Salton Sea Authority

DESERT SHORES RESTORATION PROJECT

Feasibility Study comprising Geotechnical, Geologic, and Hydrogeologic Services for the proposed restoration project in Imperial County, California

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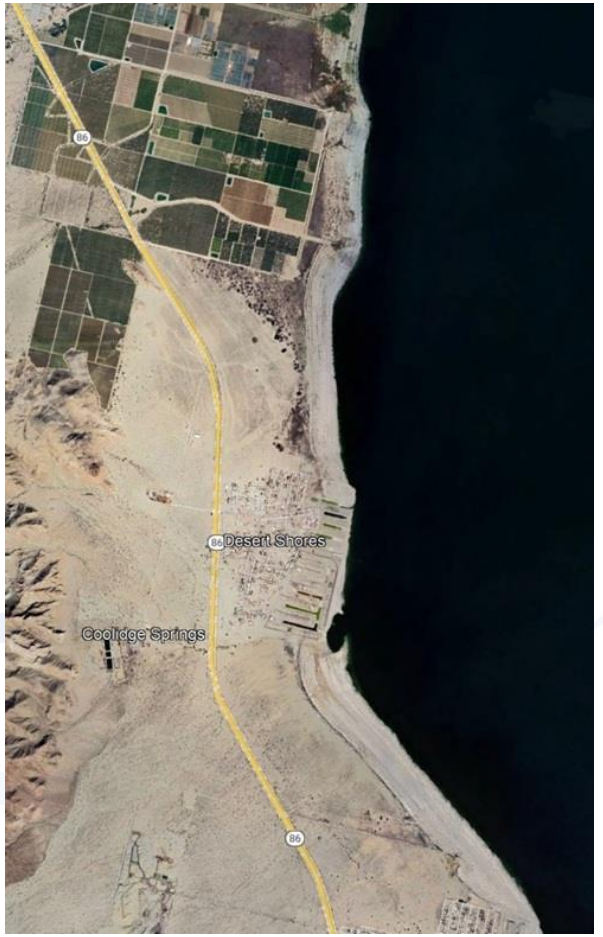
Feasibility and Sustainability of Restoration Project

DESERT SHORES RESTORATION PROJECT

- Introduction
- Project History
- Feasibility Study Overview



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Feasibility and Sustainability of Restoration Project

Nicklaus Engineering, Inc. in association with AECOM performed this Feasibility Study to develop and evaluate potential restoration alternatives for the Finger Lakes. The Feasibility Study included:

- A geotechnical evaluation, which consisted of performing subsurface investigation, laboratory testing, and preliminary engineering evaluations.
- A hydrogeological evaluation to assess groundwater conditions at Desert Shores.

Field Activities for Evaluation of Restoration Project

- Used geophysical methods to attempt to locate old well
- Drilled pilot borehole for assessment of groundwater
- Collected Groundwater samples for water quality assessment

- Conducted a topographic survey
- Drilled geotechnical borings to collect soil samples for laboratory analysis
- Collected soil samples for environmental laboratory analysis

