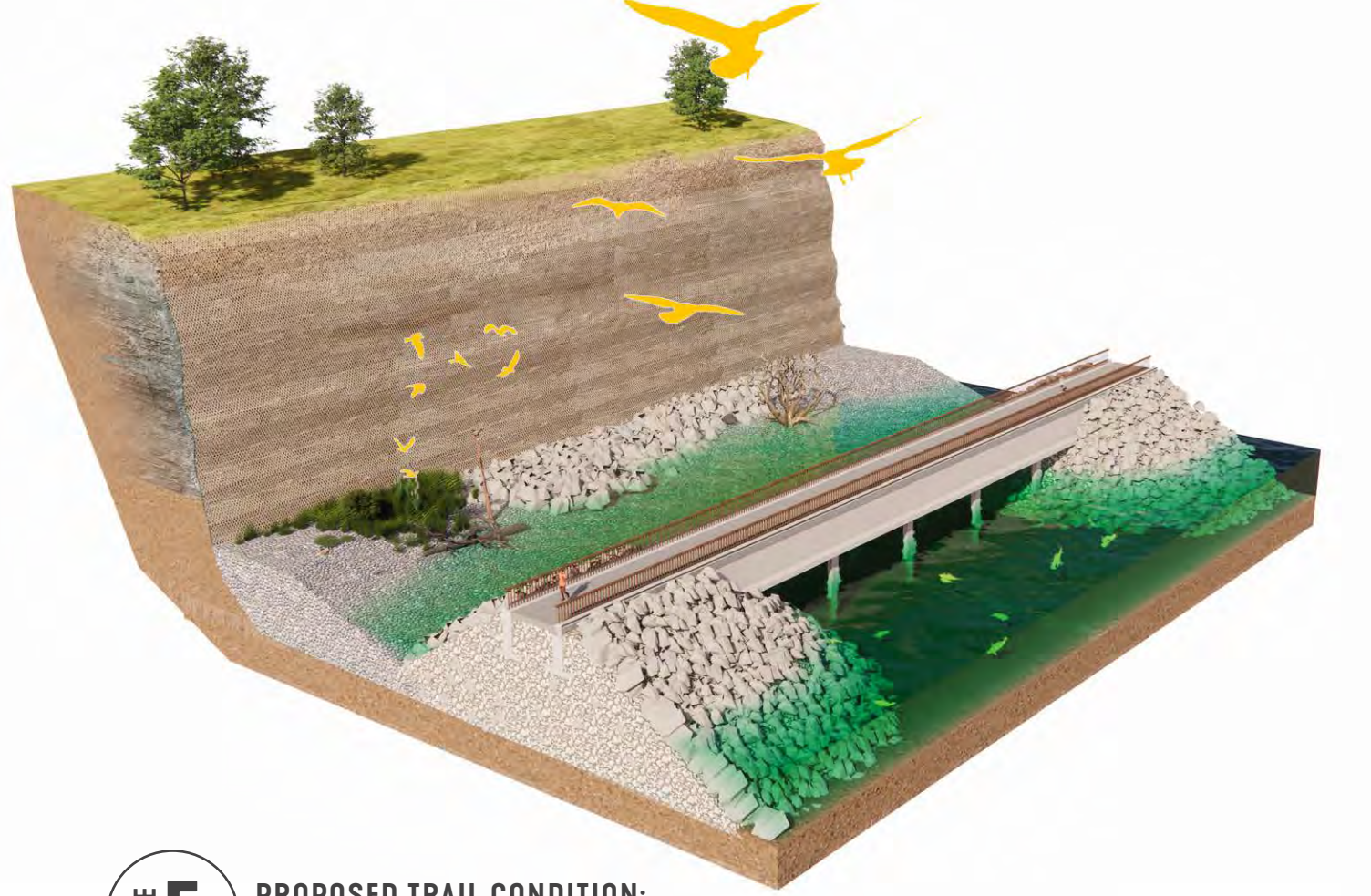
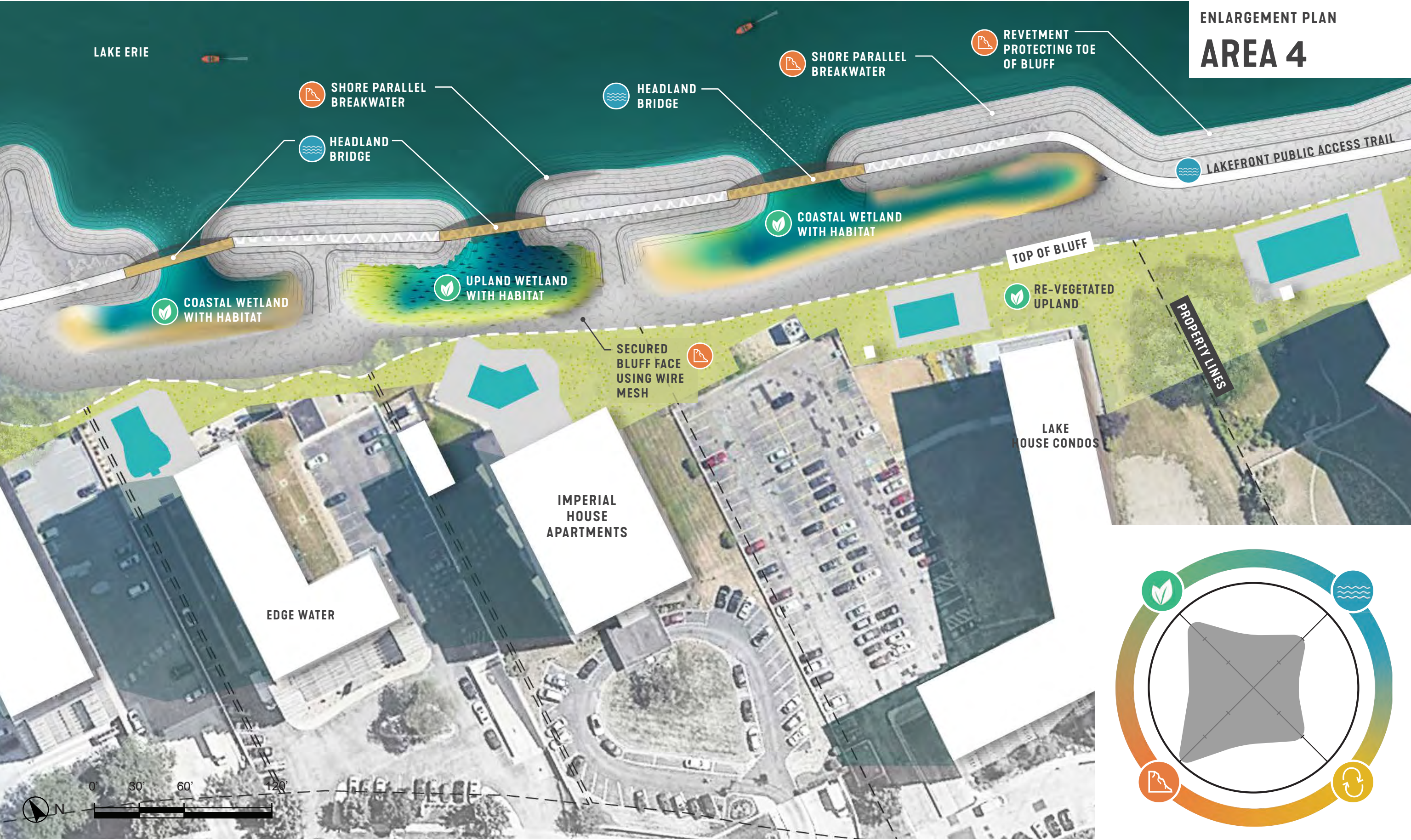


