



C2-03: Spring Lake Trail Rehabilitation

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Sponsor: Jon Cradit with the San Marcos Greenbelt Alliance



Trail Section

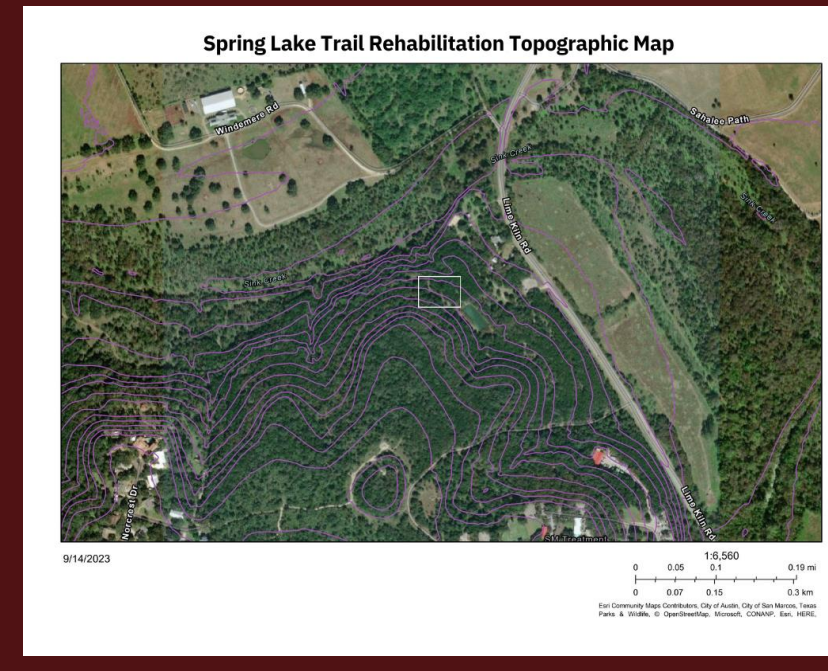
Goal: Return trail to its intended width and improve functionality in wet conditions with low impact design.



110-foot section of Spring Lake Trail



Trail section located 750 feet from the trailhead



Topographic map from Esri Community Maps

Updates

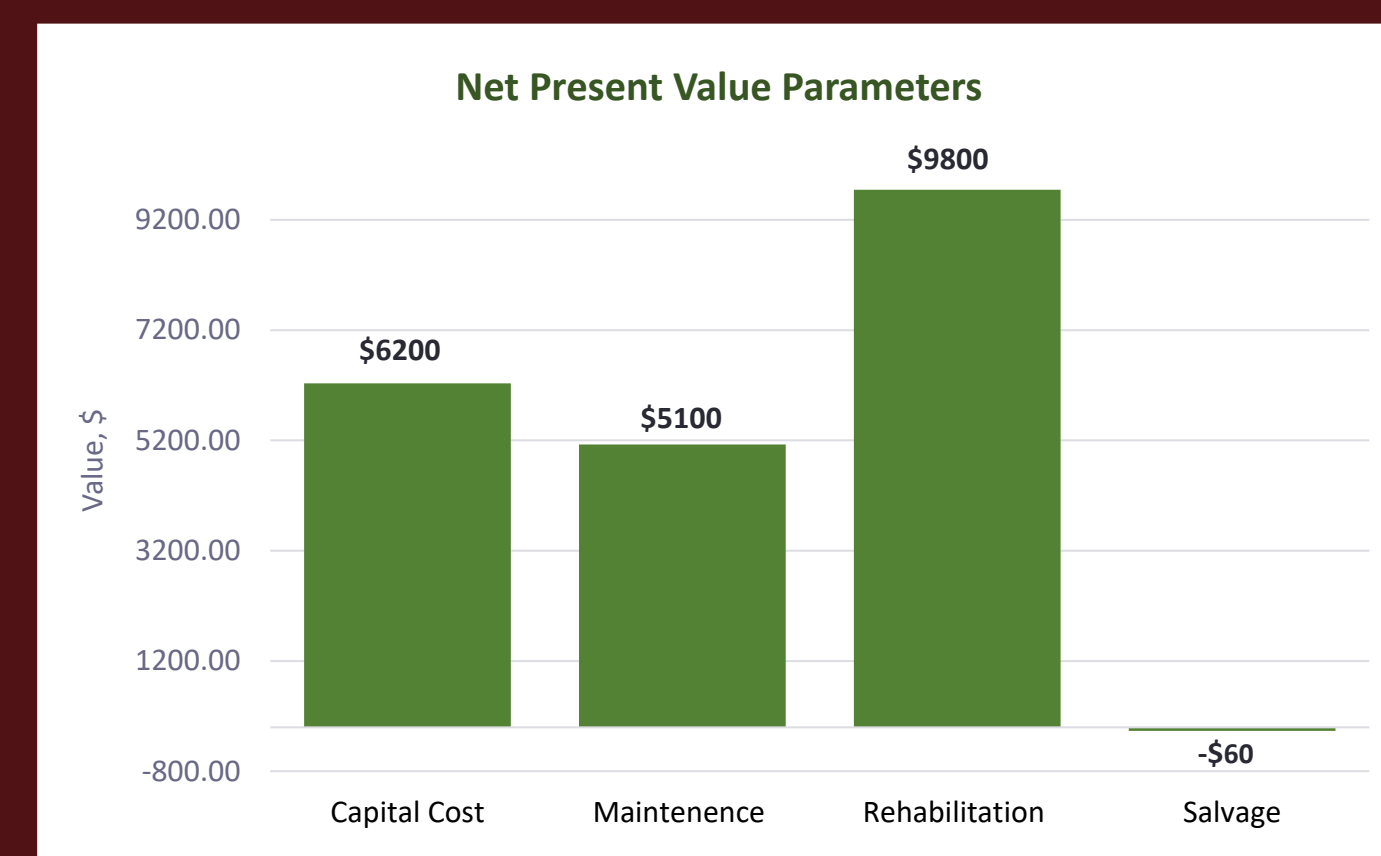
Sustainability Evaluation:



