Stormwater Infiltration using Dry Wells as a Low Impact Development (LID) Tool

Presented by:

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June 4, 2014

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PROUD HERITAGE. BRIGHT FUTURE.

Today's Discussion

- Background
  - California's water situation
  - Groundwater recharge (hydrologic cycle)
  - Effects of urbanization
  - Stormwater as a resource
- Use of Dry Wells as a Low Impact Development Tool
  - What is Low Impact Development?
  - What are dry wells?
- Elk Grove Dry Well Projects
  - State funded projects
  - Other projects

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Background

- California is in a severe drought
- Legislation is calling for:
  - Water reuse
  - Treating stormwater as a resource
  - Strengthen groundwater management
- A solution may be the use of dry wells for these challenges

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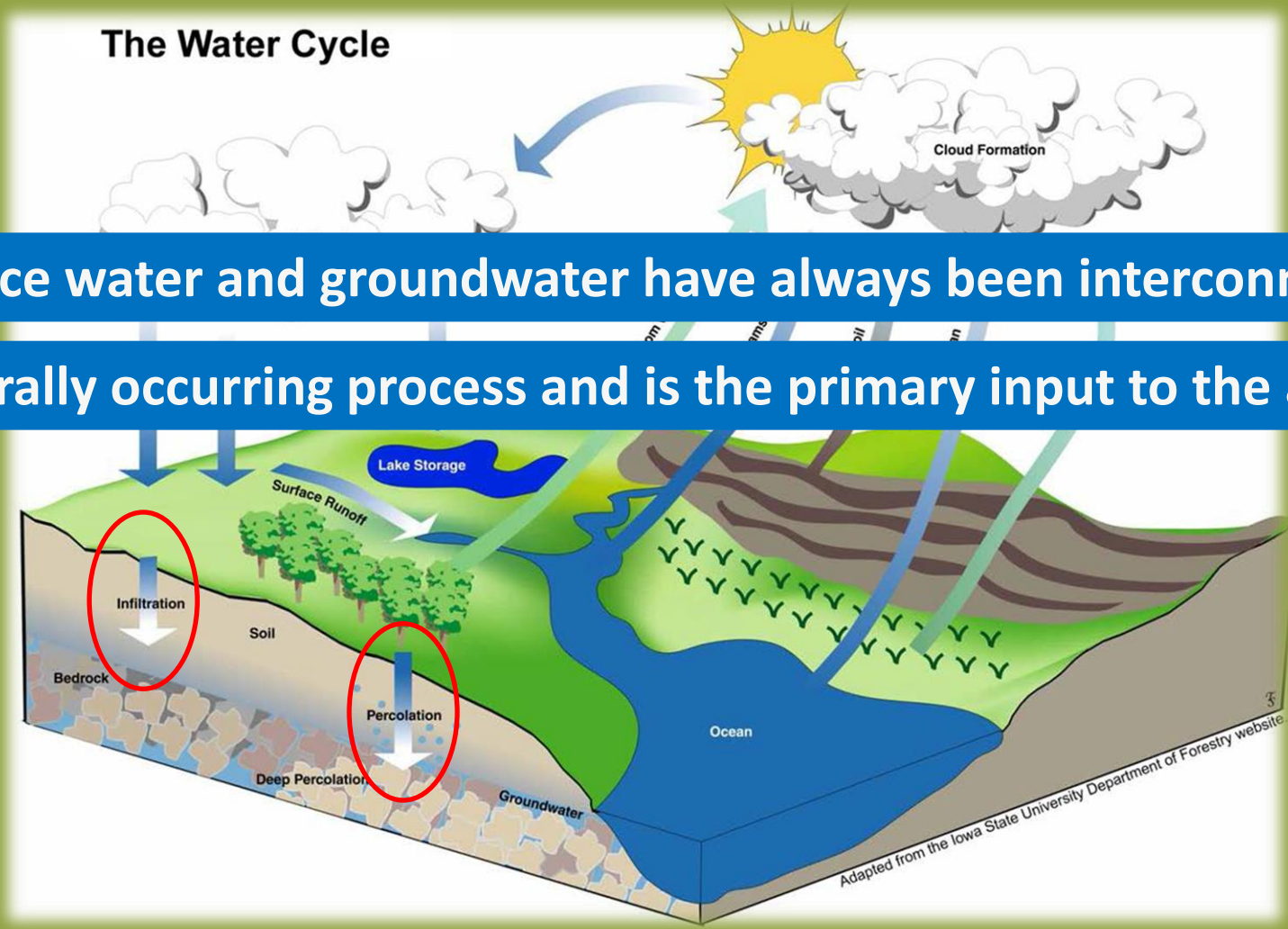
Groundwater recharge is a hydrologic process where water moves downward from the surface water to groundwater.



Surface water and groundwater have always been interconnected!

Naturally occurring process and is the primary input to the aquifer

Effects of Urbanization

- Decrease in the infiltration of rain water due to hardscapes such as building and roads
- This alteration in the natural flow patterns is called hydromodification
  - Impacts aquatic ecosystem
  - Increased flood risk