TYPE B PROPOSED TRAIL CONDITION: VEGETATED BLUFF TRAIL AT SAND BEACH

D | VEGETATED BLUFF TRAIL AT COBBLE BEACH

At the center of the project area, and at portions of the west half of the project area, the vertical shale bluff yields to shallower, typically overgrown sloping bluffs. Here the public lakefront trail will be located at the base of the bluff, and the trail and bluff will be protected and stabilized with continuous revetment. Because existing shore protection measures such as revetments, seawalls, and groins are typical of these locations, flatter areas near the waterline generally afford opportunities to create stable cobble beaches. These beaches will help mitigate wave energy, allowing the trail and associated revetments to be located at a lower elevation than they are at the base of the vertical shale bluff. The sloping bluff will be re-graded to a stable slope and re-vegetated with primarily native prairie vegetation to both enhance views and stabilize soils using deep-rooted native perennials.

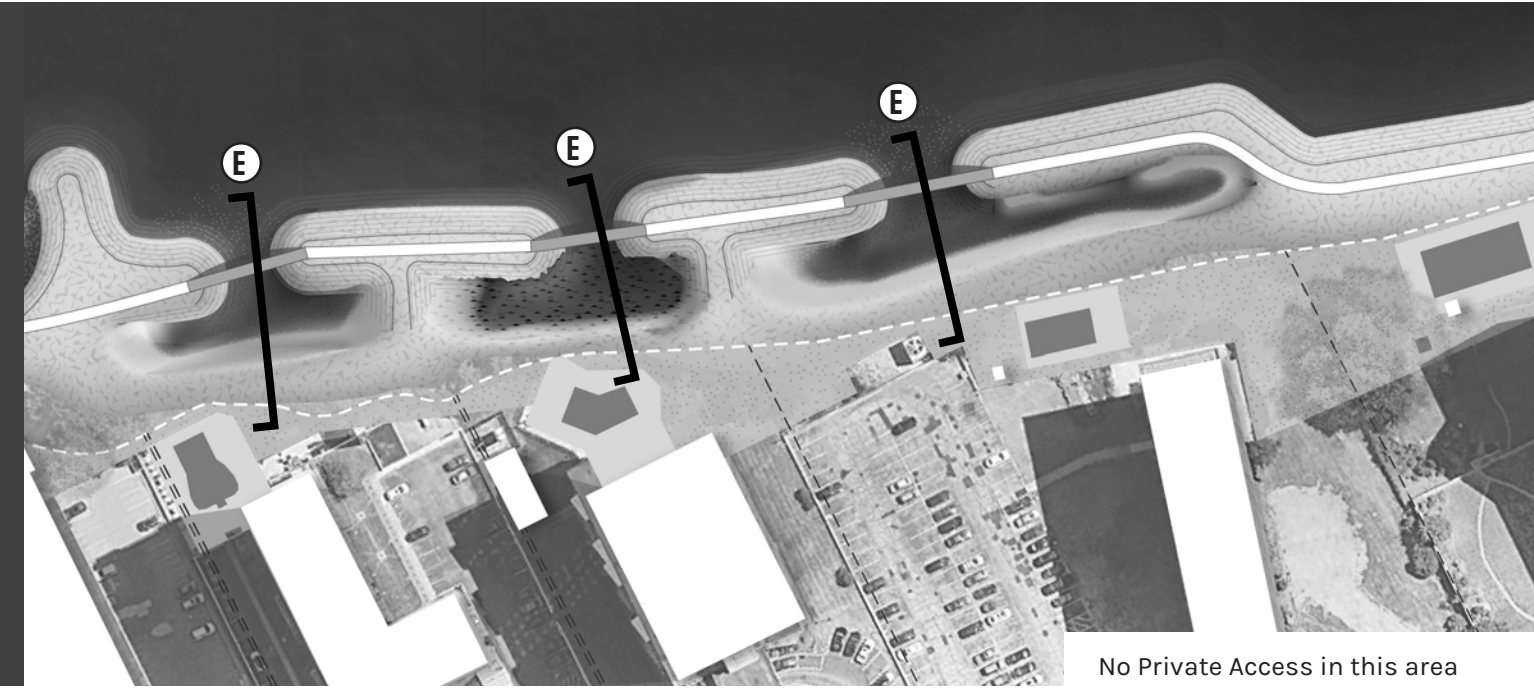




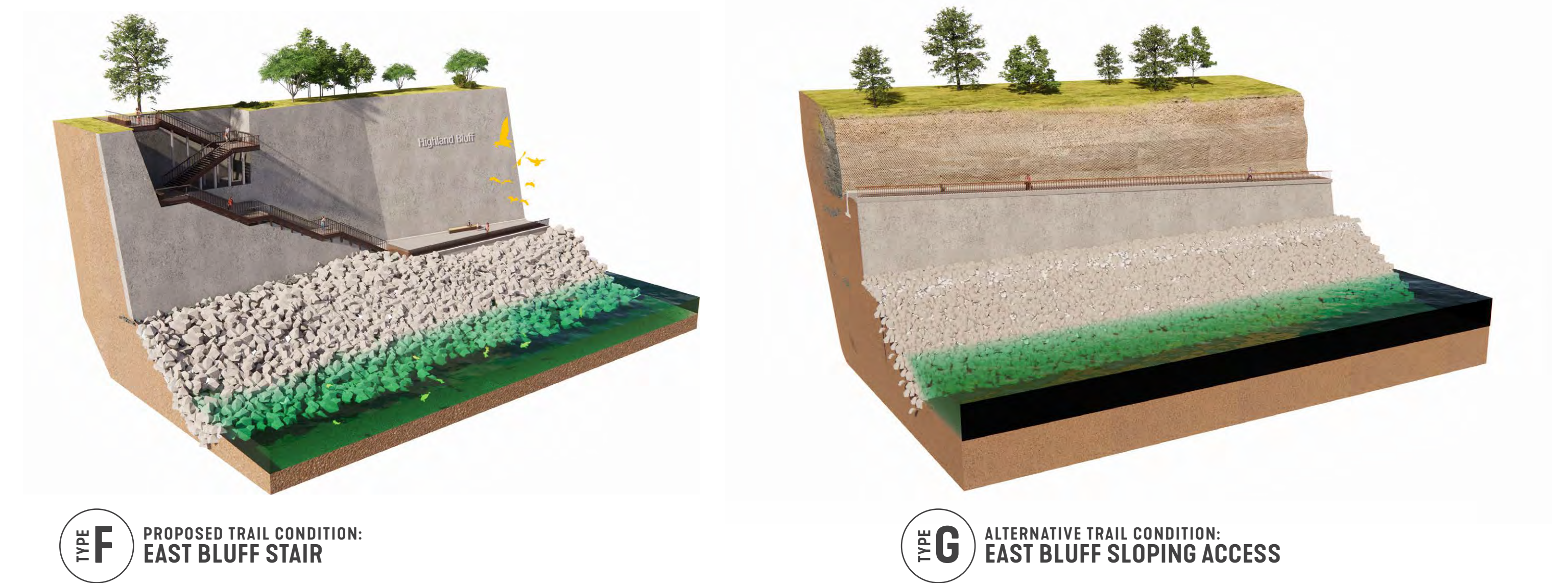
TYPE E PROPOSED TRAIL CONDITION:
HEADLAND BRIDGE AT DETACHED BREAKWATER

E | HEADLAND BRIDGE AT DETACHED BREAKWATER