Life Cycle Cost Analysis:

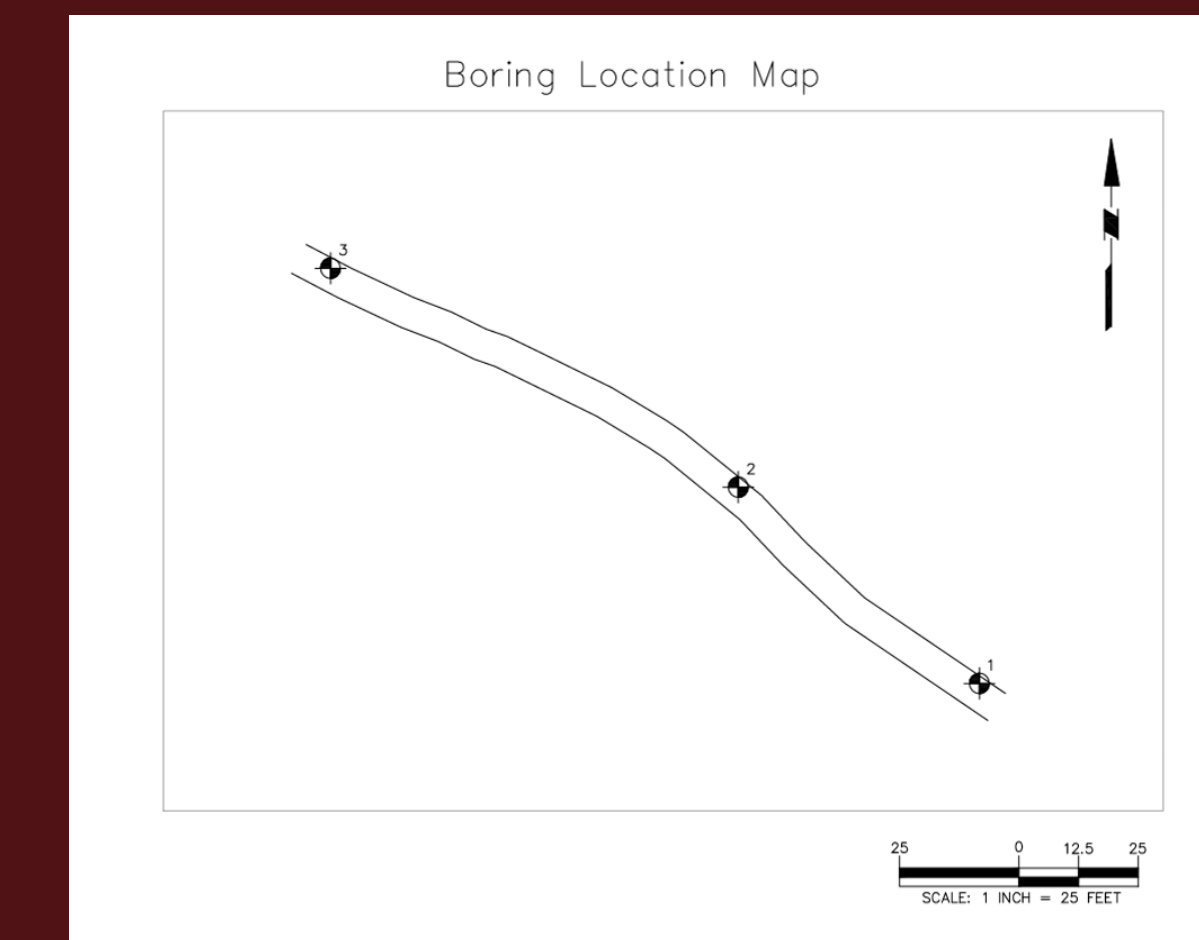
Analysis Period: 50 years

NPV = \$21,000



Soil Analysis

Soil Classification:



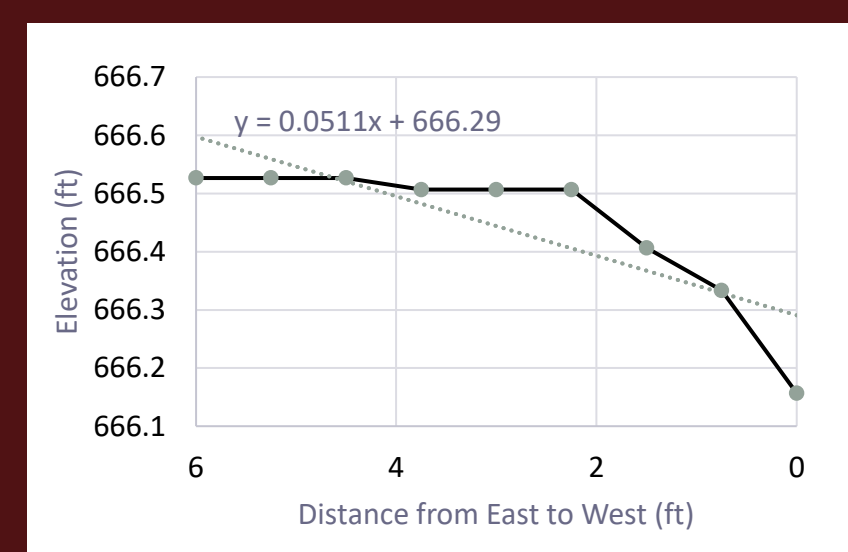
More than 50% passed the #200 sieve
Coefficient of Uniformity is greater than 6
Coefficient of Curvature is not within the range of 1 and 3