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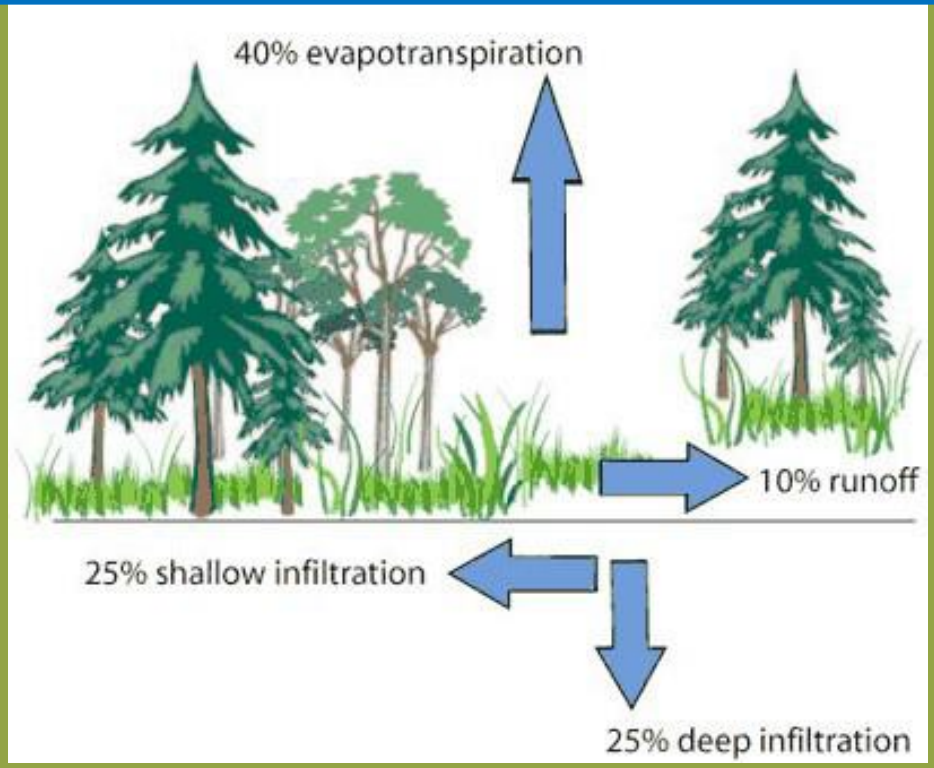
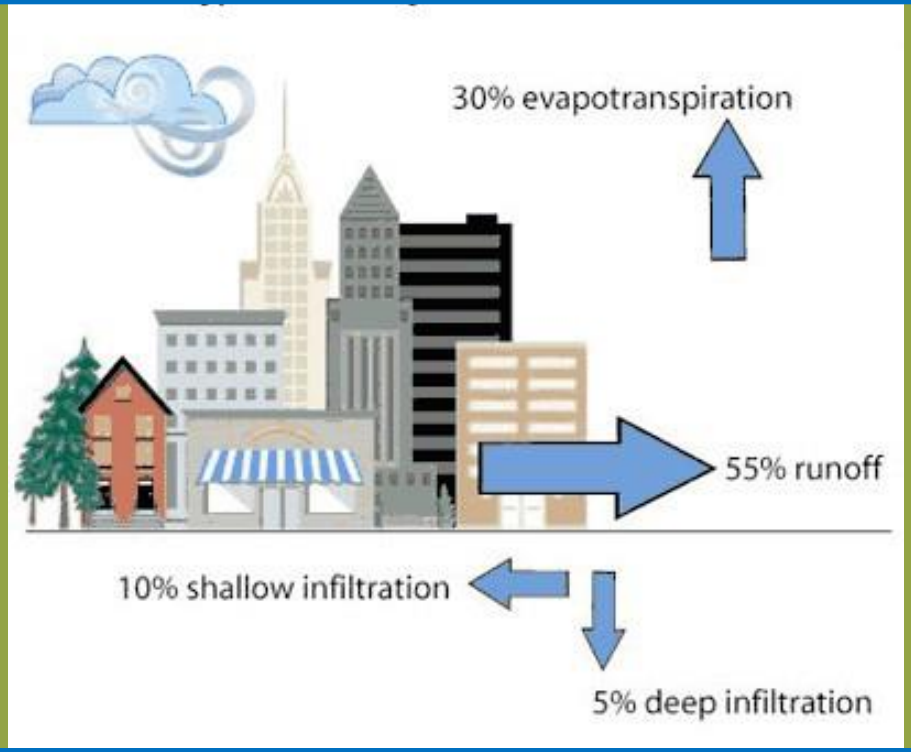
Effects of Urbanization

Typical cycle in an undeveloped area.

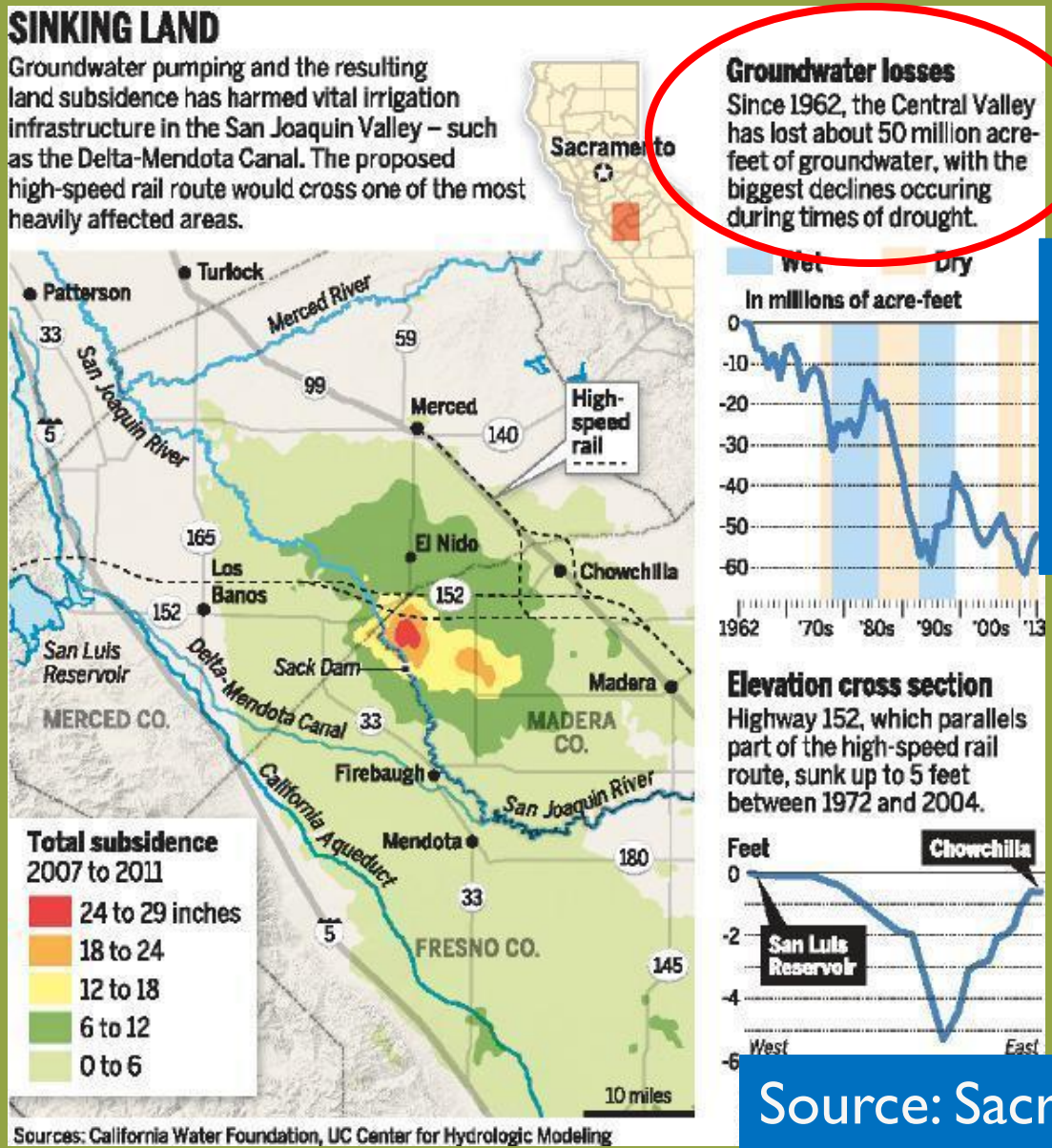


Typical cycle in an developed area.



5-fold increase in urban runoff in a developed area.

Groundwater Supplies Depleting in Central Valley in Northern California



- Sinking Land
- 50 million acre feet groundwater lost

Source: Sacramento Bee, April 2014

One Solution is to Treat Stormwater as a Resource

- Improve water quality
- Reduce urban runoff
- Provide groundwater argumentation
- Reduce localized flooding
- Provide habitat enhancement and protects aquatic resources
- Aesthetically pleasing

http://www.nwri-usa.org/documents/Boehm.pdf

"Greener approach…return to natural hydrologic regime."

