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Sutter's Landing Post Closure Landfill Development

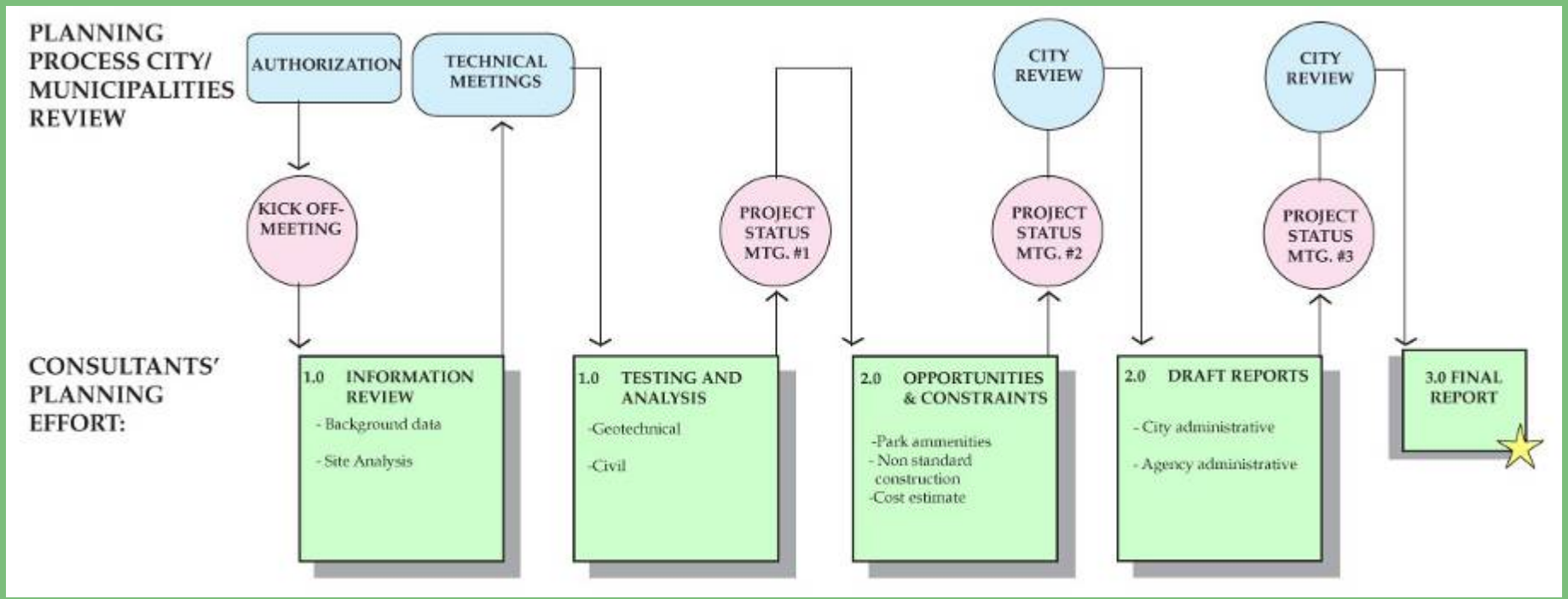
Are You Ready?

Callander Associates Landscape Architecture, Inc. BKF Engineers Treadwell & Rollo

Landfill Post Closure Land Use Symposium
Ontario, Feb. 15th & Stockton, Feb. 28th

Introduction

- **Importance of Process**



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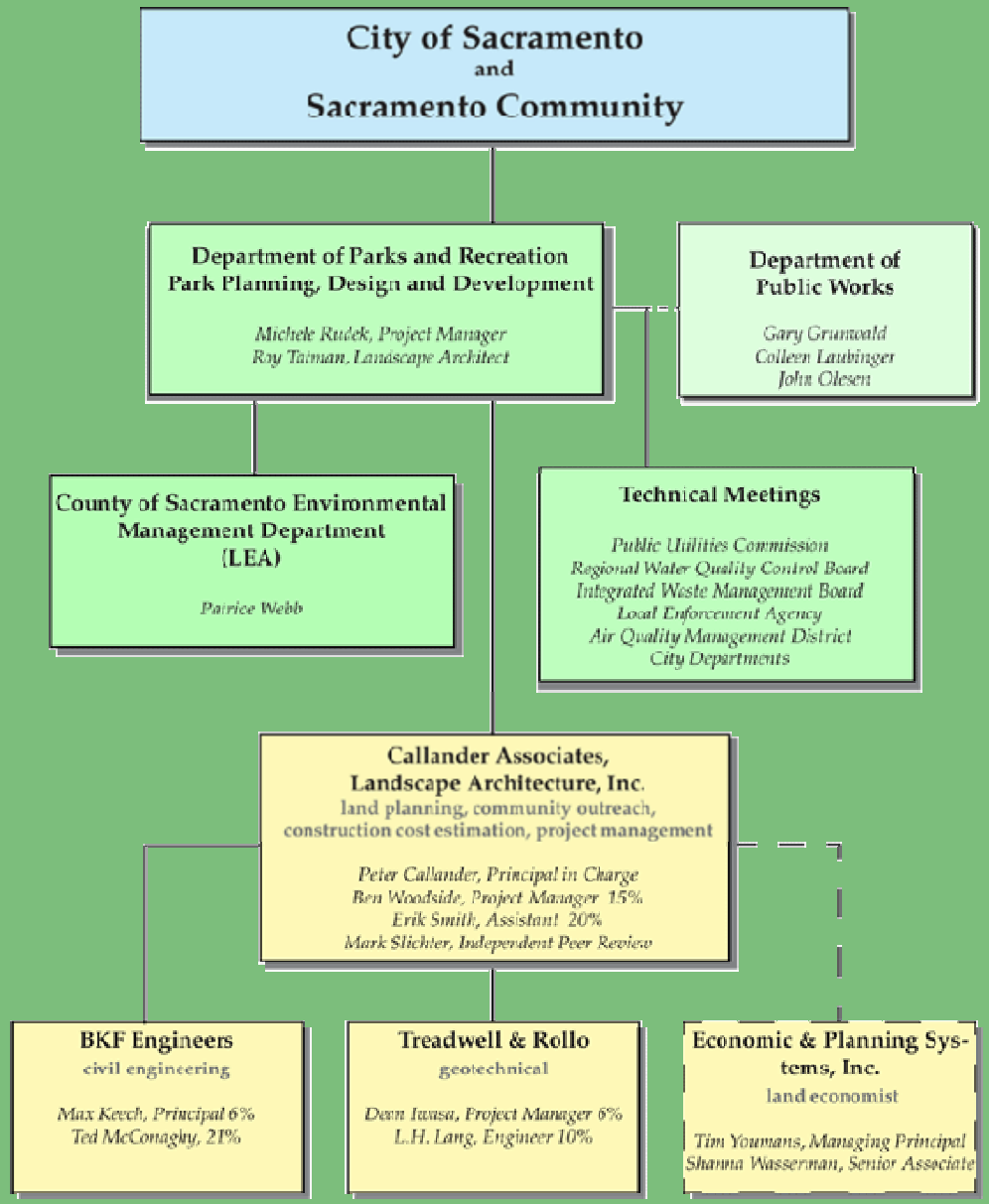
Introduction

- **Team Member Understanding**



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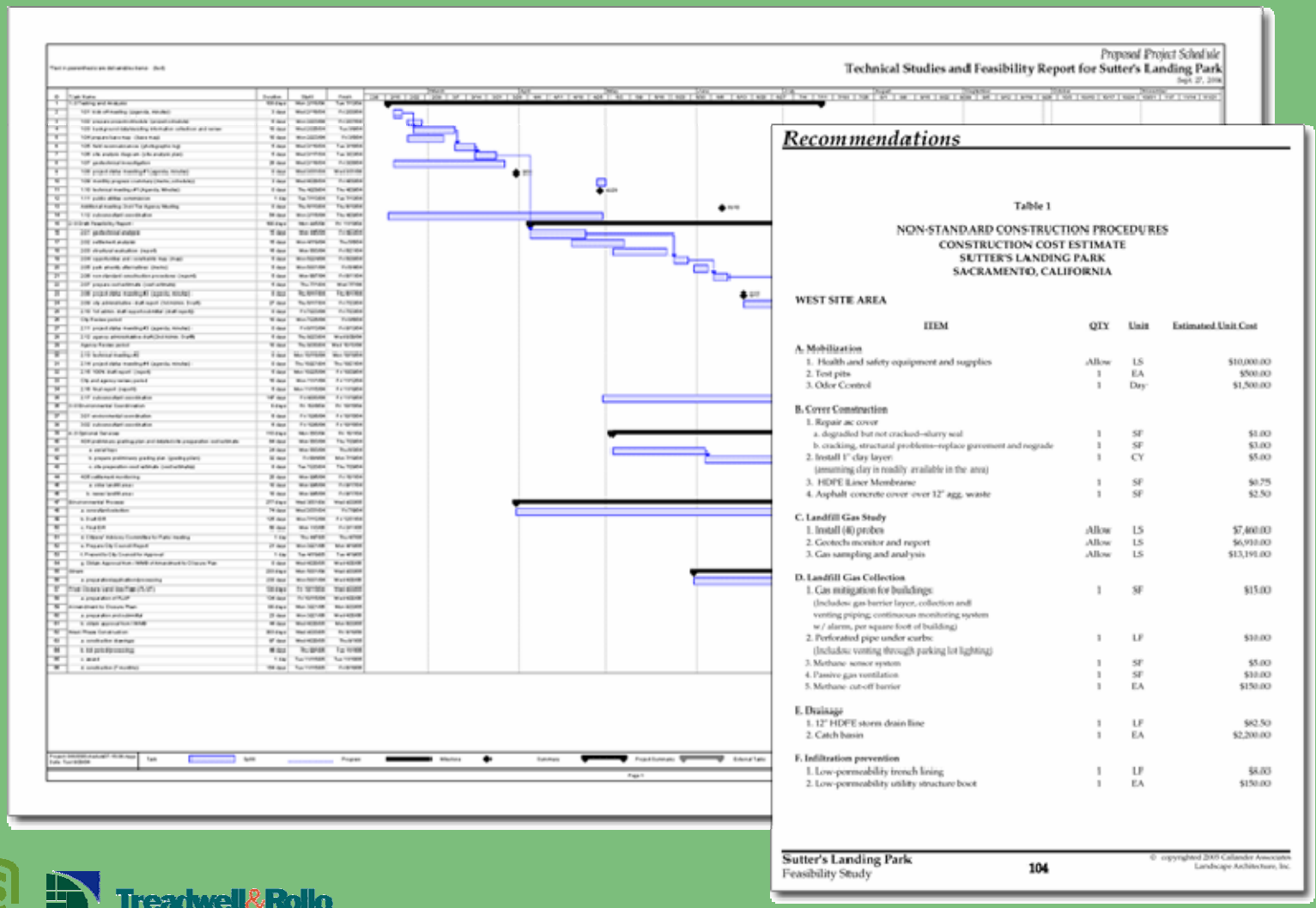
Introduction

- **Resolving the Challenges**



Proposed Project Schedule
Technical Studies and Feasibility Report for Sutter's Landing Park
Sept. 27, 2006