Finely-Grained
Poorly-Graded

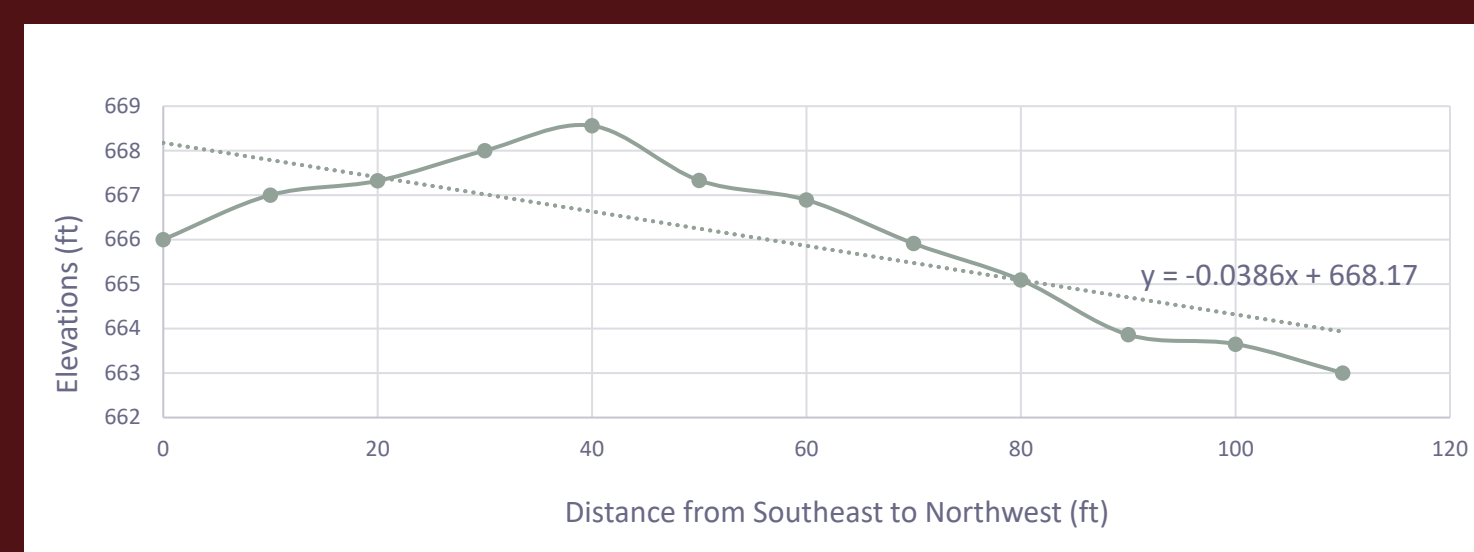
System Design

Profile Analysis

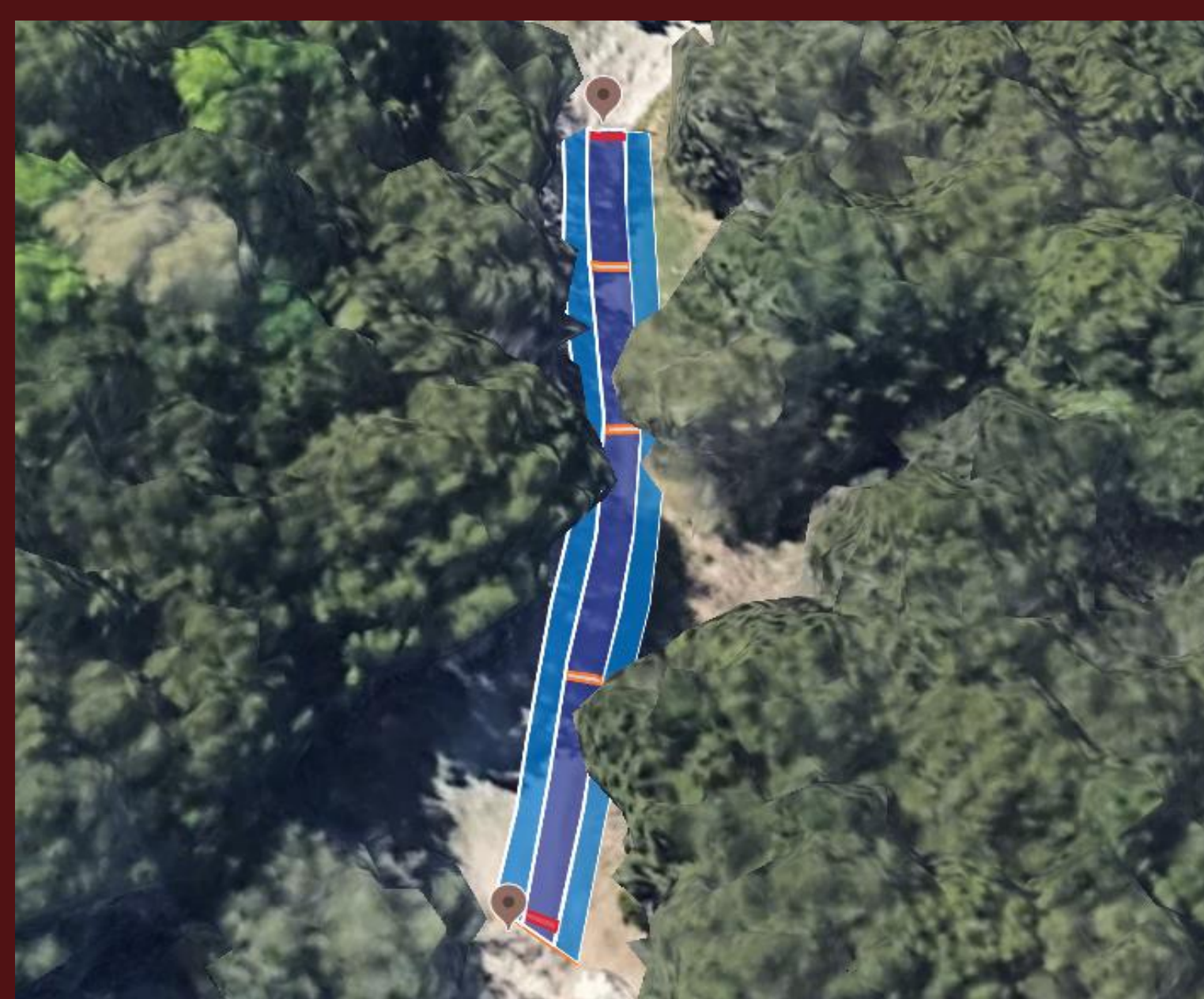
Elevations from East to West



Elevations from Southeast to Northwest

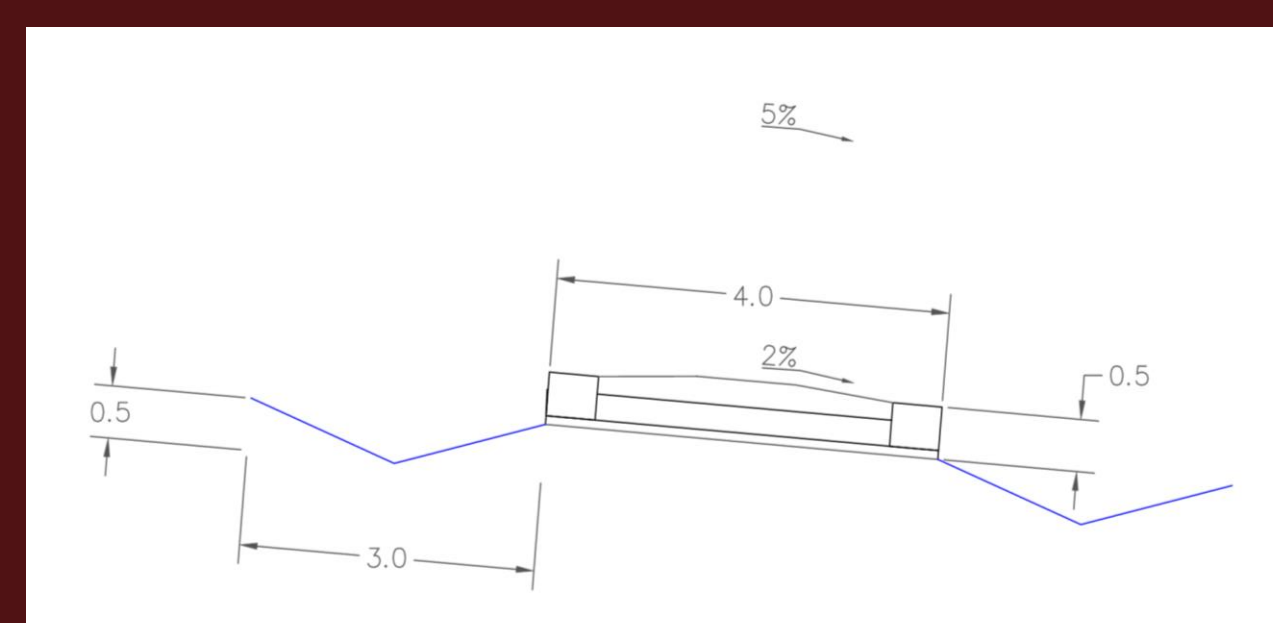


Aerial View of System Design