Dry Wells as a Low Impact Development Tool

What is Low Impact Development?

Innovative stormwater management approach

- Mimics natural hydrology
- Manage stormwater at the source
- Captures, stores, cleanses and slowly releases stormwater (reducing peak flows)
- Water quality treatment through filtration
- Recharges stormwater to groundwater
- Treats small to medium storm events
- Mitigate flooding, erosion and reduction in sedimentation

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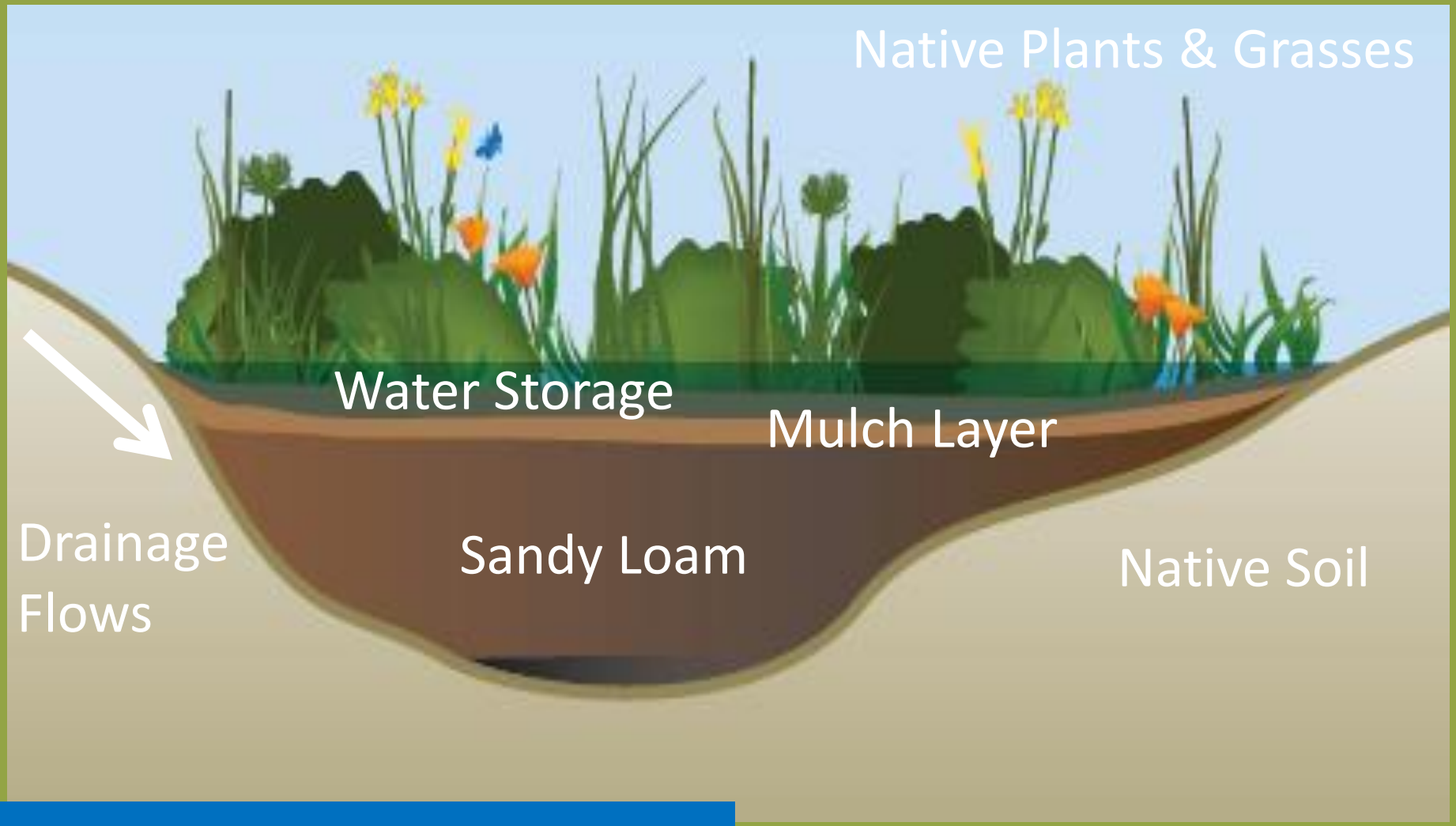
Example of Low Impact Development

Bioretention and grassy swale

Example of Low Impact Development



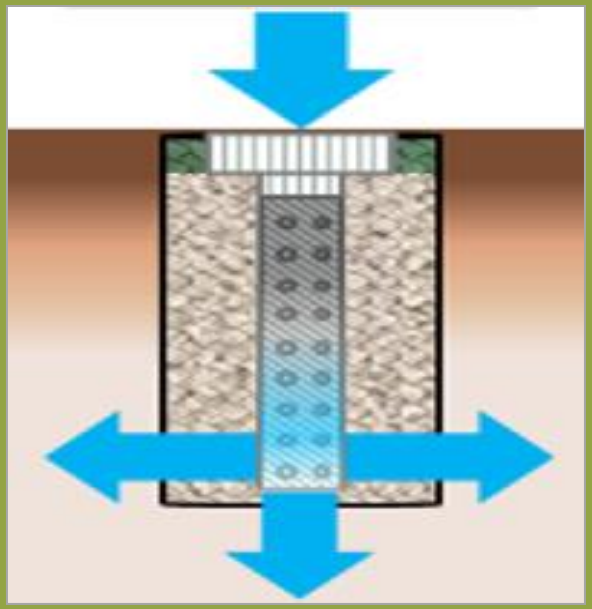
Rain gardens

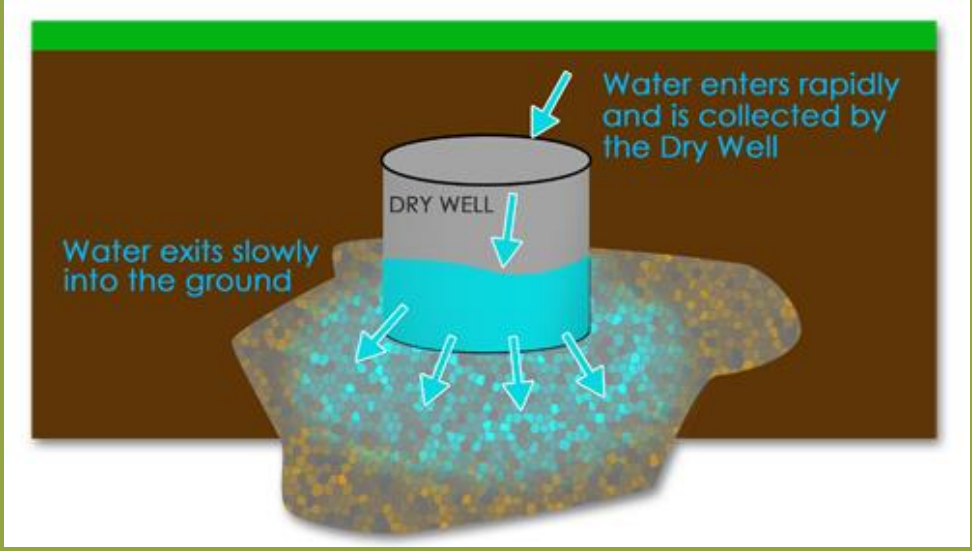
What are Dry Wells?