Portions of the public lakefront trail will be located lakeward of the base of the vertical shale Bluffs, where existing shore protection measures have set a precedent for lakefill. Here Great Lakes Armor Units will be encapsulated in a shore-parallel breakwater that supports the public trail. Gaps in the breakwater will allow water to circulate to new in-water habitat areas located between the breakwater and the shoreline. Bridges will span these gaps, reducing required revetment and lakefill, creating unique opportunities to view the habitat zones, and adding variety to the trail user's experience.



No Private Access in this area



F | EAST BLUFF STAIR (PROPOSED)

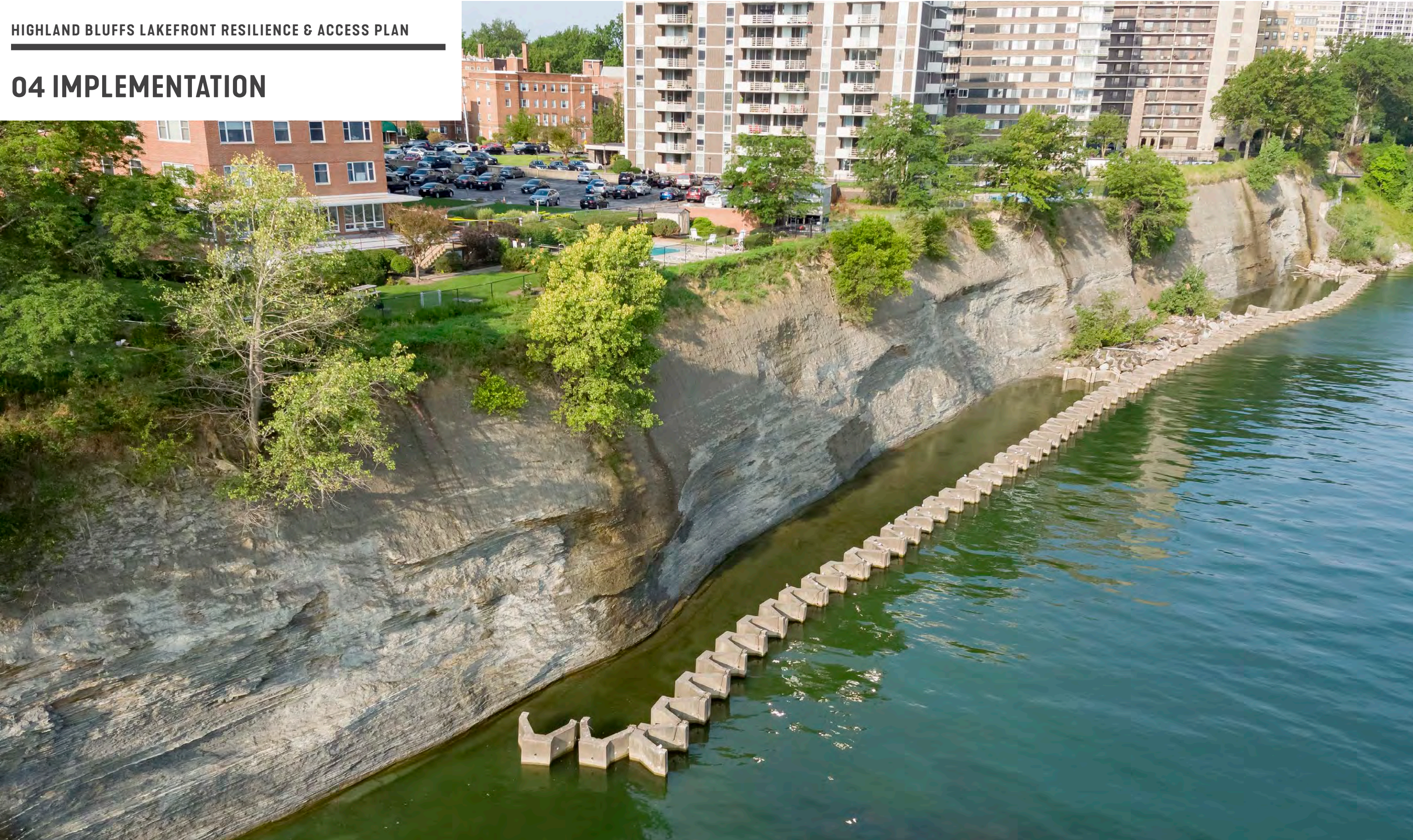
Access at the east end of the project area presents a challenge. The existing vertical shale bluff at this location is approximately 70 feet tall, and transitioning from the top-of-bluff to the trail elevation at the base of the bluff means negotiating an elevation change of more than 50 vertical feet. In order to keep this trail access compact (to minimize work and cost associated with significant excavation of the vertical shale bluff), and to minimize significant lake fill (which would be required should the access be constructed lakeward of the bluff face), the proposed east trail access point is envisioned as a vertical stair tower. The shale bluff itself would be excavated and stabilized using reinforced shotcrete to create a series of ledges. A structural steel framework would land on these ledges and support a series of steel stairs and overlook platforms, affording viewing, interpretive, and wayfinding opportunities.