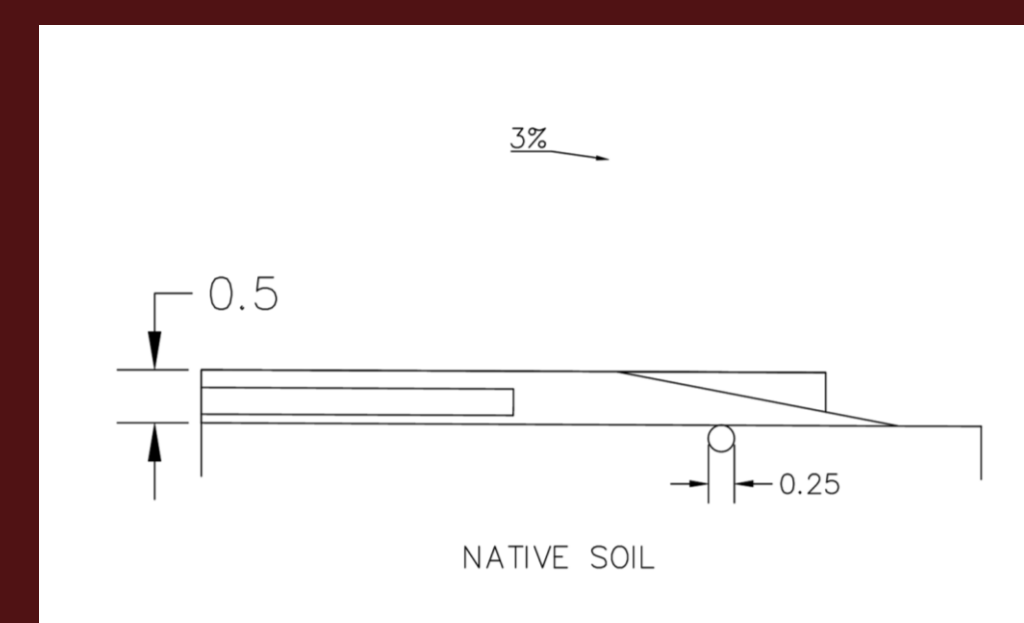


Aerial view of trail rehabilitation design

Trail Cross-Section Designs



Horizontal cross-section of trail



Vertical cross-section of trail at northwest end

Element Design

Bioswale and Conduit Design – Hydraulic Analysis

$$Q_{Capacity} > Q_{Required}$$