- Promote infiltration of stormwater runoff to recharge groundwater
- Can infiltrate stormwater through clay soils
- Use in conjunction with Low Impact Development practices

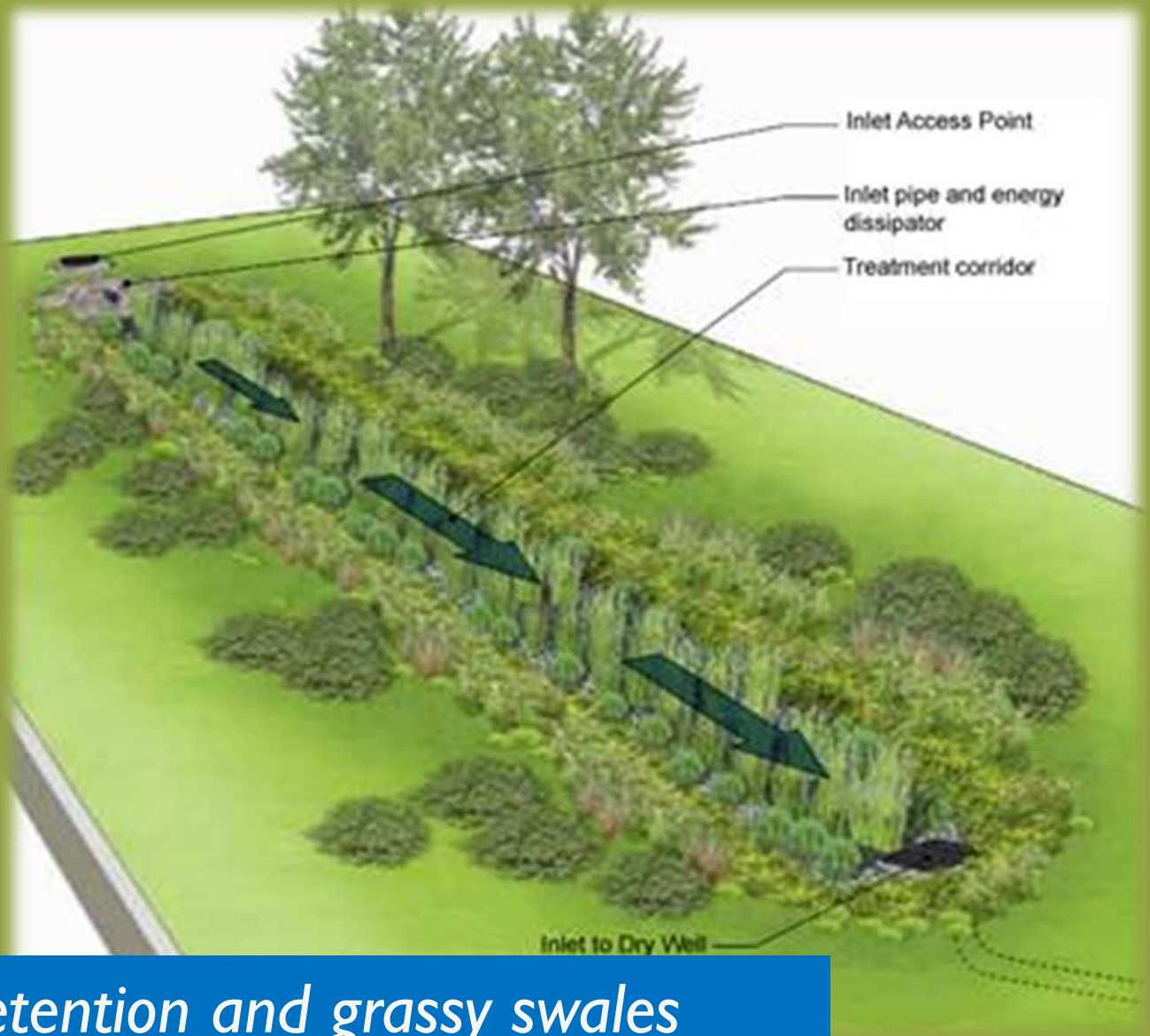
How does it Work?

- Receives water from one or more entry points
- Collect, store and disburse water
- Discharges water through small openings
- Bottom of dry well is placed at permeable soils





Example Grassy Swale and Dry Well



Bioretention and grassy swales

Challenges

- Competing regulations:
  - Water Code 13710: guidelines to prevent surface water entering water well (DWR Bulletin 74-81/90)
  - State Water Board promotes stormwater infiltration and dry wells are an important tool in the Low Impact Development tool kit
- Perception that dry wells contribute to groundwater contamination

