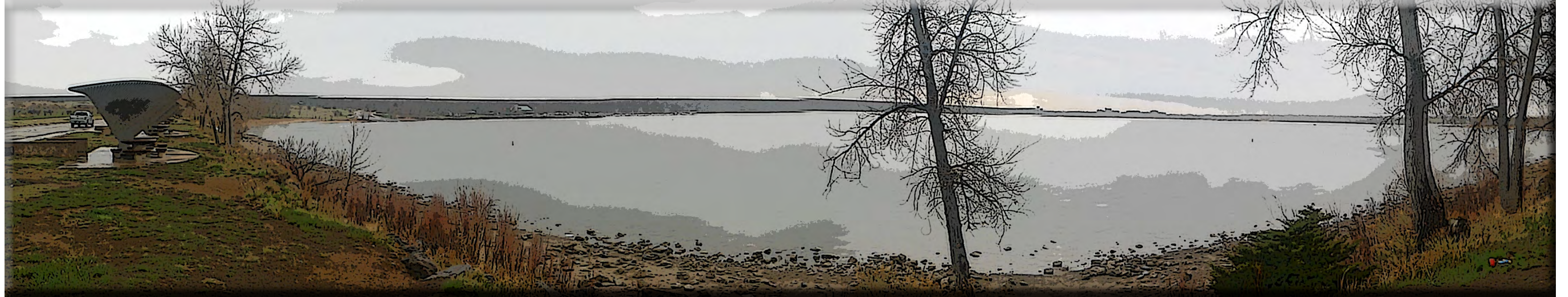


West Shade Shoreline Stabilization

Cherry Creek State Park



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LA-5572 Advanced Ecology / Professor Charlie Chase

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August 2013

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INTRODUCTION

The Cherry Creek Water Quality Authority identified the West Shade Shoreline at Cherry Creek State Park as a priority area for a shoreline stabilization project due to poor water quality control. A multitude of factors, including stormwater runoff, a network of social and informal trails leading to the reservoir, and degradation of the shoreline from both the social use and water forces has degraded the quality of water entering the reservoir. The West Shade Shoreline currently does little to reduce sedimentation and slow stormwater runoff before it enters the reservoir.

This West Shade Shoreline Stabilization Concept Plan proposes features to reduce water forces including waves and ice buckling that deteriorates the shoreline, as well as reduce erosion from social use and stormwater runoff. This plan also proposes new recreational benefits including water access for the mobility impaired and a challenge course featuring Universal Design concepts to allow all individuals to experience the shoreline, beaches and reservoir.



West Shade
Study Area

Mountain & Lake Loop
Shoreline Stabilization

Cherry Creek
Reservoir

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SITE ANALYSIS AND EXISTING CONDITIONS

SURFACE RUNOFF



Left: Looking to the southwest along the road and parking area just west of the shade shelters. The arrows illustrate how the water flows along the impermeable surface to the terminus at the the southwestern end.

Right: Looking directly at the only stormwater outlet for the parking area. The outlet is surrounded by willows, but is contributing to erosion in the immediate vicinity. Water flows directly out of the culvert and into the sandy beach. There is currently no catchment for the water or means to slow the water before entering the reservoir.



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SITE ANALYSIS AND EXISTING CONDITIONS

SOCIAL USE



Numerous social trails exist between the shade shelters and reservoir which contributes to the erosion of the shoreline. Close, immediate access is important for the users of the picnic areas and requires careful consideration in the design.

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SITE ANALYSIS AND EXISTING CONDITIONS

ACCESSIBILITY



Current access between the shelters and reservoir is an extensive network of social trails and deteriorating stairs and ramps.

Left: Timber stairs located in the center of the site serve as the primary access point for users, but are badly eroded. Many users have started to use areas to the side as a preferred alternative to the steps.

Right: The end point of the existing ramps, at both the north and south end of the site. Both locations have a small platform with limited turn-around space above a pile of rip-rap rock. These areas serve as the closest access points for mobility impaired trail users.

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SITE ANALYSIS AND EXISTING CONDITIONS

SURFACE RUNOFF



Shoreline erosion is predominant throughout the site. In addition to surface runoff and social use, the frozen ice and limited vegetation contribute to the degrading shoreline.

The arrows on the right depict sharp grade changes that occur between the shade shelters and water. Bumping out the shoreline and reducing the grade will help improve water quality and recreational access.

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SITE ANALYSIS AND EXISTING CONDITIONS

EXISTING CONDITIONS SITE CONTEXT

PRIMARY ACCESS
Timber steps

EXISTING RAMP ACCESS
Commencement of ramps. Access beyond the ramp is not delineated and spurs between the water and shoreline.