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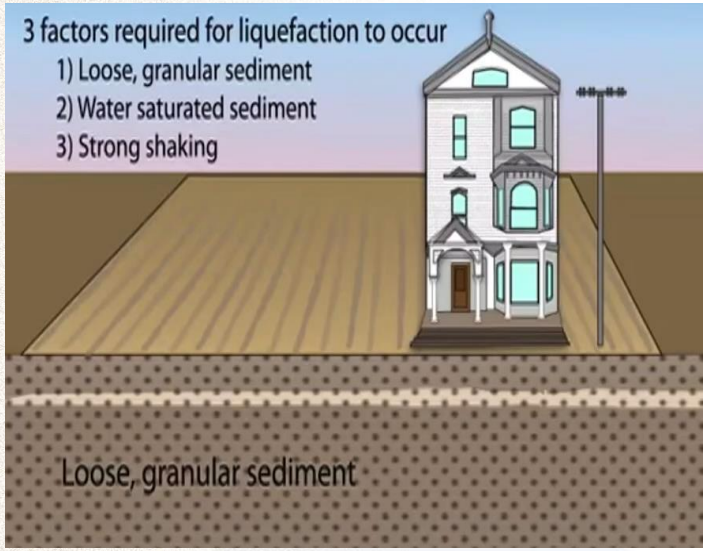
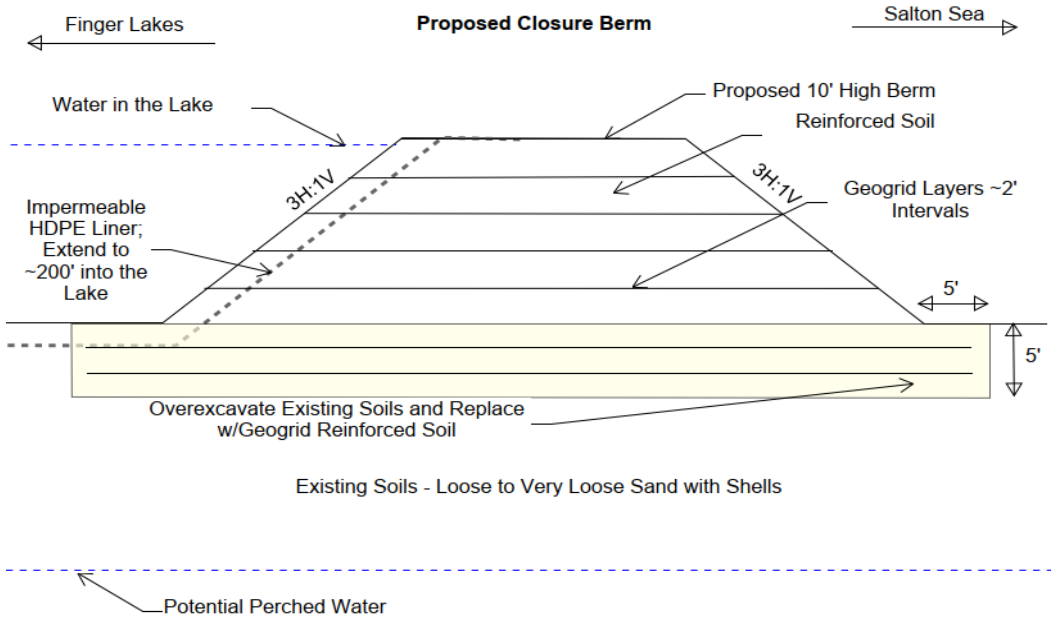
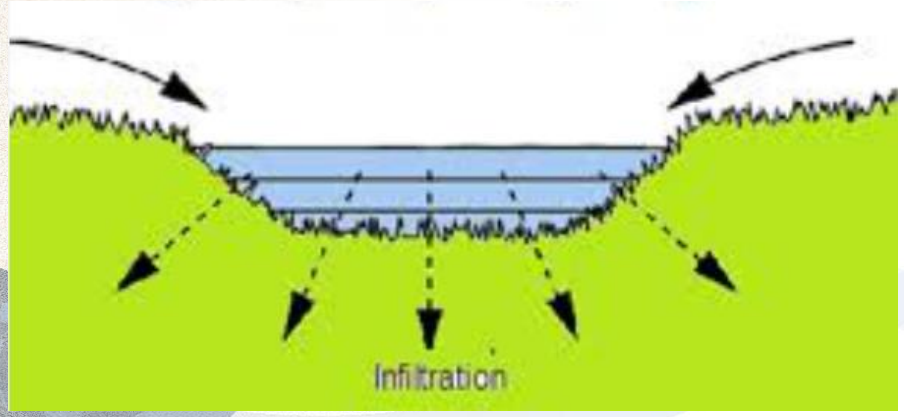
Geotechnical Challenge 1: Seismic Soil Liquefaction





- Highly variable soils across the site
- In strong earthquake, 10+ inches of settlement at inlet channel
- Design closure berm with geogrid reinforced fill
- Less/variable liquefaction settlement around the lakes (no change to current conditions)