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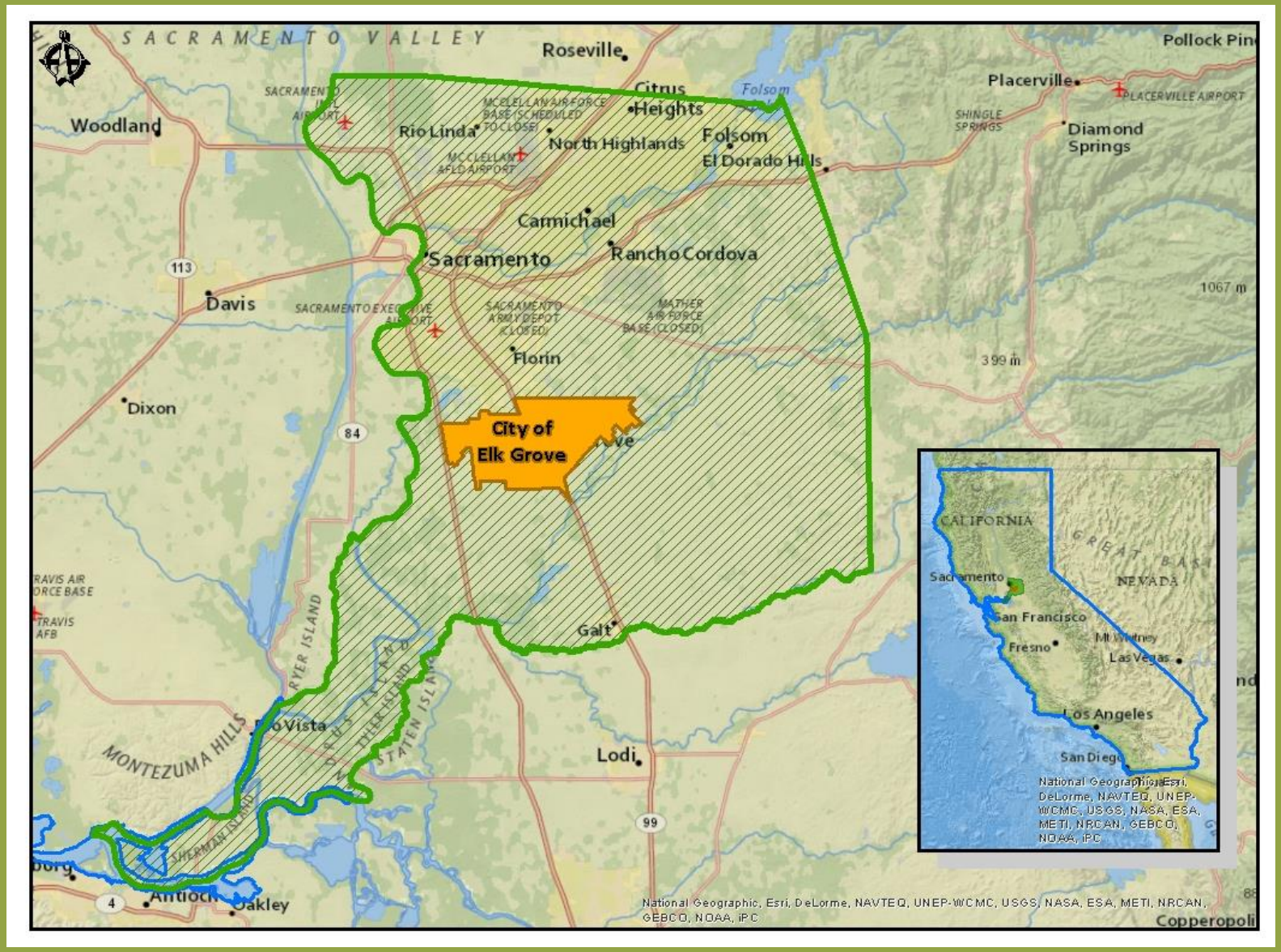
Elk Grove Dry Well Projects

City of Elk Grove, California



Project 1: Dry Wells as Low Impact Development

Background

- State funded Stormwater Grant Program
- Total project budget $825,000
- Received grant funding amount $489,820
- In-kind services $335,180

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Project Purpose

Evaluate the potential for using dry wells, in combination with low impact development practices to:

- Infiltrate stormwater runoff
- Alleviate localized flooding
- Recharge groundwater

…without negatively impacting quality of groundwater.

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Project Team

WILLDAN | extending your reach

cbec eco engineering

Hydrology | Hydraulics | Geomorphology | Design | Field Services

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OEHHA
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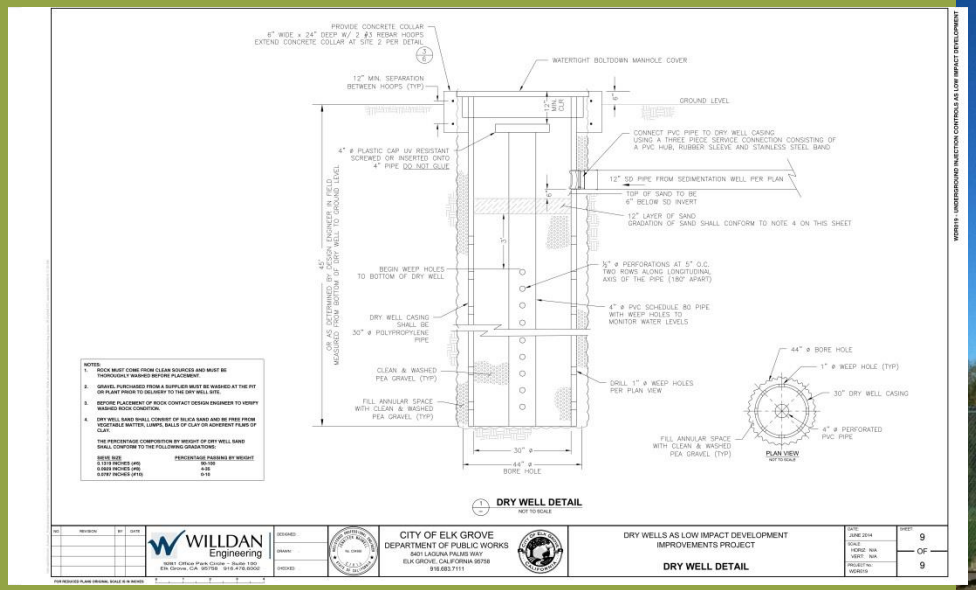
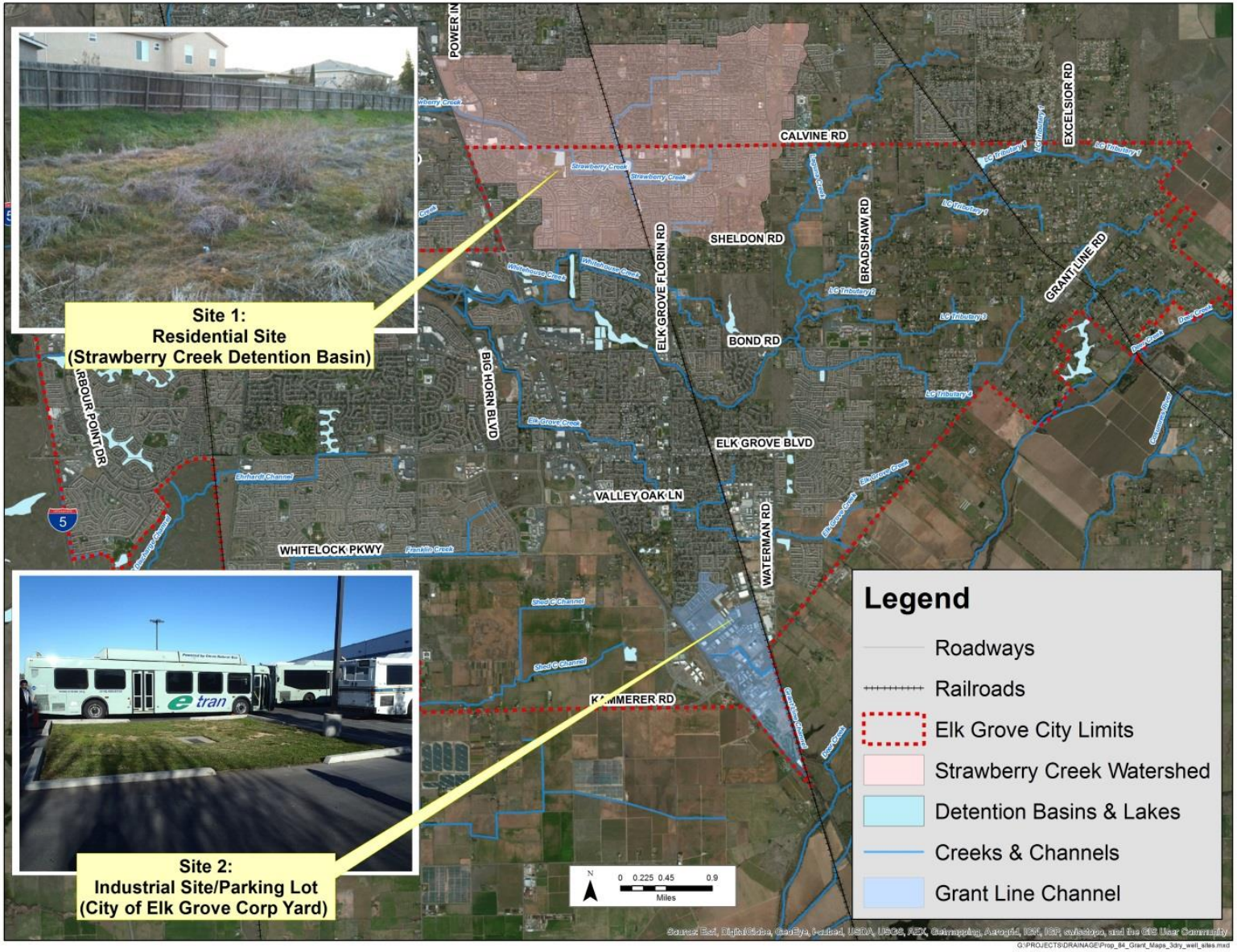
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



