Installing LID as a Retrofit: The Sacramento State LID Project

John Johnston and Maureen Kerner

Low Impact Development Regional Conference

American Basin Council of Watersheds

Office of Water Programs

November 4, 2015

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Funding provided by the State Water Resources Control Board through the Proposition 84 Grant Program

Campus Stormwater

Drain Inlet - Campus

Storm Drain Discharges into American River

American River

Outfall – Guy West Bridge

Upstream Sample

Discharge Sample

Project Background

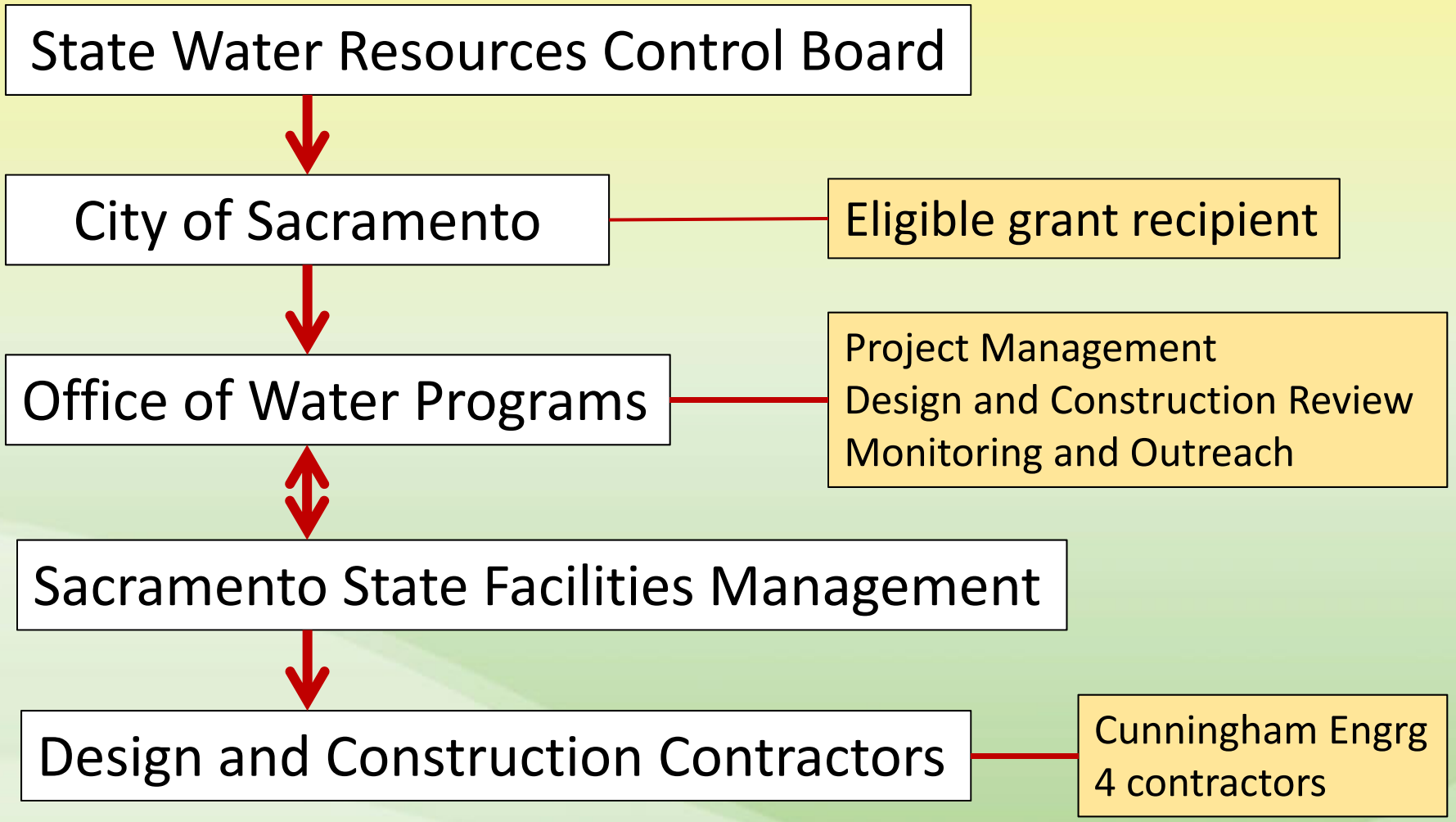
✓Objectives:

- Prevent stormwater contamination of water bodies
- Meet stormwater permit requirements
- Implement LID in a retrofit situation
- Monitor performance
- Educate and outreach

Project Benefits

- ✓Meet Permit Reqmts
- ✓Campus Involvement
- ✓High Visibility
- ✓Protect American River
- ✓Replenish Groundwater (irrigation supply)
- ✓Demonstration of LID BMP types

Project Collaborators



Project Funding -- Sources

- ✓Project Total - $3.3M
  - Prop 84 - $2.6M
  - Local Match - $700k
    - Sacramento State FM - $500K
    - City of Sacramento - $112K
    - Office of Water Programs – $31K
    - Dry Creek Conservancy - $30K
    - Local LID Expertise - $25K
    - County of Sacramento - $1K

Project Funding - Outlays

✓Project Total - $3.3M

- Project Admin: $0.2M
- Planning and Design: $0.5M
- Construction: $2.1M
- Monitoring and Reporting: $0.3M
- Education and Outreach: $0.3M

Project Timeline

- ✓November 2014: Contracts executed
- ✓Spring 2015: Design Completed
- ✓Summer 2015: Construction
- ✓2015/2016: Post-Construction Monitoring
- ✓January 2017: Final Report
- ✓2016 – 2036: O&M

Site & BMP Selection: Bang-for-the-Buck

- ✓ Utilize Large Drainage Areas
  - Parking lots, streets, roof tops, and existing landscaping
- ✓ Maximize Infiltration
  - Replace less pervious with more pervious
- ✓ Use Existing Infrastructure
  - Tie into existing grades
  - Use existing storm drain system for overflow
  - Minimize new irrigation infrastructure
- ✓ Upgrade Vegetation
  - Drought- and inundation-tolerant
- ✓ Demonstrate Variety of BMP Types

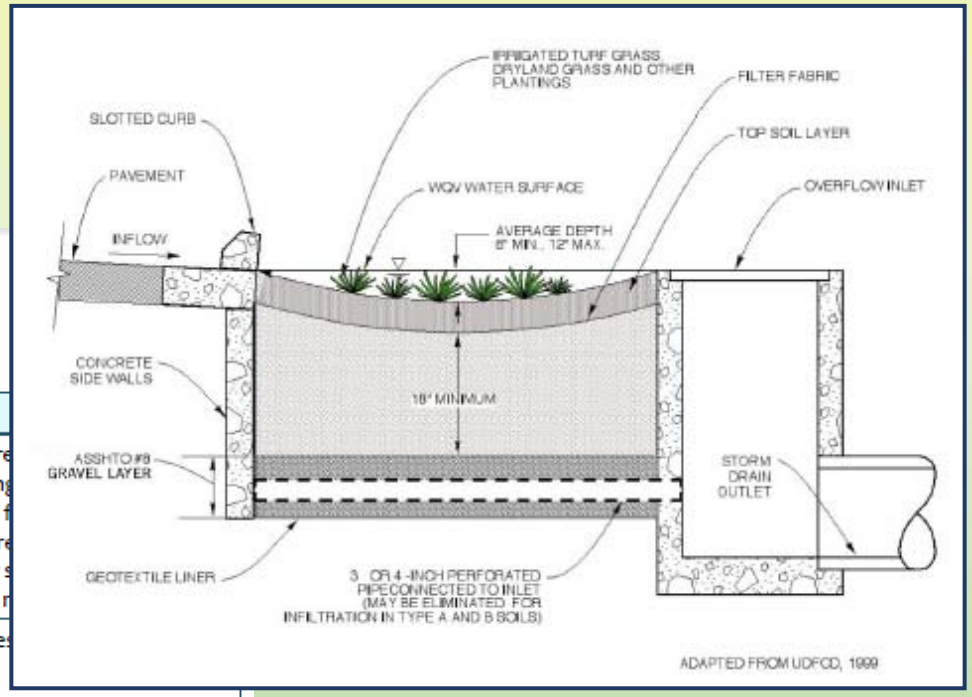
Design Goals

✓Enhance Infiltration

- Silty sands over gravels
- Only one device lined
- Estimated 14 acre-feet per year captured and treated
  - 13.2 acre-feet per year - infiltration alone

BMP Design: Methodology

✓Sacramento Stormwater Quality Partnership Standards



Stormwater Planter

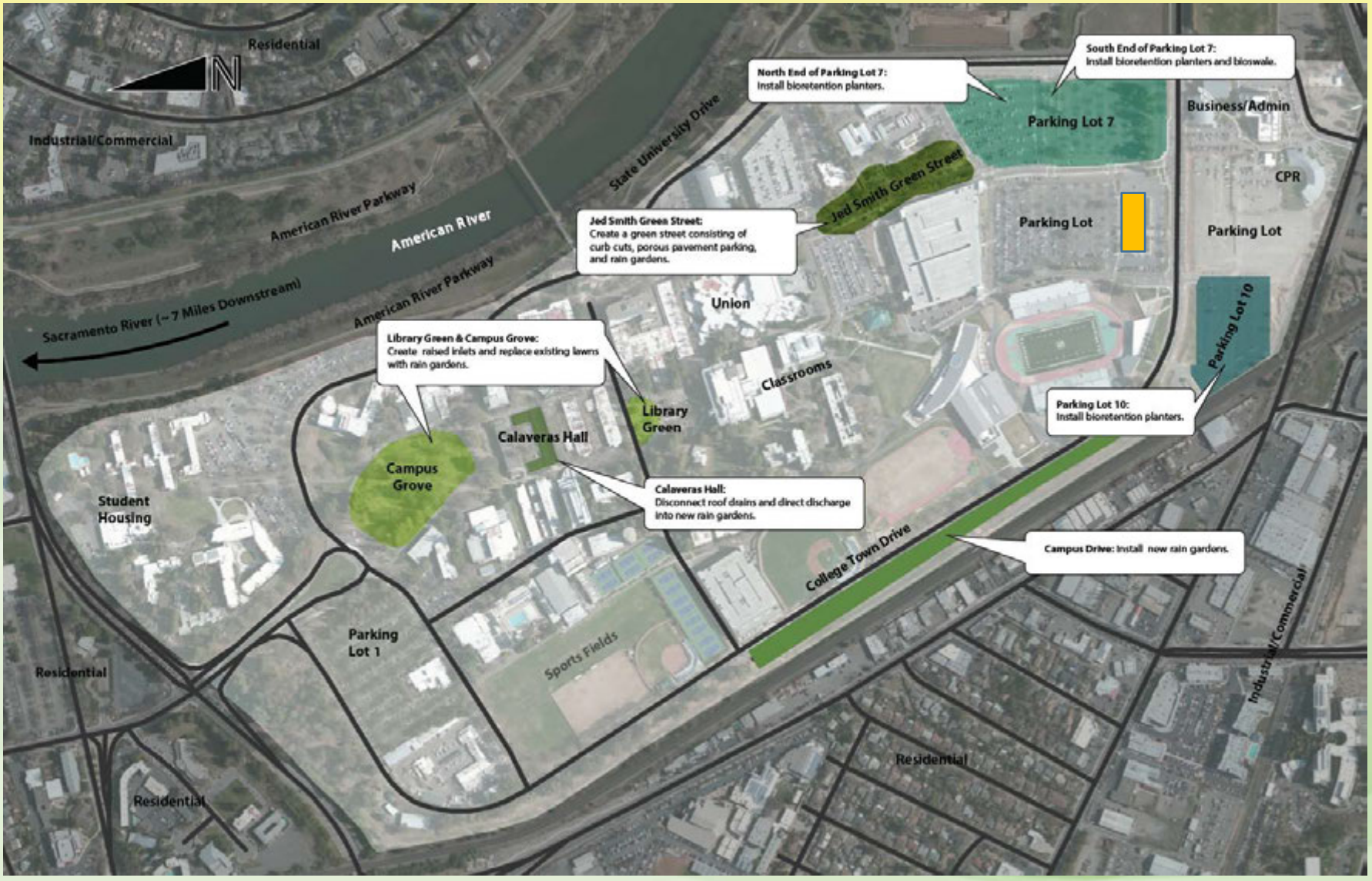
Table SP-1. Stormwater Planter Design Criteria

