Quality Assurance Project Plan

SEPARATING FACT FROM FICTION: ASSESSING THE USE OF DRY WELLS AS AN INTEGRATED LID TOOL FOR REDUCING STORMWATER RUNOFF WHILE PROTECTING GROUNDWATER QUALITY IN URBAN WATERSHEDS

City of Elk Grove

Agreement No.: 12-424-550

November 8, 2013

Version 2

GROUP A ELEMENTS: PROJECT MANAGEMENT

ELEMENT 1. APPROVAL SIGNATURES

GRANT ORGANIZATION

Title:	Name:	Signature:	Date:
Project Director	Darren Wilson. P.E., City of Elk Grove		11/8/13
Project Manager	Connie Nelson, CFM, City of Elk Grove		11/8/13
QA Officer	Barbara Washburn, PhD., Office of Environmental Health Hazard Assessment (OEHHA)	BHWashburn	11/8/13

State Water Resources Control Board

Title:	Name:	Signature:	Date:
Grant Manager	Kelley List		11/8/2013
QA Officer	Renee Spears	Renée Spears	11/12/2013

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ELEMENT 3. DISTRIBUTION LIST

Table 1. (Element 3) Distribution List

Name	Organizational Affiliation	Title	Contact Information (Telephone number, email address)
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Darren Wilson, P.E.	City of Elk Grove	Project Director	916-627-3446 dwilson@elkgrovecity.org
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Casey Meirovitz, P.G.	Luhdorff & Scalmanini Consulting Engineering	Project Hydrogeologist/Team Lead	530-661-0109 cmeirovitz@lsce.com
Barbara Washburn,	Office of Environmental Health Hazard Assessment	Staff Toxicologist	916-316-7982 barbara.washburn@oehha.ca.gov

PhD.	(OEHHA)		
Gail Cho	Water Pollution Control Lab, Department of Fish and Wildlife	Lab Manager	916-358-2840 gcho@ospr.dfw.ca.gov
Mark Smith	California Laboratory Services	Lab Manager	916-638-7301 marks@californialab.com

ELEMENT 4. PROJECT AND TASK ORGANIZATION

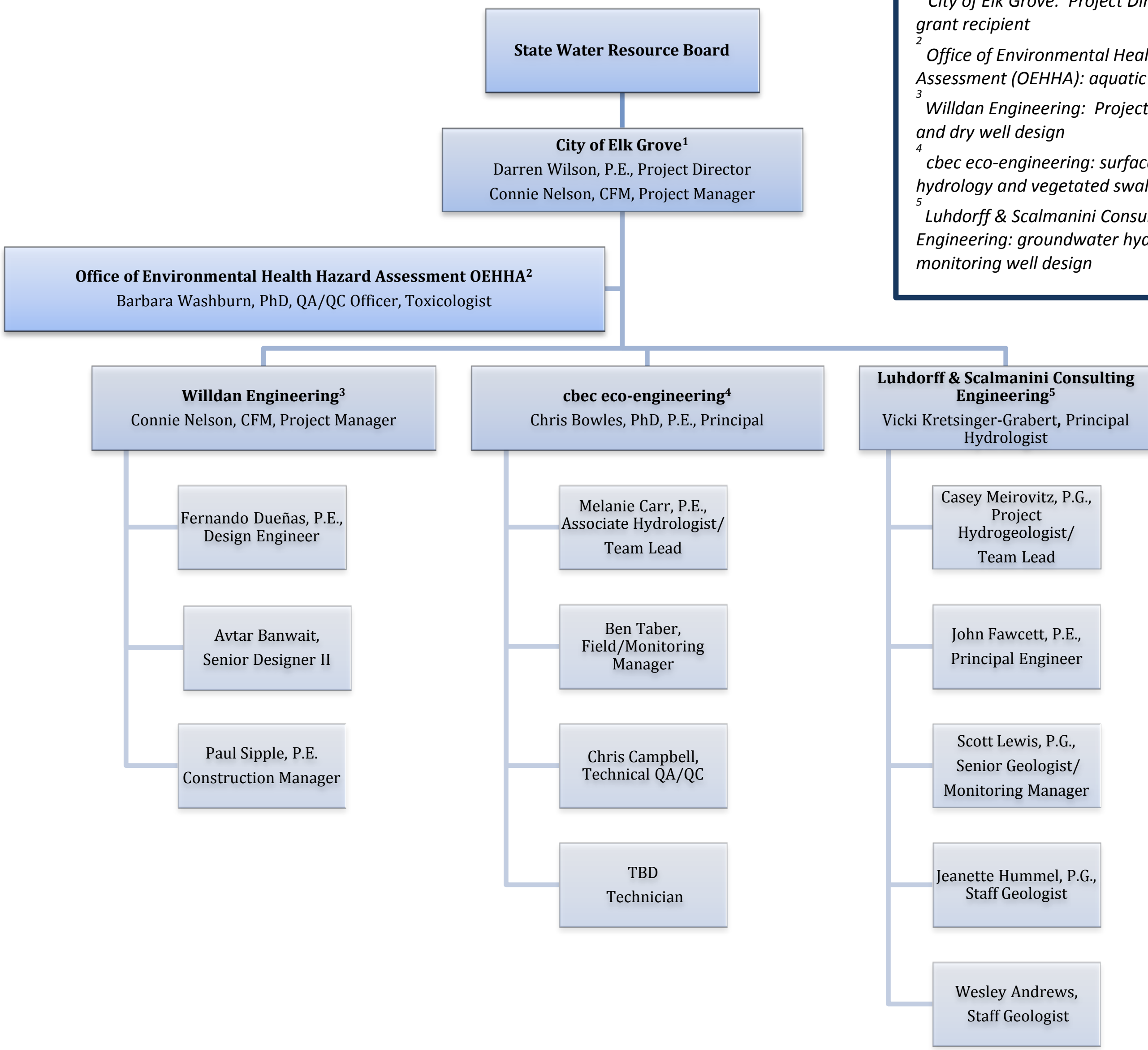
4.1 Involved Parties and Roles

Table 2. (Element 4) Personnel Responsibilities

Name	Organizational Affiliation	Title	Contact Information (Telephone number, email address.)
Darren Wilson, P.E.	City of Elk Grove	Project Director	916-627-3446 dwilson@elkgrovecity.org
Connie Nelson, CFM	City of Elk Grove/Willdan Engineering	Project Manager	916-478-3638 cnelson@elkgrovecity.org
Fernando Duenas, P.E.	City of Elk Grove/Willdan Engineering	Design Manager	916-627-3434 fduenas@elkgrovecity.org
Chris Bowles, PhD., P.E.	cbec eco-engineering	Principal	916-231-6052 c.bowles@cbecoeng.com
Melanie Carr, P.E.	cbec eco-engineering	Associate/Team Leader	916-231-6052 m.carr@cbecoeng.com
Ben Taber	cbec eco-engineering	Field Service/Monitoring Manager	916-231-6052 b.taber@cbecoeng.com
Chris Campbell	cbec eco-engineering	Technical QA/QC	916-231-6052c.campbell@cbecoeng.com
Vicki Kretsinger-Grabert	Luhdorff & Scalmanini Consulting Engineering	Principal Hydrologist	530-661-0109 vkretsinger@lsce.com

