Capturing Runoff in Alumni Mall

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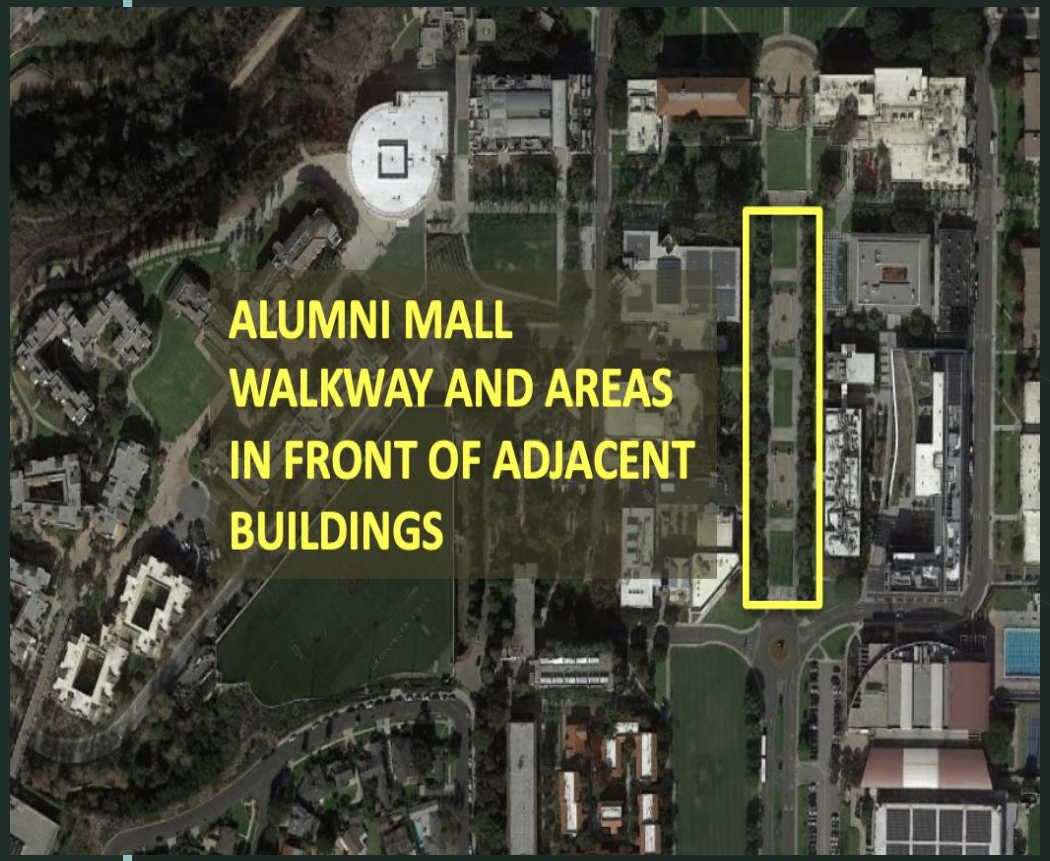

Figure 1: Map of Alumni Mall on LMU's campus

Background Information

- Westchester average annual rain totals (2010-present)
  - 13.3 inches / year
  - 36 rainy days / year
  - Single rain-day rainfall: 0.37 inches
- Approximated C-Coefficient
  - Adopting model for High-Density neighborhood development with 70% impervious cover
  - C ~= 0.69
- Peak Discharge
  - Q = C*I*A
  - Estimate I = 0.03 in/hour (0.37 inch of rain in 12 hours)
  - A = 0.045 acres = 2100 square feet
  - Calculated Q = 1.6 cubic inches / second