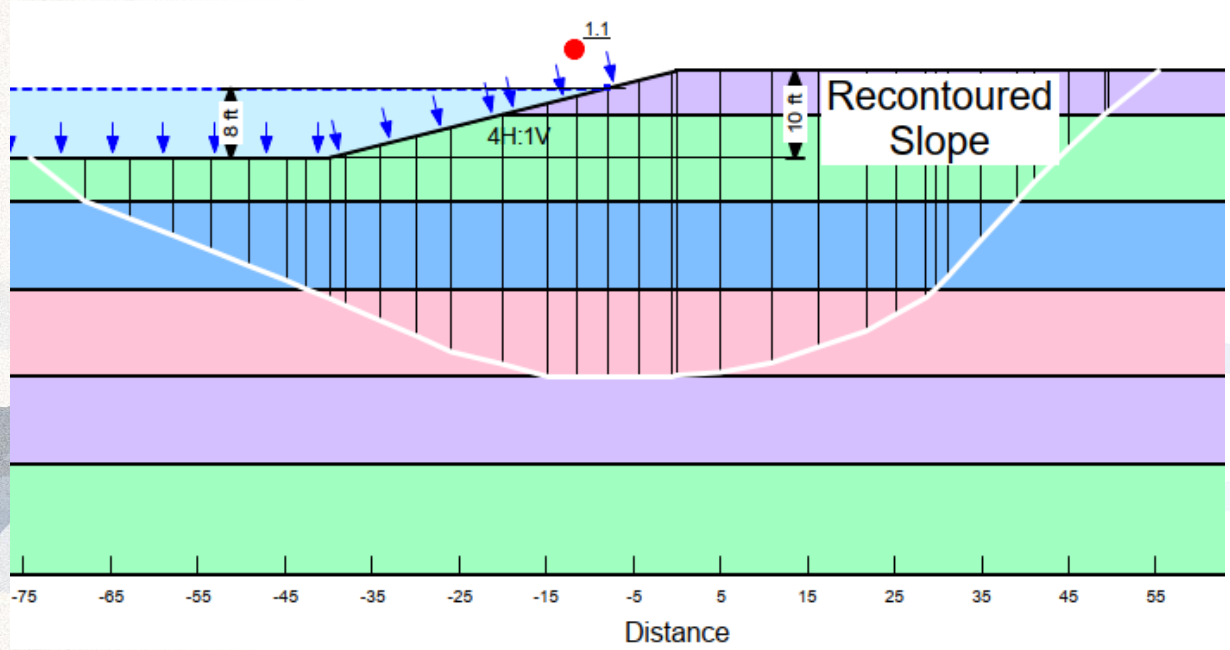
Geotechnical Challenge 2: Infiltration



- Variable soil, could infiltrate 5 to 10 inches of water per day
- Limit infiltration through/below closure berm by including liner in design
- Impractical to fill ponds as-is to retain water
- Mitigations could include different methods of lining ponds

Geotechnical Challenge 3: Seismic Slope Stability

- Existing slopes (with or without water) may experience localized failures
- Potential to compromise pond configuration and shoreline structures
- Limiting pond depth and recontouring slopes would improve stability
- Slope stability of closure berm addressed through design approach



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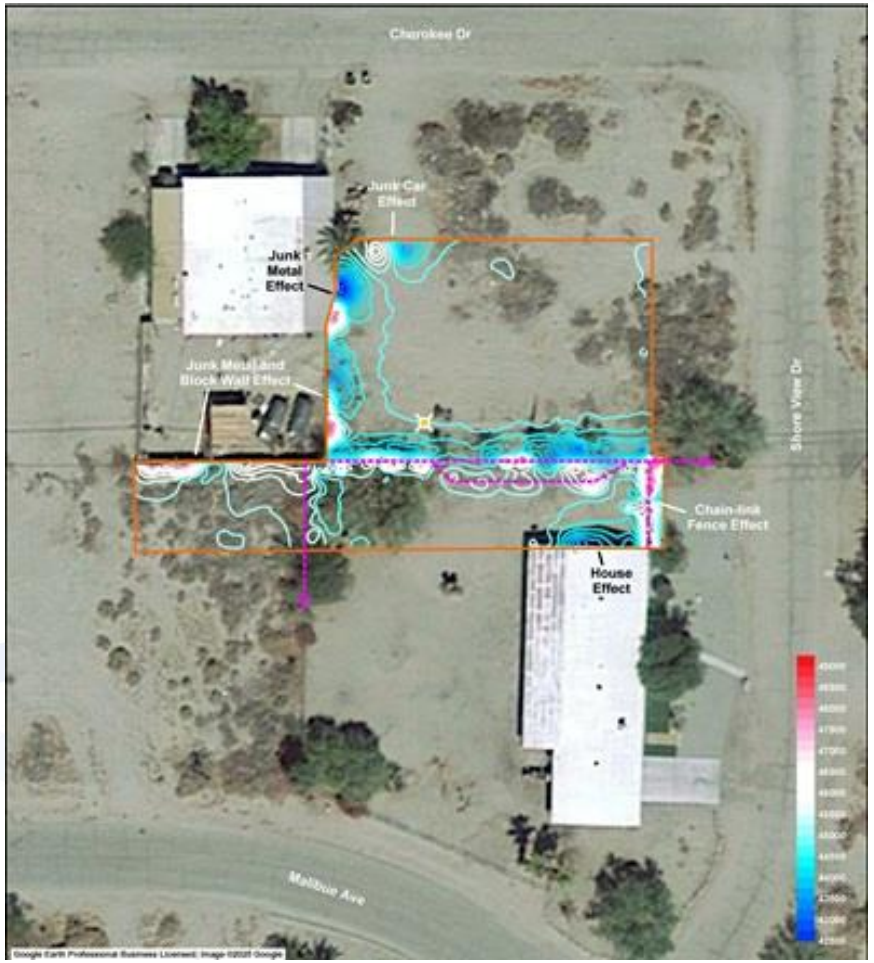
Hydrogeological Assessment Results