Rainfall Event	Intensity (ft/h)	Q Required (ft ³ /s)
5-min for 25-Year	0.95	0.232
15-min for 25-Year	0.631	0.154
2-Hour for 25-Year	0.196	0.048
24-Hour for 25-Year	0.032	0.008

$$Q_{Required} = 0.232 \text{ ft}^3/\text{s}$$

Bioswales:

$$Q_{Capacity} \text{ (for one bioswale)} = 21.189 \text{ ft}^3/\text{s}$$

$$\text{Number of bioswales: } 2$$

$$Q_{Capacity} = 42.378 > Q_{Required}$$

$$m = 3$$

$$T = 2my = 3 \text{ ft}$$

Conduits:

(3 inch diameter HDPE)

$$\text{Velocity} = 1.8 \text{ ft/s}$$

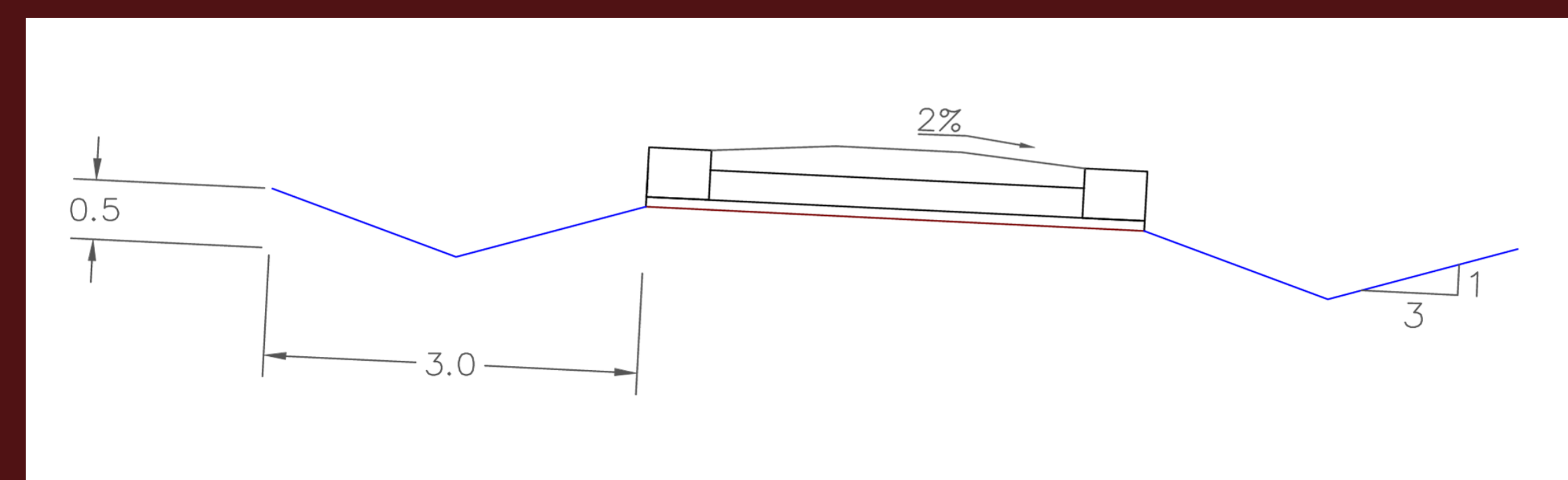
$$Q_{Capacity} \text{ (for one conduit)} = 0.093 \text{ ft}^3/\text{s}$$