Surface Type / Material			R_v	R_v*Ppt_j	Citation
Impervious	Highways		0.87 (0.35-0.95)	0.783	38
	Asphalt, concrete		0.8	0.72	45
	Brick, cobblestone		0.77	0.693	45
Impervious-Pervious	High-density neighbourhood commercial development (70% impervious)		0.69	0.621	21
	Low-density neighbourhood commercial development (50% impervious)		0.55	0.495	21
Pervious	Highly compacted	Unpaved parking, driveway, road shoulder; high automobile & human disturbance, poor drainage	0.50	0.45	45
	Mid-High Compaction	Medium density single family development (~26 units/ha) (35% impervious)	0.45	0.405	21
	Moderate compaction	Low density single family urban development (~ 13 units/ha)(26% impervious)	0.38	0.342	21
	Compacted	Unmaintained sports field, park or playground surface; high human disturbance & poor drainage	0.35	0.315	45
	Unmaintained	Moderate foot traffic & some compaction; foot paths, moderate to poor drainage	0.30	0.27	45
	Turf	Maintained lawn w/ high foot traffic (e.g., golf course, park, lawn, ballfield)	0.25	0.225	45
	Maintained	Landscaped/natural vegetated w/ low foot disturbance/foot traffic	0.20	0.18	45
	Undeveloped	Relatively low foot traffic	0.15	0.135	45
	Drainage feature w/ gravel or other coarse-grained material; porous pavement, asphalt, concrete etc w/ subsurface stone reservoir; well-drained sandy soil		0.10	0.09	45

Figure 2: C- Coefficients chart

Background Information

- Location: part of the Ballona Creek Watershed
- The Ballona Creek Watershed can be classified as urban runoff
- Higher levels of contaminants
- Nearly twice as much e-coli, enterococci, and general coliforms
- Common contaminants
  - DDT's: disrupts hormones important to good health
  - PCB's: harmful industrial chemicals that cause birth defects
  - Trash and debris: cigarette butts and other contaminants from foot traffic