Recommendations

Table 1

NON-STANDARD CONSTRUCTION PROCEDURES
CONSTRUCTION COST ESTIMATE
SUTTER'S LANDING PARK
SACRAMENTO, CALIFORNIA

WEST SITE AREA

ITEM	QTY	Unit	Estimated Unit Cost
A. Mobilization			
1. Health and safety equipment and supplies	Allow	LS	$10,000.00
2. Test pits	1	EA	$500.00
3. Odor Control	1	Day	$1,500.00
B. Cover Construction			
1. Repair ac cover			
a. degraded but not cracked--slurry seal	1	SF	$1.00
b. cracking, structural problems--replace pavement and regrade	1	SF	$3.00
2. Install 1' clay layer: (assuming clay is readily available in the area)	1	CY	$5.00
3. HDPE Liner Membrane	1	SF	$0.75
4. Asphalt concrete cover over 12" agg. waste	1	SF	$2.50
C. Landfill Gas Study			
1. Install (4) probes	Allow	LS	$7,460.00
2. Geotech monitor and report	Allow	LS	$6,930.00
3. Gas sampling and analysis	Allow	LS	$13,191.00
D. Landfill Gas Collection			
1. Gas mitigation for buildings: (Includes: gas barrier layer, collection and venting piping, continuous monitoring system w / alarm, per square foot of building)	1	SF	$15.00
2. Perforated pipe under curbs: (Includes: venting through parking lot lighting)	1	LF	$10.00
3. Methane sensor system	1	SF	$5.00
4. Passive gas ventilation	1	SF	$10.00
5. Methane cut-off barrier	1	EA	$150.00
E. Drainage			
1. 12" HDPE storm drain line	1	LF	$62.50
2. Catch basin	1	EA	$2,200.00
F. Infiltration prevention			
1. Low-permeability trench lining	1	LF	$8.00
2. Low-permeability utility structure boot	1	EA	$150.00

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Existing Conditions

- **Public's Perception**
- **History**
- **City Role**
- **Regulatory Agency Involvement**

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Public's Perception

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Public's Perception

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Public's Perception

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Location

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Location

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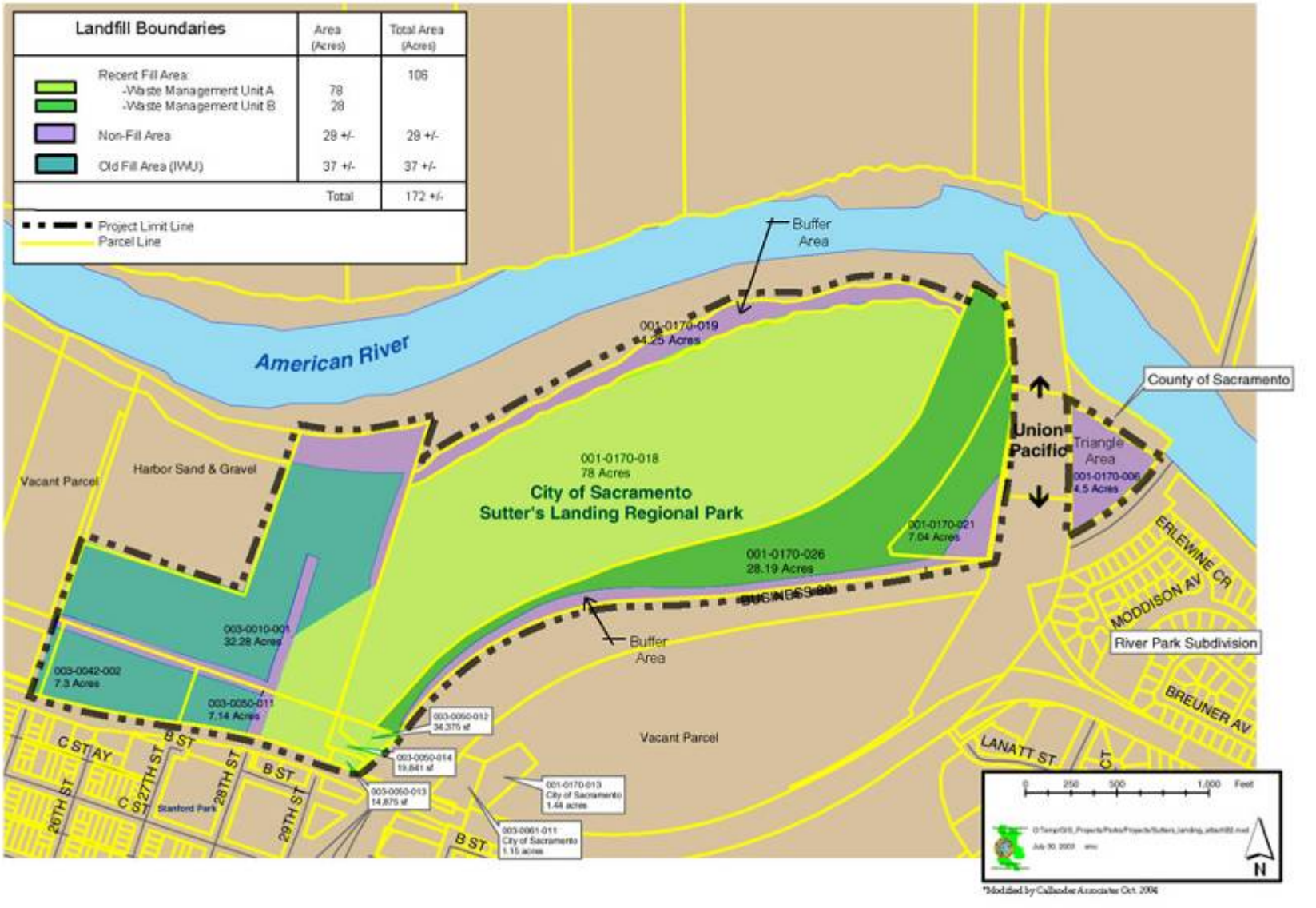
Existing Conditions



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Community Input

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City and Consultant Team

- Solid Waste
- Planning
- Parks and Recreation
- Building
- Public Works
- Engineering
- Transportation

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Regulatory Agencies

- **Local Enforcement Agency (LEA), County or City**
- **Regional Water Quality Control Board (RWQCB)**
- **Integrated Waste Management Board (IWMB)**

Site Specific Agencies

- American River Flood Control District (ARFCD)
- Sacramento Area Flood Control Agency (SAFCA)
- Army Corps of Engineers
- U.S. Fish and Wildlife Service
- California Department of Fish and Game
- Business Environmental Resource Center (BERC)
- County of Sacramento, Parks and Recreation & Planning
- California Department of Water Resources
- California Public Utilities Commission

Owner's Perception- Solid Waste

- **Exposed Methane Gas Collection Pipes**
- **Ongoing Methane Gas Monitoring**

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Owner's Perception- Solid Waste

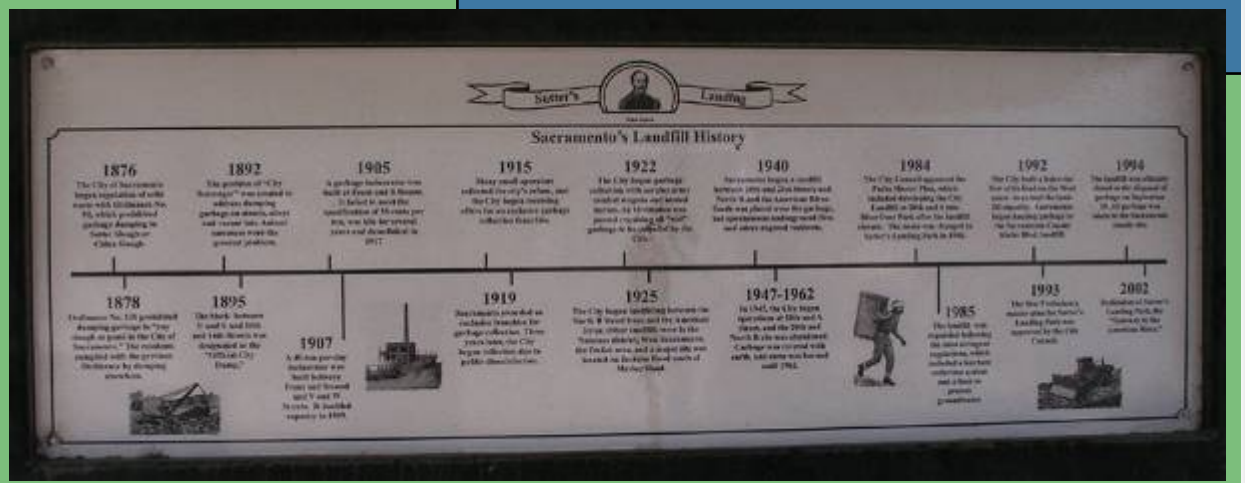
- Continual upkeep and monitoring
- Balancing development with ongoing post closure maintenance

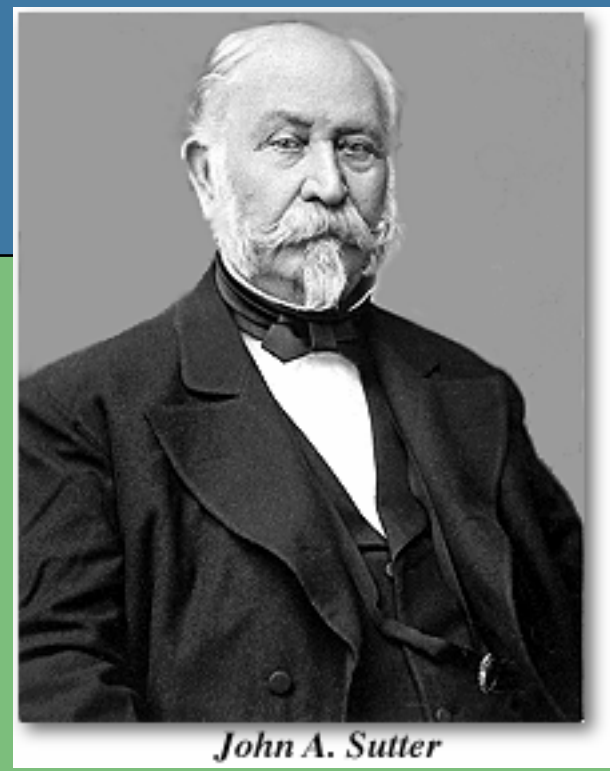
Owner's Perception- Planning

- Historic Significance
- Open space opportunities
- Community needs

Historic Significance

- Captain John A. Sutter landed there in August 1839
- Soil taken from site to build levees and elevate the city
- Pits began filling up with garbage
- Became city's primary landfill
- Highest point in the City of Sacramento




John A. Sutter

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Open Space Opportunities

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Open Space Opportunities

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Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report
5. Design Development
6. Preparation Of Construction Documents
7. Construction Quality Assurance
8. Post-Closure Maintenance and Monitoring

Process/ Steps

1. Site Program - *A Delicate Balance*

- **Post Closure Development Opportunities**
- **Community Needs/ Owner Needs**
- **Regulatory Requirements**

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Development Opportunities

Singleton Sports Park, San Jose

- **Recently Closed Landfill**
- **Public Workshops**
- **90 Acre Sports Park**

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Development Opportunities

Bayside Park, Burlingame

- Phased Project
- Ongoing Maintenance
- Environmental Constraints

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Development Opportunities

Sierra Point, S. San Francisco

- 120 acres
- Landfill Materials up to 20 ft thick with 90 ft of bay mud
- Post Construction Settlement: 5 ft

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Program

Community Needs

- Fitness park
- Fish cleaning station
- Native plant nursery
- Wading pool for kids, lap pool for adults
- Picnic area/green space
- Historic building relocation area
- Bike ferry across River
- Pedestrian bridge over I-80
- Parking for cars and bicycles
- Tot-lot, super adventure play area
- Above ground water spray feature
- Ice rink
- Tennis and badminton courts
- Motor boat docking & kayak rental
- Rock climbing
- BMX course and ramps
- Tagging wall