Existing sand beach

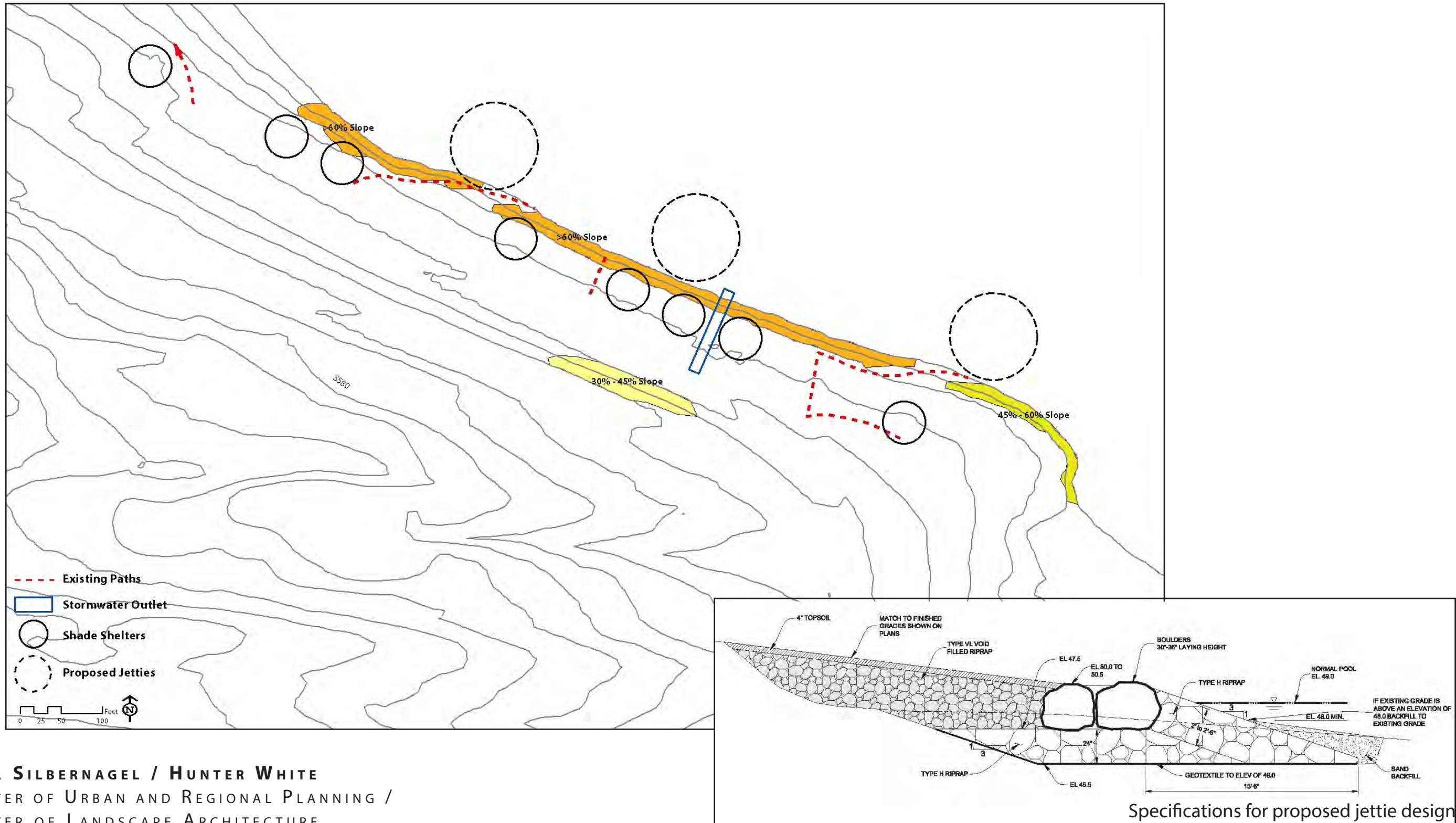
Secondary trails lead from shelters to the shoreline.

Stormwater outflow

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SITE ANALYSIS AND EXISTING CONDITIONS