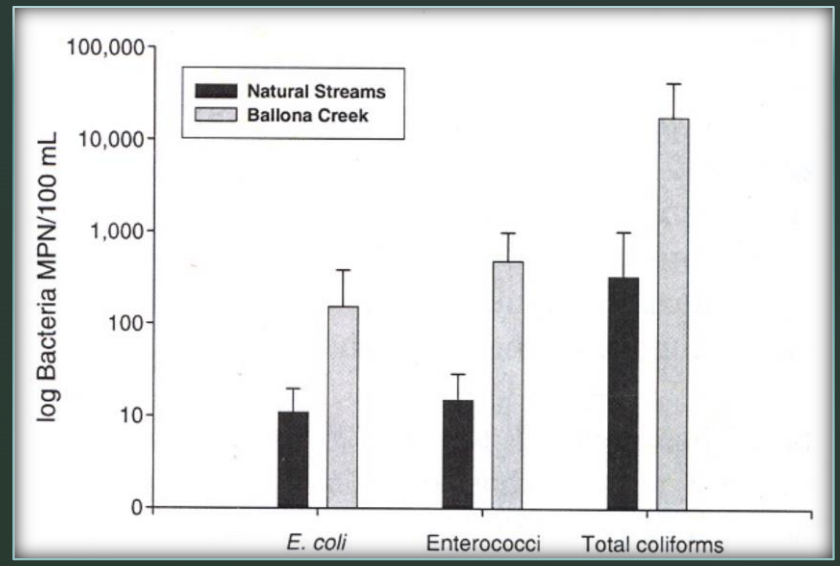

FIGURE:3 Ballona Creek Contaminates

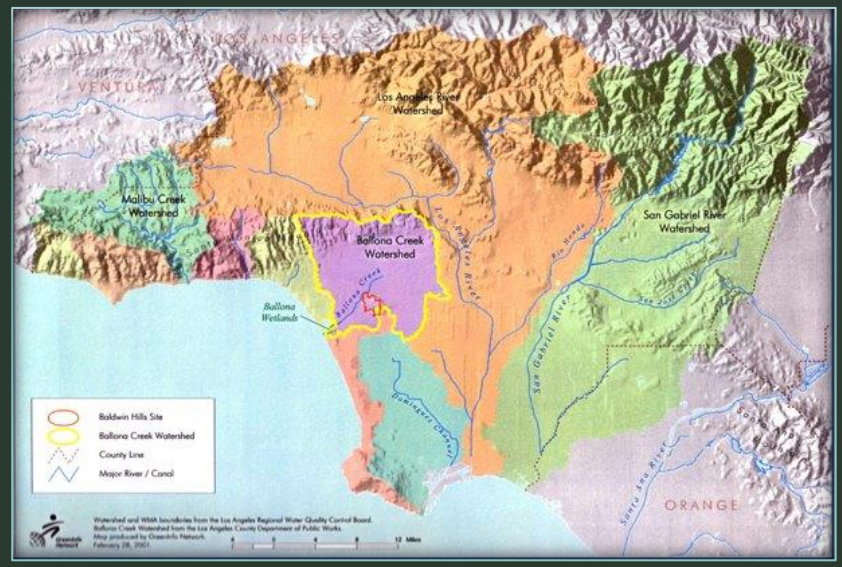

FIGURE 4: Los Angeles Watersheds

Filtration options

- Bio–Filtration
  - Natural alternative to filtration
  - Use biological agent present in soil to filter ground water
  - Effective against bio-degradable carbon based contaminates
  - Less impact to C-coefficient
- In-line filtration
  - Higher impact form (increases C-coefficient)
  - Can support higher levels of discharge
  - More Maintenace and easily clogged
- Campus application
    - Both techniques are viable for projected peak discharge
    - Bio–filtrations is lower impact that meets our needs

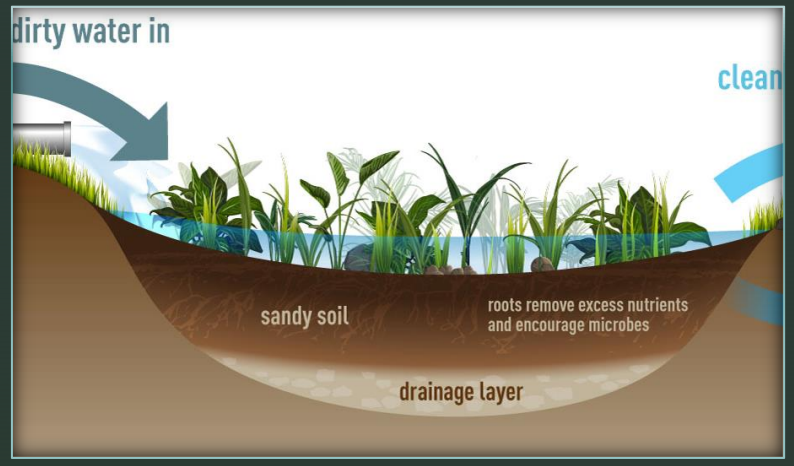

Figure 5: Bio-Filtration

Figure 6: In-Line Filtration Grate

Figure 7: Alumni Mall North end

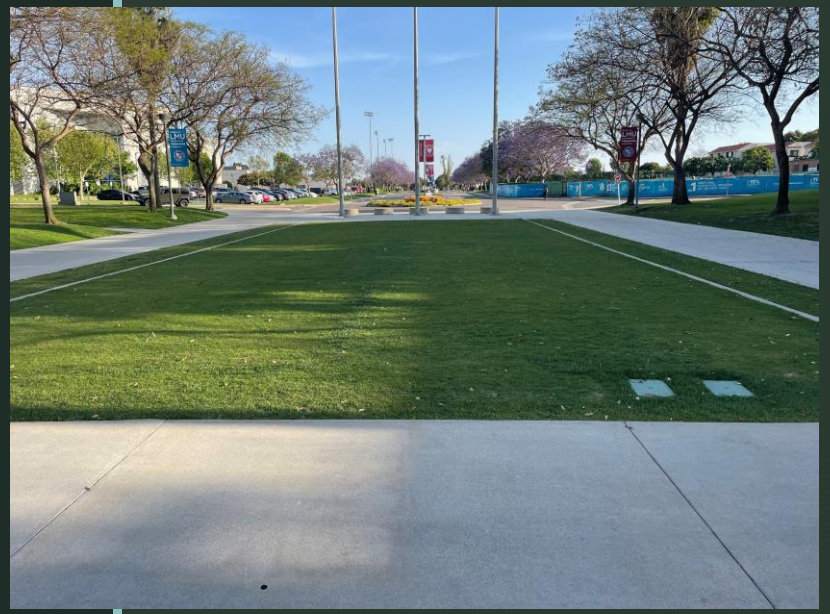

Figure 8: Alumni Mall South end

Alumni Mall

- Area to the west of Seaver Science Hall and east of Charles Van der Ahe building
- South border: flag poles
- North border: palm walk
- Main thorough-fare on campus
- High levels of foot traffic
- Not much vehicle traffic, aside for few food trucks
- Location for various campus events