Park Master Plan

PROPOSED

RECREATION CAMPUS LEGEND

1. ACTIVE RECREATION COURT / FIELD AREAS
   - VELODROME
   - SOCCER / FIELD SPORTS
   - BASKETBALL
   - ROLLER HOCKEY
   - SKATEPARK
   - SAND VOLLEYBALL
   - BMX BIKING
2. DOG PARK AREA (3AC +/-)
   - W/ AGALITY COURSE
3. NEW ADDITIONAL PARKING AREA
4. PASSIVE RECREATION / COURT AREAS
   - BOCCE BALL
   - GIANT CHESS / BOARD GAMES
   - GAME TABLES
   - SHUFFLE BOARD
   - WALKING MAZE/MAPS
5. RESTROOM
   - *FISH CLEANING STATION
6. CONCESSION / RESTROOM RECREATION STATION
7. CONNECTION TO TWO RIVERS BIKE TRAIL
8. SHADE STRUCTURES/ SPECTATOR VIEWING
9. PARK OPERATIONS/ RECREATION OFFICES
10. EXISTING BALER BUILDING
    - LIGHTED / COVERED RECREATION AREA
11. FUTURE RIVER ACCESS W/ COUNTY
    - SMALL BOAT LAUNCH
    - PICNIC AREA
    - HIKING TRIALS
12. FUTURE NATURAL AREAS
    - HIKING TRAILS
    - VIEWING / OVERLOOK AREAS
    - HISTORICAL / NATURAL INTERPRETIVE SIGNAGE
    - DISC GOLF
    - MOUNTAIN BIKING
13. NEW TREE PLANTINGS IN CONTAINERS

LANDSCAPE ARCHITECT/PROJECT MANAGER: ROY TATTAN
DRAWN BY: MICHAEL ROSALES

Adopted Master Plan Elements

- Active recreation court and field areas
- Passive recreation and court areas
- Dog Park
- Additional parking
- Concession and restrooms
- Shade structures, viewing areas
- Skate park
- River access, trail connections and natural areas

Process/ Steps

2. Technical Investigation

- Site Analysis
- Review Of Previous Reports
- Geotechnical Testing and Evaluation
- Civil Engineering Analysis

Site Conditions

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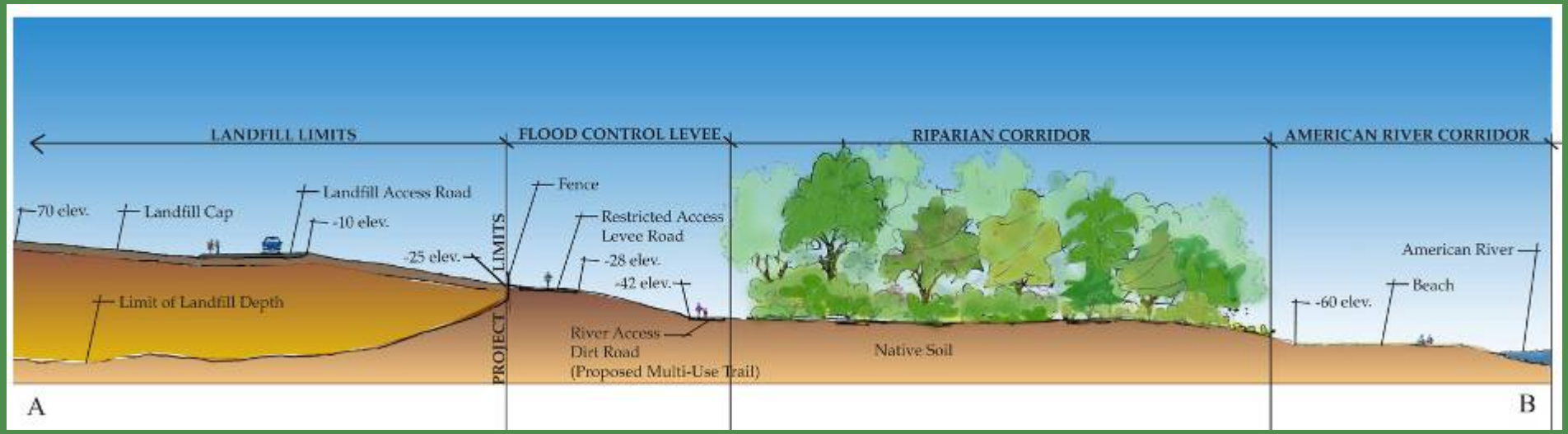
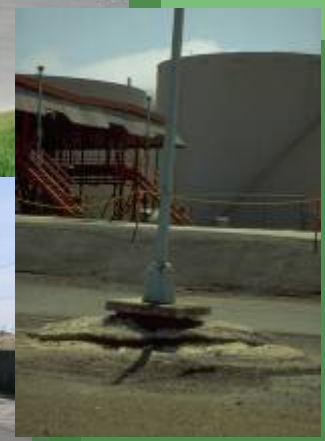
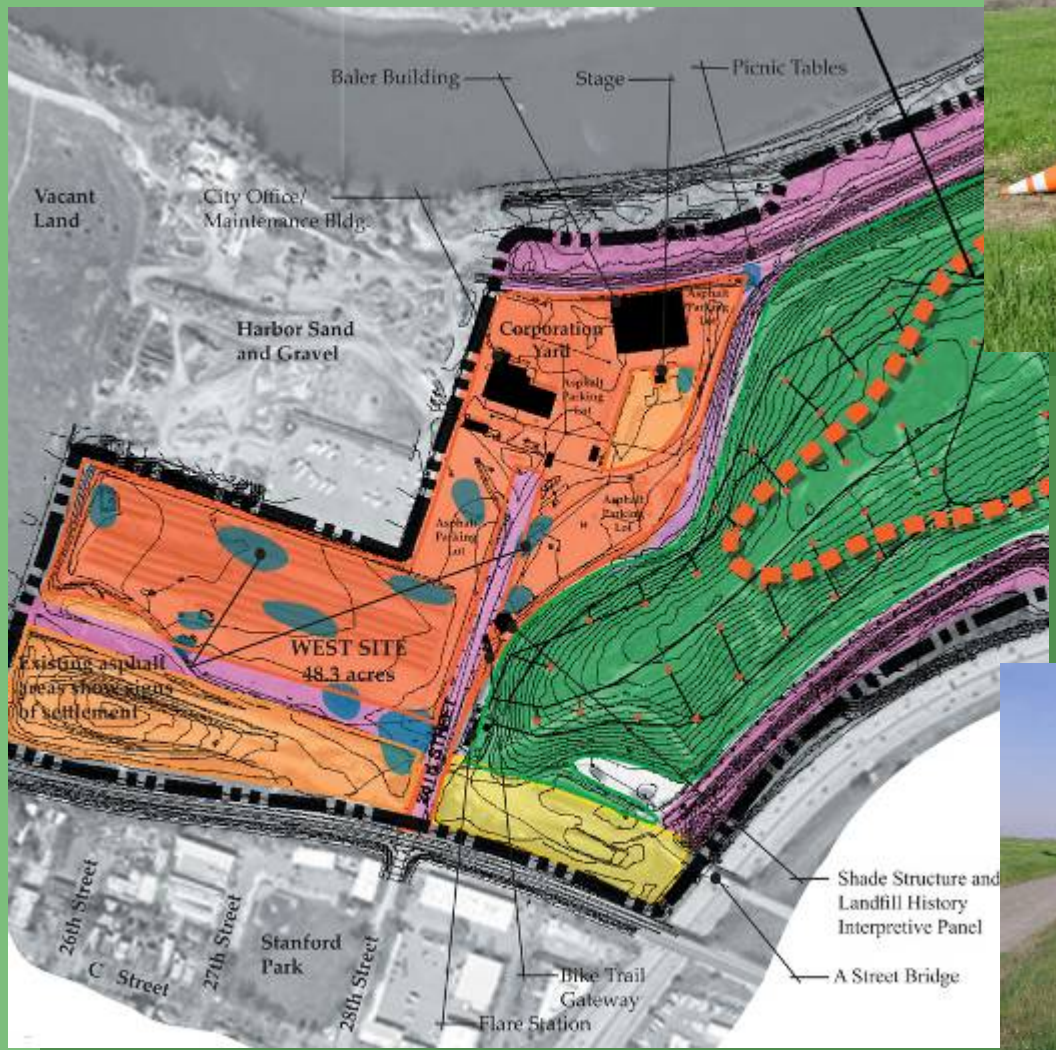
Site Conditions



Built Conditions



Cover Conditions



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Review of Historic Documents

- Feasibility Study, Sutter's Landing Parkway Geotechnical Evaluation Between 28th St. and Union Pacific Railroad Tracks, June 2002.

- Solid Waste Test Report, City of Sacramento 28th & A St. Sanitary Landfill, June 1987.

- Final Environmental Impact Report, Sutter's Landing Park and Richards Connector, May 1991.

- Final Closure and Post Closure Maintenance Plans, Sacramento City Landfill, March 1987.

- City of Sacramento Closure Plan for 28th Sanitary Landfill, April 1986.

- Air Quality Solid Waste Assessment Test Report for City of Sacramento Sanitary Landfill 28th and A Streets, 1987.

- Final Closure and Post Closure Plan, June 1991.

- City of Sacramento 28th Street Sanitary Landfill Semi-Annual Title V Monitoring Report, July 2003.

- Subsurface Landfill Gas Reported as Percent Methane, August 2002.

- Sutter's Landing Park and Richards Connector, CEQA Statement of Findings and Facts and Statement of Overriding Considerations, Sept. 1991.

- Landfill Maintenance Building Addition and Restroom, Dept. of General Services Facility Management, City of Sacramento, Jan. 1993.

3. Technical Investigation

Geotechnical Testing and Evaluation

Geotechnical Testing and Evaluations

- **Perform a feasibility and design level geotechnical investigations which included:**
  - reviewing previous investigations at the site
  - drilling borings through the landfill
  - performing geotechnical and environmental laboratory tests
  - performing static and seismic slope stability and seismic slope deformation analyses
  - evaluating geologic hazards, including liquefaction potential of granular soil
  - evaluating vertical pile capacities and lateral behavior of piles
- **Ground motion studies included development of site- specific response spectra for design**

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Subsurface Conditions

- **Soil cover**
  - **Thickness**
  - **Soil type – low permeability soil?**
  - **Environmental quality – is special handling necessary?**

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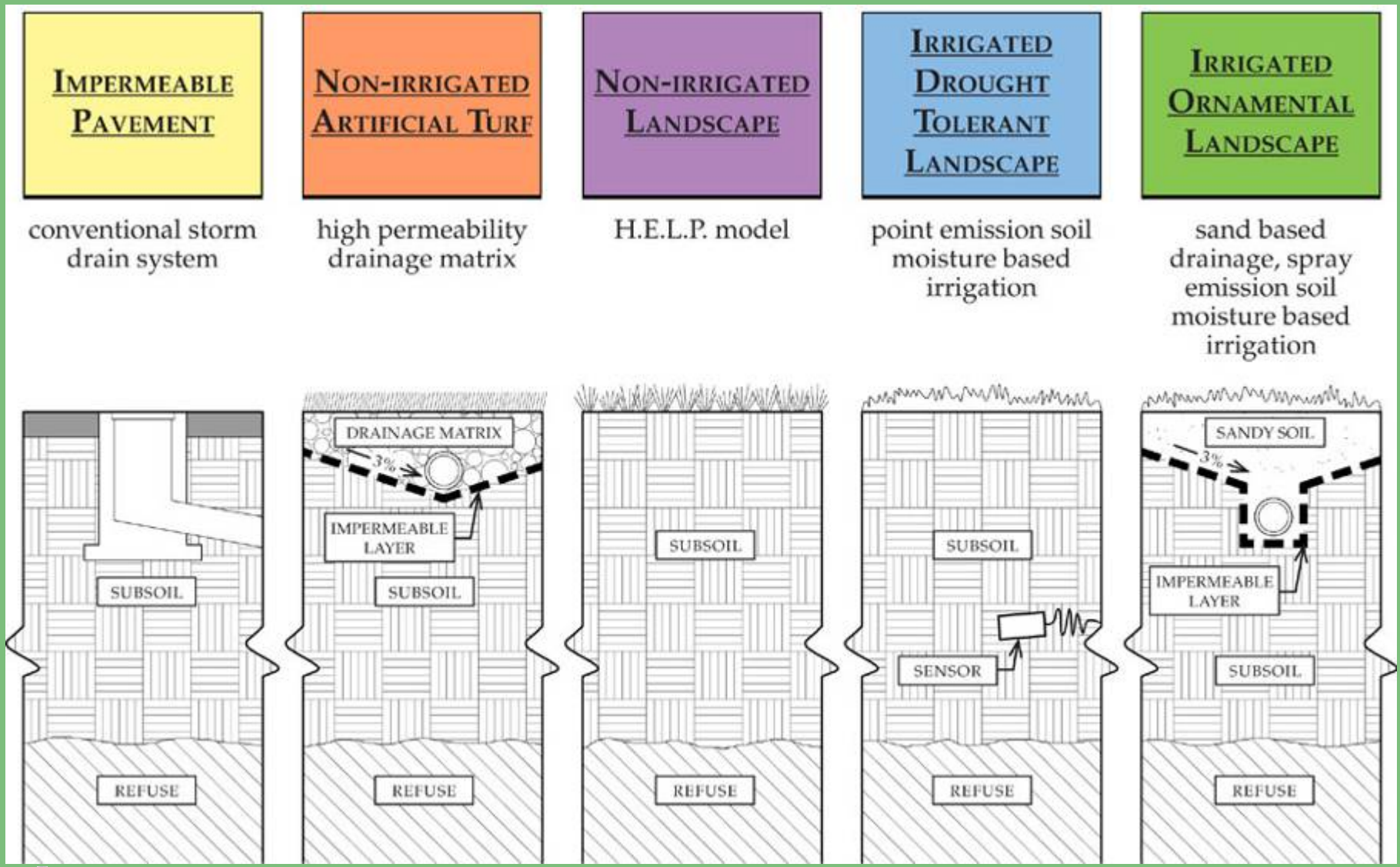
Subsurface Conditions