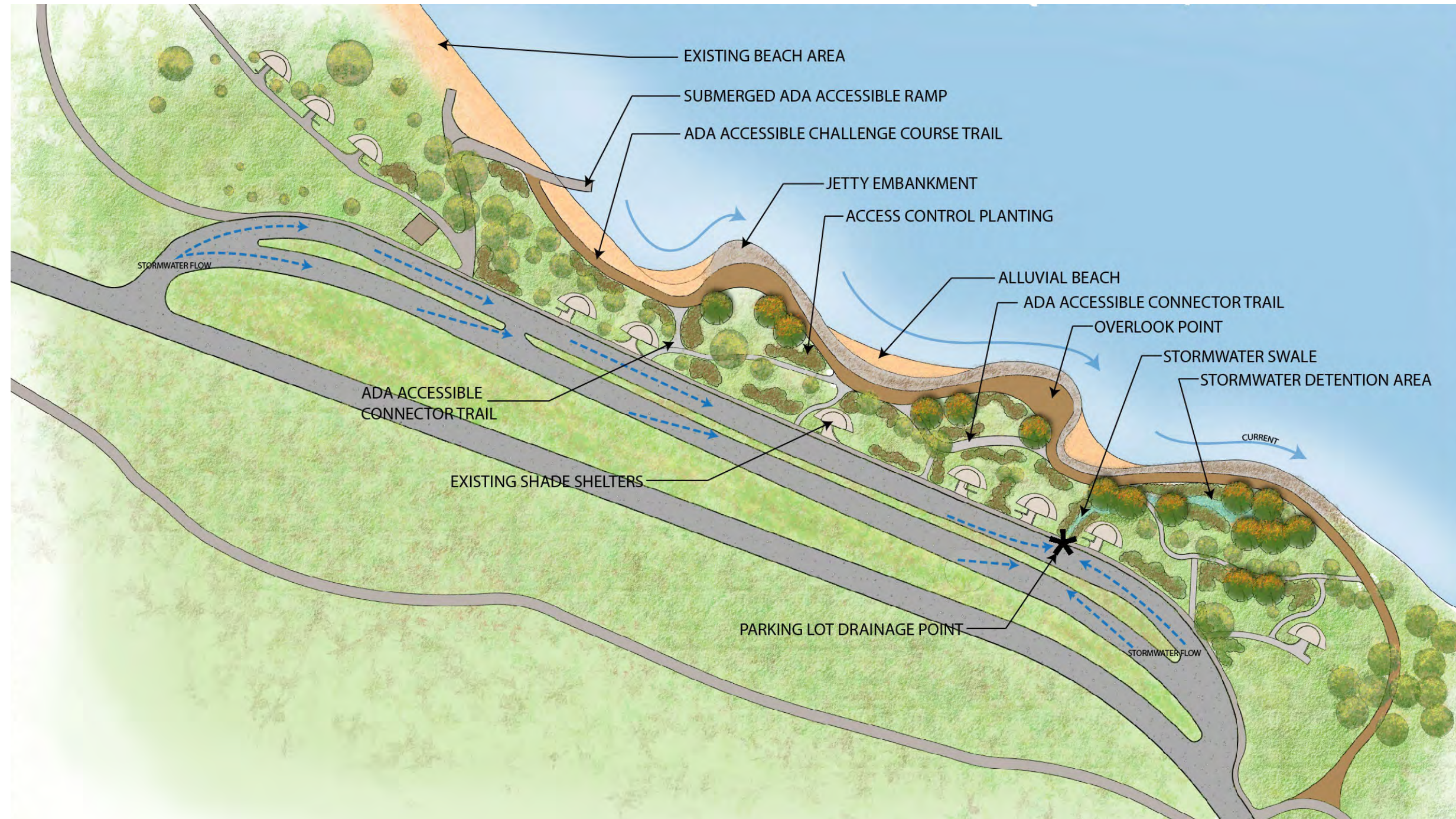
SLOPE AND KEY ELEMENTS



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PROPOSED SITE PLAN

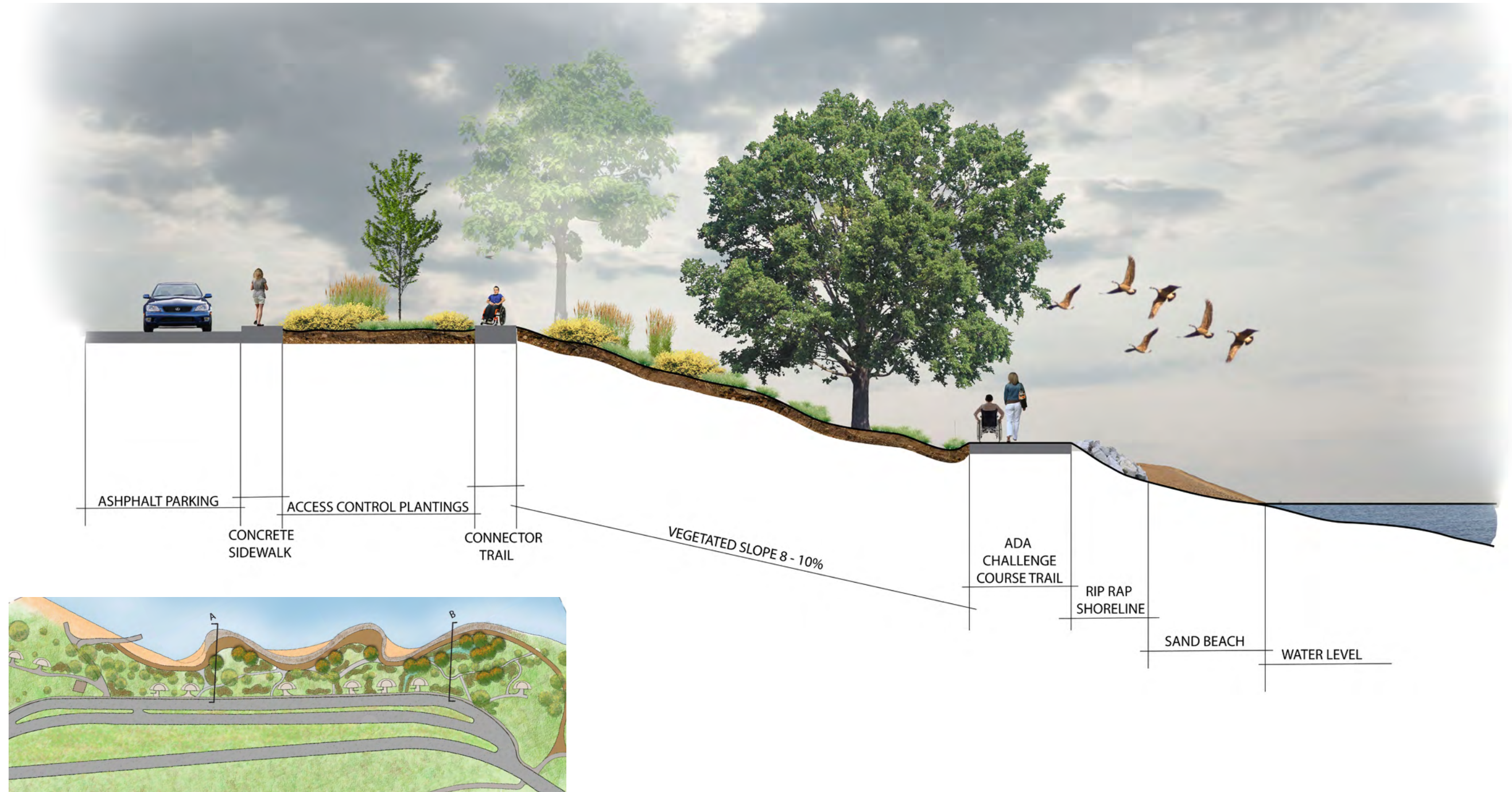