G | EAST BLUFF SLOPING ACCESS (ALTERNATIVE)

A fully-accessible, sloping access pathway was studied during the masterplanning process as an alternative approach for public access at the east end of the project. While this fully-accessible solution, in contrast to the proposed East Bluff Stair, offers advantages related to equitable access, it presents significant challenges in terms of cost, regrading and restructuring of the existing vertical shale bluff, and lakefill (which would be required where critical blufftop improvements limit the ability to excavate the bluff face to construct the sloping access pathway). The need to transition from the top of bluff to the pathway below, by way of a pathway that does not exceed a 5% longitudinal slope, would require nearly 1,000 LF of existing bluff be carved and terraced to receive the walkway. The Shoreham's bluff frontage presents an exception, where the proximity of the building's parking deck and infrastructure to the top of bluff would not allow for the bluff to be restructured to receive a sloping pathway, and would instead require either substantial lake fill to support an elevated trail, or a significant and very tall, bridged segment of walkway to span this reach. Not only are these solutions structurally very challenging, but



04 IMPLEMENTATION



ANTICIPATED COSTS

To assist in implementing the plan recommendations and to budget for public investments associated with lakefront improvements, a concept-level opinion of probable construction costs has been prepared.

Estimates do not include costs for reconstructing or relocating private improvements that may be desired or necessary to protect the shoreline and associated bluff. All costs are based on 2023 dollars and can be anticipated to increase in response to inflation and potential construction material shortages. A 3 to 5 percent annual escalation factor is recommended beyond 2023. A 25 percent construction contingency, common at this level of planning and conceptual budgeting, is included. The actual cost is expected to fall within -25 percent to +50 percent of the concept phase estimate. Detailed design, project permitting, and construction administration typically ranges from 10 to 20 percent of the total construction cost and is also included in the costs outlined in this section. All projections are based on concept level design and incorporate a level of conservatism appropriate for this stage of the design process. While phasing may occur, this budget assumes a single phase of construction. Phased construction is possible, however, this is likely to increase the overall construction cost due to multiple mobilizations and smaller material quantities. As the design of the project progresses, updated cost opinions should be performed to reflect a better understanding of project details and timing.

CONSTRUCTION	CONTINGENCY	DESIGN AND PERMITTING	TOTAL COST
\$37,370,000	\$9,350,000	\$5,610,000	\$52,330,000

MAJOR ELEMENT	DESCRIPTION	ELEMENT TOTAL
Shoreline Treatments and Waterfront	The treatment measures of the waterfront to include erosion control at the bluff's toe, armored revetment protection, recreational access, and public pathways along the lake.	\$13,730,000
Bluff Stabilization	The necessary engineering activities of the existing vertical bluff's face, elimination of potential bluff erosion where no future recession is allowed, and rock fall protection above-and-near the pedestrian access sections.	\$9,420,000
Coastal Structures and Beaches	The proposed breakwaters and beaches (cobble and sand) extending offshore into the lake.	\$12,460,000
West and Central Public Gateways	The designated main west and central public gateways, sloping trails, retaining walls, and connections to public rights-of-way.	\$1,760,000



PROJECT PARTNERS AND RESPONSIBILITIES

Partnerships are key to advancing complex, meaningful projects that expand equitable lakefront access and address coastal resilience at scale. Preparation of the Highland Bluffs Lakefront Resilience & Access Plan as well as its future implementation are no exception and involve many groups to help fund it, support its implementation, and ultimately own, manage and operate the improvements. Key partners and their roles in developing this plan are highlighted below.

- 1

CUYAHOGA COUNTY
Including both County Planning Commission and the Department of Public Works who have dedicated staff to manage the project and lead community outreach. The County is also leading efforts to secure outside grant funding and allocating financial resources to serve as the local match to awarded grants.
- 2

LAKEWOOD HIGHLAND BLUFFS RESIDENTS/LANDOWNERS
Including 13 privately-owned parcels (condos and apartments) that have established preliminary agreements with the County to support the project, provide the necessary future easements to allow for development of the improvements, explore relocation and reconstruction of private improvements, and support its ultimate implementation.
- 3

CITY OF LAKEWOOD
Partnering with Cuyahoga County in communicating with the lakefront landowners and the broader community.
- 4

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Providing a portion of the funding to support community engagement, analysis, and preparation of the Highland Bluffs Lakefront Resilience & Access Plan
- 5

FEMA / OHIO EMERGENCY MANAGEMENT AGENCY
Providing funding to advance preliminary engineering and the development of draft project permits for improvements identified in the Highland Bluffs Lakefront Resilience & Access Plan.