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Subsurface Conditions

- **Landfill refuse thickness**
  - **Depth below soil cover**
  - **Settlement calculations**
  - **Subsurface obstructions**

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Boring	Landfill Thickness (ft)	Approximate Percentage of Landfill Constituents Encountered			
		Soil	Concrete	Wood	Refuse
B-1	55	28	1	51	19
B-2A	45	40	29	26	6
B-3	48	38	6	53	2
B-4	48	50	2	30	18
B-5	57	61	14	7	18
B-6	57	42	1	42	15
Normalized Percentages		43	9	35	13

Landfill Materials Observed In Test Borings- Example

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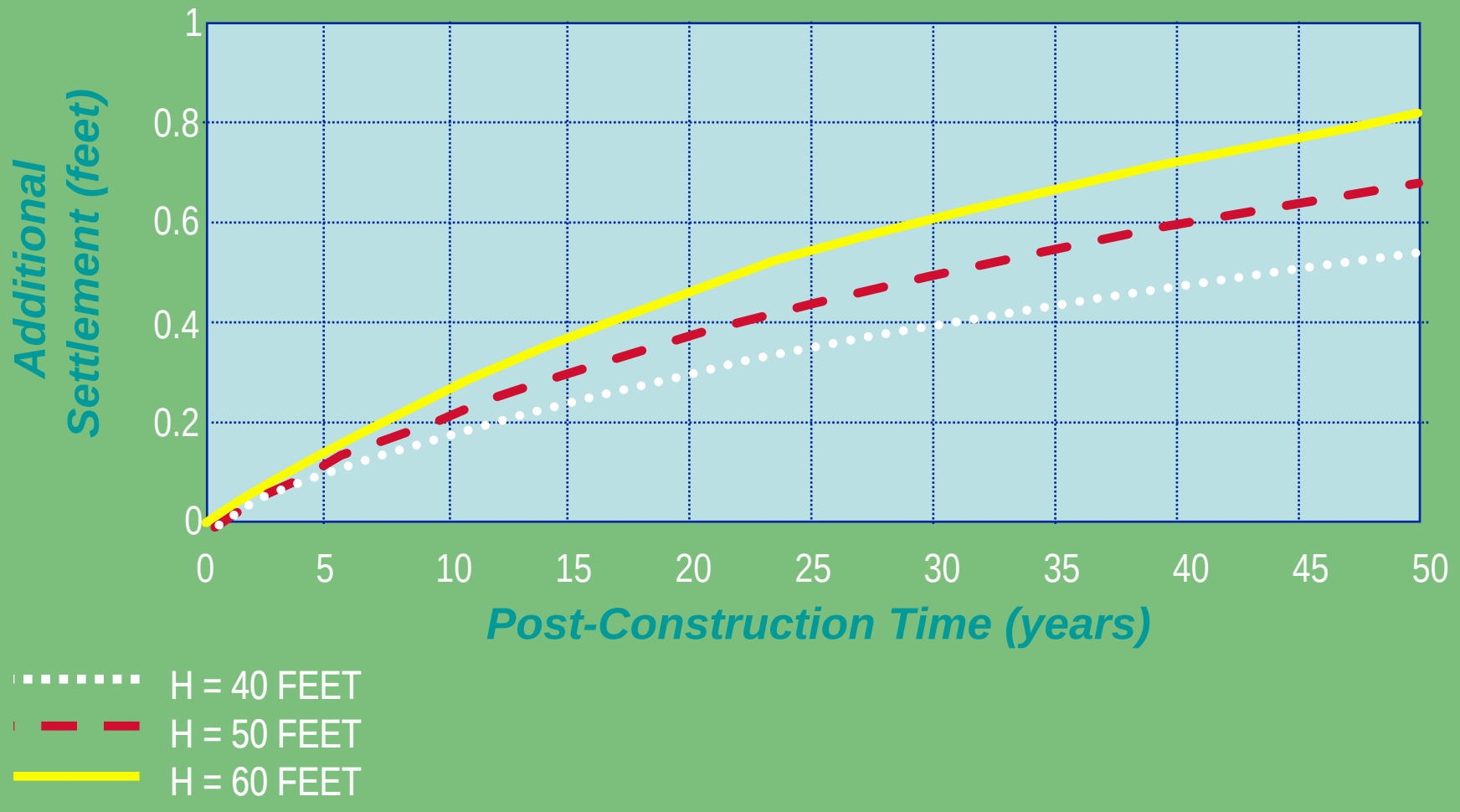

Additional Settlement Over 50-Year Post-Construction Time

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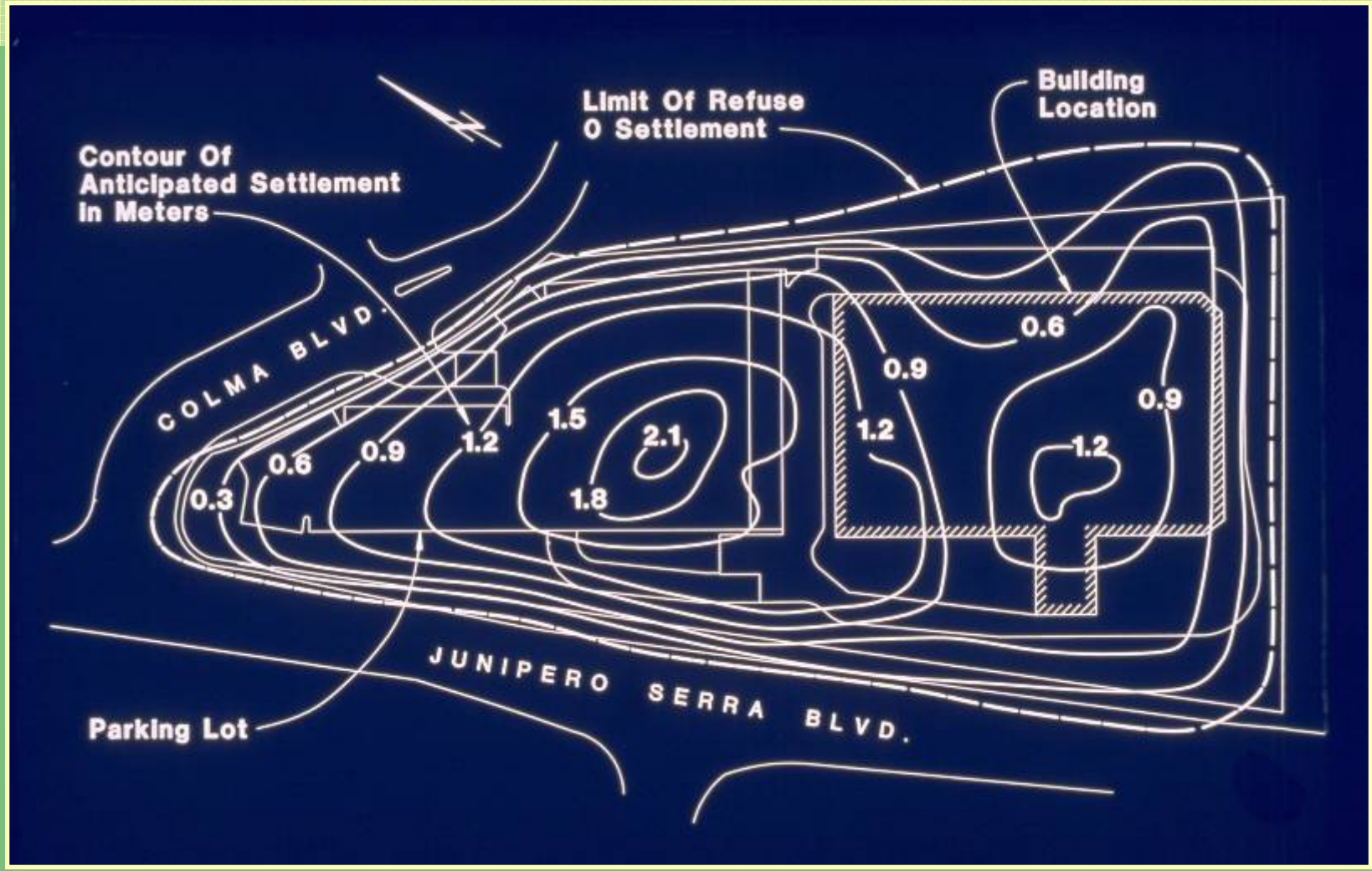

Review of Predicted Settlement

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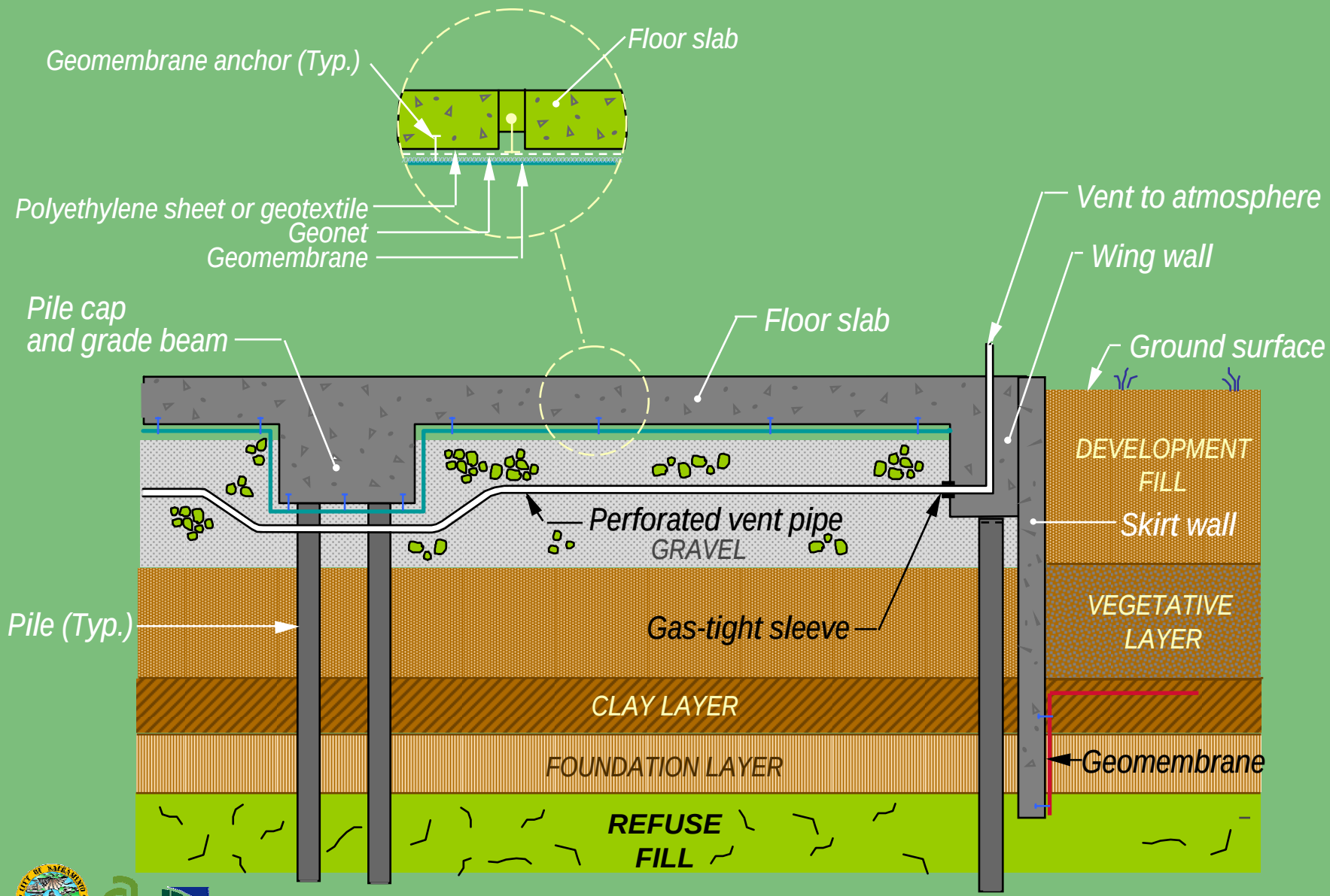
Subsurface Conditions