Casey Meirovitz, P.G.	Luhdorff & Scalmanini Consulting Engineering	Project Hydrogeologist/Team Lead	530-661-0109 cmeirovitz@lsce.com
John Fawcett, P.E.	Luhdorff & Scalmanini Consulting Engineering	Principal Engineer	530-661-0109 jfawcett@lsce.com
Scott Lewis, P.G.	Luhdorff & Scalmanini Consulting Engineering	Senior Geologist/Monitoring Manager	530-661-0109 slewis@lsce.com
Jeanette Hummel, P.G.	Luhdorff & Scalmanini Consulting Engineers	Staff Geologist	530-661-0109 jhummel@lsce.com
Wesley Andrews	Luhdorff & Scalmanini Consulting Engineer	Staff Geologist	530-661-0109 wandrews@lsce.com
Barbara Washburn, PhD.	Office of Environmental Health Hazard Assessment (OEHHA)	Staff Toxicologist	916-316-7982 barbara.washburn@oehha.ca.gov
Gail Cho	Water Pollution Control Lab	QA Officer	916-358-2840 gcho@ospr.dfw.ca.gov
Mark Smith	California Laboratory Services	Lab Manager	916-638-7301 marks@californialab.com

Figure 1. (Element 4) Organizational Chart



[1] *City of Elk Grove: Project Director and grant recipient*
[2] *Office of Environmental Health Hazard Assessment (OEHHA): aquatic toxicology*
[3] *Willdan Engineering: Project management and dry well design*
[4] *cbec eco-engineering: surface water hydrology and vegetated swale design*
[5] *Luhdorff & Scalmanini Consulting Engineering: groundwater hydrology and monitoring well design*

4.2 Role of Key Team Individuals

Individuals identified in the organizational chart and their roles are as follows:

City of Elk Grove

- Darren Wilson, P.E., Project Director – Grant administration and project oversight.
- Connie Nelson, CFM, Project Manager - Project quality assurance/quality control and oversight of day to day operations.

Office of Environmental Health Hazard Assessment (OEHHA)

- Barbara Washburn, PhD, QA/QC Officer, Toxicologist – Project coordination, scientific guidance and lead for education and outreach.

Willdan Engineering

- Connie Nelson, CFM, Project Manager - Project quality assurance/quality control and oversight of day to day activities.
- Fernando Duenas, P.E., Design Engineer – Designer of dry wells and technical support.
- Avtar Banwait, Senior Designer II – Design drafter for improvement plans.
- Paul Sipple, P.E., Construction Manager – Construction oversight.

cbec eco-engineering

- Chris Bowles, Principal – Project planning and review of key aspects of project.
- Melanie Carr, Associate Hydrologist/Team Lead - Manages technical work, client coordination, project oversight and day to day operations.
- Ben Taber, Field/Monitoring Manager–Manages field operations and equipment used in field sampling.
- Chris Campbell, Technical QA/QC – Project quality control, GIS analysis and technical advisor.
- TBD, Field Technician - Performs desktop project work and field work at the direction of supervisors.

Ludhorff & Scalmanini Consulting Engineering:

- Vicki Kretsinger Grabert, Principal Hydrologist – Project analysis and review of key aspects of project, expert in California groundwater law/policy, geochemistry/water quality, and fate and transport in hydrologic systems.
- Casey Meirovitz, P.G., Project Hydrogeologist - Project technical work, client coordination, project oversight, and day-to-day activities.
- John Fawcett, P.E., Principal Engineer – Project technical expertise relating to facility well/water systems design, groundwater chemistry, facility operations and maintenance, and managerial oversight and technical insight.
- Scott Lewis, P.G., Senior Geologist /Monitoring Manager- Project technical insight relating to facilities design and monitoring, expertise relating to construction management/logistics, and manages all field activities and staff.
- Jeanette Hummel, P.G., Staff Geologist -Project technical analysis and field work.
- Wesley Andrews, Staff Geologist - Project technical laboratory and field work including construction inspection and oversight.

4.3 Role of Technical Advisory Committee

The project convened a Technical Advisory Committee (TAC) of diverse, well qualified stormwater and groundwater experts. There are eleven individuals with expertise in stormwater, groundwater, dry wells, and monitoring wells that will severe in an advisory role for the project. The TAC's input and feedback will be of significant value to achieve the Project's goals and outcomes. The list of TAC members are as follows:

Name		Agency
1.	Annalisa Kihara, PE, Water Resource Control Engineer, Stormwater Unit	State Water Resources Control Board, Division of Water Quality
2.	Dana Booth, PG, QSD, Program Manager, Stormwater Quality	Sacramento County Department of Water Resources and Sacramento Stormwater Quality Partnership
3.	Darrell Eck, Senior Civil Engineer	Water Supply Planning and Development Sacramento County Water Agency
4.	Genevieve Sparks, Environmental Scientist	Central Valley Regional Water Quality Control Board, Stormwater MS4 Program
5.	John Borkovich, P.G., GAMA Program Manager	State Water Resources Control Board, Division of Water Quality
6.	Julie Haas, PE, Senior Engineer	California Department of Water Resources, Division of Integrated Regional Water Management
7.	Mark Madison, General Manager	Elk Grove Water
8.	Paul Marshall, P.G.	Laguna Creek Watershed Council
9.	Rob Swartz, PG, CHG	Regional Water Authority, Sacramento Groundwater Authority
10.	Susan Williams, M.S.	Sacramento County Environmental Health Department, Well Program – Permitting & Enforcement, Environmental Compliance Division
11.	Elaine Khan, PhD	Chief Water Toxicology Branch, Office of Environmental Health Hazard Assessment (OEHHA), Cal/EPA

4.4 Persons Responsible for Quality Assurance Project Plan Update and Maintenance

Dr. Washburn will be the individual responsible for making changes to the Quality Assurance Project Plan and will provide updates, in consultation with project team, as needed.