Cuyahoga County, the City of Lakewood, the Lakewood Highland Bluffs landowners, and the broader community are anticipated to remain active partners throughout the life of the project. The roles of the partners may change over time, however, the County is likely to remain as the primary grant seeker and funder of the project through the design phases.

OWNERSHIP AND OPERATIONS & MAINTENANCE


Like funding of its construction, ownership responsibility for the lakefront improvements will be determined as the project advances. Similar projects being advanced out of the Cuyahoga County Lakefront Public Access Plan are following a model where the County oversees the construction of the improvements and turns over the responsibility for ownership of the capital improvements to the local municipality – for the Highland Bluffs project that would be the City of Lakewood.

Multiple partners are likely to be involved in the ongoing maintenance and operations of the lakefront improvements once built. Potential strategies could include the City of Lakewood taking on responsibility for routine operations and maintenance activities as they would with any other public park. Alternatively, entities such as Cleveland Metroparks may become involved, or a partnership may be forged with a group such as the Downtown Cleveland Alliance's Clean & Safe Ambassador program which has been trialed along the Euclid Lakefront.

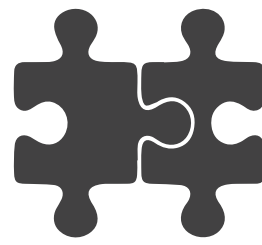
FUNDING STRATEGIES

The Highland Bluffs Lakefront Resilience & Access Plan seeks to achieve a broad range of goals: expanding equitable lakefront access, enhancing the natural environment through the integration of green infrastructure, supporting and protecting economic investment, creating a more resilient and adaptive shoreline, and providing places for people to access and enjoy the lake. Sharing the value of these investments and the recommendations within this plan are key to sustaining momentum.


Construction funding sources will be determined as the project advances and may include some combination of grants (local, state, and federal sources), City of Lakewood, and County resources. Highland Bluffs landowner financial contributions toward construction, which may include relocation and reconstruction of improvements near the top of the Bluffs or toward some portion of the shoreline protection, will also be considered as the project advances. Potential grant sources and key strategies helping sustain project momentum and attract additional investment from grant funding sources are summarized on the following page.




MAXIMIZE THE LOCAL FUNDS
Funds allocated by the County and other local partners should be used to match grants whenever possible. Stretching local dollars will be important and leveraging state and federal resources can double or triple what is invested locally.



MATCH PROGRAMS
State and federal grant program funds can be used to match one another. Non-profit funds and local funds can match both state and federal programs. Aligning timelines for expending grant funds can take effort but is an important management consideration.



CELEBRATE SUCCESS, SHARE MOMENTUM
Plans are necessary but become stagnant quickly. Building improvements incrementally will be both necessary and important. Walking on a new pier or portion of lakefront trail will help build and sustain momentum. Showing progress through securing project permits should be highlighted. Securing a significant grant is a reason to celebrate. Success begets success.



CONSISTENCY
Being upfront and sharing a consistent message about project details and the status of things is key, particularly when working to build and maintain partnerships with private landowners. Trust is essential and having consistent faces present in discussions and maintaining open, clear communication is critical to achieving the Highland Bluffs Lakefront Resilience & Access Plan.

SUMMARY OF POTENTIAL FUNDING OPPORTUNITIES

PROGRAM				FUNDS AVAILABLE	SOURCE		MATCH	APP. DUE DATE	AWARD DATE	FUNDING USE
	PLANNING	DESIGN & ENGINEERING	CONSTRUCTION							
ODNR Recreational Trails Program (RTP)		X	X	Up to \$150,000	Federal	DOT	20% Match	April	March (following yr)	Trails and trailhead facility development
ODNR Clean Ohio Trails Fund (COTF)		X	X	Up to \$500,000	State	DOT	25% Match	April	March (following yr)	Trails and trailhead facility development
OEPA - Recycle Ohio Grant - Scrap Tire Grant			X	Up to \$300,000	State	EPA		December 1	Spring	Applications OPEN October 2, 2023. Projects that may support beneficial reuse of ground tire rubber and asphalt shingles - trails, etc.
ODNR Paddling Enhancement Grant		X	X	Up to \$75,000	State		No Match Req'd	March 1	August	Improving and/or developing recreational boating access. Support paddlecraft access and improvements
ODNR Land & Water Conservation Fund (LWCF)		X	X	\$50,000 - \$500,000	Federal	DOI	1:1 Match	November 15, 2023	Early Spring	Acquisition, development and rehab of recreational areas in alignment with Ohio SCORP priorities
ODNR Natureworks		X	X	Up to \$150,000	State		25% Match	June 1	Fall	Acquisition, development and rehab of recreational areas in alignment with Ohio SCORP priorities
ODNR Coastal Management Assistance Grant Program (CMAG)	X	X	X	\$50,000 - \$150,000	Federal		1:1 Match	October (pre-application)	July	Funding for all phases of project development and aspects including water quality, coastal planning, recreational access, and ecological enhancements, education programs, land acquisition, research, public access, habitat restoration, and other purposes.
National Coastal Resilience Fund	X	X	X	Varies	Federal	NFWF	No Match Req'd	April (pre-application)	October	Expand and enhance resilience and ecological benefits.
FEMA Building Resilient Infrastructure and Communities (BRIC)		X	X	Varies, multi-million dollar projects typical	Federal	DHS	25% Match	Fall	18-24 months pending reviews	Proactive investment toward coastal resilience/protection
FEMA Hazard Mitigation Grant Program (HMGF)	X	X	X	Varies, multi-million dollar projects typical	Federal	DHS	25% Match	Fall, Annually	Spring, Annually	Risk Mitigation associated with flooding and coastal hazards.
LWCF Outdoor Legacy Partnership Program	X	X	X	Up to \$500,000	Federal	DOI	1:1 non-Federal, including in-kind donations	~May/Nov (Alternates)	~Jan/July (Alternates)	Recreation improvements including trails
Army Corps of Engineers Planning Assistance to States (PAS)	X			Varies	Federal		1:1 Match	Ongoing	Month After Submittal	Technical assistance in site investigations and planning prior to permits. Provide planning assistance in any matters related to water resources. No design or construction is authorized under this program.
OEPA WRRSP (Water Resource Restoration Sponsor Program)		X	X	Varies, \$500,000 typical	State	EPA	No Match Req'd	August 15	October (preliminary)	Planning, design and construction of wastewater treatment facilities and infrastructure.
Lake Erie Protection Fund		X	X	<\$50,000	State		No Match Req'd	May	July	Water quality related as well as ecological focused projects. Finance research and on-the-ground projects aimed at protecting, preserving and restoring Lake Erie and its watershed.
Cuyahoga County Municipal Grant (ref CDBG)				\$150,000	County			December		
Cuyahoga County Supplemental Grant Fund					County					Safety, Streetscaping, Lighting and landscaping, Road resurfacing, Park construction and improvement, Cameras, Acquisition and demolition.
Cuyahoga County Casino Revenue Fund		X	X	Varies, multi-million dollar projects typical	County		No Match Req'd	Varies	Varies	Transformative projects that support economic development and community enhancement. Loan and grant
State Capital Community Projects	X	X	X	\$100,000 - \$5M (200K-1M Typ.)	State	DNR	No Match Req'd	Jan/Feb (every other year)	April/May	Projects focused on economic development & comm enhancement.
Ohio Water Development Authority	X	X	X	\$200,000	Revenue Bonds and Notes		1:1 Match	June	October	Projects that address wastewater, drinking water, water resource management, solid waste management and energy resource development in Ohio.
ODNR H2Ohio Fund Wetland Project Grants		X	X	Min \$50,000	State		No match required.	25-Aug-23	TBD	High quality natural infrastructure that reduce nutrient runoff and improve water quality
OPWC Clean Ohio Fund - Greenspace Conservation Program			X	Varies, up to 5% over appraised value	State	PW	25% match	October, Annually	April, Annually	Projects for Open Space or Riparian Corridor.
NFWF Five Star and Urban Waters Restoration Program	X		X	\$25,000-\$50,000 (ave \$40,000)	Federal	NFWF	No match required.	January, Annually	September, Annually	Education and community participation is prioritized
ODNR Erosion Emergency Assistance Grant		X	X	Up to \$1,000,000	State		No match required.	April/May	August	Erosion mitigation. May become annual program