SITE OVERVIEW



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PROPOSED SITE PLAN

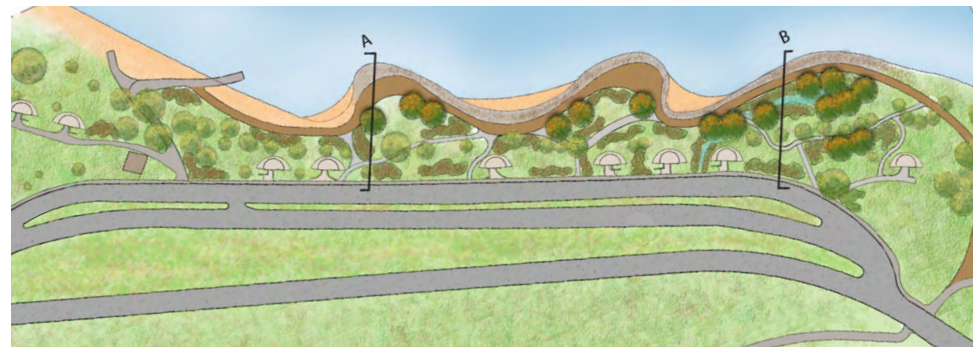
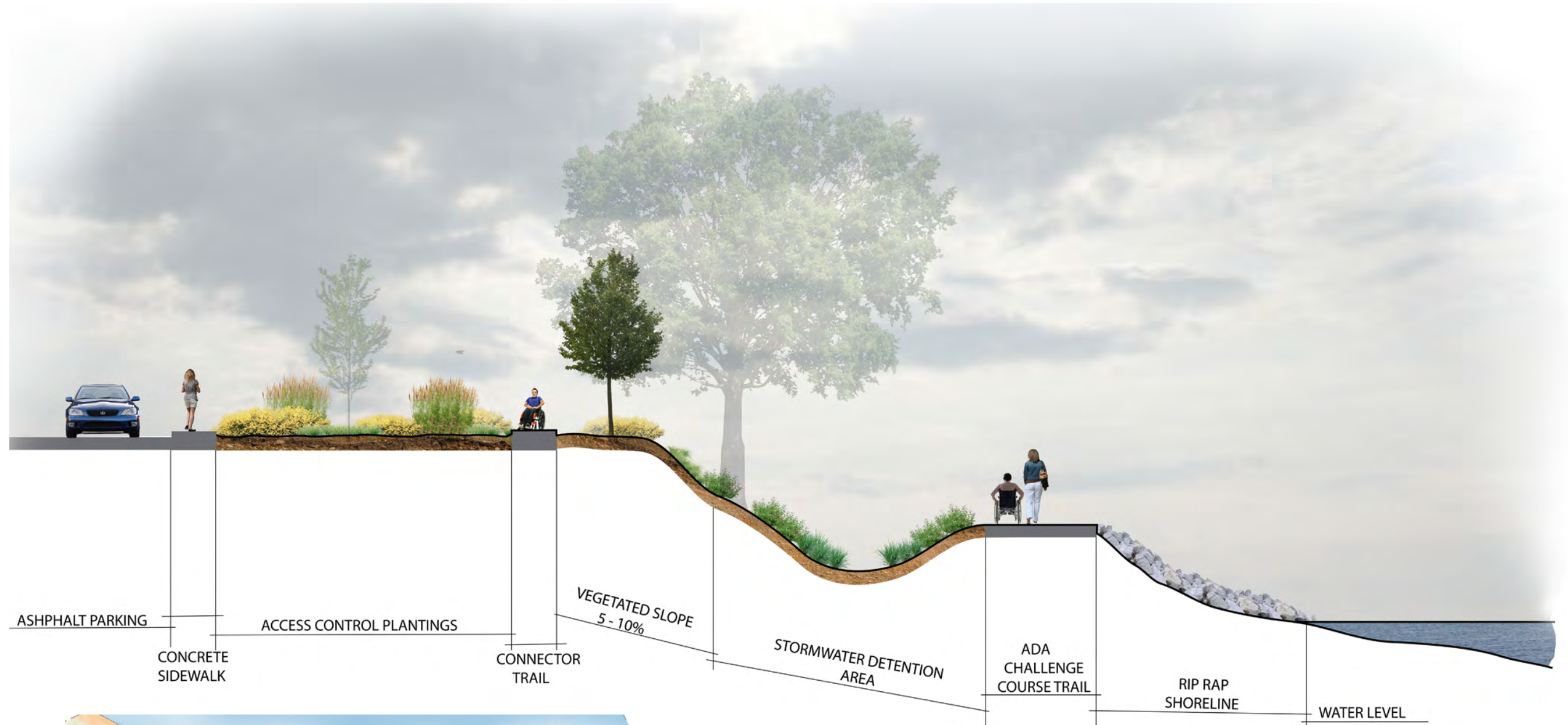
SECTION VIEW A