Element 5. Problem Definition and Background

5.1 Problem Statement

In many areas throughout California, the use of low impact development (LID) practices is challenging due to poor infiltrative capacity of clay soils. Dry wells offer a solution to this problem because they allow runoff to bypass the upper layers of clay, thus avoiding a major obstacle to infiltration. In neighboring states such as Arizona and Oregon, dry wells are used extensively as stormwater management tools. However, in California, they are used infrequently and with caution due to the concern that they provide a conduit for contaminants to enter the groundwater.

The basis for this concern is that dry wells allow stormwater to bypass much of the natural filtration and degradation of contaminants that occurs in the upper, aerobic units of the soil, allowing pollutants to pass directly into the deeper, vadose zone. Although two studies conducted in California suggest the risk of groundwater contamination is minimal, in many cases regulators and stormwater/groundwater managers have been reluctant to use or permit these types of wells. In addition, stormwater runoff that drains into local creeks may cause degradation of water quality and damages aquatic habitat and LID practices could help to minimize this problem. Therefore, the purpose of this study is to help fill in data gaps, quantify the risk of groundwater contamination, and investigate the effectiveness of vegetated pre-treatment and natural attenuation through a systematic, field-based investigation.

5.2 Background Studies

The project involves a combination of summarizing and assessing existing dry well monitoring research as well as conducting new research. There is a limited amount of research related to dry wells available. All reports and peer-reviewed literature will be evaluated and summarized in a literature review. Particular attention will be given to information from other communities that use and/or have studied dry wells such as Los Angeles and Modesto[2]. While these reports provide useful information, in various ways, each of the studies had limitations. In the Los Angeles study, a single dry well site with a monitoring well was included in their project and pre-treatment was not used prior to runoff entering the dry well. The Modesto study's purpose was to evaluate groundwater quality, not the relationship between dry wells and groundwater quality. In this study, relationships between specific dry wells and upgradient or downgradient monitoring wells were not identified. Also, neither study examined pyrethroids in stormwater or groundwater.

In addition to reviewing studies and reports on dry well, local stormwater data can also lend insight into potential risks to groundwater quality. The Sacramento Stormwater Quality Partnership has collected receiving water data associated with rain events for the past 5+ years at two locations along Laguna Creek. This information provides insight into the risk of contamination that might be linked to the use of dry wells. The receiving water sampling sites were located along Laguna Creek at Franklin Boulevard, as well as one adjacent to Highway 99 near the cemetery. Appendix 3 contains a preliminary summary of the findings from these locations. Briefly, at both locations, there were a small number of low level exceedances of water quality guidelines. The exceedances were associated primarily with bacteria and some metals. While detections of pyrogenic polycyclic aromatic hydrocarbons, pesticides, and semi-volatile organics were found, none exceeded a regulatory or health based standard. Although effluent (stormwater) was not directly measured, this data does provide some indication of the potential nature of contaminants in stormwater. Further analysis will be performed on the Sacramento Stormwater Quality Partnership data as it is generated and comparisons will be made with data from this project.

[2] Los Angeles San Gabriel River Watershed Council's Water Augmentation Study posted at http://watershedhealth.org/programsandprojects/was.aspx; USGS's 2008 Hydrogeology, water chemistry, and factors affecting the transport of contaminants in the zone of contribution of a public-supply well in Modesto, eastern San Joaquin Valley, California posted at http://pubs.usgs.gov/sir/2008/5156/pdf/sir20085156.pdf.

5.3 Decisions or Outcomes

A document summarizing lessons learned will be produced from the project findings. This document will contain recommendations on dry well construction, pre-treatment and appropriate uses and benefits of dry wells. In addition, findings will be compiled into a literature review and a series of factsheets, all of which will be posted on project's website. All information will be assembled with the goal of providing science-based information on the risks and benefits of dry wells to stormwater/groundwater managers and interested stakeholders.

5.4 Water Quality or Regulatory Criteria

A list of all contaminants and their regulatory/action limits are itemized in Appendix 2.

ELEMENT 6. PROJECT AND TASK DESCRIPTION

6.1 Work statement and produced products

Study Design and Approach

The project will design and construct one dry well system with a groundwater monitoring well network. The dry well system is a treatment train of three features: 1) a vegetated pre-treatment area that will infiltrate and/or slow and filter sediment out of stormwater runoff, 2) a structural pre-treatment sedimentation well that permits particles and associated pollutants to settle, and 3) the dry well with additional filtration through sand and gravel.

At each site, three groundwater monitoring wells will be installed: one up-gradient and two down-gradient of the dry well system to facilitate the assessment of the introduction of contaminants through the dry well. The upgradient well will provide information on the baseline water quality while the two downgradient wells will assess the affects, if any, of the dry well on downgradient groundwater quality. One downgradient vadose zone well will also be installed within 20 feet downgradient of the dry well as an aide to trace the movement of contaminants that pass through the dry well.

Monitoring of total suspended sediment and pyrethroid concentrations will be measured at the entrance to the vegetated area and just prior to entering the dry well in order to determine the effectiveness of the pre-treatment features at reducing two common urban contaminants: excess sediment and pyrethroids. Stormwater and groundwater samples will be analyzed for organic and inorganic contaminants commonly found in stormwater, including pesticides, metals, and volatile/semi-volatile organics. Samples from both wet and dry seasons will be compared to assess changes in groundwater quality.

At each site, stormwater and groundwater samples will be collected for analysis for a minimum of three times each year for two years. Evaluations of contaminants in stormwater and/or groundwater will be compared to understand the following:

- Differences in stormwater quality before and after runoff has passed through the vegetated and structural pre-treatment features to evaluate the effectiveness of pre-treatment.
- Differences between stormwater just prior to entering the dry well, water in the vadose zone and aquifer, measured at various depths and distances from the dry well, to evaluate potential pollutants introduced from the dry well.

- Differences in upgradient and downgradient groundwater quality to compare background groundwater quality with groundwater influenced by dry well inputs.
- Differences between stormwater, vadose zone, and groundwater quality. This information will provide an insight into the treatment of runoff in the vadose zone and attenuation of contaminants by the confining clay layers that exist at the two sites.