Design Parameter	Criteria	Notes
Tributary drainage area	≤ 1 acre	Ideally suited for small are islands, perimeter building medians, roadside swale f entrance or buffer feature implemented on a larger s WQV and average depth r
Design volume	WQV or as dictated greater by SAHM modeling (for projects with hydromodification requirement)	See Appendix E in this Des
Design drawdown time	12 hrs	Period of time over which WQV drains from planter.

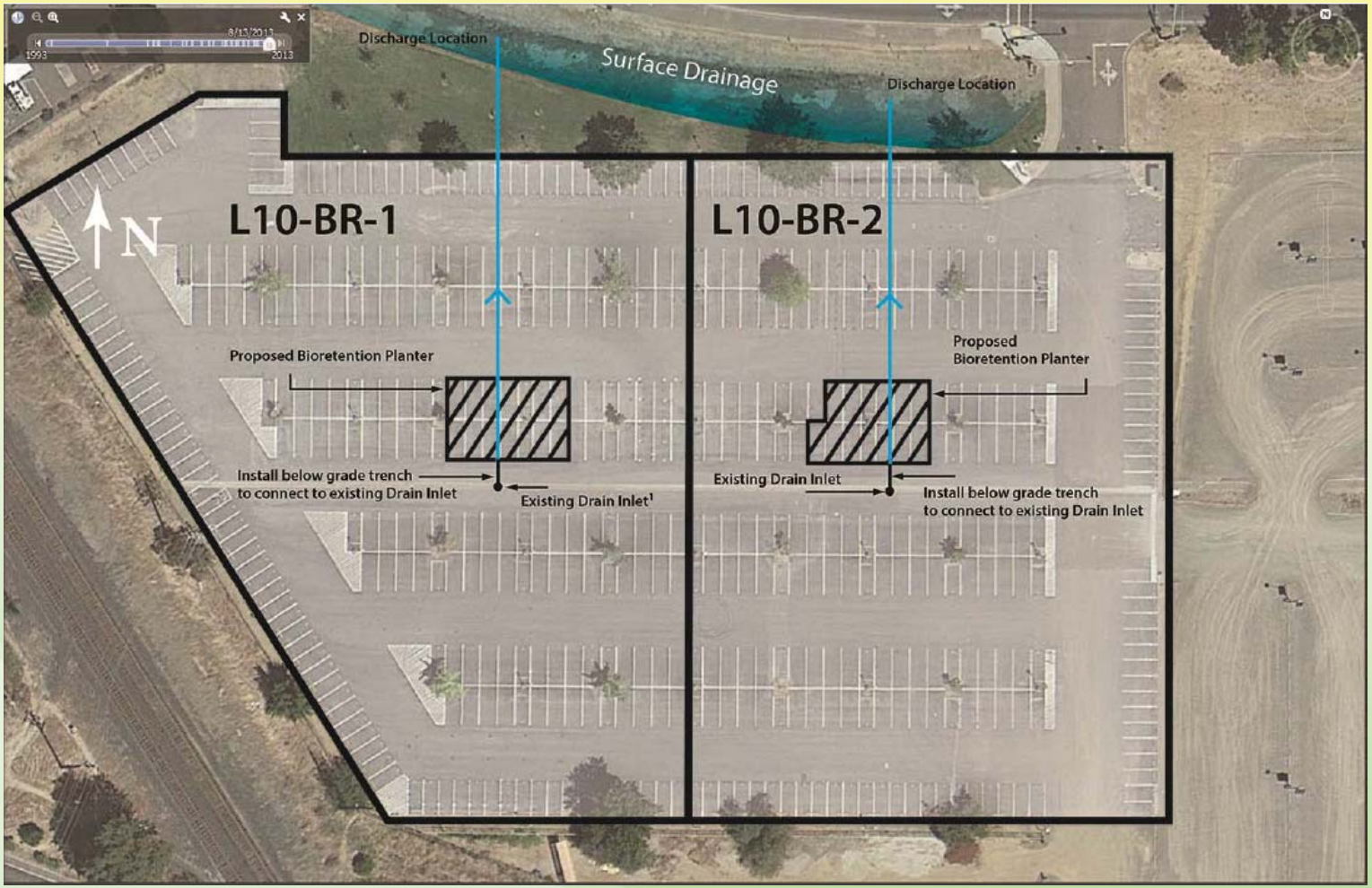
Planned LID Construction

- ✓8 Bioretention Planters
- ✓8 Rain Gardens (curbside and lawn drain inlets)
- ✓2 Rain Gardens treating roof runoff
- ✓1 Bioswale
- ✓1 Green Street (porous pavement and 4 rain gardens)