- **Landfill gases**
  - **Control of landfill gases beneath buildings, within utility trenches, and below paved areas**

Landfill Gas/Water Barrier



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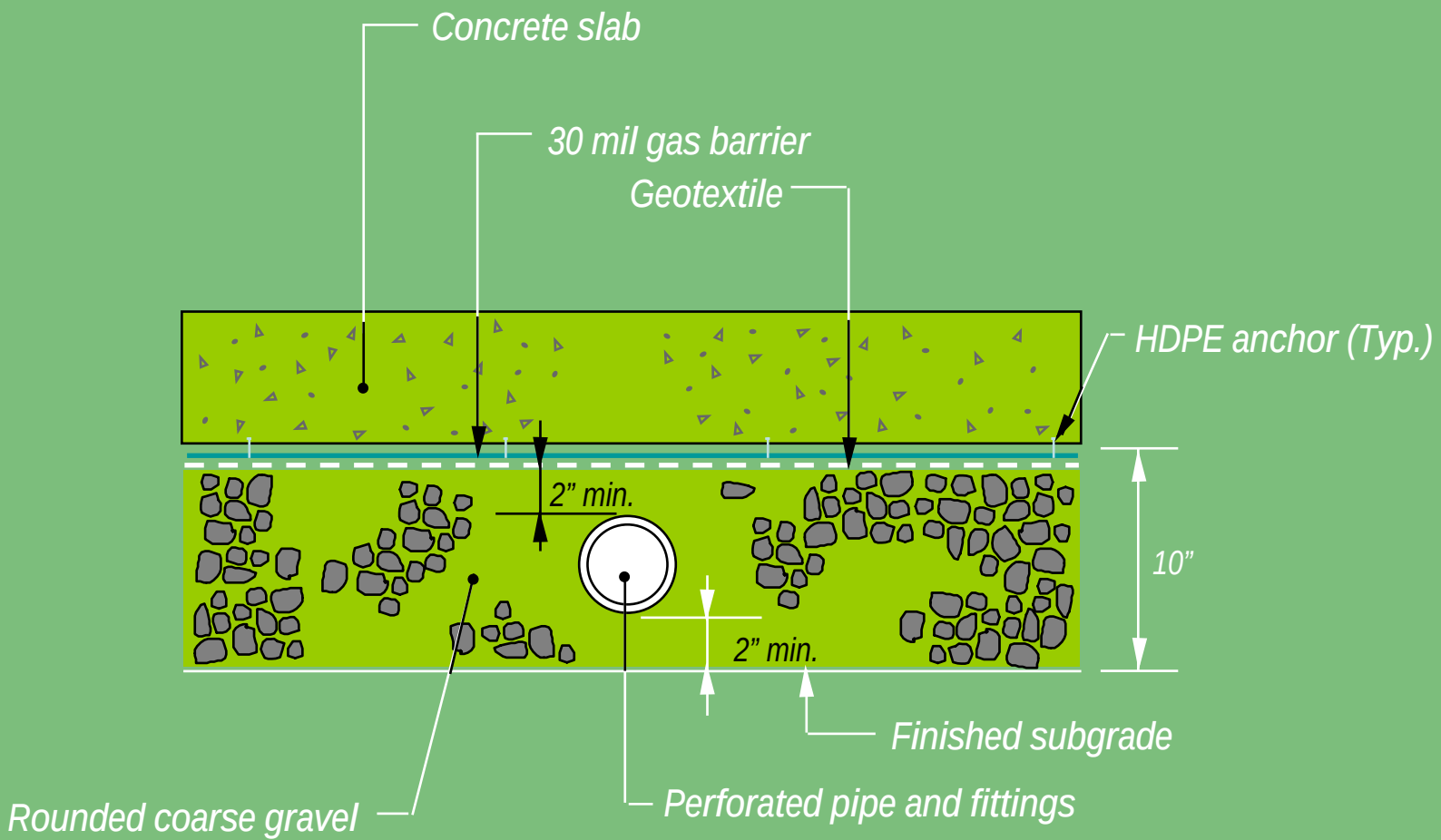
Gas Vent Pipe



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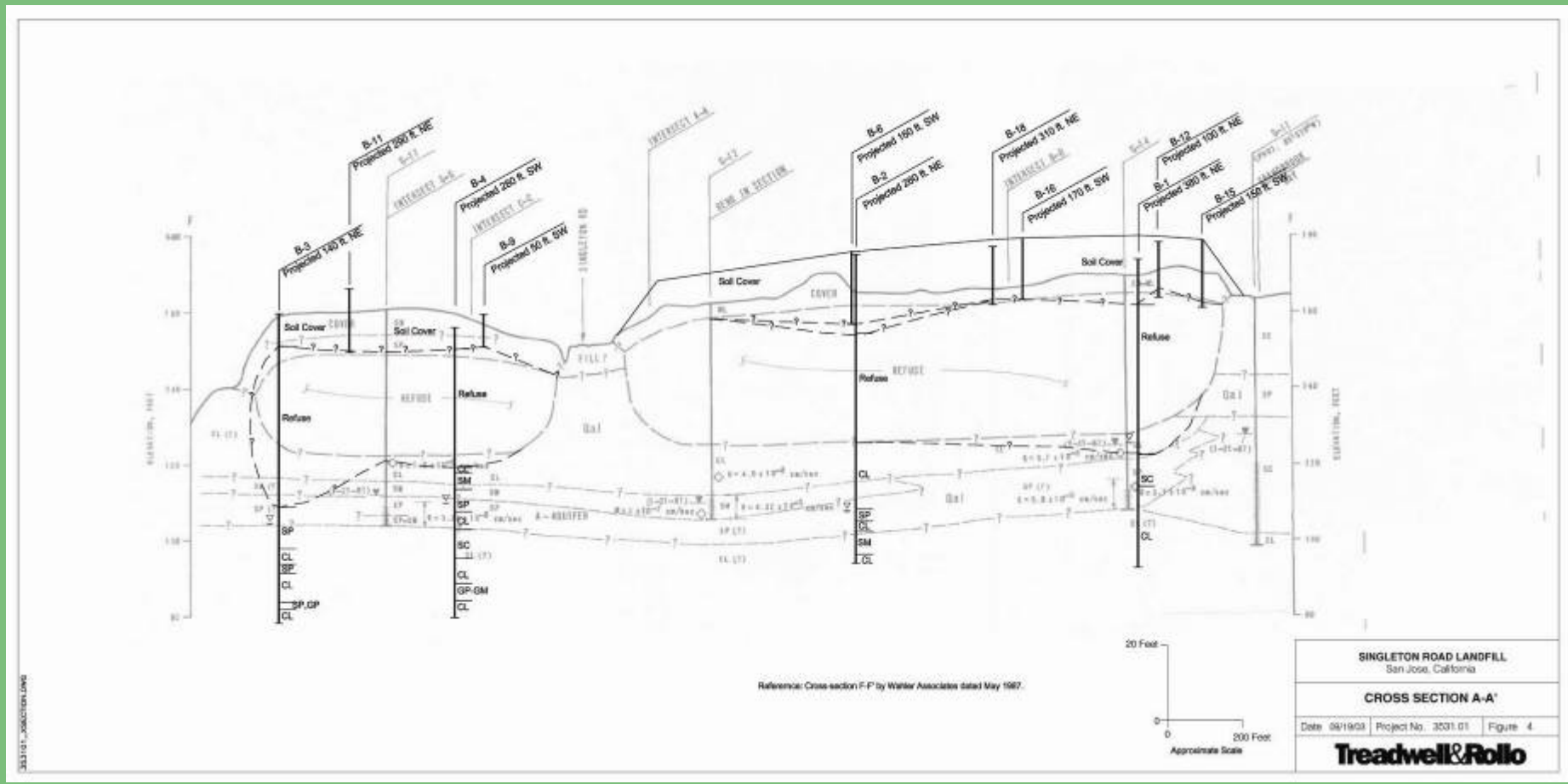
Subsurface Conditions

- **Native soil**
  - **Permeability**
  - **Settlement**
  - **Liquefaction potential**
- **Groundwater or leachate present?**

Subsurface Conditions



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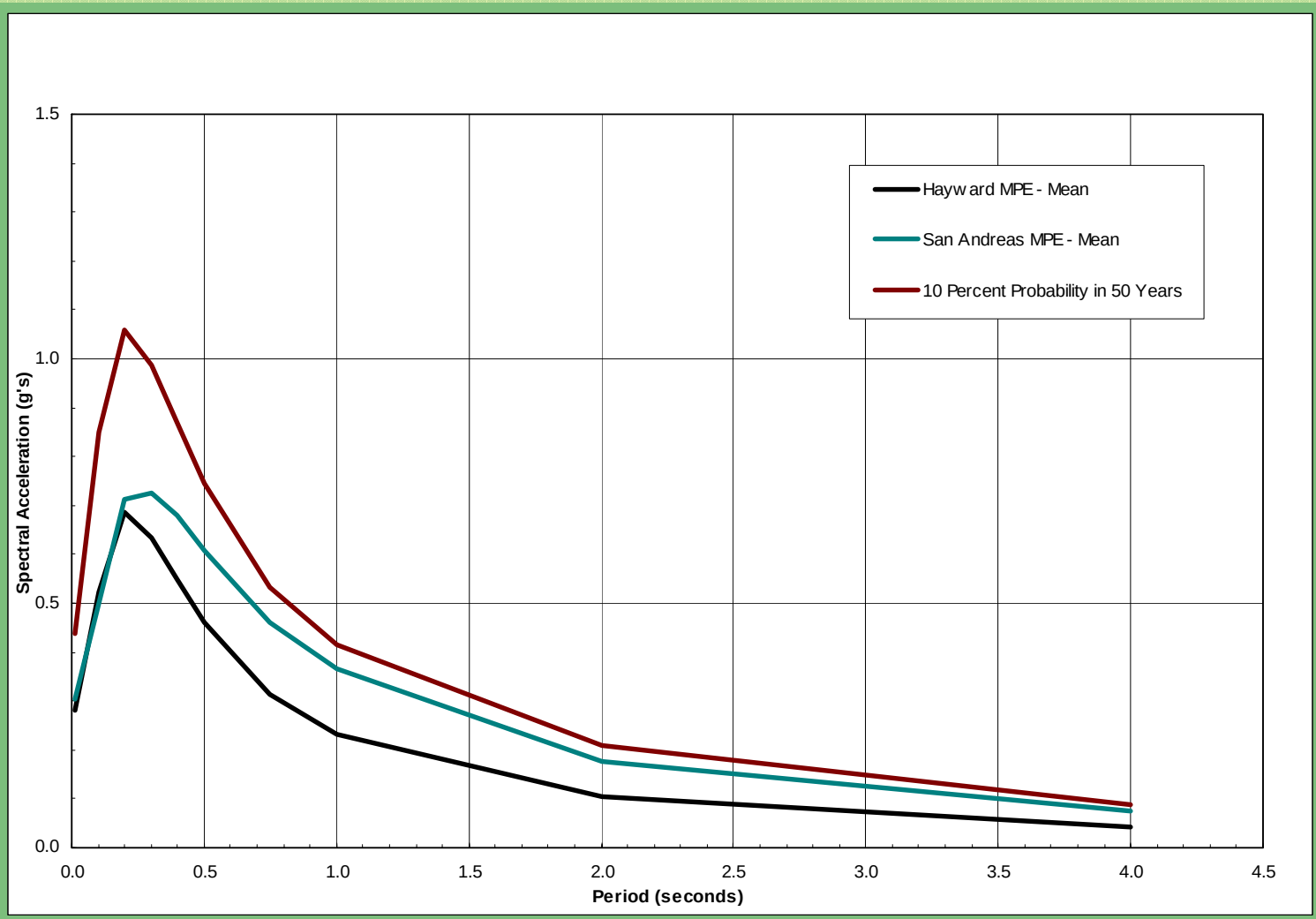
Ground Motion Studies