$$\text{Number of conduits required: } 3$$

$$Q_{Capacity} = 0.279 \text{ ft}^3/\text{s} > Q_{Required}$$

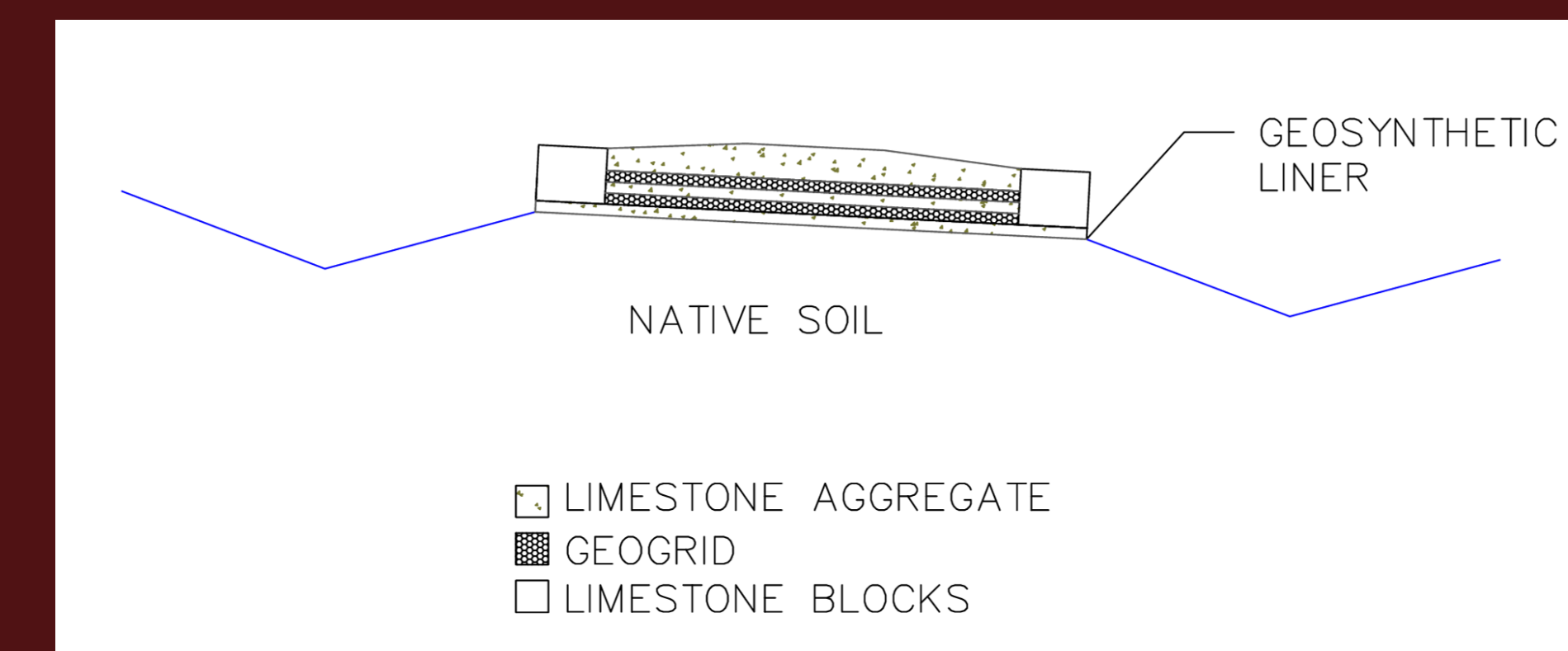
Bioswale Dimensions:
3 feet wide
0.5 feet deep