Results and deliverables from this project will include:

- Two factsheets on dry wells.
- A literature review of approximately ten reports/journal articles addressing the relationship between dry wells and groundwater quality.
- Presentations at meetings and conferences.
- A draft scientific paper.
- A "lessons learned" guidance document targeted at engineers, scientist, and groundwater/stormwater managers.
- A list of interested stakeholders.
- A project website that will contain not only information from this project, but numerous links to other sources of high quality information on dry wells.
- Progress reports and a final report.

6.2. Constituents to be Monitored and Measurement Techniques

A list of all constituents to be analyzed is provided in Appendix 2. The parameters of greatest interest to the study are those that are commonly found in stormwater such as pyrethroid pesticides, some combustion by-products, certain metals, and nitrates. However, no assumptions will be initially made regarding which contaminants will be detected at the two sampling sites. Initially, a wide range of potential contaminants, including combustion by-products, volatile organics, metals, diesel and gasoline by-products, herbicides and pyrethroid pesticides, coliform bacteria, and total suspended solids will be measured in both stormwater and groundwater.

As the study progresses, and if this large group of contaminants are not detected in stormwater or groundwater, fewer pollutants will be analyzed at subsequent monitoring events, as described in the sampling plan in Section 6.1. Conventional water quality parameters such as pH and turbidity will be measured in the field, while groundwater and stormwater samples will be collected and taken to analytical laboratories for the measurement of contaminants. The details of sample collection and field and laboratory measurements are described in Elements 10 – 14.

6.3 Project Schedule

The project schedule is depicted below with beginning and completion dates for project tasks in Table 3.

Table 3. (Element 6) Project Schedule

DESCRIPTION	BEGINS	COMPLETED
Project Assessment and Evaluation Plan and Quality Assurance Project Plan including Monitoring Plan.	April 1, 2013	July, 2013
Design Plans - Pre-treatment , Dry Wells and Monitoring Wells	April 1, 2013	July 2013
Monitoring Well Installation	October 2013	October 2013
Dry Well and Structural Pre-treatment installation	May 2014	October 2014
Year 1 Monitoring	October 2014	March 2016 estimated
Year 1 Data Analysis and Interpretation	December 2014	June 2015
Year 2 Monitoring	September 2015	March 2016 estimated
Year 2 Data Analysis and Interpretation	December 2015	December 2016
Project Team and TAC Report of Results and Interpretations	January 2015	December 2016
Education, Outreach and Organization Capacity Building (factsheets, literature review, conferences, etc.)	March 2013	March 2017
Draft Scientific Paper and Summary of TAC Peer Review Comments	June 2016	December 2016
Lessons Learned Guidance Document	June 2016	January2017

6.4 Geographical Setting

Two sites have been selected for the study and are identified and described below with the GPS coordinates in Table 4.

Table 4. (Element 6) Location of Two Study Sites

Site	Land Use Type	Latitude	Longitude
Strawberry Creek Water Quality Basin	Residential	38° 27' 4"	-121° 23' 29"
Elk Grove Corporation Yard	Transit and Police Department fleet, maintenance, parking lot	38° 23' 8"	-121° 21' 37"

These two sites (Figure 2) were selected based on input from the Project's Technical Advisory Committee and the State Water Board. The residential site receives runoff from a large sub-division. Stormwater from this site drains into the Strawberry Creek Water Quality basin. The commercial/light industrial site is the City of Elk Grove's Corporation Yard which includes a large parking lot. The Corporation Yard is a three acre site which is 98% impervious. This site is used as the City's operation maintenance and transit and police facilities. It houses the City's transit and police fleet and maintenance vehicles; provides fueling for these vehicles, is the maintenance/repair facility for the transit fleet, and has City offices for Public Works.

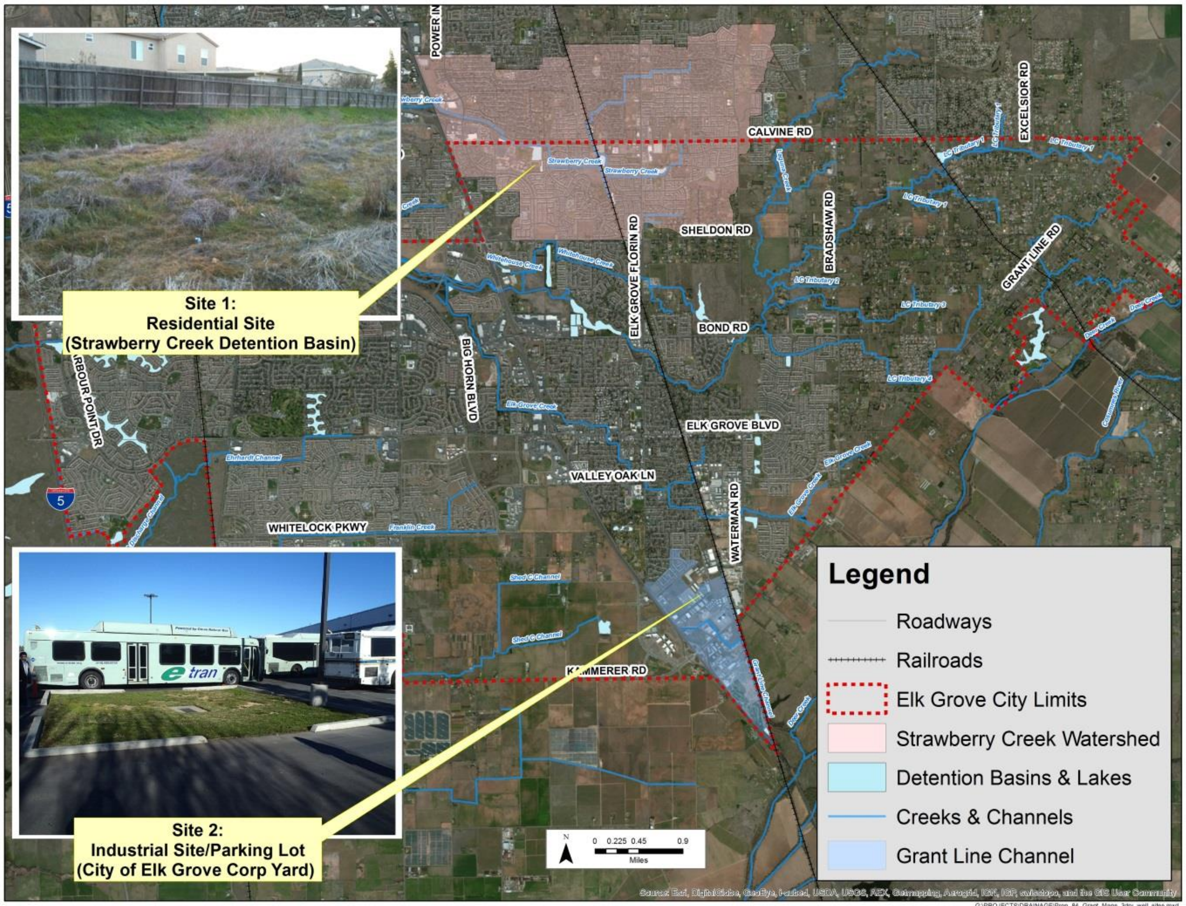


Figure 2. (Element 6) Map of Study Sites.