- **Developed site-specific response spectra for Design Basis Earthquake (DBE) and Maximum Probable Earthquake (MPE)**
- **DBE consistent with the definition of the California Building Code as the ground motion having 10% probability of exceedance in 50 years**
- **MPE for nearby faults – Example from San Jose Site**
  - **Hayward M = 6.9 at 13 km**
  - **San Andreas M = 7.9 at 20 km**



Rock Spectra

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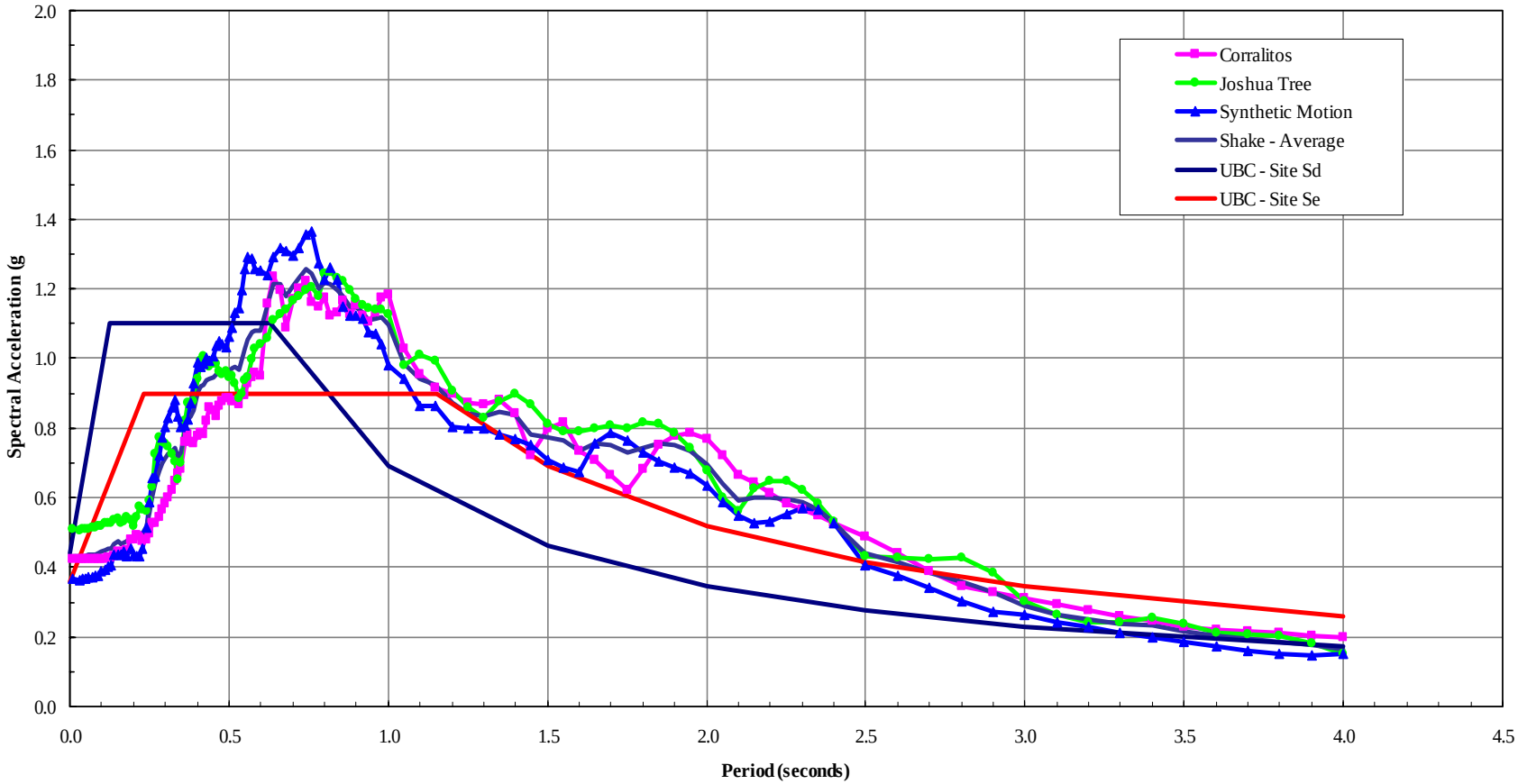

Results of SHAKE Analysis

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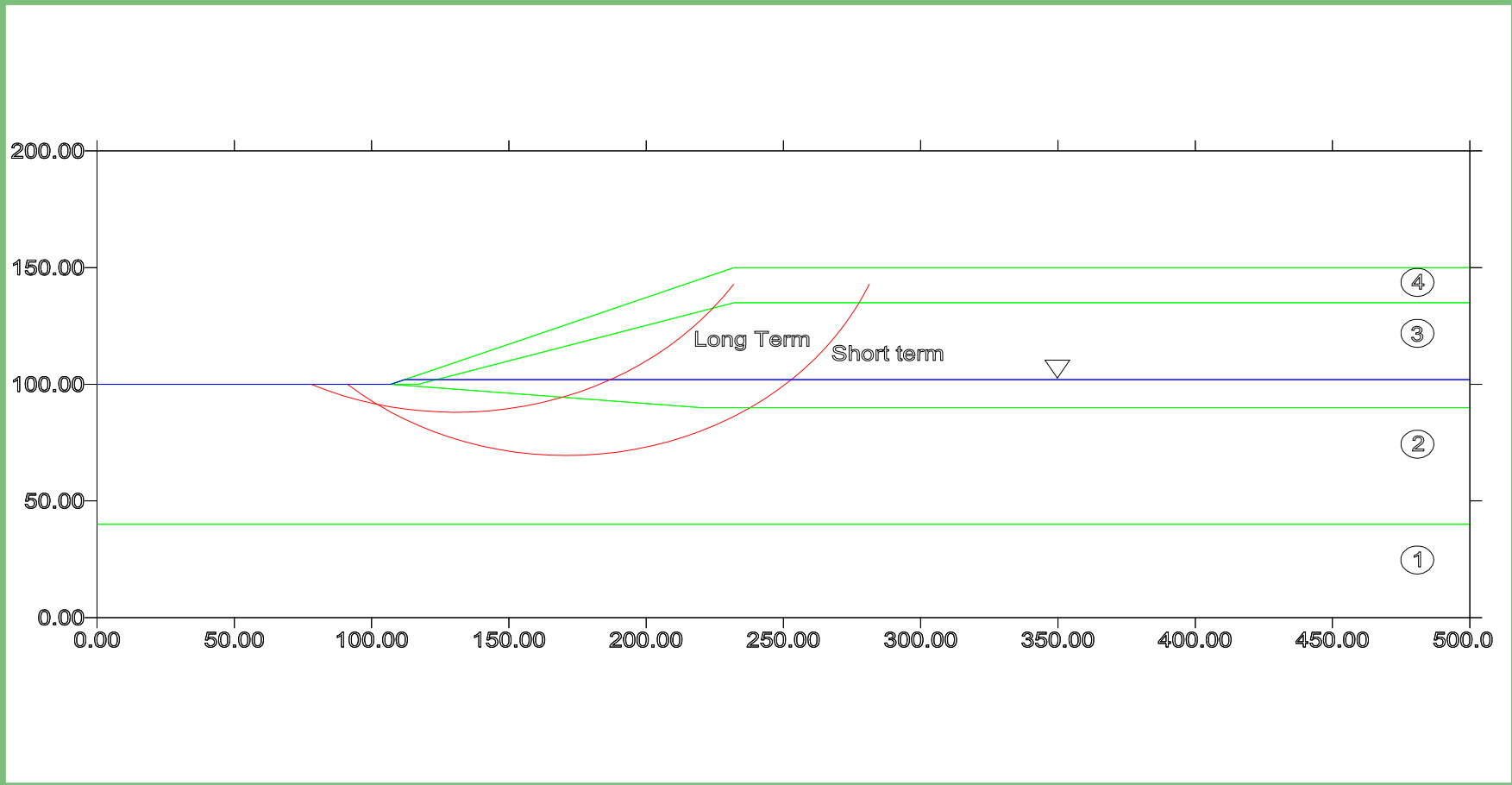
Slope Stability Analysis

- **Stability analyses for critical cross sections**
- **Evaluated short and long term static stability**
- **Evaluated seismic stability and slope displacements**



Static Analysis
Section A-A’

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Foundation Design

- **Issues that affect foundation design**
  - **Compressible and settlement**
  - **Soil Strengths**
  - **Obstructions in the landfill (pile driving)**
  - **Regulatory requirements**
- **Possible foundation types**
  - **Stiffened spread footings**
  - **Piles**
  - **Soil improvement techniques**

3. Technical Investigation

Civil Engineering Analysis

Civil Engineering Analysis

1. Settlement Design

2. Environmental Design

3. Structural Foundation Designs

4. Maintenance and Monitoring

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Civil Engineering Analysis

1. **Settlement Design**
   a. **Review of Predicted Settlement**

Civil Engineering Analysis

1. **Settlement Design**
   a. **Review of Predicted Settlement**
   b. **Finished Slopes and Grading Design**

Civil Engineering Analysis

1. **Settlement Design**
   a. **Review of Predicted Settlement**
   b. **Finished Slopes and Grading Design**
   c. **Site Gravity Utility Design**

Site Gravity Utility Design

- "Be Flexible"
- Downhill Before and After !
- Minimize Maintenance

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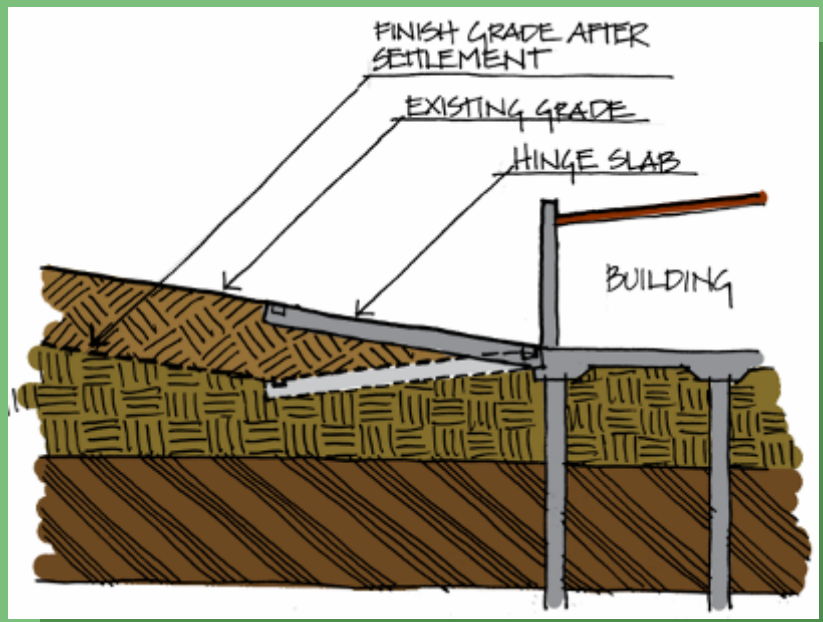
Civil Engineering Analysis