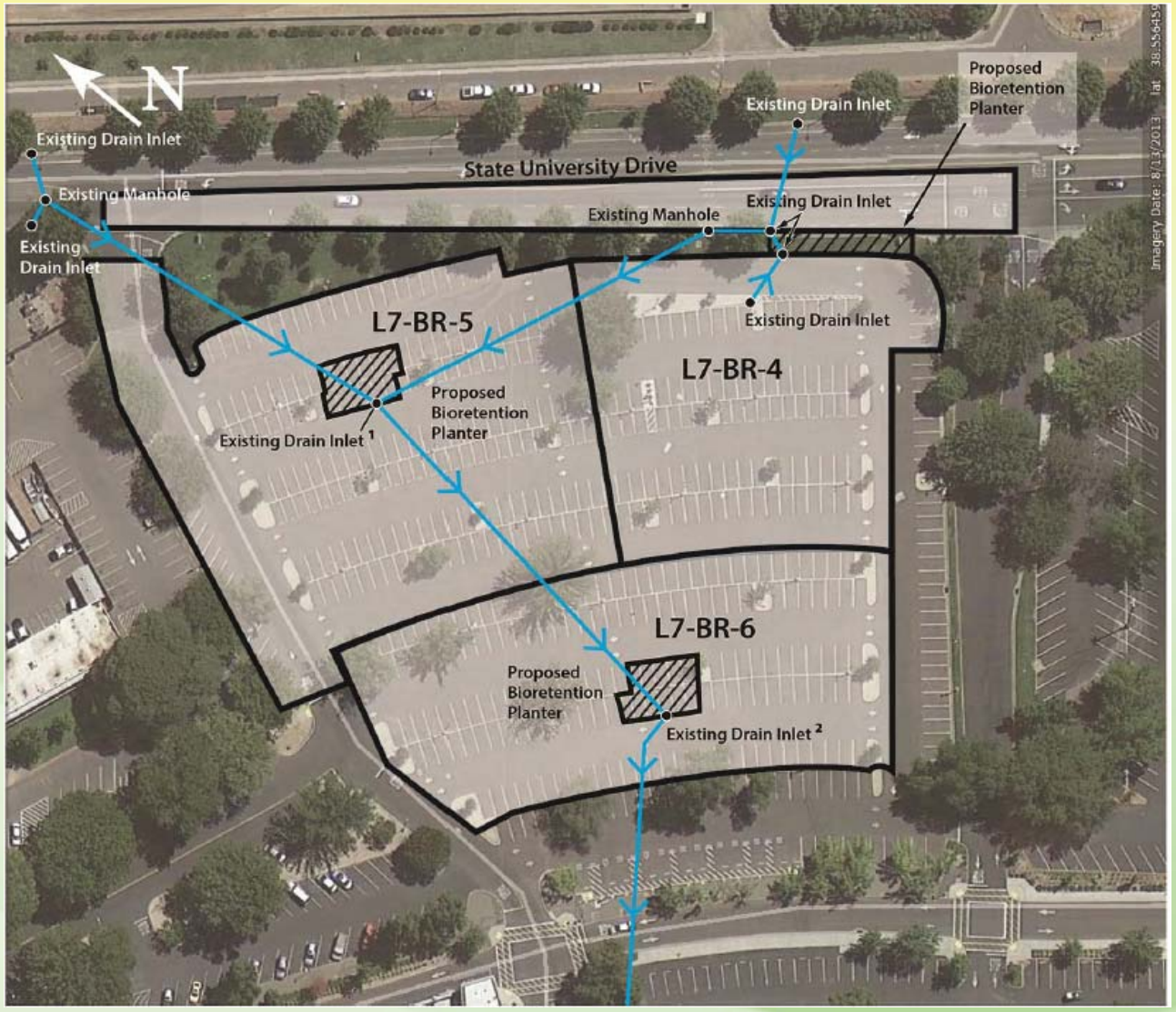
Campus Layout



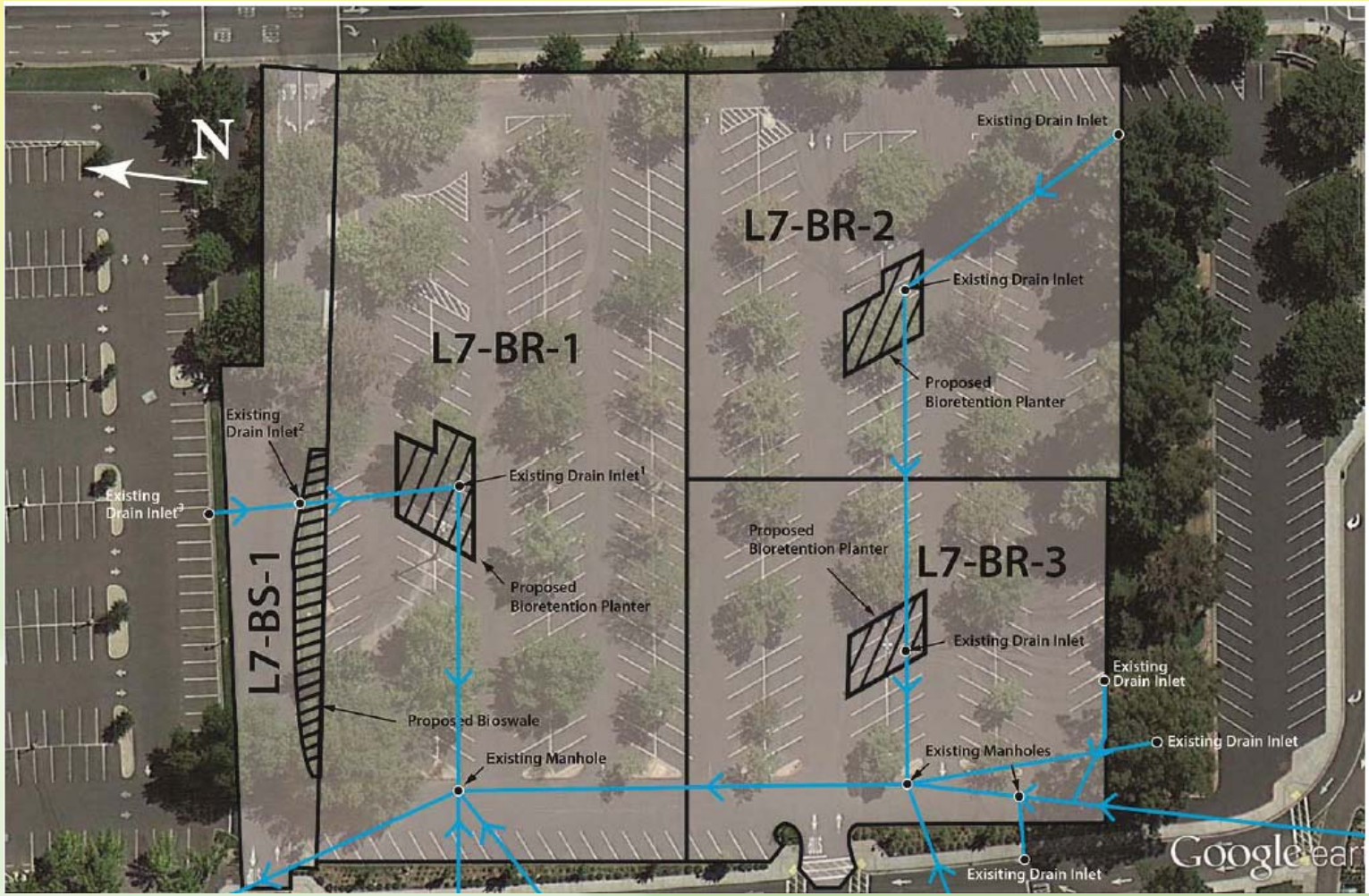
Bioretention Planters – Lot 10



Bioretention Planters - Lot 7N

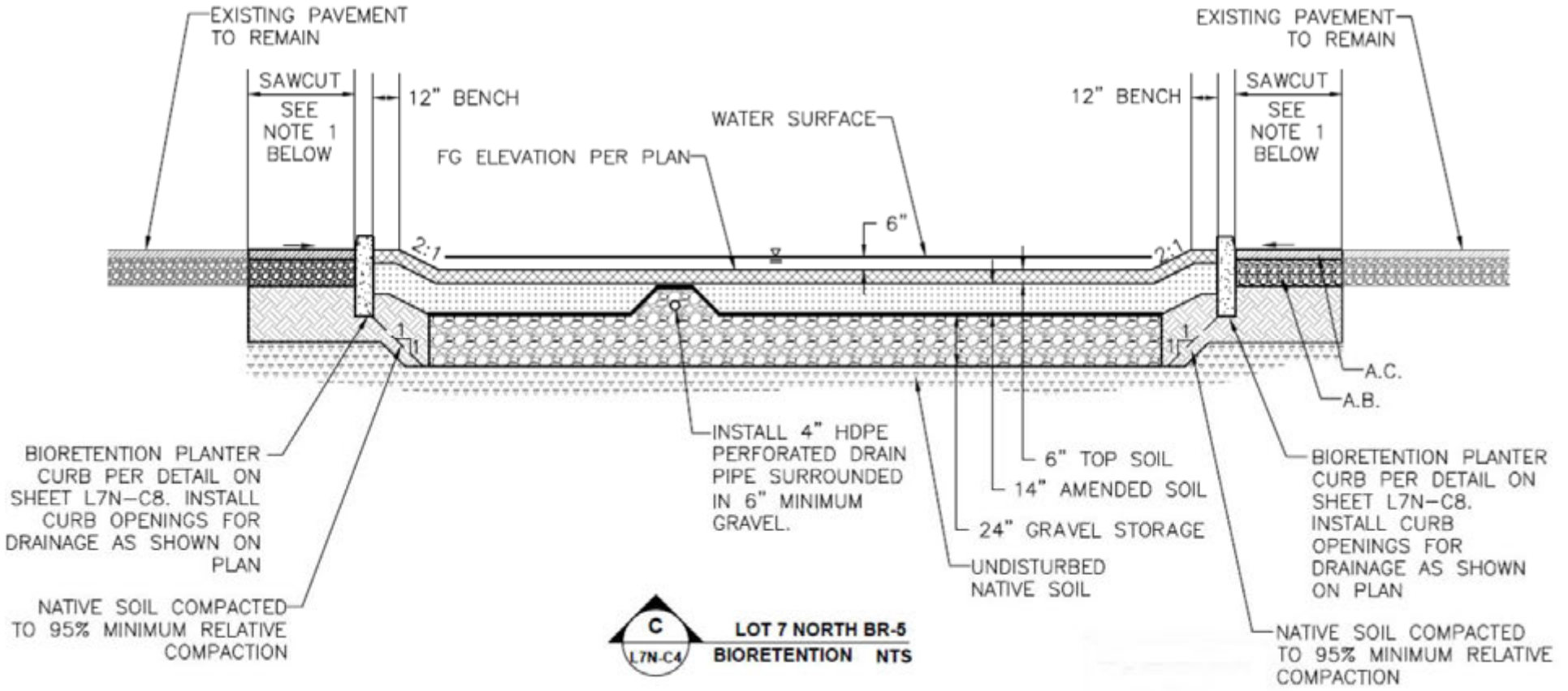


Bioretention Planters and Bioswale – Lot 7S



Bioretention Planters

✓Filtration with underdrains and infiltration



Bioretention Planters

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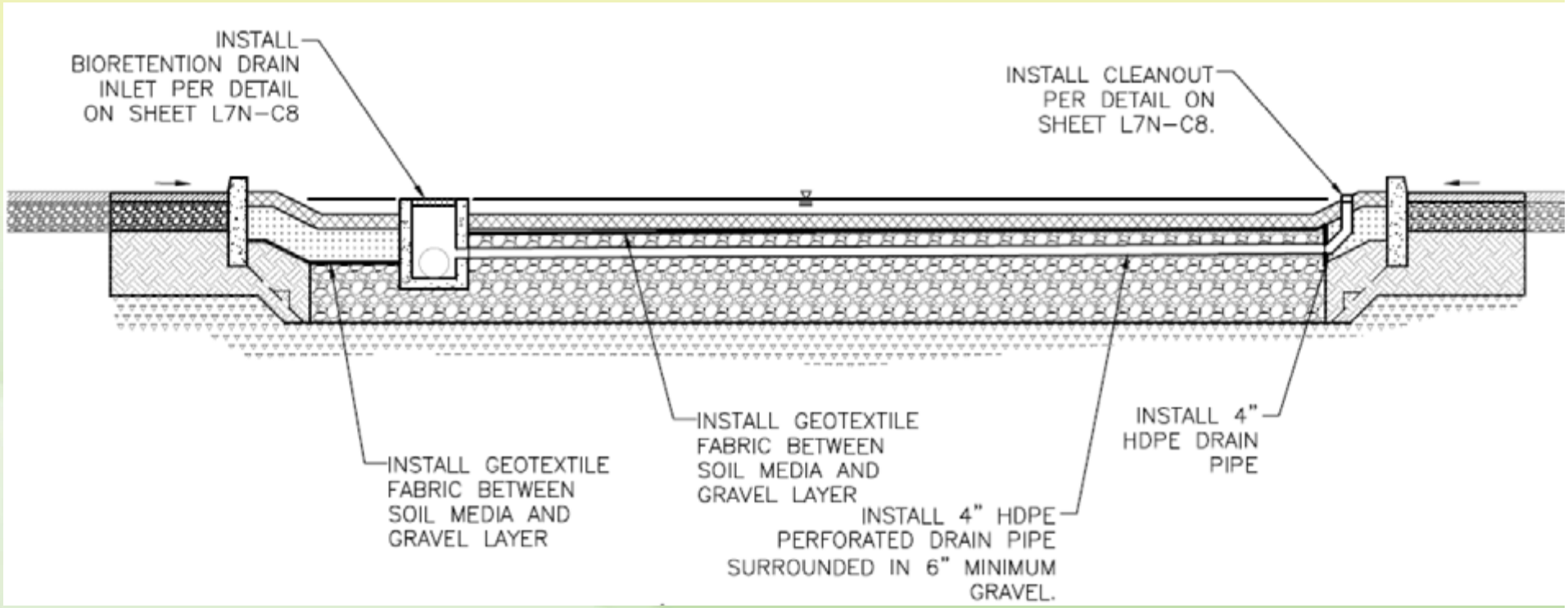
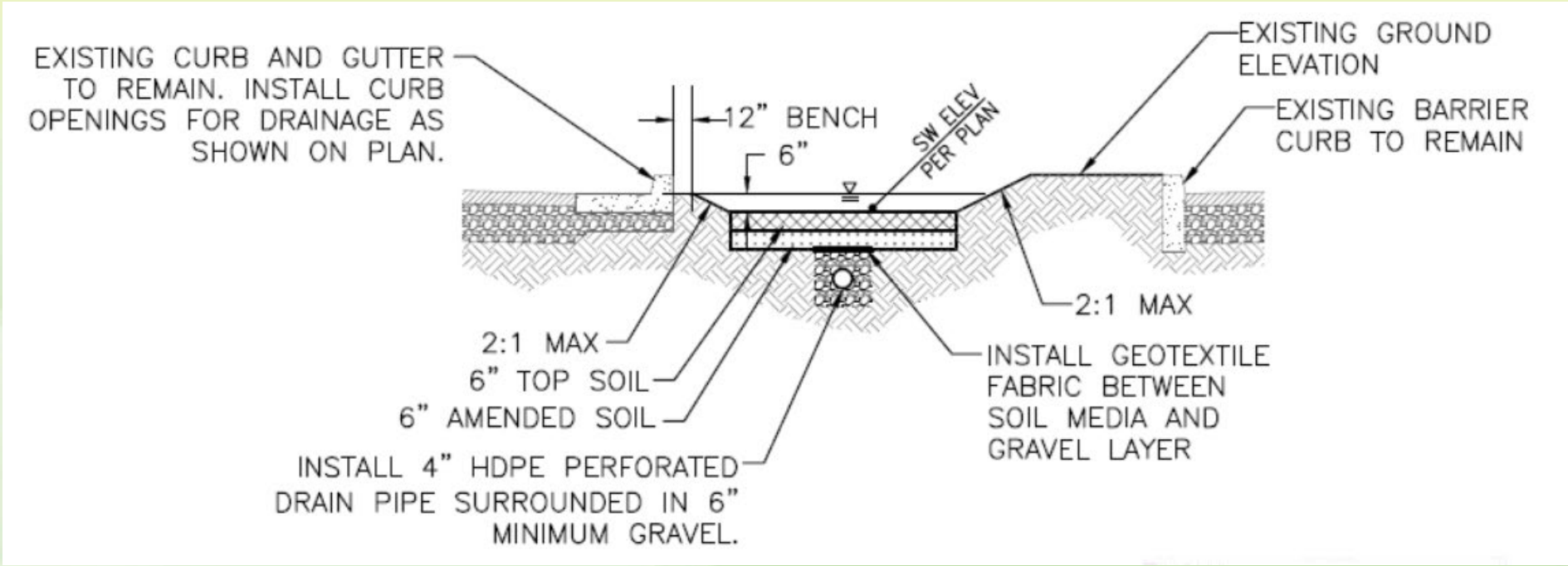