The Strawberry Creek sub-watershed is part of the larger Morrison Creek watershed. The Grant Line Channel sub-watershed is part of what is known as Shed C, a largely constructed drainage area composed of channels and ditches, which drains into the Stone Lakes National Wildlife Refuge west of Elk Grove.

6.5 Constraints

Sample acquisition will be limited to rain events of a minimum of ½" in 24-hours. The City monitors National Weather Service[3] forecasts on a daily basis during the rainy season. These forecasts contain alerts 3 – 4 days in advance of storm events. The City will send out an alert to the Project Team when there is a reasonably likelihood (50% or greater probability) that an event will generate the minimum volume. If storms produce less rain than the threshold, samples will not be collected. During the 2012-13 water year, there were 10 events ½" or larger with approximately 15-inches total; and in the 2011-12 water years, there were 17 events greater than ½" with approximately 18-inches total.

It is expected that during the dry season the vadose zone will not contain sufficient water to collect a sample. It is also possible that the vadose zone will not contain sufficient water for sampling during some wet season sampling events. In this case, the scope of analysis may be limited to samples collected from monitoring wells

[3] Posted at: http://www.wrh.noaa.gov/forecast/wxtables/index.php?lat=38.4087993&lon=-121.37161779999997&clrindex=0&table=custom&duration=7&interval=6

completed at the water table. Regardless of conditions in the vadose zone, differences between upgradient and downgradient groundwater quality, and differences between surface water and groundwater quality will be determined and analyzed.

ELEMENT 7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Table 5 identifies the different classes of contaminants that will be analyzed and associated data quality indicators.

Table 5. (Element 7) Data Quality Indicators

Measurement or Analyses Type	**Applicable Data Quality Indicators**
Laboratory Measurements	
1. Total suspended solids (EPA 160.2)	Accuracy, precision, recovery, completeness
2. Pyrethroid pesticides (WPCL Method 53)	Accuracy, precision, recovery, completeness
3. Chlorinated herbicides (EPA 8151A)	Accuracy, precision, recovery, completeness
4. Total petroleum hydrocarbons (EPA 8015-diesel and gas)	Accuracy, precision, recovery, completeness
5. Pyrogenic polycyclic aromatic hydrocarbons (EPA 8310)	Accuracy, precision, recovery, completeness
6. Semi-volatile organics (EPA 625)	Precision, presence/absence, completeness
7. Volatile organics (EPA 8260B)	Accuracy, precision, recovery, completeness
8. Drinking water metals (EPA 200 series)	Accuracy, precision, completeness
9. General physical (EPA STDM)	Accuracy, precision, completeness
10. General mineral (EPA STDM)	Accuracy, precision, completeness
11. Total coliform (SM 9221)	Precision, presence/absence, completeness
Field Measurements	
1. Surface water flow	Accuracy, precision, completeness
2. pH	Accuracy, precision, completeness
3. Temperature	Accuracy, precision, completeness
4. Electric conductivity	Accuracy, precision, completeness
5. Dissolved oxygen	Accuracy, precision, completeness
6. Turbidity	Accuracy, precision, completeness

As indicated in Table 5, accuracy, precision, and completeness will be determined on both field and laboratory samples. Specific steps used to assess both parameters are discussed in detail in Element 14.

Stormwater data collected from this study's two sites, along with the Sacramento Stormwater Quality Partnership data from Laguna Creek, have been reviewed and will serve as an initial estimate of contaminants that have been released into receiving waters in the past. A summary of this data is presented in Appendix 3.

The following table identifies the various classes of contaminants and relevant measurement quality objectives for each class.

Table 6. (Element 7) Measurement Quality Objectives for Field Data

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limit	Completeness
	1. Total suspended solids (EPA 160.2)	50-150%	20%	50-150%	Varies (2.0 – 8.0 mg/L)	
Laboratory Measures	2. Pyrethroid pesticides (WPCL #53)	50-150%	< 25%	50-150%	0.002-0.010 µg/L, varies with analyte	90%
	3. Chlorinated herbicides (EPA 8151A)	50-150%	15%	50-150%	0.004-0.112 µg/L	90%
	4. Total petroleum hydrocarbons (EPA 8015-diesel and gas)	50-150%	<25%	Gas: 68-132% Diesel: 46-137%	Gas: 50 µg/L Diesel: 0.05 mg/L	90%
	5. Pyrogenic polycyclic aromatic hydrocarbons (EPA 8310)	50-150%	25%	Ref: 70-130%; Matrix: 50-150%	0.2 µg/L, except B[a]P, 0.1 µg/L	90%
	6. Semi-volatile organics (EPA 625)	12-127%, depending on analyte	<25%	Ref: 70-130% Matrix: 50-150%	10 µg/L	90%
	7. Volatile organics (EPA 8260B)	50-150%	15%	Ref: 70-130% Matrix: 50-150%	0.5 µg/L	90%
	8. Drinking water metals (EPA 200 series)	75-125%	25%	75-125%	Varies (0.17-1.35 ppb)	90%
	9. General physical (EPA STDM)	80-120%	20%	80-120%	Color: 0 Turbidity: 0.50 NTU Odor: 1 TON pH 0.000 units EC: 1.0 µS/cm	n/a
	10. General mineral (EPA STDM)	80-120%	20%	80-120%	Alk.: 5.0 mg/L Anions: 0.1-2.0 mg/L MBAS 0.10 mg/L GM metals: 1.0 mg/L TDS: 10 mg/L	n/a
	11. Total coliform (SM 9221)	Neg control – no growth; Pos control – 80-120% recovery	25%	n/a	1.1 MPN/100 ml	*90%*
Field Measures	Surface water flow	5% of flow	8%	n/a	n/a	90%
	pH	+/- 0.2 pH units	5%	n/a	n/a	90%
	Turbidity	2% NTUs	5%	n/a	n/a	90%
	DO	0.2 ppm	5%	n/a	n/a	90%
	Electric conductivity	1% of µS/cm	5% of µS/cm	n/a	n/a	90%
	Temperature	0.2 C	5% of C	n/a	n/a	n/a

Element 8. Special Training Needs and Certification

8.1 Specialized Training or Certifications

Relevant project personnel have advanced degrees in surface water or groundwater hydrology. No additional training or certification is needed by personnel. New staff will be trained in the use of the instruments and sample collection methods by experienced staff at cbec and Luhdorff & Scalmanini for monitoring. After initial training, staff will be observed performing water collections, handling and using instruments in the field, and completeness and accuracy of records. If errors are observed, re-training will occur until all work can be completed properly.