Phase 1:
Site Selection, Design and Construction

2012 - 2014

Project Site Locations



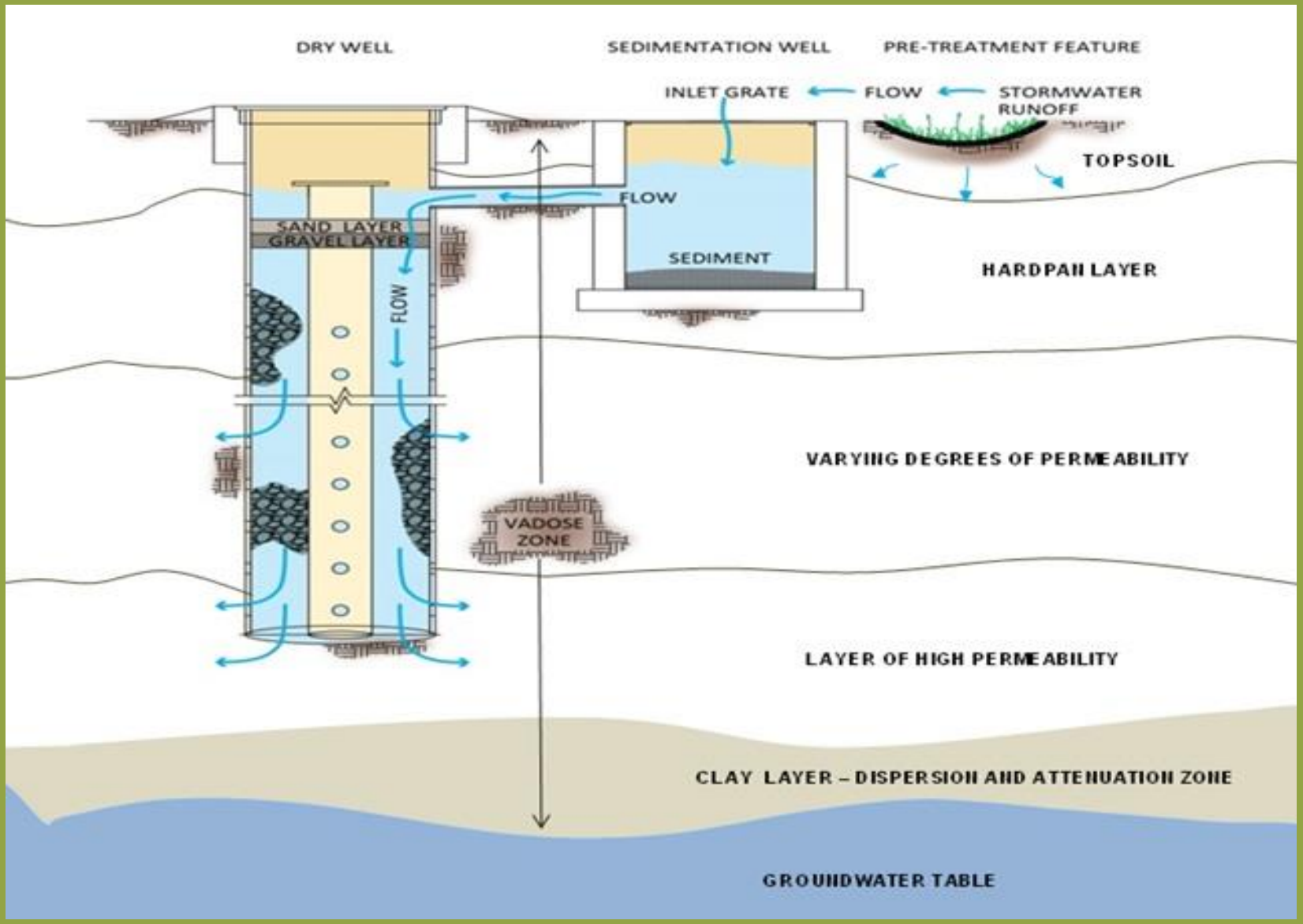
Project Site Schematic

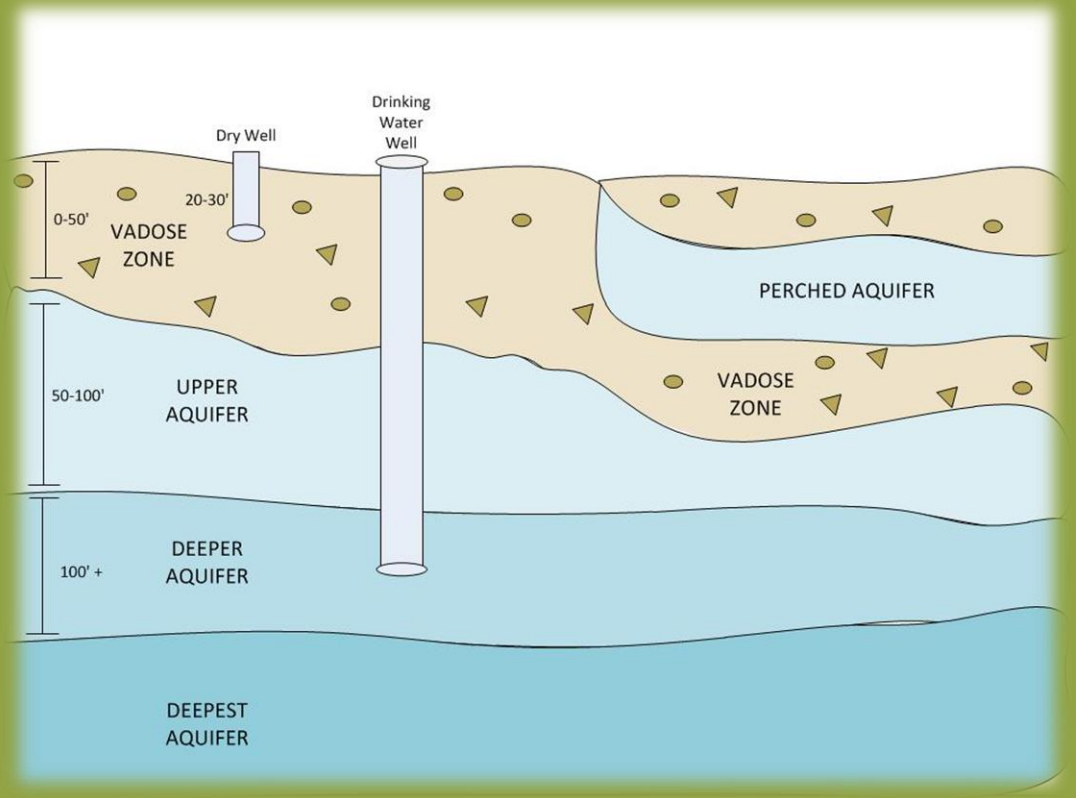
Shallow groundwater well: 55 feet

Deep groundwater wells: 110 feet

Monitoring Well Network

Dry Well Design





Phase 2: Field Study

Begins Fall, 2014

Field Study

- Collect and sample stormwater and groundwater for 2 years
  - 3 wet weather stormwater samples