Figure 9: Concrete Area in Alumni Mall

Figure 10: Clogged Tubes in Alumni Mall

The Problem

- Excess concrete
- Insufficient drainage system
- Certain areas are “trapped” by benches
- Perfect subject for Low Impact Development to control run-off
- Clogged drainage tubes randomly dispersed along walk

Figure 11: Target Area

Target Area

- Two identical spots along Alumni Mall
- This area: minimal attention to runoff
- Benches create enclosed area trapping water
- Minimal filtration through the non-porous concrete
- Concrete is sloped towards the sides
- Diverts water to the grass banks on each side
- Captures water alongside the benches

Plan

- Trench system like that on LMUs campus
- Focus on “trapped” area that prevents infiltration
- Create slight slope pointing inward
- Water is diverted to soil
- Runoff is captured and infiltrated into ground
- Clean water added back to ground water

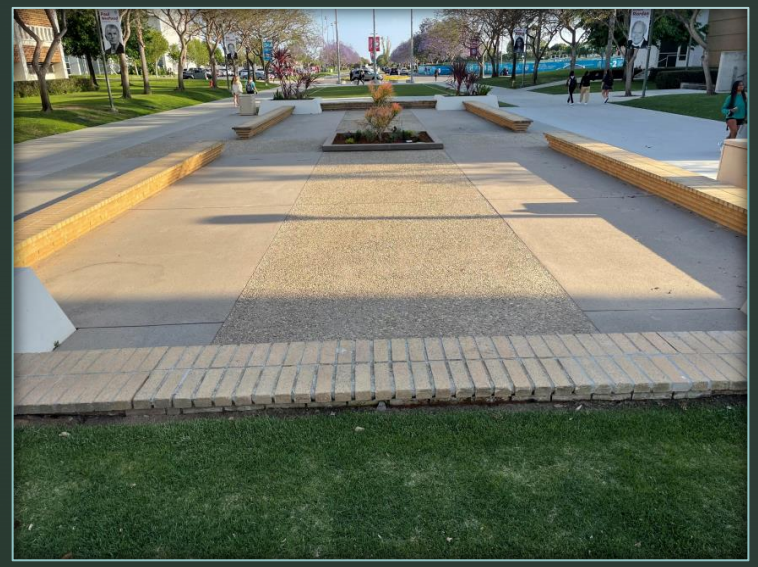

Figure 12: Target Area for infiltration

Figure 13: LMU trench system

Trench Design

- Native plant life on surface: Coast Live Oak, CA Sagebrush, Apricot Mallow
- Soil underneath plant life
- Sand layer underneath soil for extra filtration
- Leads to ground water