8.2 Training Personnel

Specialized personnel training and certification are indicated in the table below:

Table 7. (Element 8) Specialized Personnel Training or Certification

Specialized Training Course Title or Description	Training Provider	Personnel Receiving Training/ Organizational Affiliation	Location of Records & Certificates *
Stormwater Field Measurements	Melanie Carr, M.S. cbec eco-hydrologist	Technician TBD Ben Taber	cbec
Stormwater collection for analytical chemistry	Melanie Carr, M.S. cbec eco-hydrologist	Technician TBD Ben Taber	cbec

8.3 Training and Certification Documentation

Sampling training records will be included in the project reporting results as an appendix.

Element 9. Documents And Records

9.1 Documents and Records Maintained

The following information describes the documents and records that will be maintained for the project.

Data packages will include the following:

Field Work Forms:

- Emergency contact sheet.
- Calibration records.
- Field sampling protocol and qualifying storm events.
- Field sampling data sheet (2 sites).
- Flow metering protocol.
- Flow metering data sheet (2 sites).
- Field equipment checklist.
- Chain of custody form.
- Quality Assurance (QA)/Quality Control (QC) site check and data check, including holding times.
- Summary of lessons learned for next site visit.

Data Analysis Information:

- Spreadsheets with water quality and field data (i.e., raw data).
- QA/QC checklist.
- Outputs from statistical analysis of data (using Excel, Statistica, or other program).
- Figures of water quality data and secondary calculations.
- Narrative of the results and accompanying discussion.

Additional Information

Additional documentation that will be provided includes the following:

- Quarterly Reports.
- Annual Reports.
- Final Report.
- Copies of PowerPoint presentations.
- Copy of draft scientific paper.

Records will be maintained by the following individuals at each organization:

- Casey Meirovitz, Luhdorff & Scalmanini
- Melanie Carr, cbec
- Barbara Washburn, OEHHA
- Connie Nelson, City of Elk Grove/Willdan Engineering

9.2 Record Retention Practices

Details regarding the record retention practices are presented in Table 8.

Table 8. (Element 9) Document and Record Retention, Archival and Disposition Information

	Type	Retention	Archival during Project	Long Term Archival Disposition
Sample Collection Records	Groundwater	Luhdorff & Scalmanini	OEHHA	City of Elk Grove
	Stormwater	cbec	OEHHA	City of Elk Grove
Field Records	Groundwater collections	Luhdorff & Scalmanini	OEHHA	City of Elk Grove
	Stormwater collections	cbec	OEHHA	City of Elk Grove
Analytical Records	California Lab Service	California Lab Service	Luhdorff & Scalmanini & OEHHA	City of Elk Grove
	Water Pollution Lab	Water Pollution Lab	cbec & OEHHA	City of Elk Grove
Data Records	Groundwater Analytes	Luhdorff & Scalmanini	OEHHA	City of Elk Grove
	Stormwater Analytes	cbec	OEHHA	City of Elk Grove
Assessment Records	Analysis by Luhdorff & Scalmanini	Luhdorff & Scalmanini	OEHHA	City of Elk Grove
	Analysis by cbec	cbec	OEHHA	City of Elk Grove
	Analysis by OEHHA	OEHHA, cbec, Luhdorff & Scalmanini	OEHHA	City of Elk Grove

9.3 Document Disposition

After the project is completed, records will be archived with the City of Elk Grove, Department of Public Works. A copy will be given to Kelley List, Grant Manager, State Water Resource Control Board. Records will be maintained for 35 years after the completion of the project.

9.4 Quality Assurance Project Plan Distribution

The Quality Assurance Project Plan will be distributed electronically to individuals identified in the Distribution List as indicated in Element 3.

9.5 Back-Up Plan for Records

In addition to back up on servers and Ludhorff & Scalmanini and cbec, all records will be backed up on the data server at OEHHA. Records are back up each evening. Long term back up will occur at the City of Elk Grove.

GROUP B: DATA GENERATION AND ACQUISITION

ELEMENT 10. MONITORING PLAN

10.1 Site Descriptions

The study will be conducted at two sites in the City of Elk Grove. The identified sites have been carefully selected to represent different types of land uses: a residential neighborhood site and a commercial/light industrial site with a large parking lot. These two sites will demonstrate the use of dry wells in different settings that could potentially be used in future projects in the Sacramento region and throughout the State.

The site descriptions are as follows:

Site 1: Residential Site. This site is located adjacent to Monterey Trails High School in northeast Elk Grove, and is within an existing water quality basin. The single family residential neighborhood is 168 acres and routes stormwater into a 6 foot diameter storm drain trunk line that releases runoff into the water quality basin. Data from this site will provide insight into the feasibility of retrofitting water quality/detention basins with dry wells to increase groundwater recharge and reduce or eliminate the runoff associated with smaller rain events which are damaging to the aquatic ecosystem. Contaminants commonly found in a residential neighborhood are from landscaping and street runoff such as nitrogen, phosphorus, and pesticides (National Stormwater Quality Database[4]). The City of Elk Grove is the property owner of this site.

Site 2: City of Elk Grove Corporation Yard Site: This site is located northwest of Grant Line Road and east of Highway 99, in the south central section of the Elk Grove. Buses, automobiles, and other types of City-owned equipment are maintained and parked at this site. This site will be a good example of using dry wells in conjunction with bioretention. This site serves as a surrogate for parking lots, an ideal land use for LID retrofitting considering that more than 50% of all impervious surfaces in urban areas are used for vehicle travel and parking. Retrofitting parking lots with dry wells, in combination with other LID practices, could provide an efficient way to filter, cleanse and reduce stormwater runoff draining to local waterways. Contaminants such as oil, grease, diesel exhaust, solvents, and metals are likely to be associated with runoff from this location. The City of Elk Grove is the property owner of this site.