Bioretention Planters

WATER PROGRAMS
SACRAMENTO STATE

Bioswale

- ✓Overland flow and infiltration
  - Drain pipe plugged; to be used if needed

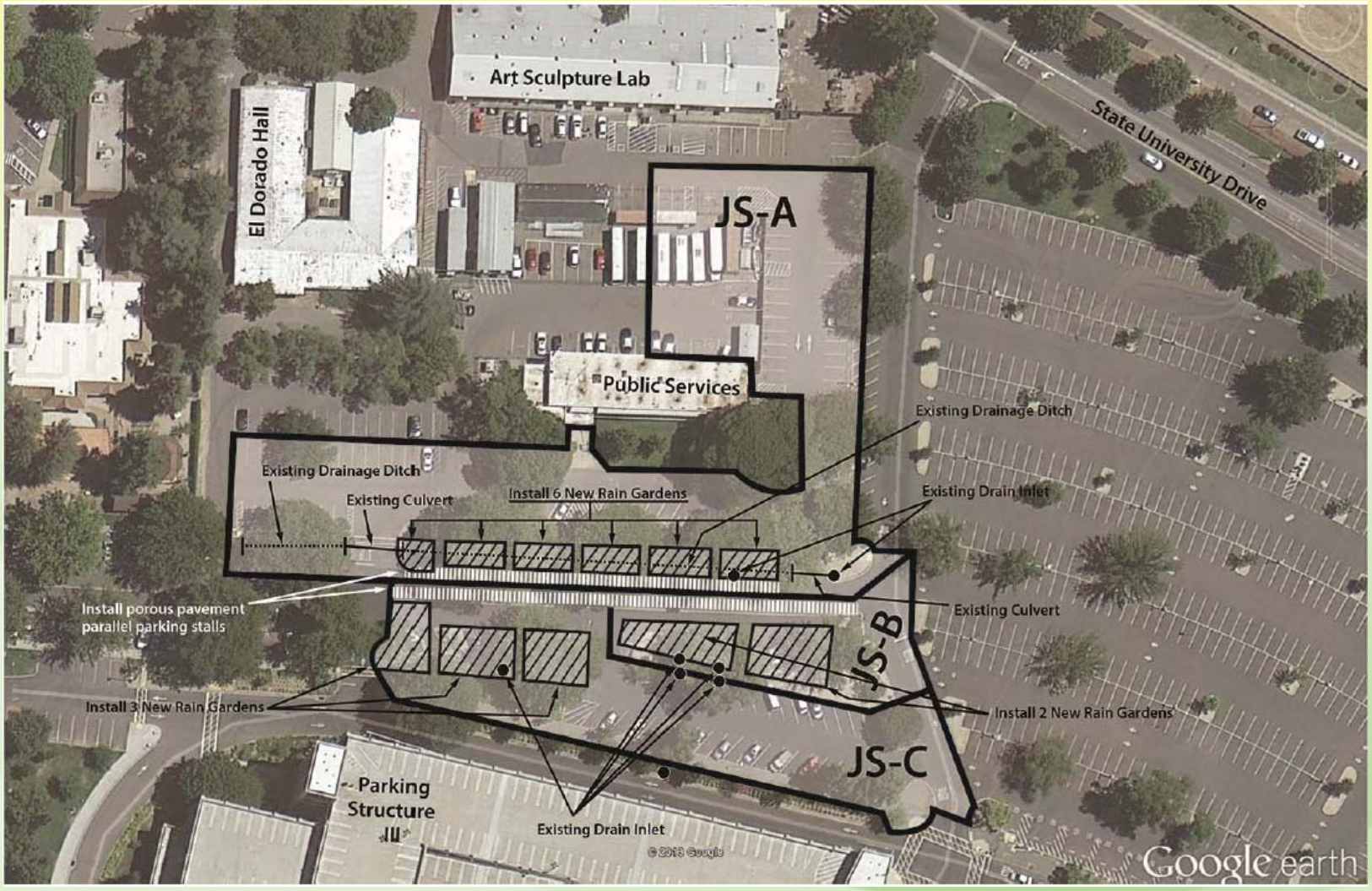


Lot 7S Bioswale

Before

WATER PROGRAMS
SACRAMENTO STATE

Jed Smith Green Street:
Porous Pavement & Rain Gardens

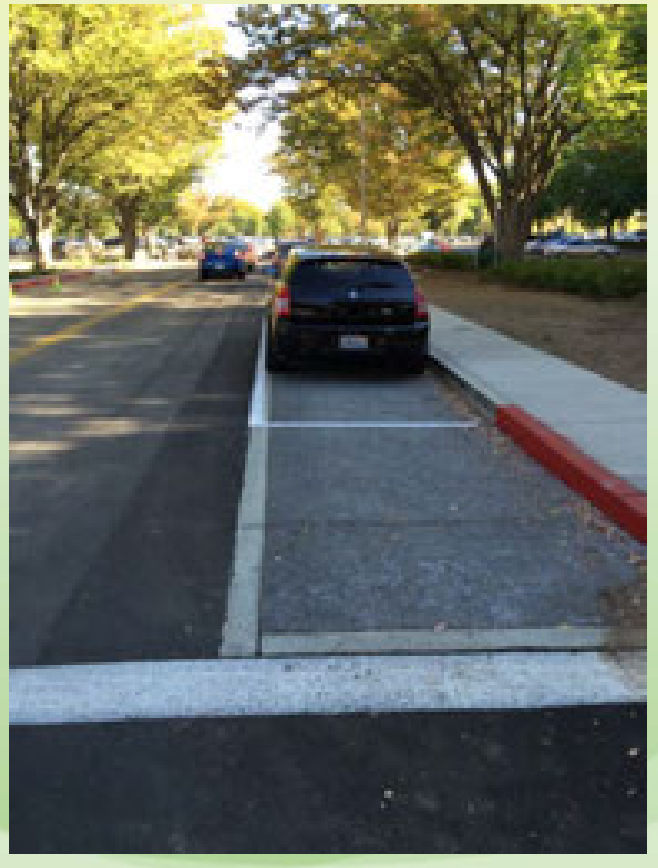


Jed Smith Green Street

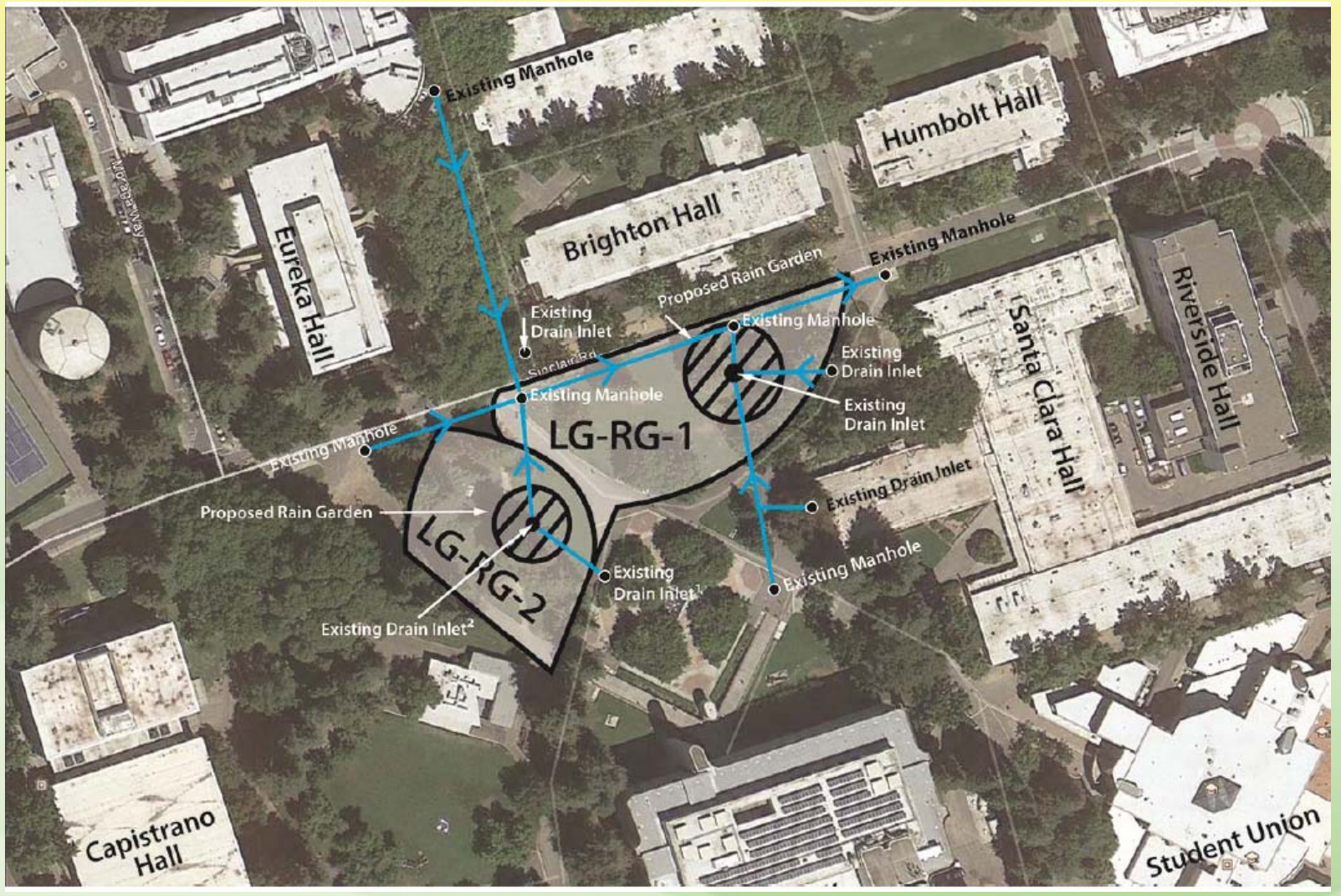
Jed Smith Green Street