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PROPOSED SITE PLAN

SECTION VIEW II



Note: Slope not to scale

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PROPOSED SITE PLAN

VEGETATION PLAN

Plant Palette



Parry's rabbitbrush
Chrysothamnus parryi



Buffalograss
Buchloe dactyloides



Sand dropseed
Sporobolus cryptandrus



Switchgrass
Panicum virgatum



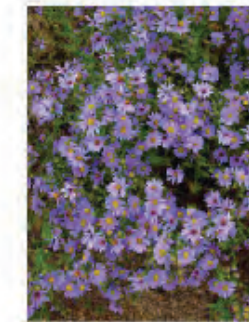
Scarlet globemallow
Sphaeralcea coccinea



Blue grama
Bouteloua gracilis



Blanket flower
Gaillardia aristata



Blue aster
Aster laevis



Western wheatgrass
Pascopyrum smithii



Dotted gayfeather
Liatris punctata



Sideoats grama
Bouteloua curtipendula



Indian ricegrass
Oryzopsis hymenoides

Native Prairie Plants

Native Bioretention Plants

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PROPOSED SITE PLAN

TRAIL ELEMENTS - IMPROVING AND CONTROLLING ACCESS



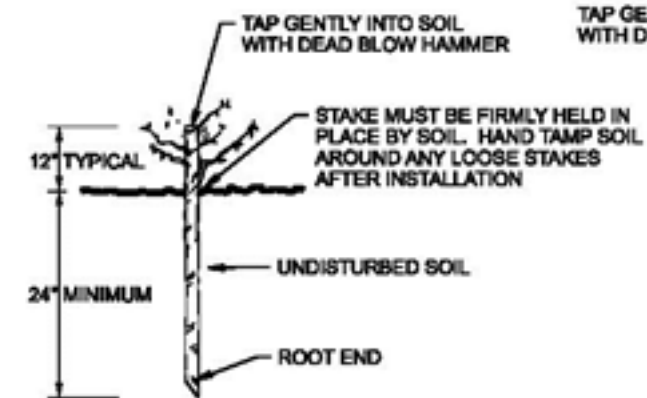
Existing informal trails between the shelters and the water would be restored as secondary routes with rock steps to still facilitate access at each shelter. The primary access points will be located at the steps in the middle of the site and the ramps that flank the ends of the site area.

In between these access points, willow staking would be used to establish vegetation. Rabbit brush would also be planted along the plateau of the shelters as further access barriers guiding users to the primary (timber steps and ramps) and secondary (stone steps) routes.

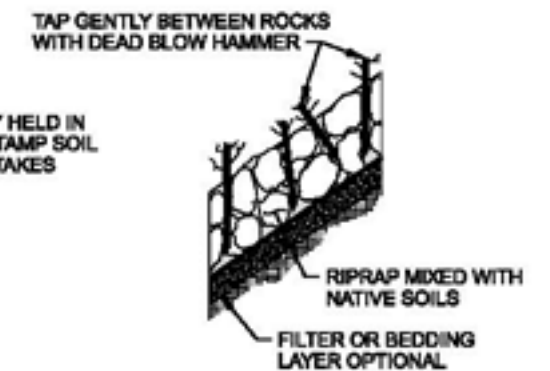
The preferred methodology for the site would include willow staking and rabbit brush as access barriers with fencing as a last alternative.



BARE GROUND INSTALLATION



RIPRAP "JOINT" INSTALLATION



NOTES:

1. THE STAKE SHALL BE INSERTED INTO THE HOLE SO STAKE IS IN CONTACT WITH WATER TABLE.
2. CUT STAKE AND INSTALL STAKES WITH A MINIMUM OF 4 BUDS ABOVE AND 4 BUDS BELOW FINISHED GRADE.