[4] Posted at: http://rpitt.eng.ua.edu/Research/ms4/Paper/Mainms4paper.html

10.2 Improvement Plans

The improvement plans for the monitoring wells and dry wells can be found in Appendix 4.

10.3 Dry Well System Design and Stormwater Sample Locations

The dry well system is composed of three parts: a vegetated pre-treatment feature, a structural pre-treatment feature and the dry well. Figure 4 illustrates the dry well system design and the three key components, as well as the location of stormwater collections.

The dry well design system collects stormwater runoff in a vegetated pre-treatment feature (either grassy swale or water quality basin, depending on the site) which is stored for a minimum of 7-minutes to meet the recommended contact time for filtering stormwater per the Sacramento Stormwater Quality Partnership Design Guide Manual[5]. The vegetated pre-treatment facility will then convey runoff to a structural pre-treatment feature, a concrete sedimentation well. A pipe, placed approximately 2 feet from the bottom of the 4 foot deep sedimentation well, will convey water into the dry well. A manually operated flap gate with chain will be installed at the pipe inlet to allow for sealing of the dry well in case of an emergency /chemical spill (not shown in Figure 3). The dry well will be 15 – 50 feet deep by 32-inch wide perforated corrugated plastic pipe that will release stormwater into a pervious lithologic layer. Exploratory borings will be completed at each site to identify a layer of pervious material that is underlain with a lower permeability layer. The pervious layer will facilitate a high infiltration rate while the clay layer will cause stormwater to move horizontally to obtain further treatment of potential contaminants and will function as a final step of attenuation.

The dry well design also includes a 2-inch diameter perforated pipe that will be installed to monitor water levels in the well. Further, a layer of sand, pea gravel and crushed rock will be used between the two pipes to stabilize them and minimize clogging of the dry well with fine material. The interior pipe will be fitted with a pressure transducer to continuously monitor the depth of water within the dry well.

10.4 Vegetated and Structural Pre-treatment Designs

The vegetated pre-treatment (Figure 3), is designed to promote retention/detention of particulate matter and associated contaminants. Since approximately 70% of stormwater contaminants are adsorbed by particles, removal of particulate matter aides in not only is reducing clogging of the dry well but also in reducing the quantity of contaminants that enter the dry well. In this project, two types of vegetated pre-treatment of stormwater will be used: an existing water quality basin (Strawberry Creek) with large amounts of vegetation that has grown in the basin during the past 15 years and a grassy swale that will be constructed to at the Corporation Yard.

The structural pre-treatment is the sedimentation basin, which is also depicted in Figure 3. This concrete box will slow the movement of water, allowing additional sediment and associated pollutants to fall out of the runoff. As solids settle to the bottom of the chamber, the stormwater will flow through a 2-3 foot long PVC pipe into the dry well.

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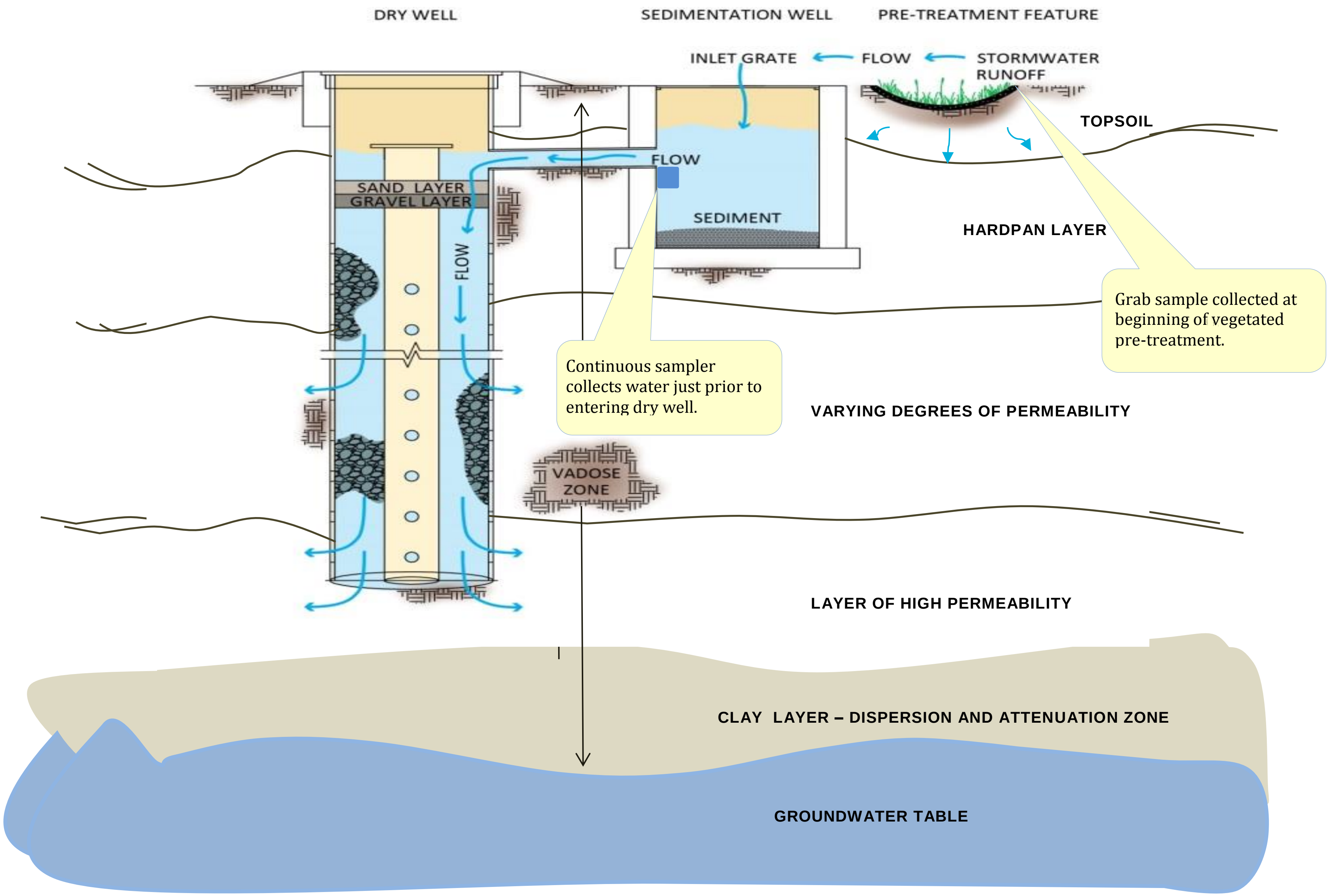
[5] Posted at: http://www.cityofsacramento.org/utilities/media-room/documents/SWQ_DesignManual_May07_062107.pdf