1. **Settlement Design**
   a. **Review of Predicted Settlement**
   b. **Finished Slopes and Grading Design**
   c. **Site Gravity Utility Design**
   d. **Building Access Design**

Building Access Design



Pedestrian

- ADA Access Before and After
- Ease of Monitoring
- Minimize Maintenance

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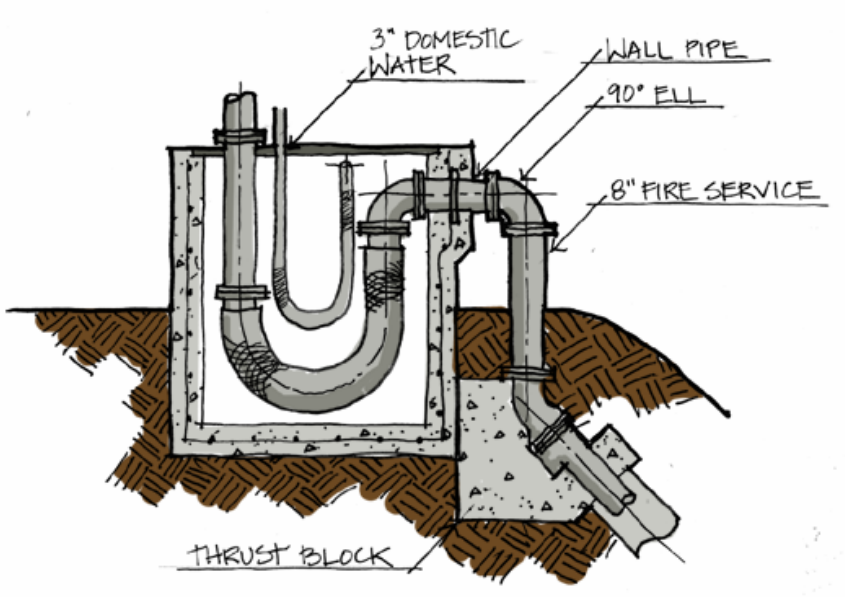
Building Access Design



Utilities

- Flexibility
- Ease of Monitoring
- Ease of Maintenance

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Civil Engineering Analysis

2. Environmental Design

a. Final Cover Penetration

Civil Engineering Analysis

Options for Final Cover Penetrations

1. **AVOID WHEN POSSIBLE !**
   a. **Add additional fill to site for utilities and foundations.**
   b. **Route utilities around the landfill area.**
   c. **Re-grade refuse during Final Cover Construction to create utility "corridors" and building pads.**

Civil Engineering Analysis

Options for Final Cover Penetrations

1. **AVOID WHEN POSSIBLE !**
   a. **Add additional fill to site for utilities and foundations.**
   b. **Route utilities around the landfill area.**
   c. **Re-grade refuse during Final Cover Construction to create utility "corridors" and building pads.**
2. **If You Can't Avoid…**
   a. **Create special detailing for penetrations.**

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Civil Engineering Analysis

2. **Environmental Design**
   a. **Final Cover Penetration**
   b. **Soil Management and Special Handling**

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Civil Engineering Analysis

2. **Environmental Design**
   a. **Final Cover Penetration**
   b. **Soil Management and Special Handling**
   c. **Landfill Gas Control**
      - **Perimeter of Landfill Site**
      - **Under Buildings**

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Civil Engineering Analysis

2. **Environmental Design**
   a. **Final Cover Penetration**
   b. **Soil Management and Special Handling**
   c. **Landfill Gas Control**
      - **Perimeter of Landfill Site**
      - **Under Buildings**
   d. **Leachate Control**

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Civil Engineering Analysis

3. **Structural Foundation Designs**
   a. **Structural evaluation of existing Structures**
   b. **Type and Size of Building**
   c. **Shallow vs. Deep**

Structural Foundation Design

Typical Issues That Affect Pile Design

- Compressible Landfill Material
- Obstruction In the Landfill
- Soil Types Below the Landfill
- Regulatory Requirements
- High Bending Moments in Piles Due to Seismic Slope Deformations

Civil Engineering Analysis

3. **Maintenance and Monitoring**
   a. **On-Going Monitoring After Construction**
   b. **Design with Maintenance in Mind**

Process/ Steps

1. Site Program

2. Technical Investigation

3. Conceptual Design Process

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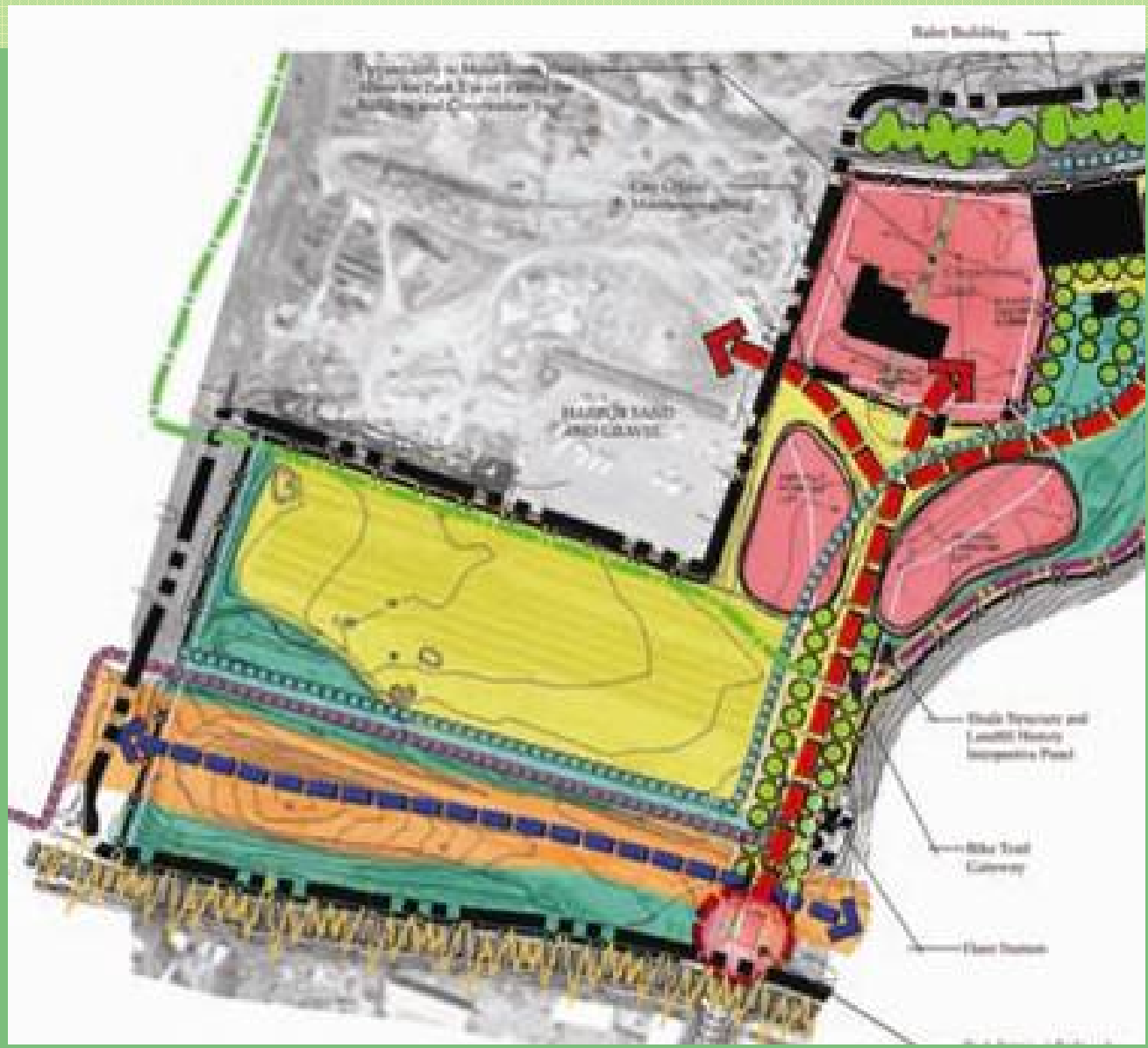
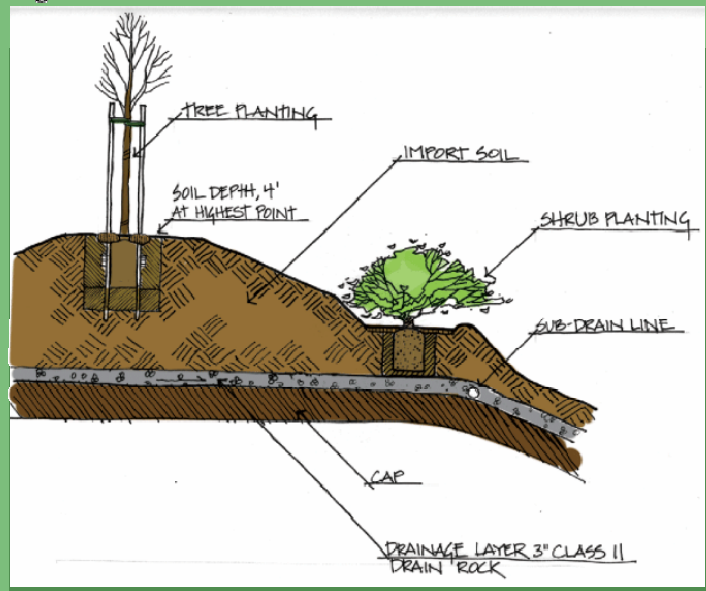


Opportunities and Constraints Map

Opportunities



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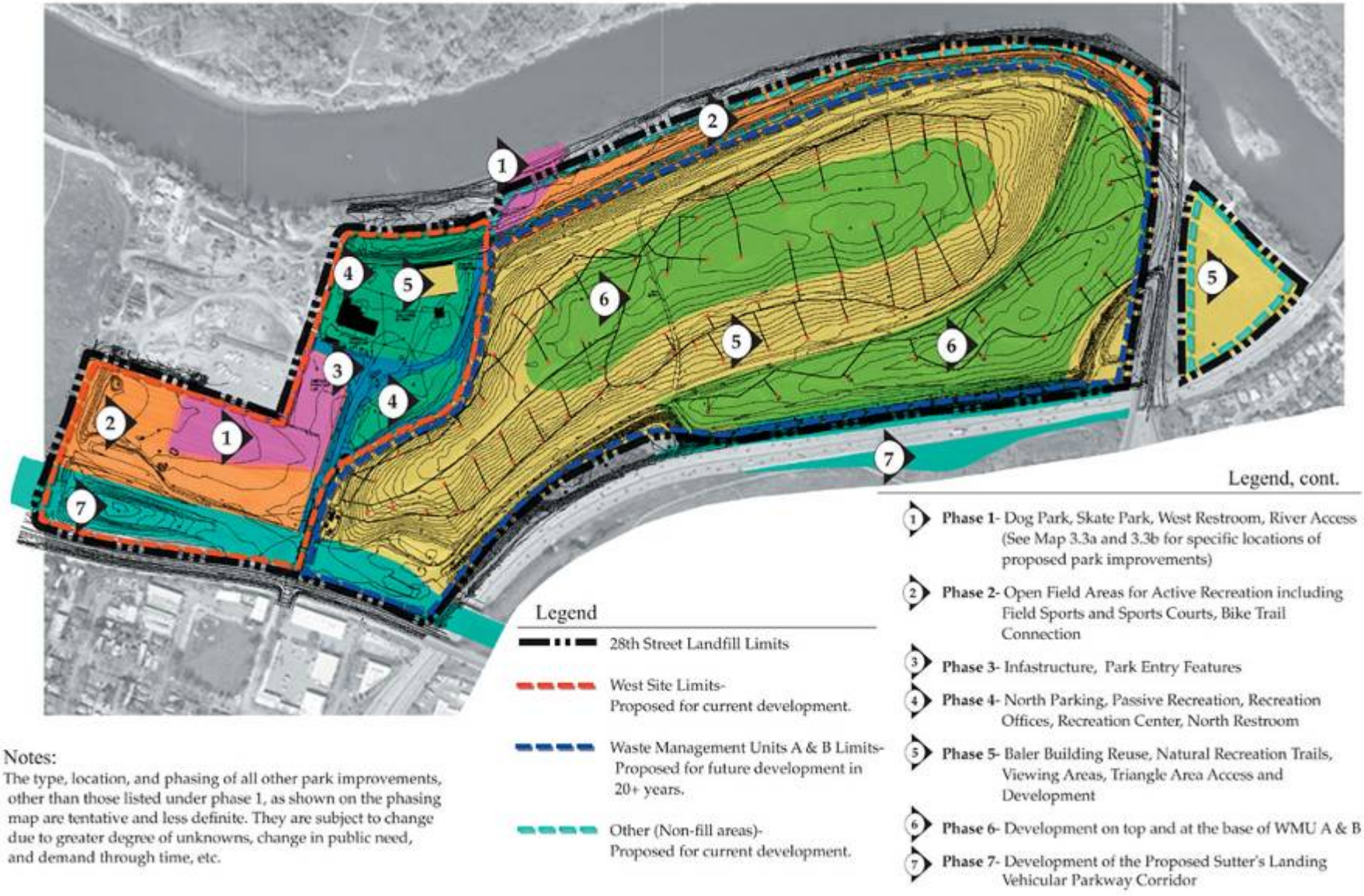