Before

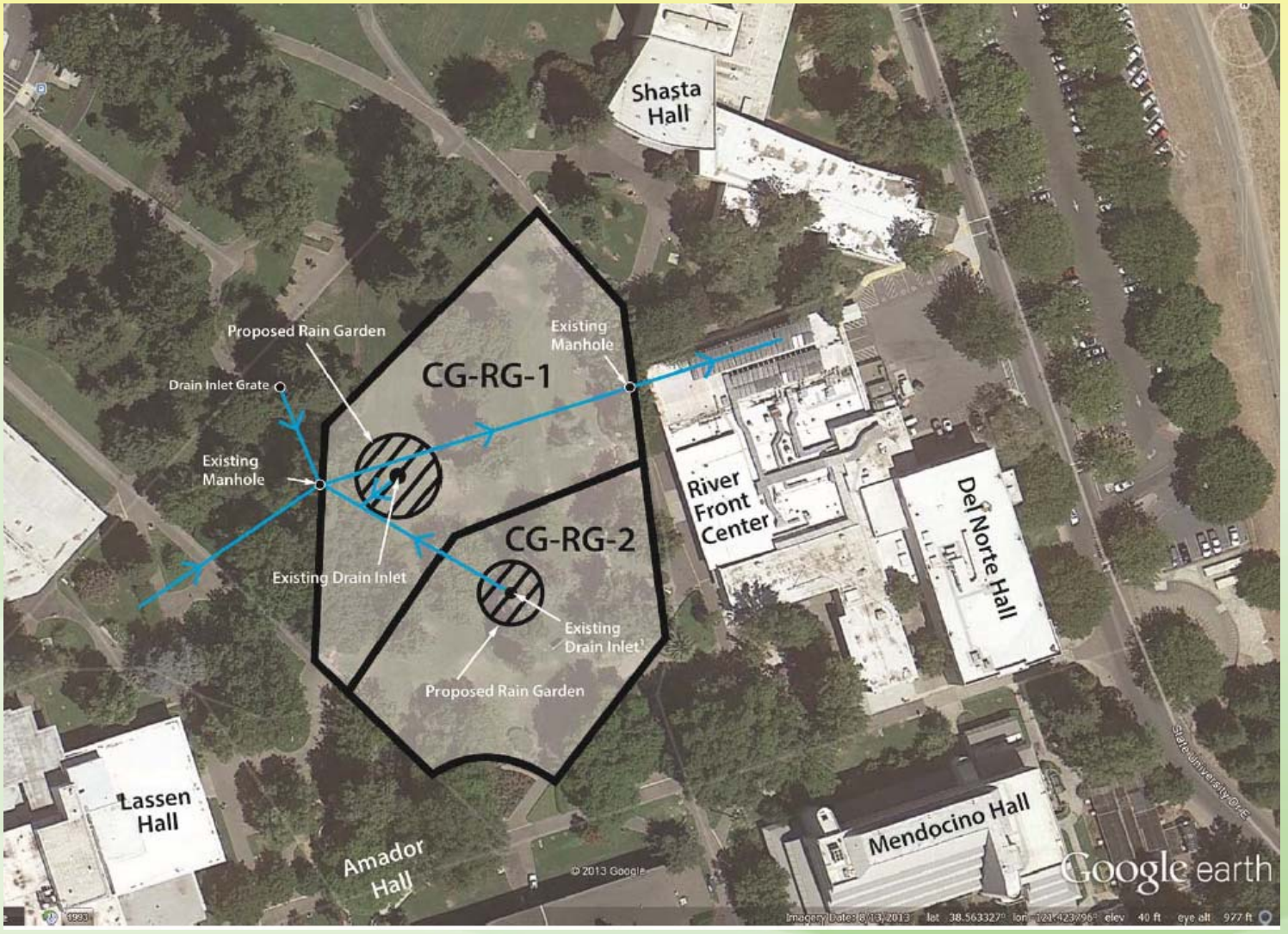
Jed Smith Green Street



Library Green: Rain Gardens



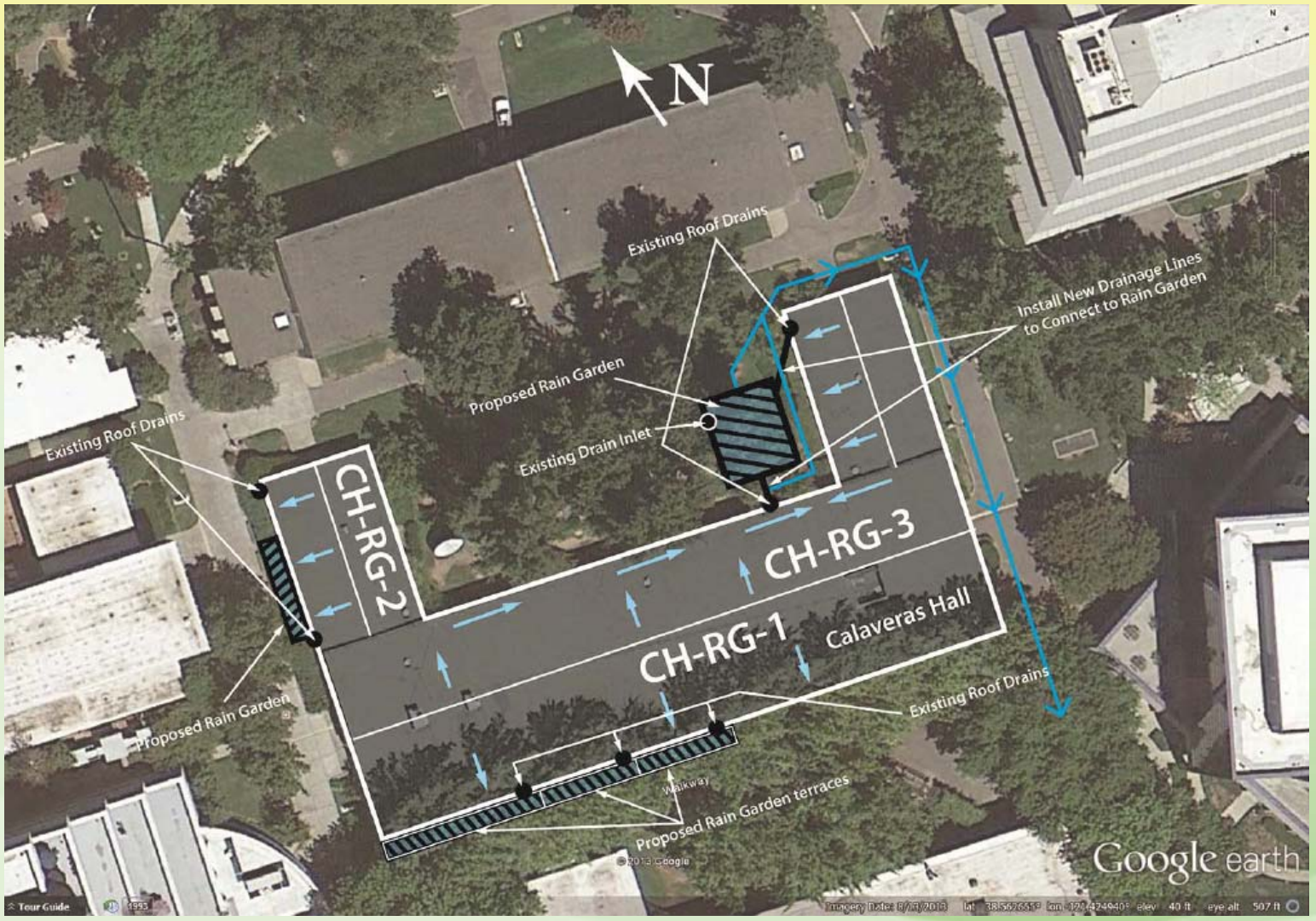
Campus Grove: Rain Gardens



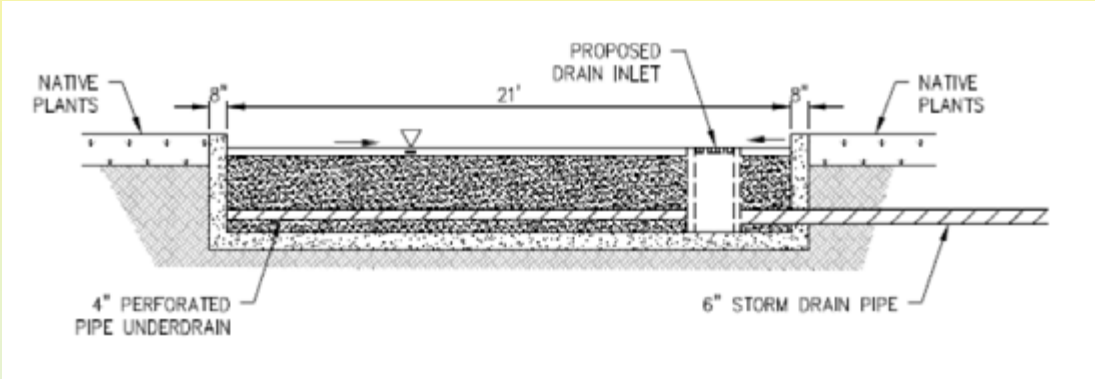
Library Green

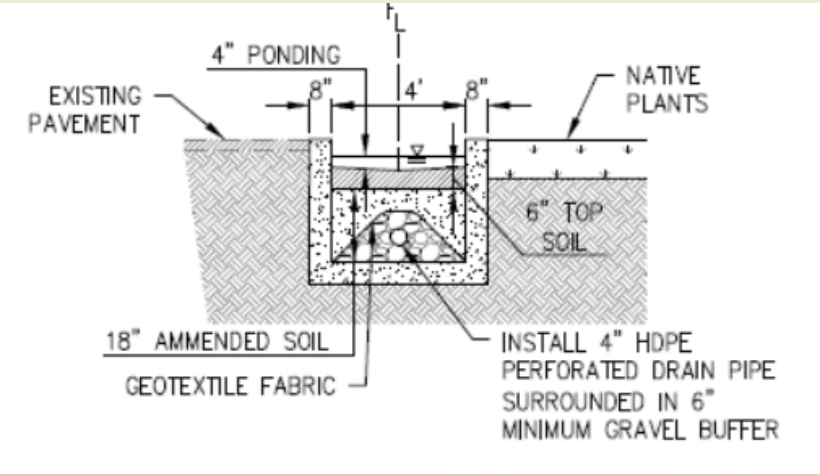
Before

Calaveras Hall:
Roof Drain Disconnects and Rain Gardens

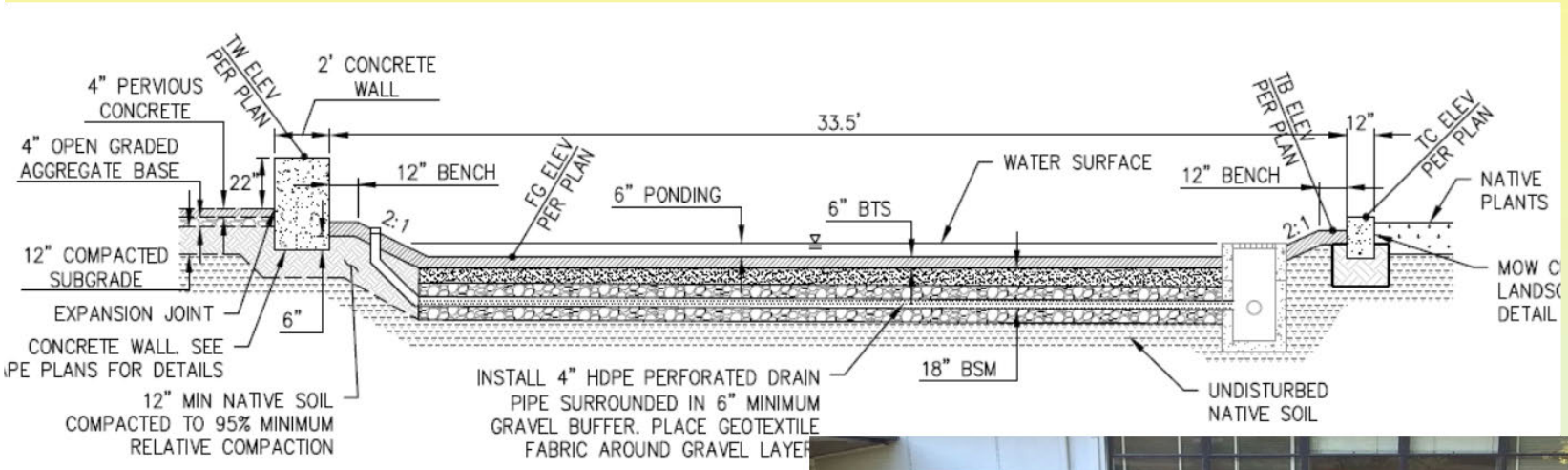


Calaveras Hall Rain Garden #2