- The old well could not be located at the location DWR records indicated.
- Groundwater quality is slightly saline.
- Groundwater in the area is in a confined or artesian aquifer.
- Groundwater and soil samples were not reported to contain any contamination



Sustainable Alternatives Evaluated for Feasibility and Sustainability

Alternative 1: The original Alternative included engineering a closure berm at the former inlet, installing a groundwater production well, and filling the finger lakes without any modifications to the finger lakes.

- This alternative is not feasible due to water loss.
- Water loss of 5 to 10 inches per day would result in a total daily water loss ranging from 11 to 22 acre-feet per day.
- Would require approximately 5 wells pumping at 1,000 gpm to maintain water levels.
- High potential for damage to the aquifer

Sustainable Alternatives Evaluated for Feasibility and Sustainability

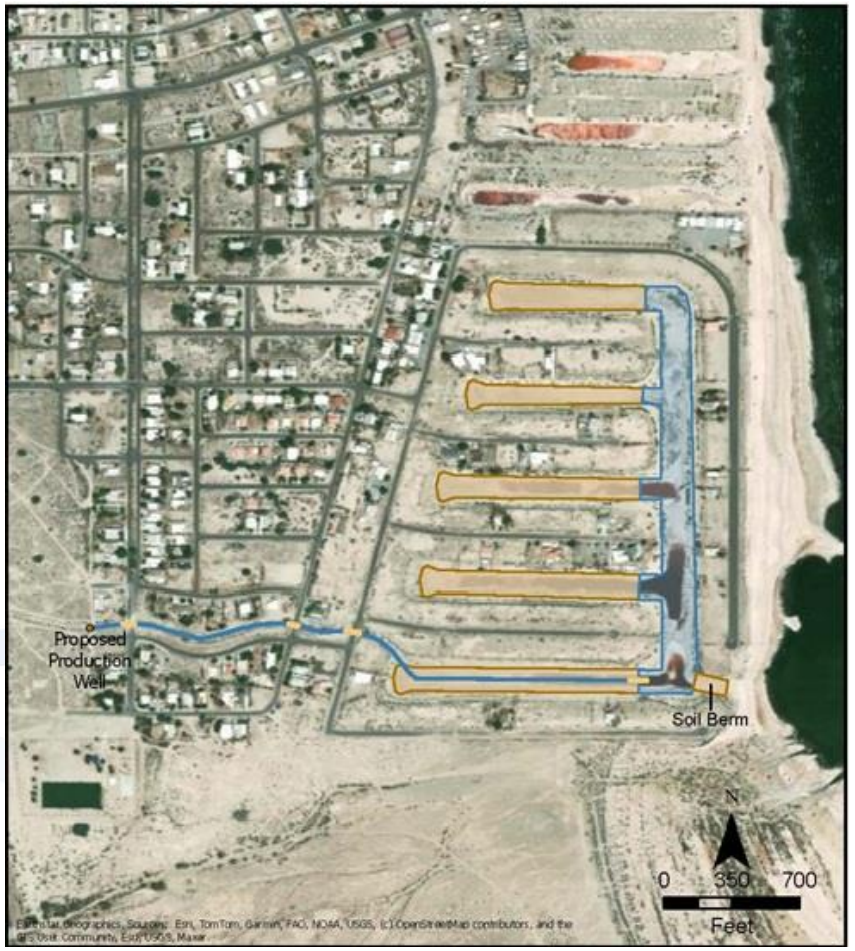
Alternative 2: Engineering a closure berm at the former inlet, installing a groundwater production well, and recontouring the finger lakes to reduce water depth and improve the stability of the side slopes, and installation of a liner to limit infiltration of water into the subsurface. Two liners types were evaluated as Alternatives 2A Soil Liner and 2B HDPE Liner.