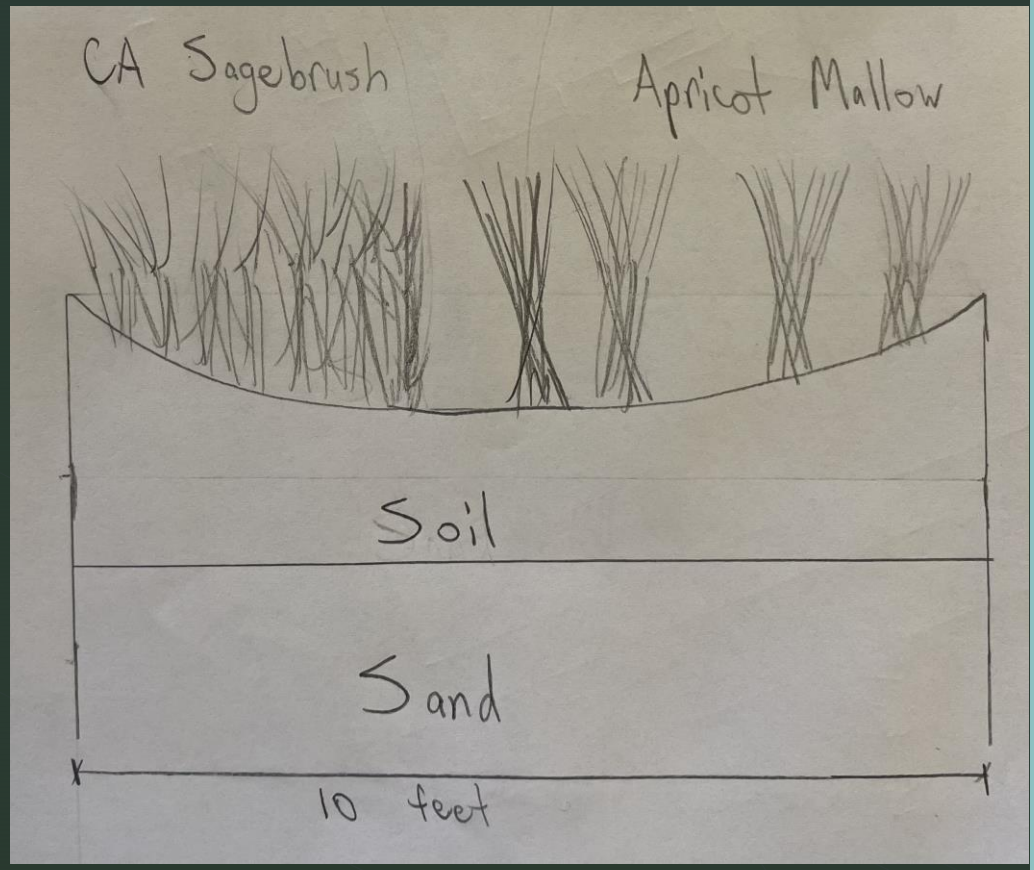

Figure 14: Trench Design for Infiltration

Project Design

- ~4 degree incline from far ends
- ~6 degree incline near center

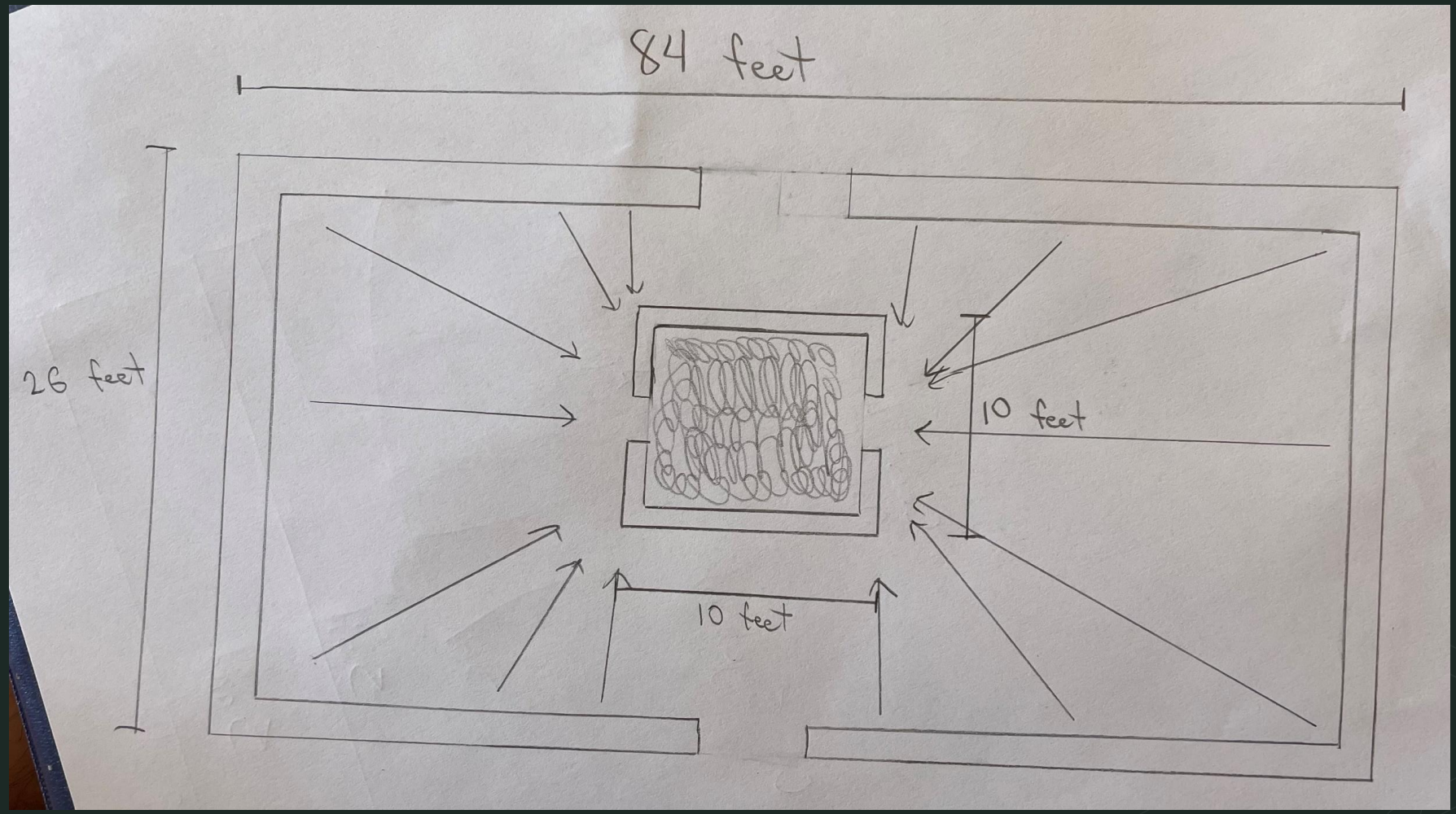

Figure 15: Diverting Runoff With Slopped Concrete Design

Construction Details and Schedule

Materials Needed

- ~2,000 square feet of concrete
- a dozen small shrubs, 1 – 2 gallons in size
- CA Sagebrush and Apricot Mallow

Figure 16: Sagebrush

Figure 17: Apricot Mallow

Construction Details & Schedule Breakdown

- Hire crew to remove concrete surrounding plantation box
- Hire someone to create surrounding sloped concrete boundary
- Insert trench system
  - Sand underneath soil and native plantation to infiltrate contaminated particles