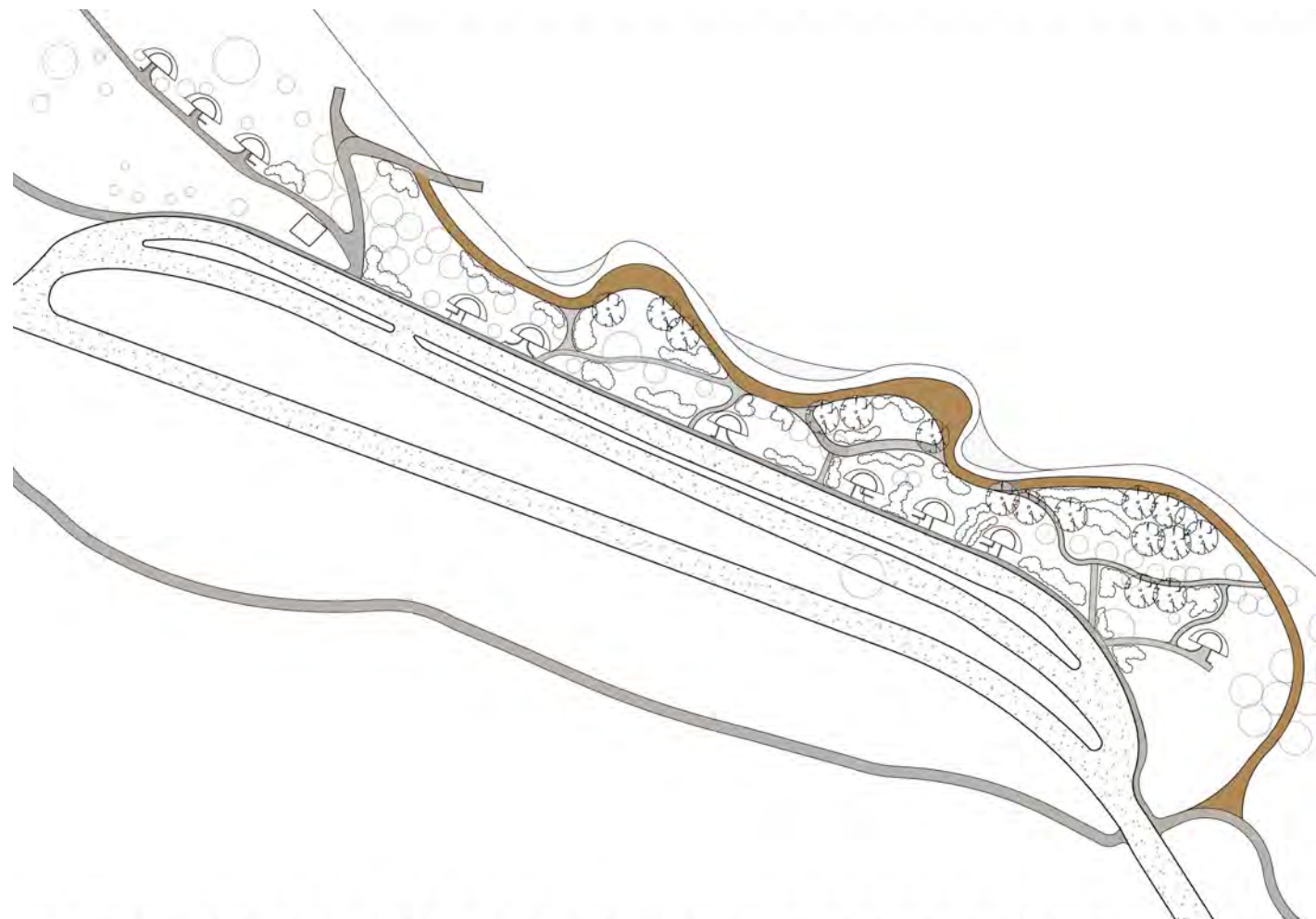
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PROPOSED SITE PLAN

TRAIL ELEMENTS - UNIVERSAL RECREATION ACCESS AND EXPERIMENTAL TRAIL

“Universal design maximizes the potential enjoyment of the outdoors for every member of the family” (Hunter, 1994). The proposed trail and linkages between the West Shade shelters and reservoir will integrate Universal Design concepts.

Proposed trail alignment along the new shoreline and beach areas.



Top: Loop above typical 5% grade.

Bottom left: Soft surface accessible trail.

Bottom right: Tactile trail surface to signal a change in the grade.

Elements for Universal Recreation Access trails.

1. Surface is firm and stable.
2. Clear tread width.
3. Cross slope no more than 3%.
4. Passing space every 200 feet.
5. Tread obstacles should not exceed 1 inch.



Partners for Access to the Woods (PAWS)



Partners for Access to the Woods (PAWS)

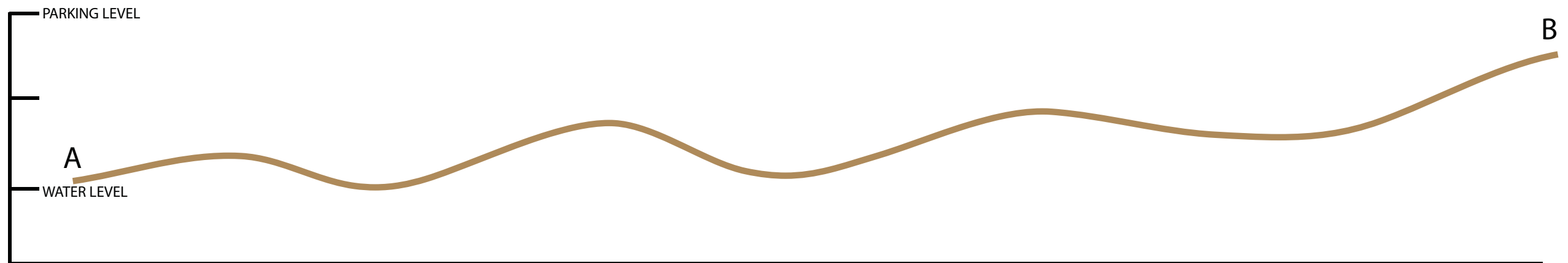


Invisible Structures, Inc.