Notes:
The type, location, and phasing of all other park improvements, other than those listed under phase 1, as shown on the phasing map are tentative and less definite. They are subject to change due to greater degree of unknowns, change in public need, and demand through time, etc.

Phasing Map

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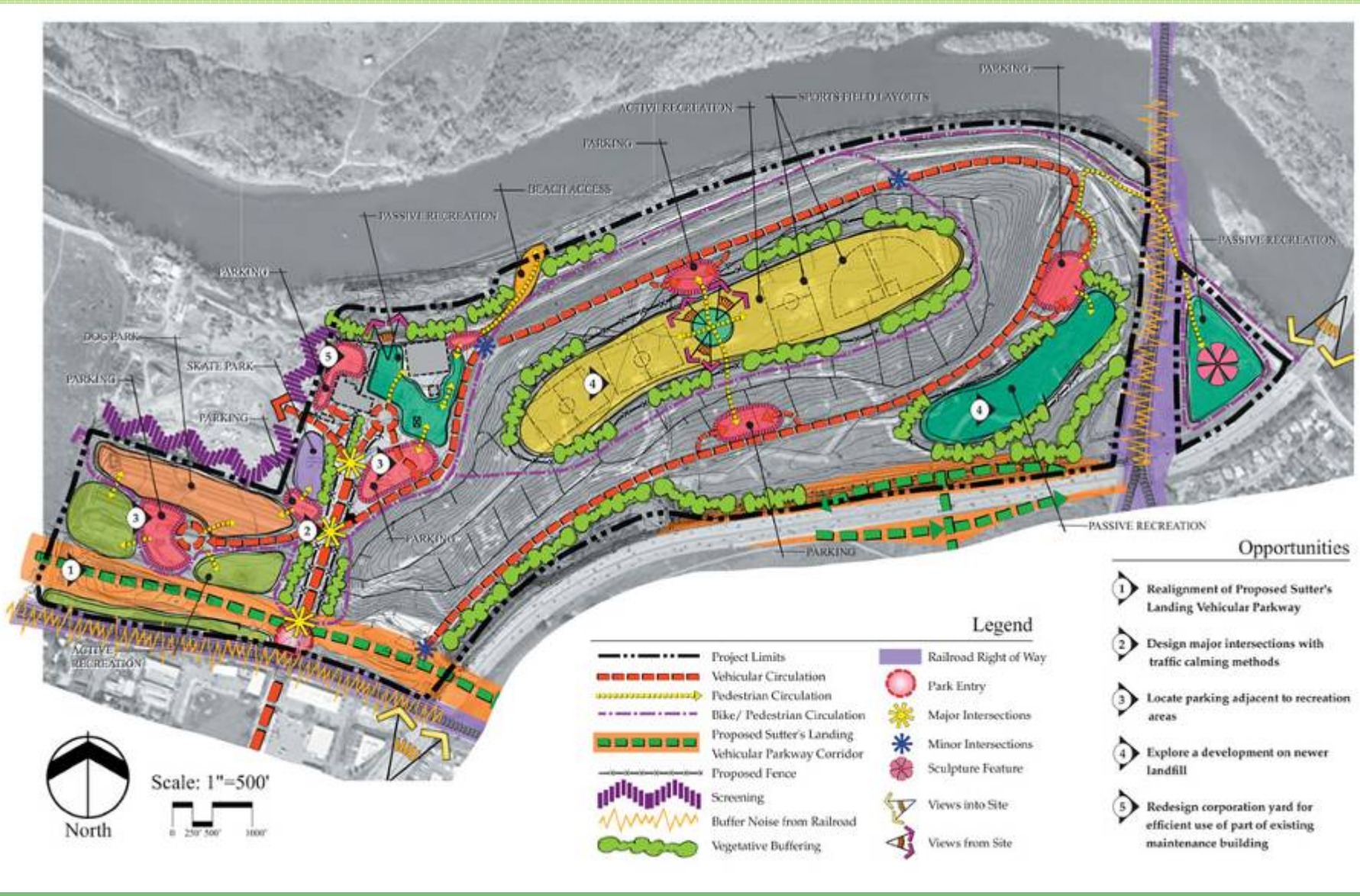

Planning Opportunities Map

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3. Conceptual Design Process

Conceptual Master Plan

- Public Approval
- Solidify Direction
- Tool for Fund Raising and Grant Applications

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Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report

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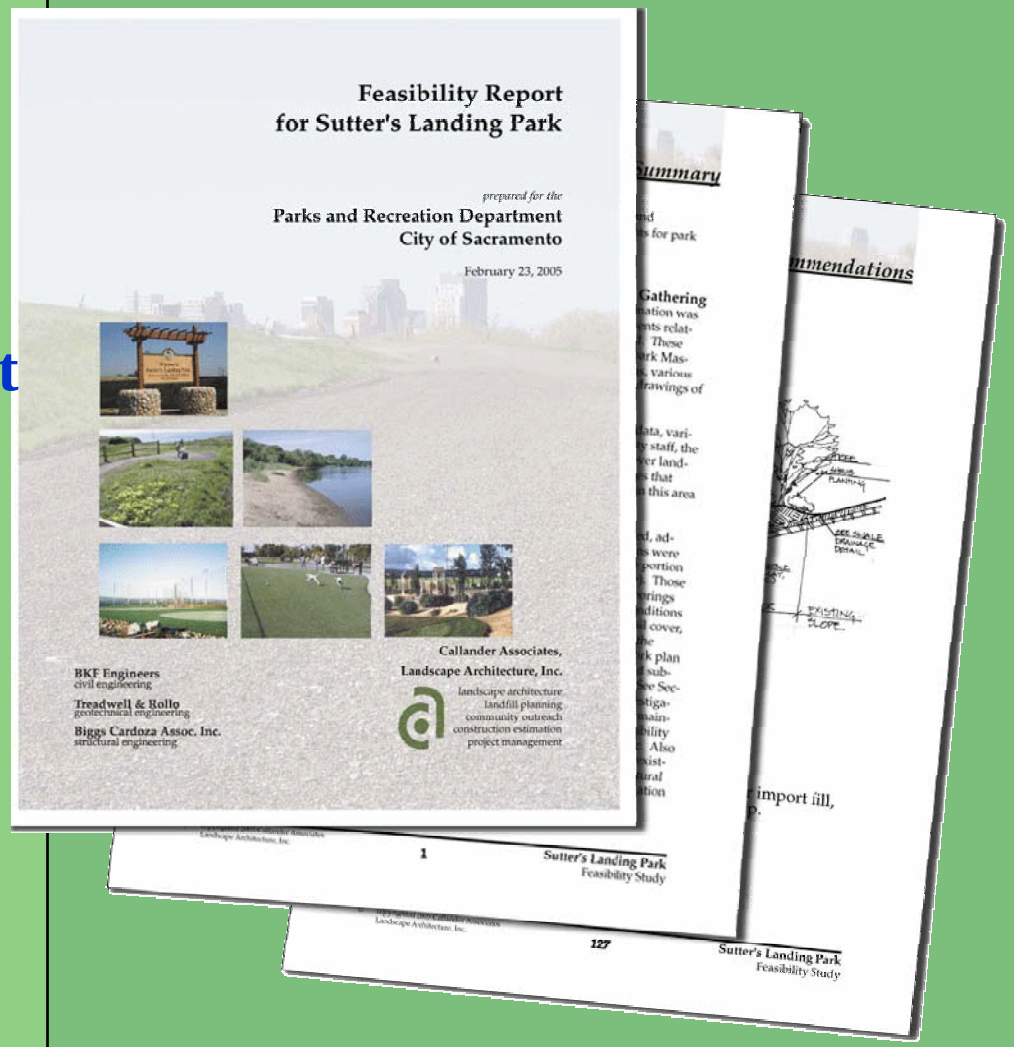
4. Feasibility Report

1. **Compilation of all findings and recommendations**
2. **Provides:**
   a. **Guide for Development**
   b. **Potential Cost Impacts**
   c. **Implementation and Phasing Strategy**



Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report
5. Design Development

5. Design Development

1. **Post-Closure Land-Use Plan (PLUP)**
   a. **Architectural/Landscape Arch. Plans**
   b. **Grading Plans**
   c. **Conceptual Utility Plans**
   d. **Foundation Plans**

2. **Regulatory Review**

3. **Cost Estimate**
   a. **Non Typical Site Costs**
   b. **Assists in Planning**
   c. **Assists in Design Decisions**

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Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report
5. Design Development
6. Preparation Of Construction Documents

6. Construction Documents

1. **Implementation of Post Closure Land Use Plan (PLUP)**

2. **Continual dialogue with regulatory agencies**

3. **Final regulatory review**

Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report
5. Design Development
6. Preparation Of Construction Documents
7. Construction Quality Assurance

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7. Construction Quality Assurance

1. **Health and Safety**
2. **Field Testing and Survey**
   a. **Soil Moisture-density**
   b. **Permeability**
   c. **Elevation and As-built Condition**
3. **Laboratory Testing**
4. **Documentation**
5. **Reporting**

Process/ Steps

1. Site Program
2. Technical Investigation
3. Conceptual Design Process
4. Feasibility Report
5. Design Development
6. Preparation Of Construction Documents
7. Construction Quality Assurance
8. Post-Closure Maintenance and Monitoring

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8. Post-Closure Maint. And Monitoring

1. **On-going Settlement Monitoring**
2. **Methane Gas Monitoring and System Test**
3. **Leachate Monitoring**
4. **Site Repairs**
5. **Reporting to Regulatory Agencies**

Post Closure Landfill Development

So, Are You Ready?

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What You Can Do Now To Be Ready

1. Control final grades prior to closure
2. Document limits/depths of material
3. Construct final cover early
   a. Stockpile import soil
   b. Document soil type and placement
      - Place low permeable material first
      - Stockpile general fill until cover is in place
      c. Be organized
      d. Start settlement surveys now!
         - Real information is the best information
         - Understanding the actual rate of settlement will reduce conservative nature of design and save money
4. What else?

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Post Closure Landfill Development

Thank You!

Callander Associates Landscape Architecture, Inc. BkF Treadwell&Rollo

Landfill Post Closure Land Use Symposium
Ontario, Feb. 15th & Stockton, Feb. 28th