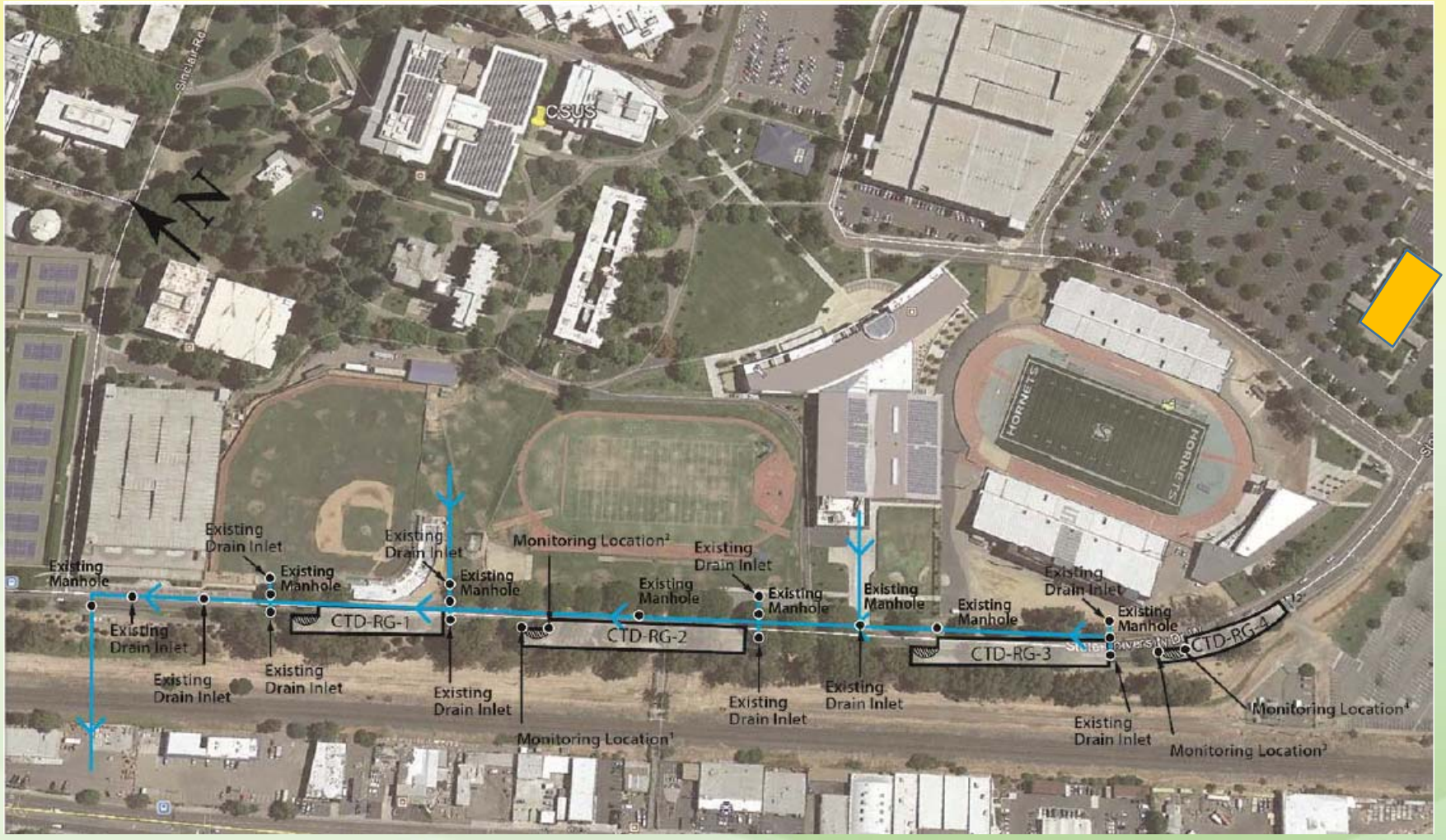


Calaveras Hall Rain Garden #3

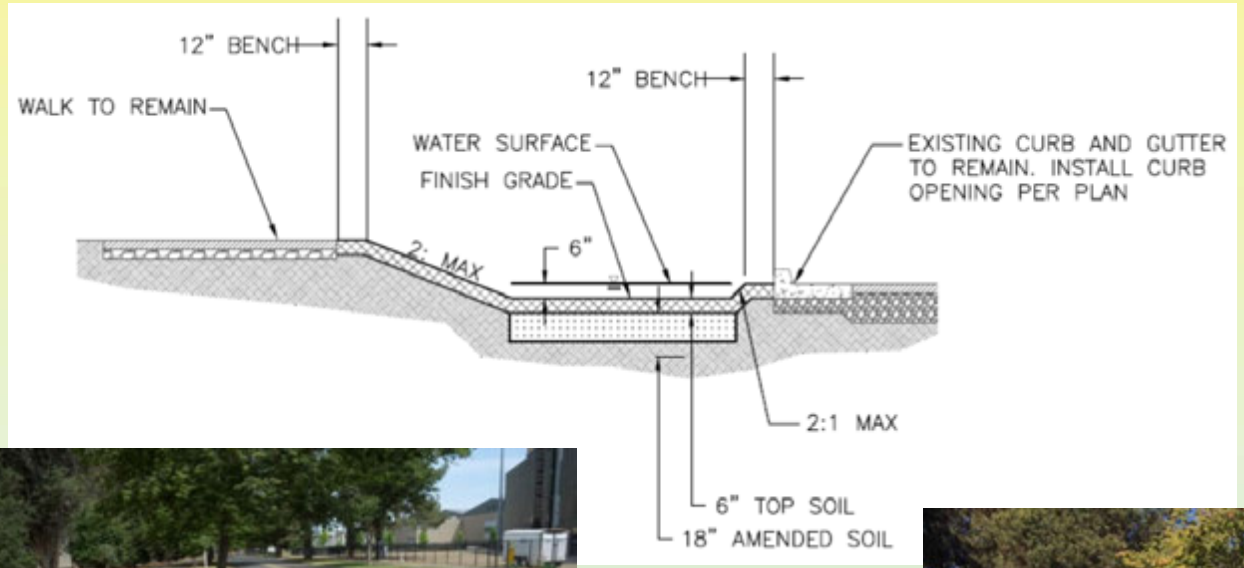


WATER PROGRAMS
SACRAMENTO STATE

College Town Drive: Rain Gardens



College Town Drive

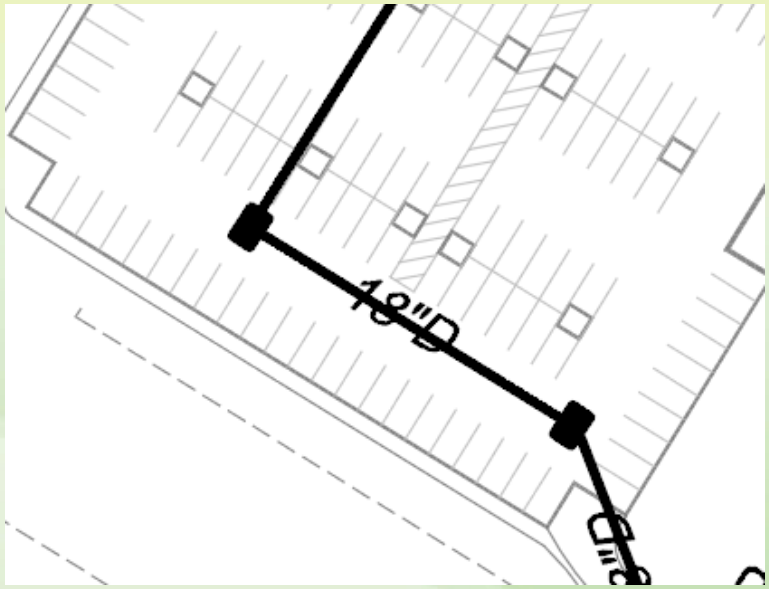


Before

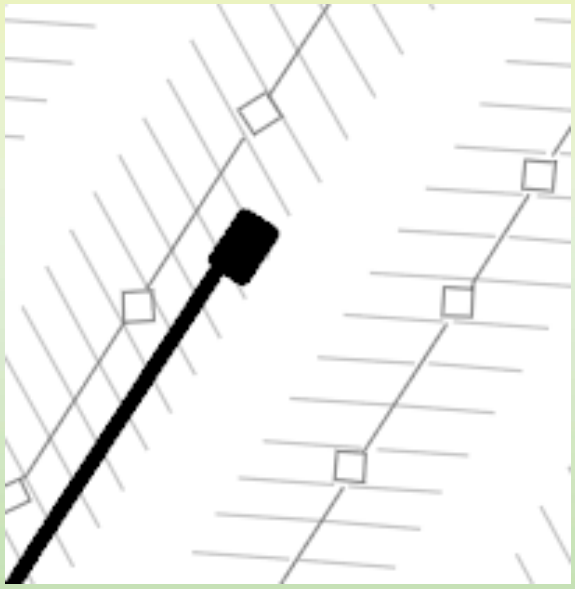
Design challenges

✓Fitting into the existing drainage system

- Horizontal



Drain in traveled way