REGULATORY REVIEW AND APPROVALS

State and federal reviews and approvals associated with shoreline improvements are key considerations and influencers of project implementation timelines. Unlike the well-known and relatively quick-to-secure permits needed for upland projects, waterfront projects entail lengthy permit and environmental review timelines. Lead state and federal agencies for shoreline improvements include the Ohio Department of Natural Resources (ODNR), US Army Corps of Engineers (USACE), and the Ohio Environmental Protection Agency (OEPA). A variety of different branches from within these agencies, as well as other entities like the US Fish & Wildlife and the Ohio Historic Preservation Office, will be involved in reviewing specific aspects of waterfront projects as well

The development of waterfront improvement plans, permits, and supplemental documents for submittal to state and federal agencies will require time. As design refinements are advanced, pre-application consultation with lead agency staff is highly encouraged; this can help expedite formal submittal review processes and eliminate the need for costly revisions. Regulatory review and approval timeframes vary based on project complexity and agency workload. The anticipated permit and environmental review duration for Highland Bluffs shoreline improvements can be expected to be a 10-14 month permit cycle. It is also important to note that state and federal water resource permits typically are valid for five years from date of issuance, although extensions may be granted in certain situations. Critical approvals associated with implementation of the Highland Bluffs Lakefront Resilience & Access Plan improvements are summarized in the following:

Section 106 National Historic Preservation Act: The Ohio Historic Preservation Office is required to review the project as part of the Section 404 permit approval process. Desktop reviews of the existing site and nearby environs may suffice where cultural and historic features are not present. Physical investigations to clear the area of buried artifacts may be needed and will be determined through future consultation as plans are refined.

Clean Water Act Section 404/Section 10:The Clean Water Act requires an Individual Permit to allow for development of key water-related improvements. This process involves developing preliminary plans for proposed improvements, preparing permit application materials, evaluating water resource impacts with respect to the OHWM, a public review and comment period which includes commentary from other agencies including US Fish & Wildlife, and technical review of project details.

Clean Water Act Section 401 Water Quality Certification: Section 401 of the Clean Water Act requires that a Water Quality Certificate be issued by Ohio EPA for discharges of fill material into wetlands and other Waters of the United States. Section 401 reviews are typically done in conjunction with USACE Section 404 permitting processes.

National Environmental Policy Act: An Environmental Assessment will be required as part of the National Environmental Policy Act (NEPA) review process for key water- related improvements. The NEPA process typically runs in tandem with the Section 404 process.

Shore Structure Permit:This permit authorizes the construction of coastal structures such as revetments, beaches, piers, creek mouth modifications, and launch ramps. The Ohio Department of Natural Resources reviews proposed improvements to confirm plans are based on sound coastal engineering including appropriateness for the intended function, effectiveness, and durability while minimizing impacts lakeward of the Natural Shoreline.

State Submerged Lands Lease: The lease is a mechanism by which the State of Ohio authorizes the development or improvement of facilities impacting the lakebed of Lake Erie. Annual lease fees vary based on the type of improvement and are typically negligible for projects that focus on public access and do not charge user fees. Shoreline protection including nearshore habitat, beach nourishment, and public access improvements that impact the lakebed all require new lease agreements with the State. Leases are reviewed by the Ohio Department of Natural Resources and executed by the Governor and are signed after all other approvals identified within this section are secured.

QUANTIFIABLE BENEFITS

■ **Public Lakefront Access** - through an innovative public-private partnership between Cuyahoga County, the City of Lakewood, and lakefront landowners, a vision for 3,800 feet of shoreline will be created that will transform the area. New universally accessible trails along the lakefront will provide approximately 7,328 people with ADA access within a 10-minute walk of their homes - a majority of whom are low income (74.8% within a 1/2 mile service area). The resulting plan will expand equitable public lakefront access and create a replicable model for blending shoreline stabilization and public access along 13 larger privately owned shoreline parcels.