- Engineered Berm would include a design to limit settlement, installation of a liner to prevent water infiltration into the subsurface, and a spillway to allow for stormwater outflow in the event of flood conditions.
- A liner, either soil or HDPE, would be installed to limit infiltration.
- Fine-grained soil liner would significantly reduce infiltration; HDPE liner would almost entirely eliminate infiltration. Water Loss of ~0.5 in soil liner to ~0.1 inches per day for HDPE Liner.
- Would require 1 well pumping at ~400 gpm to maintain water levels.
- **Estimated Cost**: **Alternative 2A: $10.9M (Soil Liner) and Alternative 2B: $22.8M (HDPE Liner)**

Sustainable Alternatives Evaluated for Feasibility and Sustainability

Alternative 3: Reducing the water feature in the finger lakes to just the north-south oriented main channel and backfilling the remaining finger lakes and turning them into a park. Two liners types were evaluated as Alternatives 3A Soil Liner and 3B HDPE Liner.

- The Berm Construction, groundwater well/pipeline, and aerators would be the same as Alternative 1.
- The soil or HDPE liner would be installed to limit infiltration.
- Recontouring would reduce water depth and improve side slope stability.
- Would require 1 well pumping at 400 gpm to maintain water levels.
- **Estimated Cost**: **Alternative 3A: $13.8M (Soil Liner) and Alternative 3B: $11.4 (HDPE Liner)**

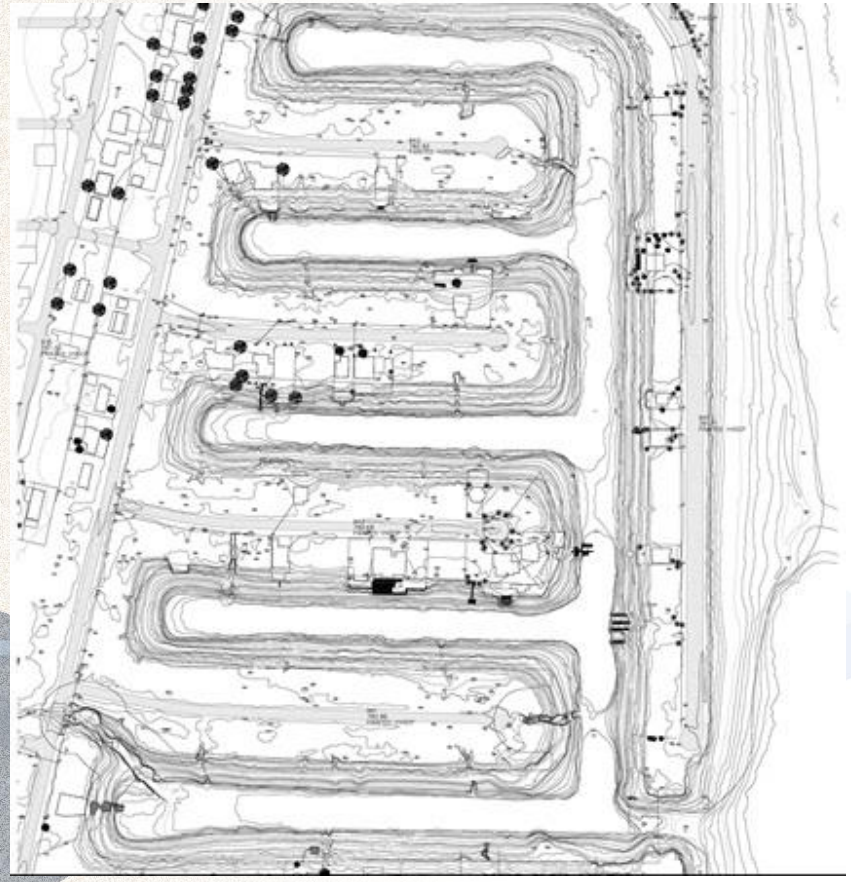


Sustainable Alternatives Evaluated for Feasibility and Sustainability

Alternative 4: Filling the finger lakes with soil and creating a landscaped park.