Conduits in Design: 5

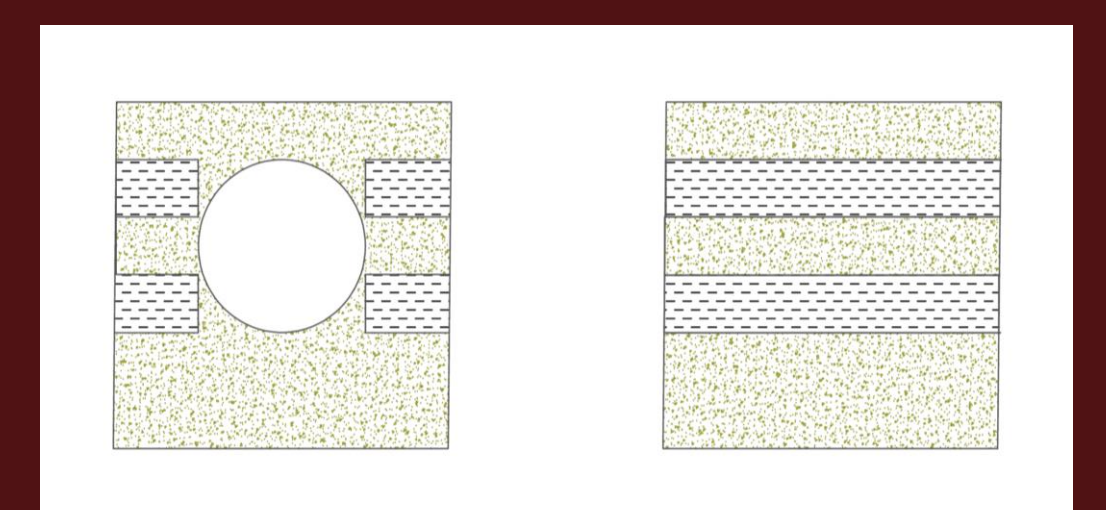


Bioswale dimensions and side slope

Layer Configuration Design



Layer Configuration of the horizontal trail cross-section

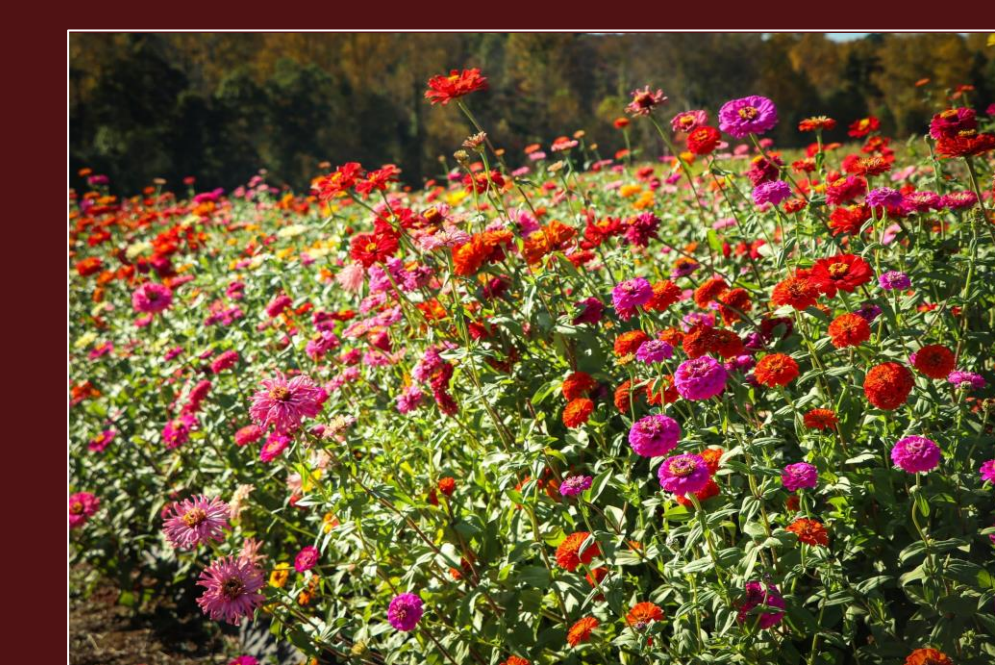


(a) (b)
Cross-section of the layer configuration of the horizontal cross-section (a) with a conduit and (b) without a conduit

Aggregate Analysis:

Limestone aggregate with low fines: Hydraulic Conductivity = 6.07E-6 ft/s

Bioswale Layer Configuration: Native Plant Selection



Zinna



Borage



Mullein

References

- San Marcos Stormwater Technical Manual
- Fundamentals of Hydraulic Engineering Systems (Textbook)
- City of Austin Land Development Code
- National Association of City Transportation Officials

Acknowledgements

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- Dr. Felipe Gutierrez
- Dr. Stacey Kulesza
- Dr. Eunsang Cho

Volunteers/Community Members:

- San Marcos Greenbelt Alliance Trail Crew & Jon Cradit
- Bob Holder