  - 3 wet and 1 dry weather groundwater samples

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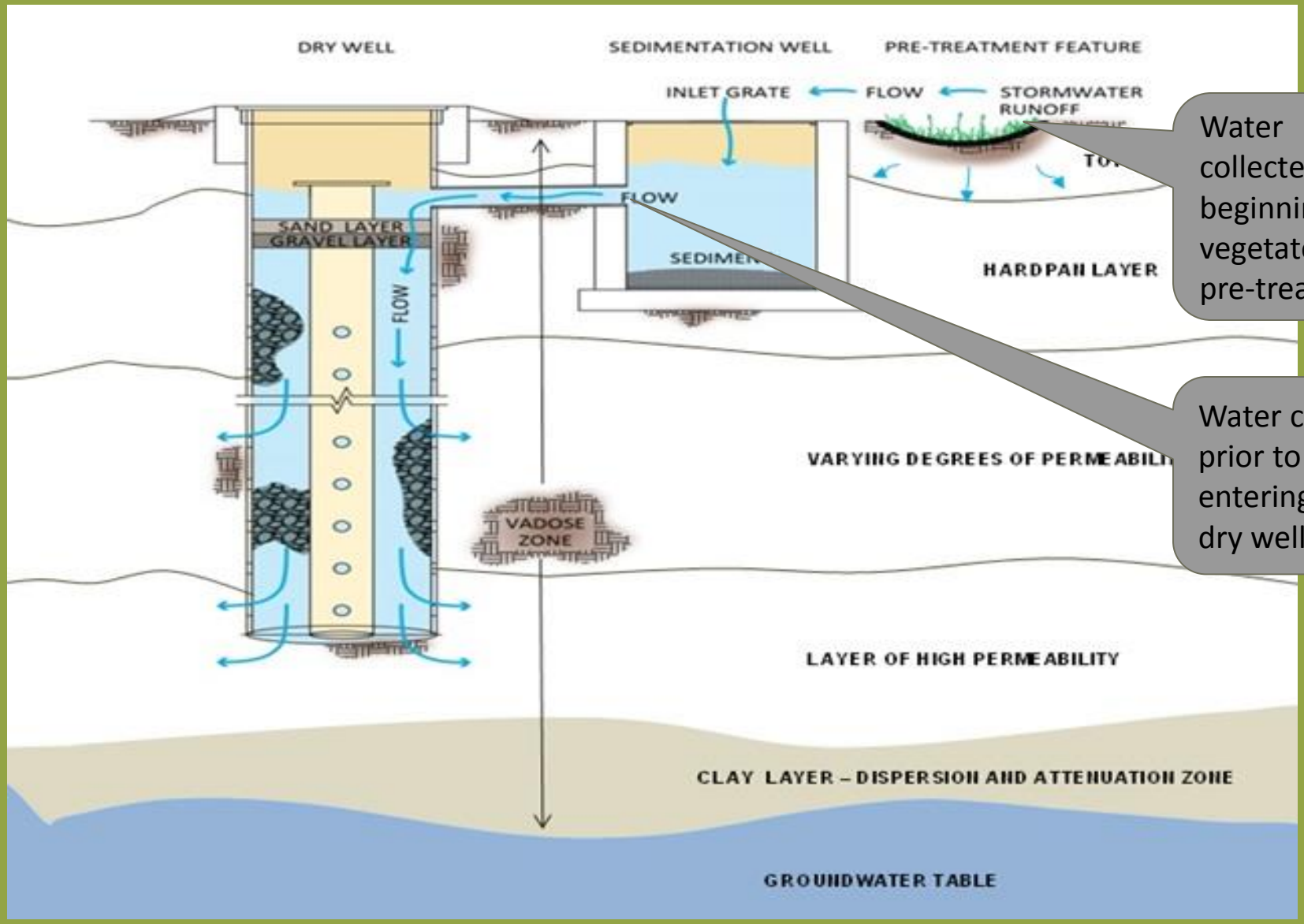
Stormwater Water Sampling



Water Quality Chemistry

- Constituents to be tested in stormwater and groundwater
  - General physical & chemical
  - Metals (EPA 200)
  - Volatiles (EPA 8260)
  - Semi-volatiles (EPA 625)
  - Herbicides (EPA 515)
  - Pyrethroids (WPCL, DFW method)
  - TPH (EPA 8015)
  - Pyrogenic PAHs (EPA 8310)
  - Total coliform