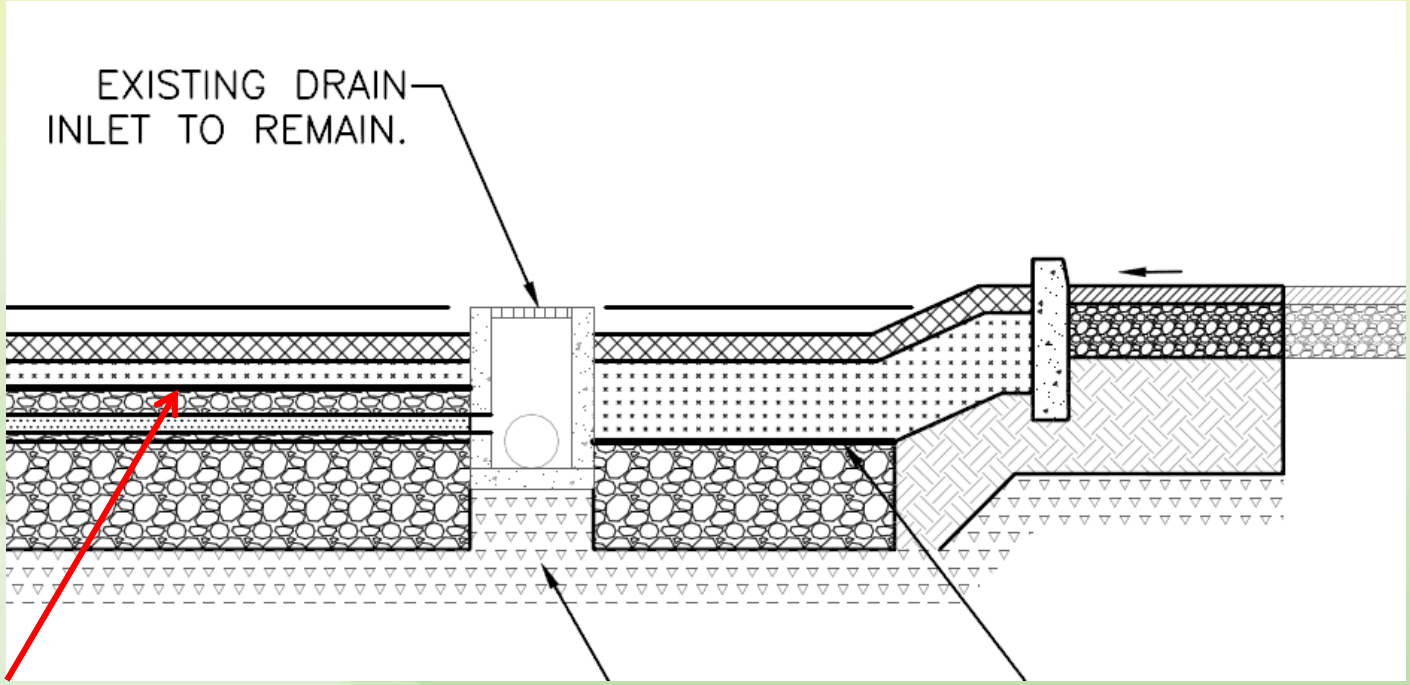


Drain conveniently located except for electrical

Design challenges

✓Fitting into the existing drainage system

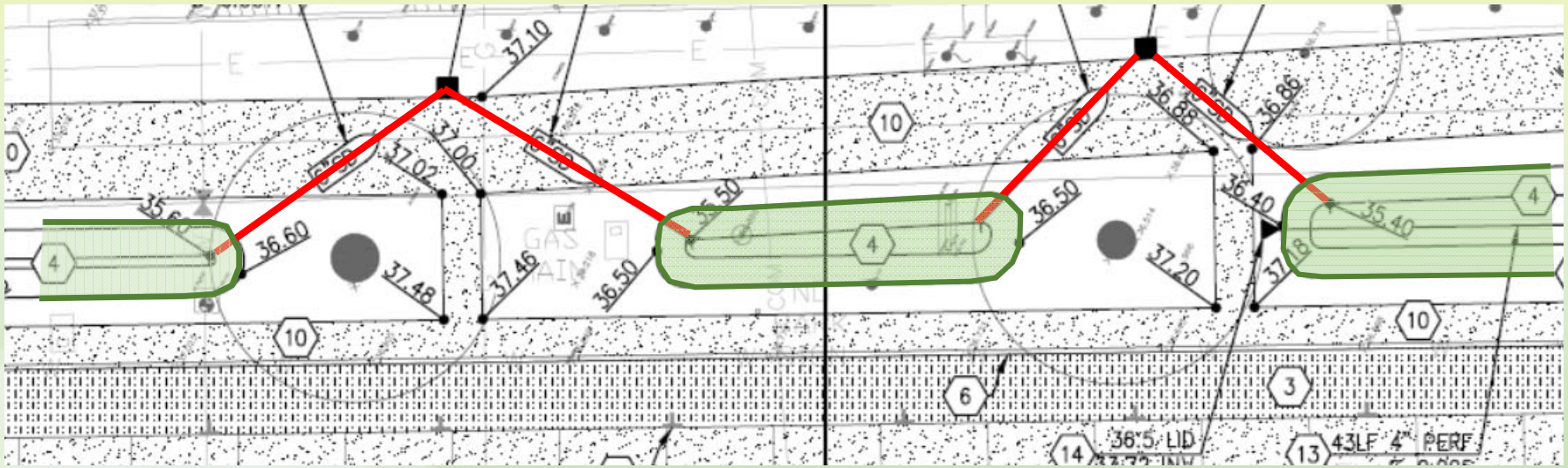
- Vertical



Existing pipe invert to be maintained
(can limit depth of bioretention media)

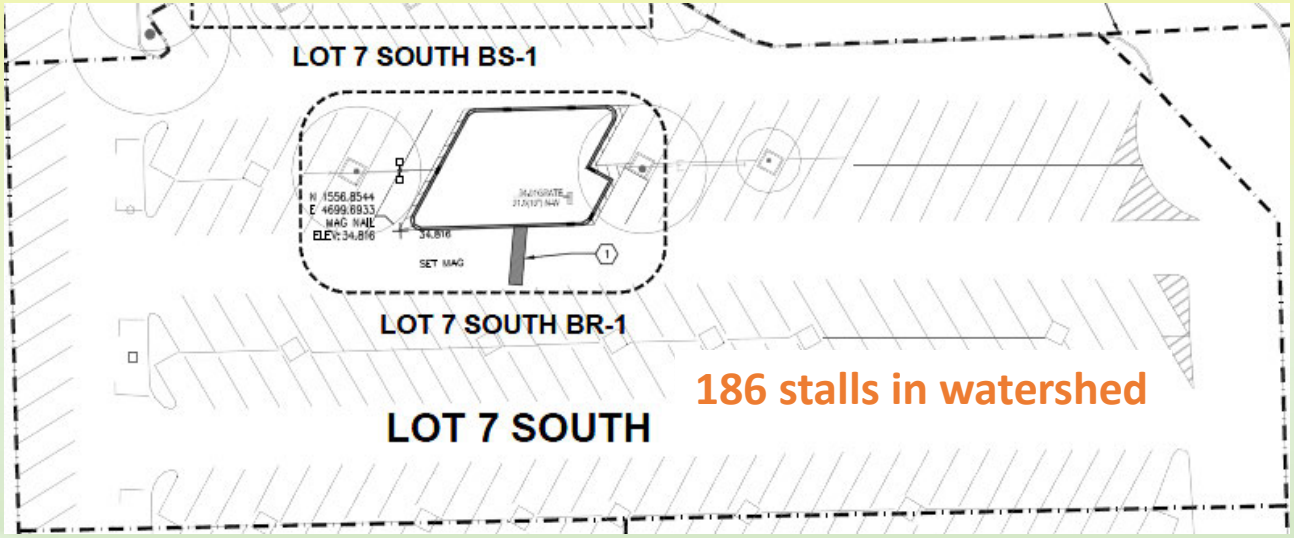
Design Challenges

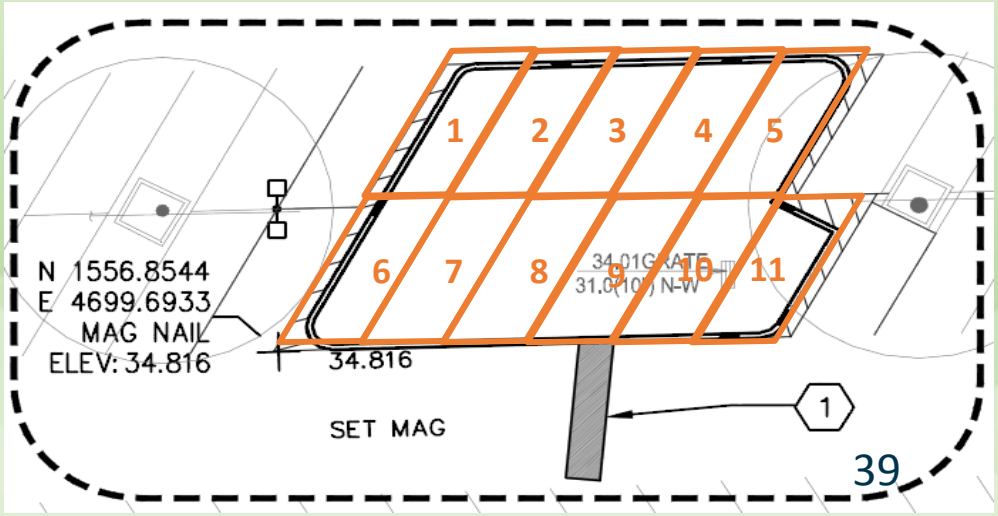
✓Protecting existing tree roots at Jed Smith Dr.