■ **Shoreline Stabilization** - provide bluff face and toe erosion protection measures to help preserve the \$225M of property and improvements located within 15-30 feet of the Bluffs top and along the 3,800 linear feet of shoreline. In addition, address 5 segments along the shoreline where unpermitted fill has been placed along the shoreline and develop strategies to support future compliance. Planned private investments toward addressing the issue of shoreline erosion and stability are anticipated to be approximately \$5M of the next 1-2 year period and there is a need for a more comprehensive, strategic approach to achieve multiple benefits and affect actual change.

■ **Ecological Enhancements** - As part of the access and stabilization measures, the plan will explore options for integrating nearshore habitat that can support fish and other aquatic species. Options for capturing and treating upland runoff as well as the integration of green infrastructure to clean stormwater being discharged from 5 outfalls along this stretch of shoreline will be developed as part of the plan.



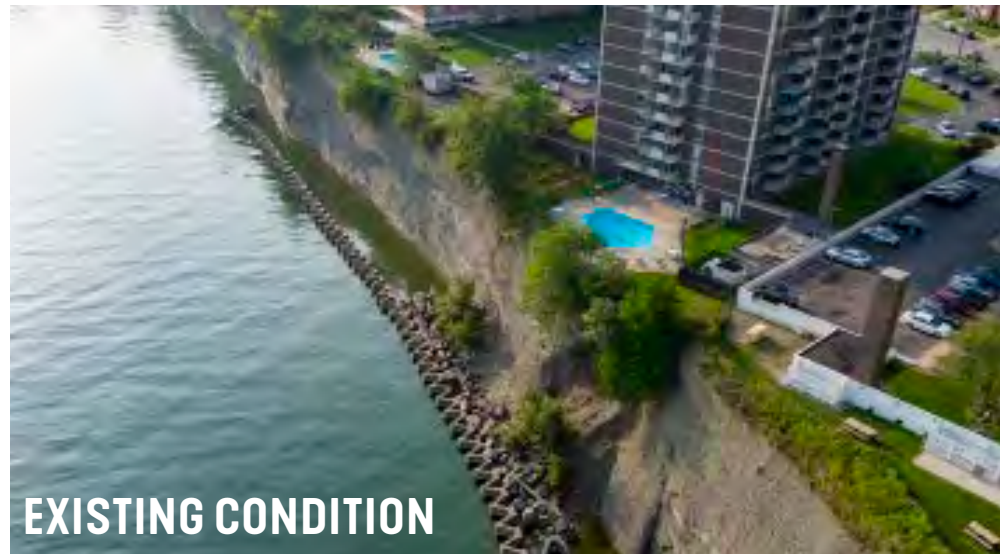
26,000

TONS OF DEBRIS IS ANTICIPATED
TO BE REMOVED

\$228M

ESTIMATED PROPERTY AND INFRASTRUCTURE
LOSS AVOIDED

(6.4M GRAND FUNDING SECURED TO ADVANCE THE
PROJECT)



EXISTING CONDITION

RECOMMENDED NEXT STEPS

The Highland Bluffs Lakefront Resilience & Access Plan presents a vision for expanding equitable lakefront access while improving coastal resilience and enhancing ecology and the environment. It includes alternative strategies for shoreline protection and access that will be refined and detailed in consultation with lakefront landowners and the broader community. The steps needed to advance the project through to implementation are summarized below.

1 PRELIMINARY DESIGN & PERMITTING

Including the review and refinement of alternatives for shoreline treatments, trail and recreational activities, and access routes to the lakefront. Deliverables generated as part of this process include 30% complete construction documents and water resource coastal permits. Additional details regarding key permits are summarized in the Regulatory Review and Approvals section of this document. The overall timeframe for completion of this step can be expected to be 8-12 months with required permits and approvals extending this timeframe by another 10-14 months.

2 FINAL DESIGN

Including final plans and technical specifications for planned improvements. Reviews typically occur at 65% and 95% complete plan sets to assure alignment with preliminary plans and budgets. Project construction phasing may also be considered. Completion of this step can be expected to require 10-14 months and may overlap with the permitting process by a couple of months.

3 BIDDING & AWARD

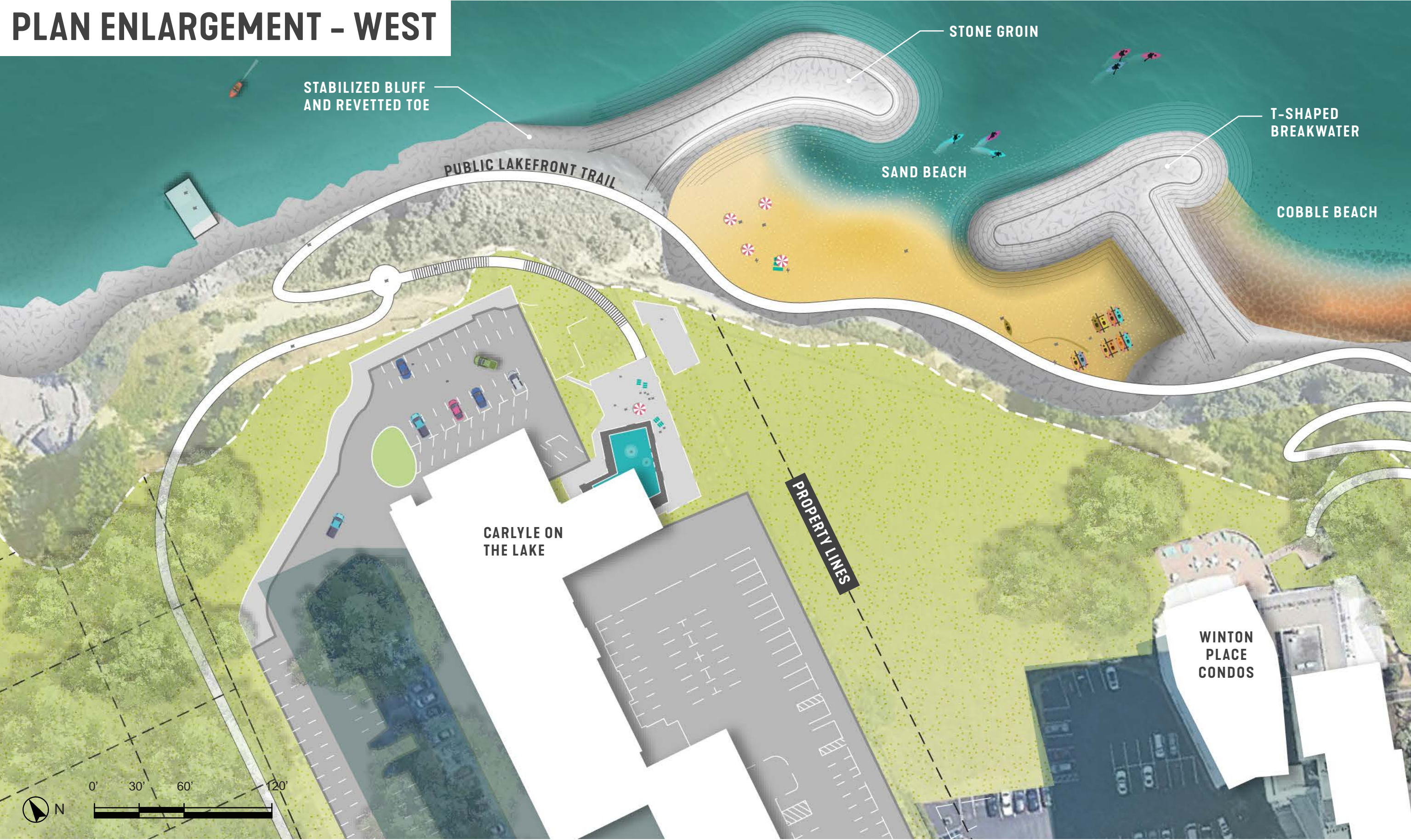
Including soliciting bids from qualified contractors and executing a construction contract with the selected contractor. Completion of this cycle is likely to require 3-5 months.