  - Seeps to ground water system

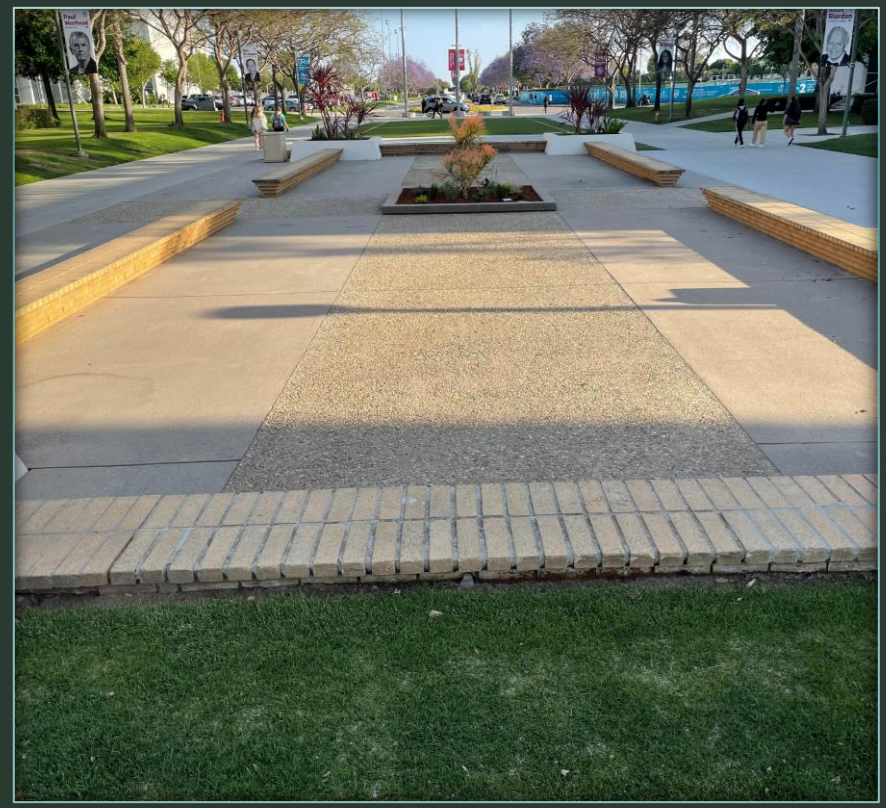

Figure 18: Construction Area

Schedule

- Assuming Project starts June 1st and 8 hours are spent each weekday working

Dates	Time	Simple Description	Reasoning
June 1st – June 10th	Takes 60 hours 1 week and 3 days	Concrete Removal	~0.03 hours = 1 square foot of concrete ~60 hours = 2000 square feet of concrete
June 13th – June 24th	2 weeks	Concrete Insulation	Sloped concrete insulation takes about 2 weeks
June 27th – July 1st	Estimate: 2 week	Trench System	Creating trench system to reaches ground water in LA may range from days to weeks
July 5th	1 day	Inserting native plants	Inserting native plants takes about a day