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PROPOSED SITE PLAN

TRAIL ELEMENTS - UNIVERSAL RECREATION ACCESS AND EXPERIMENTAL TRAIL

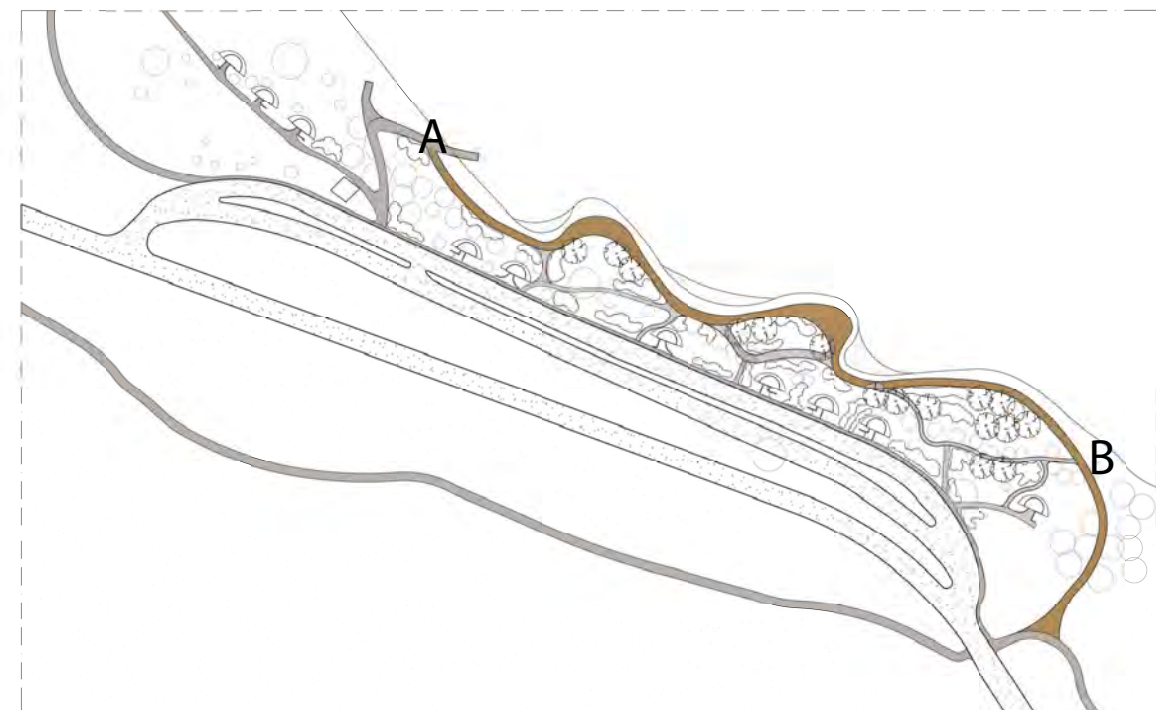


Accessible Challenge Course

Grade:

- No more than 30% of the total length of designated accessible trail will exceed a running slope of 1:12 (8.3%) or have a cross slope greater than 1:20 (5%).
- The general running slope of accessible trail will be 1:20 (5%) with steeper slopes considered accessible in the following conditions:
 - Max running slope of 1:12 (8.3%) for 200 ft with resting intervals.
 - Max running slope of 1:10 (10%) for 30 ft with resting intervals.
 - Max running slope of 1:8 (12.5%) for 10 ft with resting intervals.

Resting Intervals: Due to the steepness of the grade changes, we anticipate that many proposed slopes will be close to the maximums for accessible trails. Resting intervals that are properly spaced provide a greater degree of accessibility for persons with disabilities. The resting areas should be at least 5 ft long and as wide as the trail with a cross slope of 1:20 (5%) or less.



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PROPOSED SITE PLAN

TRAIL ELEMENTS - SIGNAGE

Trail Access Information on signs provides potential users with the information needed to determine which trails best meet their desired experiences, interests, and abilities (Beneficial Designs, Inc., 2001). Similar signage should be used at the West Shade site to communicate to users the technical challenges throughout the trail.



Symbols that may be used to signify the trail complies fully with Outdoor Developed Areas guidelines.