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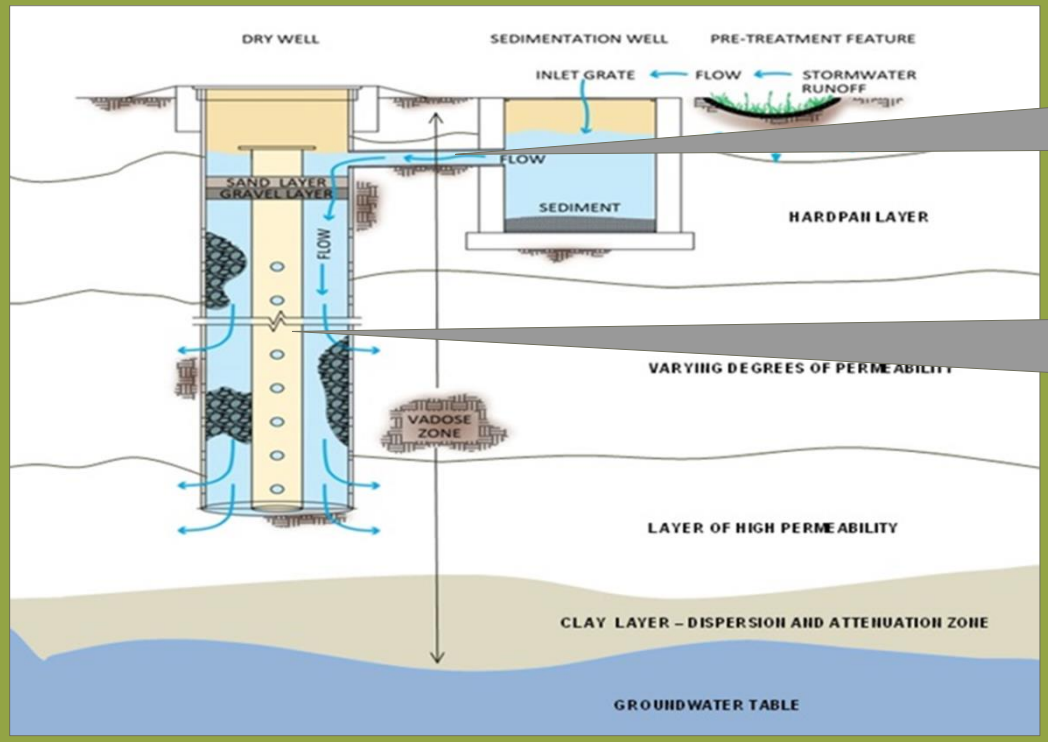
Estimate Recharge and Infiltration Capacities



Velocity sensor to monitor flow

Pressure transducer to estimate the volume of flow

Logging boring soil samples at well sites

Phase 3:
Fate and Transport Modeling

2014 - 2015

Phase 4:
Education and Outreach

Literature Review
Factsheets
Reports
Website

Questions that will be Addressed

- Primary question:
  - Are contaminants introduced into groundwater through dry wells?
- Secondary questions:
  - How effective is pre-treatment at removing contaminants and sediment from stormwater?
  - What is groundwater recharge potential?
  - What are maintenance requirements?

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Project 2: Sleepy Hollow Detention Basin Retrofit

Background

- State funded Implementation Grant
- Total project budget $850,000
- Received grant funding amount $240,000
- In-kind services $610,000

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Project Purpose

Retrofit an existing detention basin for multifunctional purposes to:

- Infiltrate stormwater runoff
- Alleviate localized flooding
- Recharge groundwater
- Improve water quality
- Provide habitat enhancement/riparian zones

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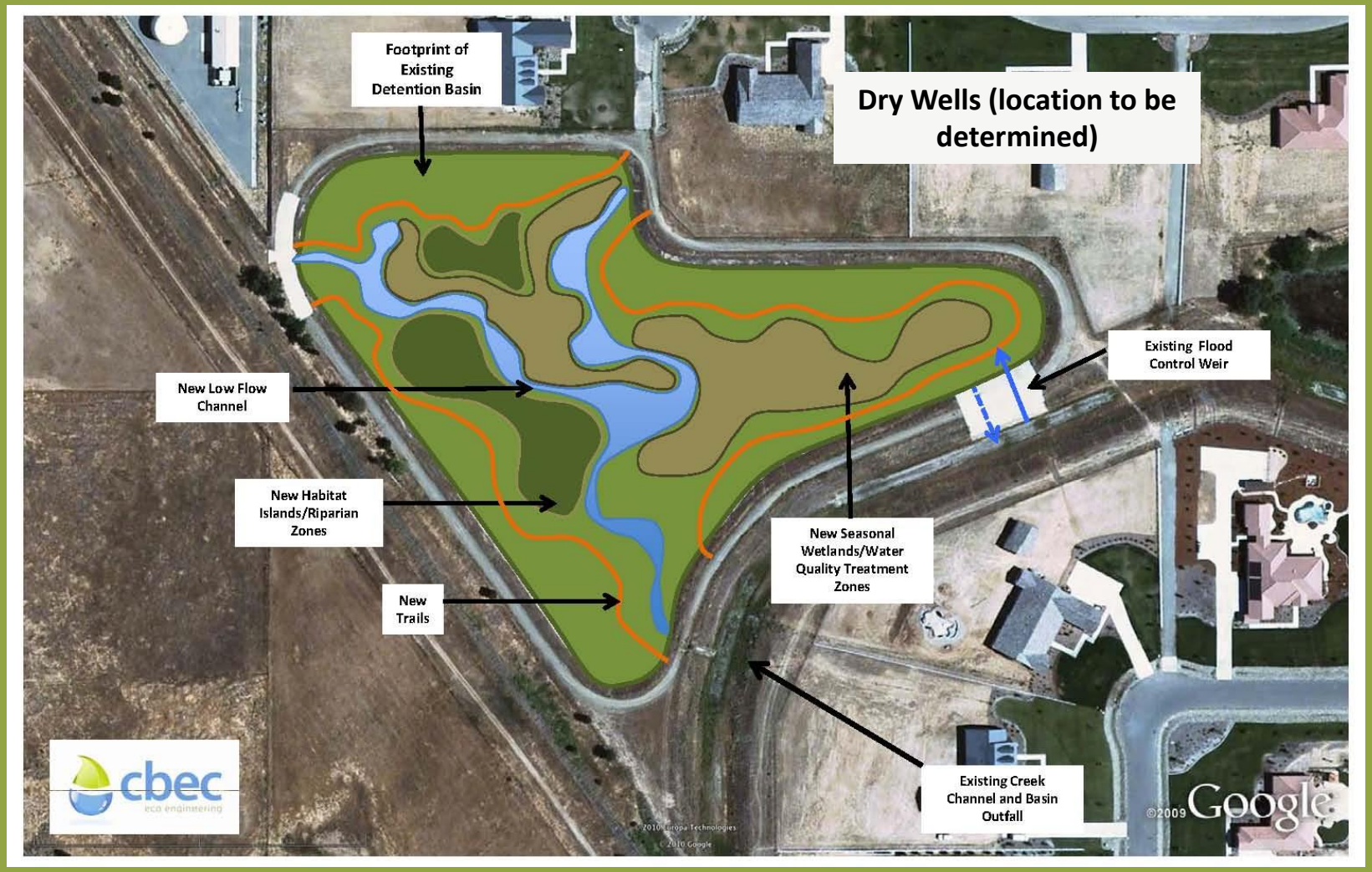
Sleepy Hollow Detention Basin



Other Elk Grove Dry Well Projects

Dry Wells Rural Roadway

- **Alternative to typical storm drain system**
- **Localized flood control**
- **Less expensive**
- **Groundwater recharge potential**

Elk Grove Rain Garden Plaza

- **Largest rain garden in California**
- **Educates sustainable stormwater practices**
- **Demonstrates Low Impact Development techniques**

"9 State and Regional Awards"

http://www.elkgrovecity.org/rain-garden/

Conclusion

- Sustainable Water Resource Management
  - Multiple purposes and beneficial uses
- Incorporate into any project
- Maintain groundwater quality
- Proposition 84 Projects
  - Provide scientific data to help local and State agency on the beneficial uses of dry wells as a Low Impact Development tool

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Contacts

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Questions?

Thank you