Operation and Maintenance

- Minimum maintenance required
- Weekly watering of plants
- Every 10 years
  - Reinstallation to maintain effective filtration
  - Replace soil and sand

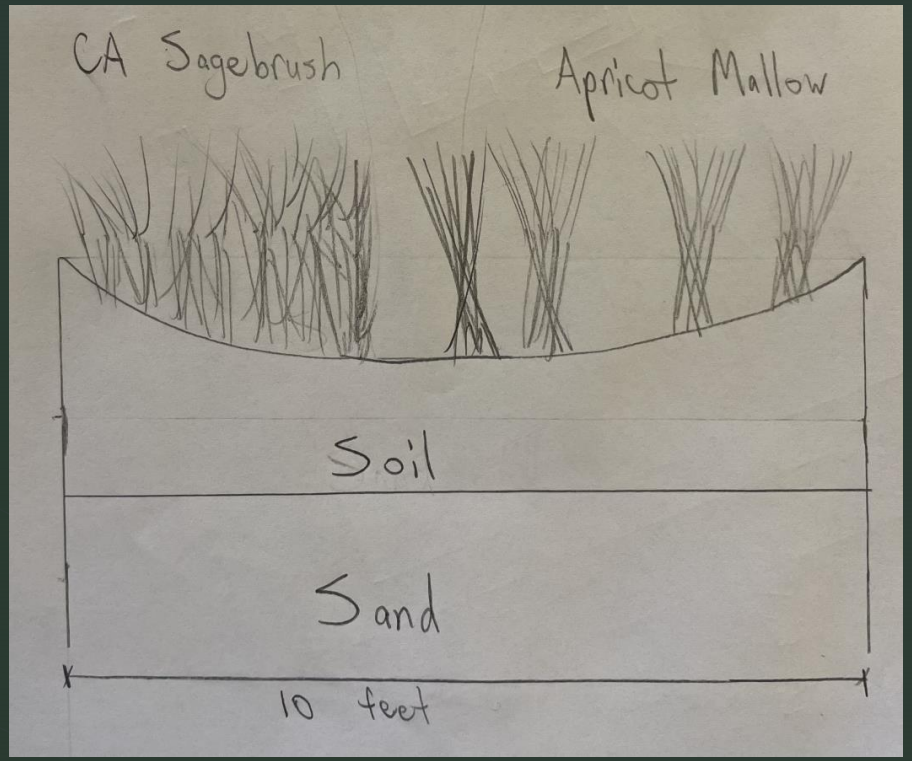

Figure 19: Trench Design

Budget

Titles	Cost	Description
Concrete Removal	$3,000 - $8,000	$2 - $6 per square foot removed. (Around 2,000 ft^2) How Much Does Concrete Removal Cost, *Jane Purnell*
Concrete Insulation	$8,000 - $16,000	$4 - $8 per square foot (Around 2,000 ft^2) How Much Does a Concrete Slab Cost, *Jane Purnell*
Reaching Ground water	$700	~$70 per foot In LA (closer to ocean), it is easier to reach ground water - Estimation: 10 feet
Plants	$5 - $20	Small shrub 1–2 gallons in size (CA sagebrush and apricot mallow) Landscape Network, *Maureen Gilmer*
Total Cost	$10,705 - $24,720	(x2 $21,410 - $49,440)

Summary and questions

- Bio-filtrations use plants and soil to drain runoff
- Target area is two concrete areas surrounded by brick walls in alumni mall
- Replace target area with trench bio-filter system
- Target area is around square feet 2,000
- Only maintenance needed is gardener and custodian for occasional cleaning
- Project cost between $20,000 and $50,000 for both areas to be replaced

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