4 CONSTRUCTION & CONSTRUCTION OBSERVATION

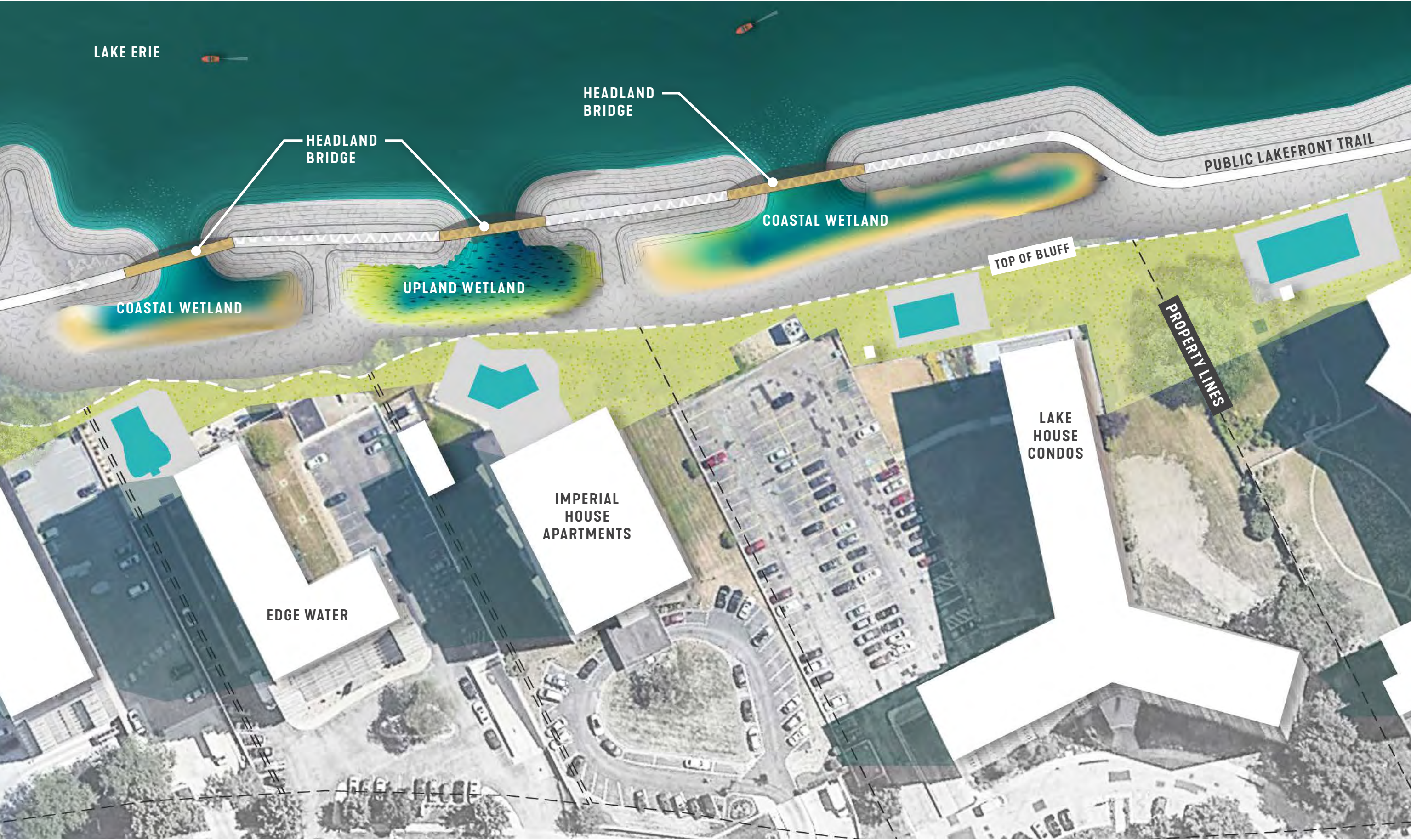
Likely occurring over a 24 to 30 month period. Specialized construction techniques for work along the waterfront will benefit from the participation of technical experts to support and represent the County's interests by observing fieldwork and confirming contractor compliance with plans and specifications.



PLAN ENLARGEMENT - WEST



PLAN ENLARGMENT - CENTRAL



PLAN ENLARGMENT - EAST



SMITHGROUP