- No berm needed.
- Landscaping and other amenities to make the finger lakes into a park area.
- Recontouring would address stability of side slopes.
- Stormwater conveyance from wash to the Salton Sea to prevent erosion of the backfill soil.
- **Estimated Cost**: **~$8M**

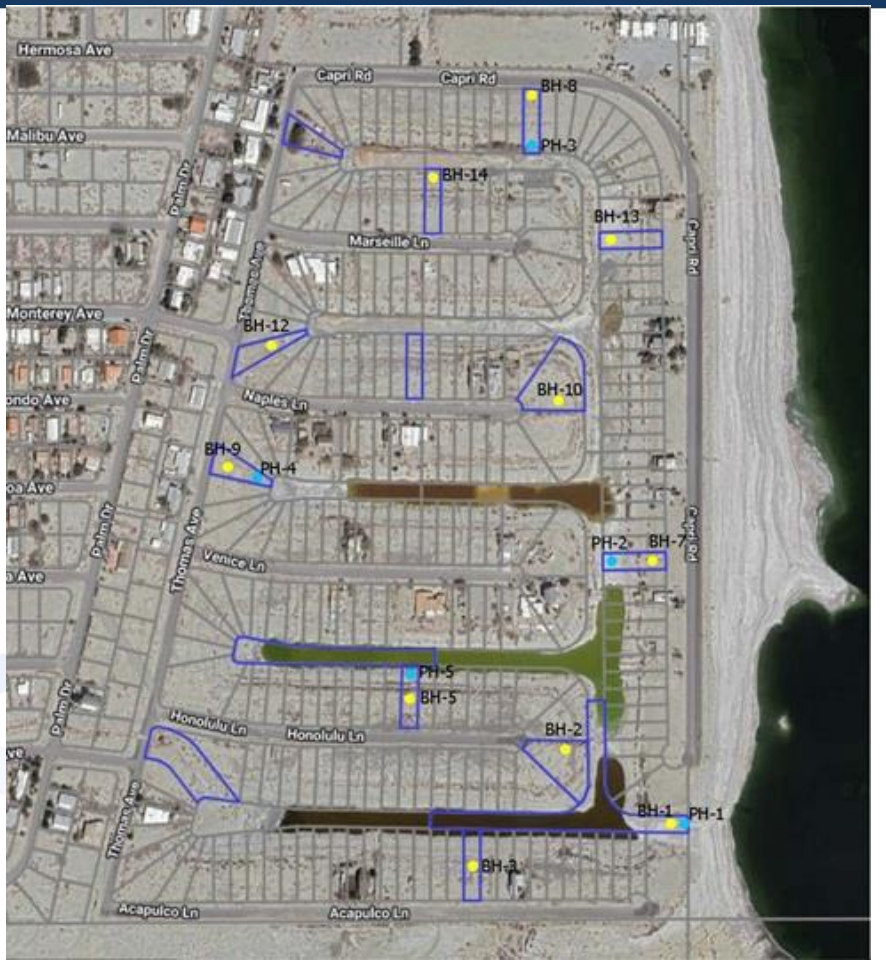
Feasibility and Sustainability of Each Alternative



- **Alternative 1:** Based on the estimated water loss to infiltration and the potential for slope instability of the existing lakes, Alternative 1 is not a viable option for restoration of the finger lakes without modification.
- **Alternatives 2 and 3:** Both alternatives are feasible from an engineering standpoint.
- **Alternative 4:** Alternative 4 is considered the most sustainable option due to elimination of the lakes, however, this option as it does not restore the water feature or create a biological habitat.

Next Steps

- Additional community meetings to discuss the project direction and design.
- Utilize remaining funds to focus on design, entitlement, and permitting.
- Explore funding strategies.
- Create a viable and sustainable project that will be shovel-ready for funding.



Questions?

Alternatives 2A and 2B

Alternative 3A and 3B

Alternative 4

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