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PROPOSED SITE PLAN

TRAIL ELEMENTS - WATER RAMP / KAYAK & CANOE LAUNCH SITE

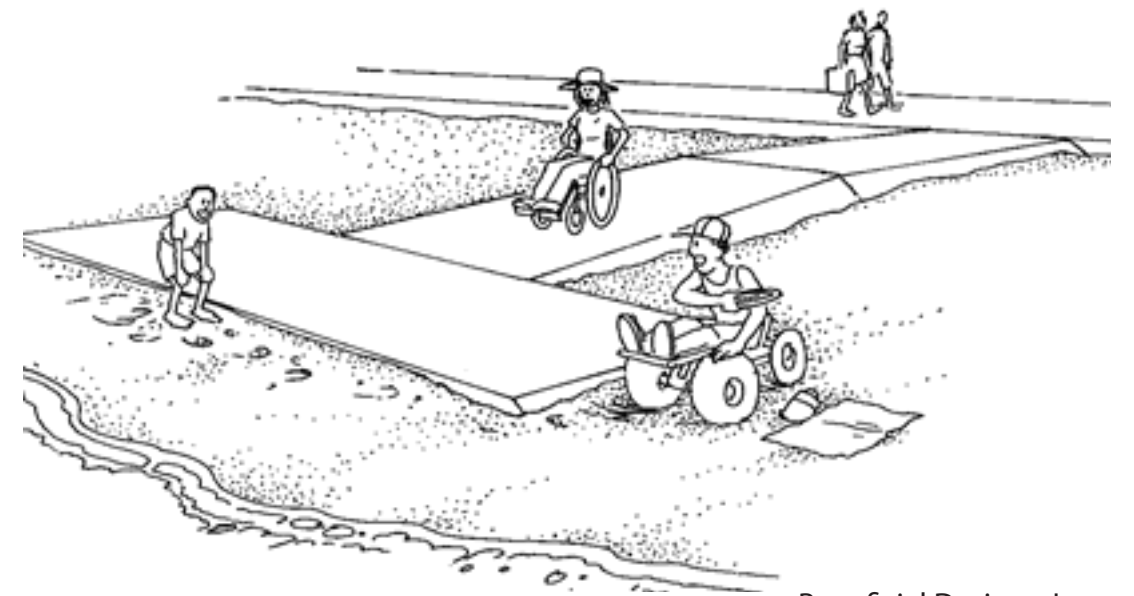


American Trails

The West Shade Shoreline will also include ramp access directly to the reservoir allowing mobility impaired individuals to access the water, including kayak and canoe access.

Soft surfaces such as sand and gravel are extremely difficult for mobility impaired users and should not be used as trail surface for water access. Permanent beach paths should be firm and stable and allow people with mobility impairments to fully enjoy the beach environment.

The ramp will utilize slip resistance measures. Slip resistance is based on the frictional force necessary to permit a person to ambulate without slipping. A slip resistant surface does not allow a shoe heel, wheelchair tires, or a crutch tip to slip when ambulating on the surface (Beneficial Designs, Inc. 2002).



Beneficial Designs, Inc.



Beneficial Designs, Inc.

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IMPLEMENTATION PLAN

COST ESTIMATES

Shoreline Reclamation:

- a. Includes bumping out the shoreline, installing three jetties, establishing retention pond area.
- b. Water retention area
- c. Vegetation
- d. Trail access and control points, including rehabbing old timber steps and informal stone step trails.

Approximately \$492,000

Area of West Shade Shoreline is approximately 60% of Mountain & Lake Loop Shoreline Project). Mountain and Lake Loop cost allowance, per the Memo Bid Evaluation, was \$820,000.

Universal Recreation Access and Experimental Trail

- a. Materials for establishing hard surface for trail
- b. Establishing mobility impaired access to the water
- c. Signage about the trail

Approximately \$12,500-17,000*

Rails to Trails Design, Build Trail toolbox estimates the cost of a natural surface to be \$50,000 -\$70,000 per mile. Cost estimates assumes 1/4 mile trail.

TOTAL: \$509,500

Maintenance Requirements:

- a. Weed management
- b. Standard trail and stair maintenance
- c. Reinforced shoreline needs little to no replenishment
- d. Removal of physical debris from stormwater detention system
- e. Standard landscape maintenance

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CONCLUSION

The intent of this concept plan is first and foremost, to mitigate and limit the effects of stormwater runoff on the overall quality of water in the Cherry Creek Reservoir. This objective could be easily met through standard civil and hydrologic engineering practices. However, our goal was to explore the concept of Universal Design and apply its principles in a creative way to improve recreational access to multiple users while still mitigating stormwater effects.

Reducing the angle of the slope, adding vegetation, and decommissioning social trails will slow stormwater runoff from the shade structures and the surrounding pavement. The bulk of the stormwater runoff comes from the paved parking areas and is currently channeled through a pipe directly onto the shore of the reservoir. Our concept proposes removing the pipe and directing the stormwater through a bio-swale and into a detention area. The engineered soils and subgrade then allow the water to infiltrate the soil and filter minerals and nutrients which may be hazardous to the surrounding ecosystem.

The Trail Challenge Course is intended to apply Universal Design that pushes the limits of accessible trails, while maintaining a safe environment for visitors of all abilities. Elevation changes, textured surfaces, sharp turns, and moments for quiet reflection are elements that should be incorporated throughout the trail to provide a wide range of experiences. Detailed signage will help users to judge the difficulty of trail elements and specifies slopes and distances for reference.

Water quality and accessibility are usually thought of as scientifically generated solutions to mandated regulations. The proposed concept set forth instead applies design and principles that can improve an area's ecological systems and improve users' access that is both visually and physically appealing. How can water quality and accessibility work together instead of against each other? How could the two drive creative design? Our concept explores the relationship between technical guidelines and creative design.

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