Design Challenges

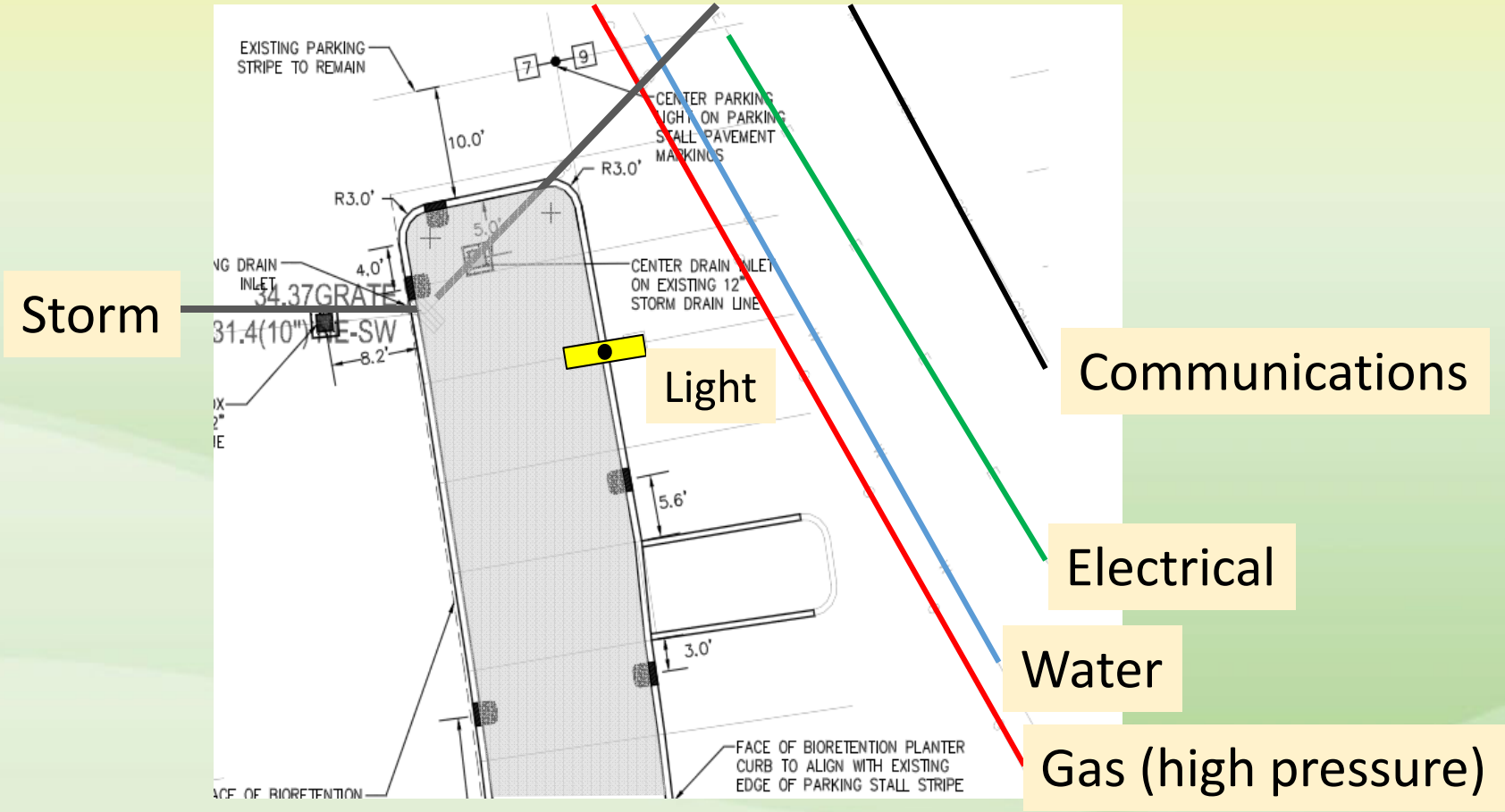
✓Negotiating the removal of parking stalls





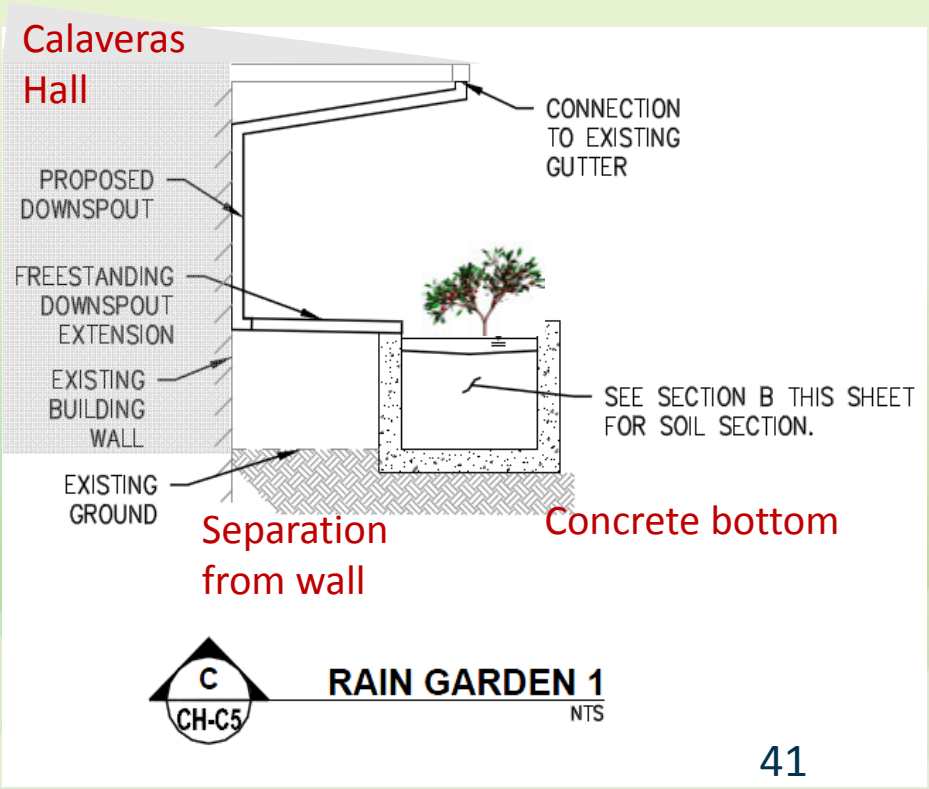
Design challenges

- ✓Conflicts with other infrastructure
  - Sanitary sewer, gas, electric, light standards, trees



Design Challenges

- ✓Interactions with buildings
  - Avoid saturating soils around foundations
  - Tapping into building drainage systems
    - –May require architect or mechanical engineer
  - Public safety issues



Design Challenges

- ✓Subsurface soil infiltration rate
  - Natural variations
  - Effects of previous construction
    - –Fill
    - –Compaction

Construction Challenges

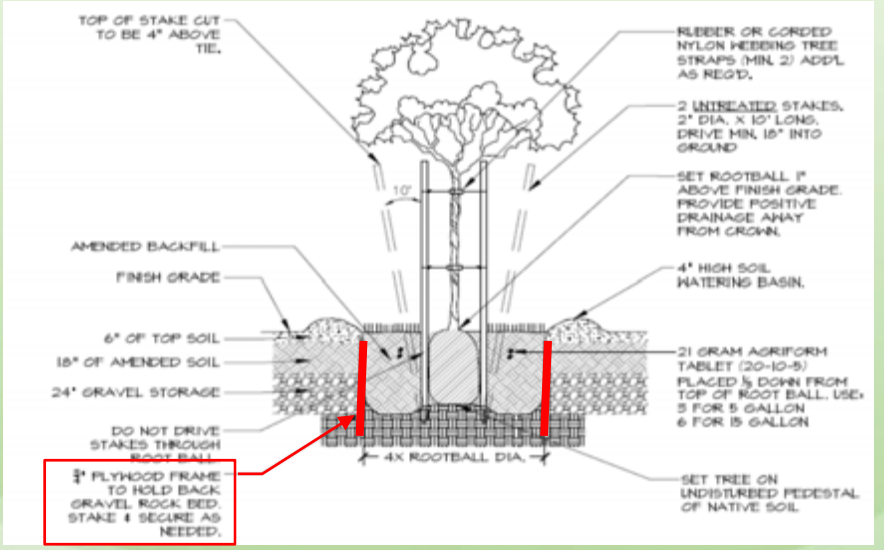
- ✓Unanticipated utilities and tree roots
  - Reduced footprints
  - Changed geometry
  - Broken irrigation lines flooded excavations

Construction Challenges

- ✓Contractors not understanding intent
  - Raised inlets should be raised
  - Keep heavy equipment off excavations
    - –Care of the infiltrative surfaces
  - Use specified soils

Construction Challenges

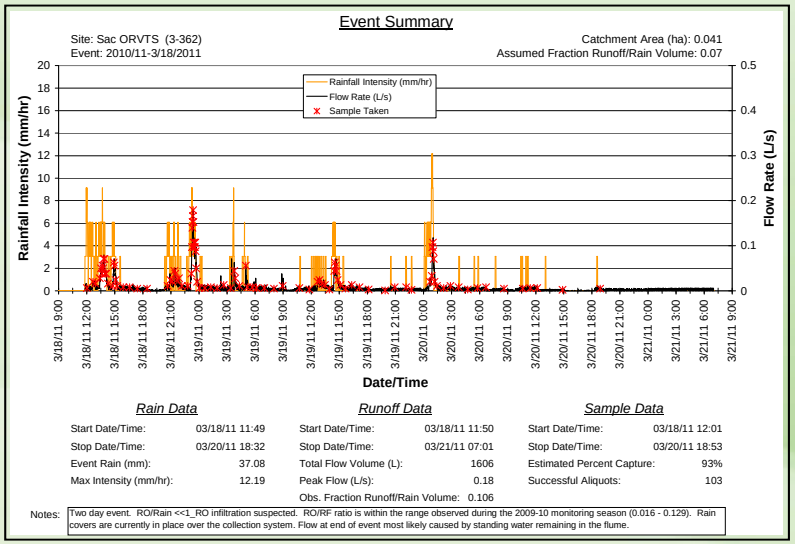
- ✓Special planting needs
  - Specified plants not available
  - Extremely hot weather
  - Need proper planting techniques, particularly for trees



Success?

Monitoring

- ✓Performance Monitoring
  - Flows (pressure heads)
  - Volumes (calculated)
  - Water Quality (grab samples)
    - TSS, TDS, turbidity
    - Chlorpyrifos & Diazinon
    - Copper, Lead, & Zinc



Preliminary Lessons Learned

- ✓Retrofit is expensive
- ✓If you think you know what's underground, there's a good chance you're wrong
- ✓Parking stalls are valuable
- ✓Need a lot of site-specific information for good design – takes time and field presence
  - Nov→ June perhaps too short for 20 sites

Preliminary Lessons Learned

- ✓Even if it is green it is still a street
- ✓Not all top soils are permeable (?)

Join us for the walking tour