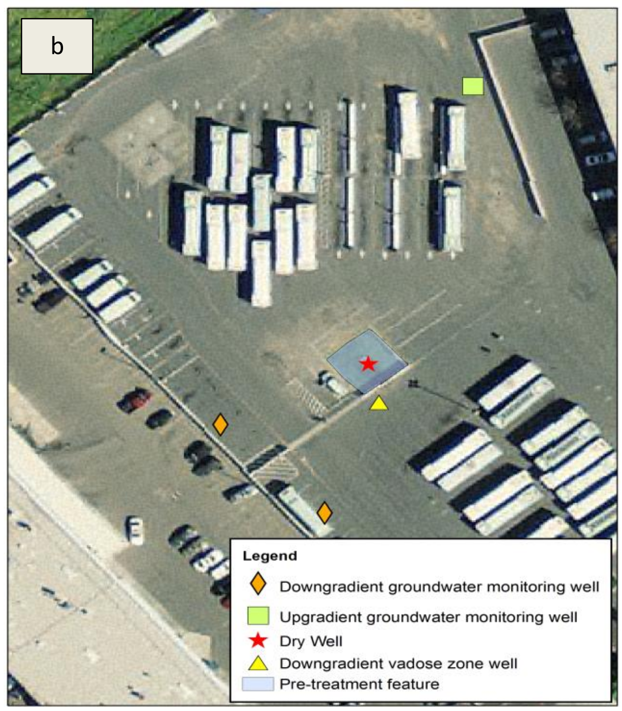
Figure 3. (Element 10) Schematic of the Dry Well System and Stormwater Collection Locations



10.5 Monitoring Well Design

A total of four groundwater monitoring wells have been constructed at each site. At the Strawberry Detention Basin site (Figure 4a), one upgradient and two downgradient wells have been constructed and completed at 120 below ground surface (bgs). The upgradient well is approximately 250 feet from the dry well while the two downgradient wells are 50 and 150 feet from the dry well location. A fourth vadose zone well was completed at 55 ft. bgs and will be approximately 15 feet downgradient of the dry well. At the Corporation Yard (Figure 4b), the depth of all monitoring wells is 120 ft. bgs, as at Strawberry Creek Water Quality Basin, however, the placement of the wells is slightly different. The upgradient well is 150 feet from the dry well, the vadose zone well is 10 feet downgradient from the dry well, while the two downgradient monitoring wells are each approximately 100 feet from the dry well.

Figure 4a and b. (Element 10) Location of Monitoring Well Network. Figure 4a shows the Strawberry Creek Water Quality Basin while 4b shows the Corporation Yard configuration of the monitoring well networks.



At both sites, pressure transducers will be installed in each monitoring well to provide continuous water level and temperature data. Back-up transducers will be available should there be a malfunction. Manual measurements of flow through the monitoring wells will also be performed

Following the first year of sampling, groundwater quality and water level data will be reviewed to identify trends and evaluate the efficacy of the monitoring network. Differences in specific conductivity and other parameters should provide insight into which of the two groundwater wells are most influenced by the dry well. To verify these findings, a tracer test will be performed slightly before or at the beginning the second year of sampling. The purpose of the tracer test is to further analyze aquifer parameters, groundwater gradients, and the ability of the monitoring network to capture contaminants which may be introduced to groundwater at the dry wells. The tracer test may involve tracking stable isotopes introduced at each site. In the event that stable isotopes cannot be used, the tracer test may involve adding a known volume of an environmentally inert substance at the dry well prior to the introduction of stormwater. Water quality samples, including those collected as part of the normal sampling schedule, would then be analyzed for the tracer.

10.6 Sampling Plan

Stormwater samples will be collected from the first flush event and from two additional consecutive rain events that produce runoff volumes of a minimum of ½ ” within 24-hours each year for two years (total of six sampling events). Samples collection will begin within 3-hours of the initiation of the rain event and continue for the entire event. At each event, a flow-weighted composite sample of approximately 10 liters of stormwater (see Element 11, Table 10) will be collected from the pipe that conveys water from the sedimentation well to the dry well (See Appendix 1, Standard Operating Procedures (SOP) - Stormwater Monitoring). In addition, a grab sample will also be collected from the same location for measurement of conventional parameters (i.e., pH, DO, turbidity (NTU), conductivity, and for laboratory analysis of total suspended solids). An additional grab sample will be collected as stormwater enters the vegetated pre-treatment feature for the measurement in the lab of total suspended solids and pyrethroids. Both grab samples will also be collected within the first three hours of storm initiation. Additional details of the sampling methods are included in the SOP (Appendix 1).

Groundwater samples will be collected from three groundwater monitoring wells and the vadose zone well at each site for the same three rain events described above for two years (See Appendix 1, SOP - Groundwater Monitoring). Groundwater levels will be regularly monitored using a combination of manual and continuous measurements. During the rainy season samples will be collected within one week of each storm events to allow time for water to infiltrate through the vadose zone[6]. The exact timing of the delayed collection will be determined by monitoring well water level after rain events.

In addition, a fourth sample will be collected during the dry season from the three monitoring wells. It is unlikely there will be sufficient water at the level of the vadose zone well to collect a sample during the dry season. Collections will be performed by first purging the wells using three wet casing volumes or until indicator parameters have stabilized (less than 5% variation in three consecutive readings taken 5 minutes apart) prior to sample retrieval. The indicator parameters include temperature, pH, electric conductivity, dissolved oxygen, and turbidity. After completion of purging activities, approximately 10 L of groundwater will be collected in laboratory-supplied bottles with or without preservative (depending on analyses to be conducted) without headspace. Samples will be delivered to an analytical laboratory with the proper chain-of-custody documentation within the required holding time of two hours. The pump assembly and discharge hosing will be thoroughly flushed with tap water between sites to ensure cross-contamination between wells does not occur.

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[6] The deferral in sample collection after rain event is based on previous experience in the watershed (C. Meirovitz, MS thesis). Percolation time varies from location to location based on differences in soil, geology, antecedent moisture conditions, and other related factors. Lag times are estimates and could be adjusted up or down based on field conditions.

10.7 Description of a Single Sampling Event

The City of Elk Grove's Stormwater Program, which regularly monitors weather conditions during the rainy season, will alert project staff when significant storms are forecasted. Collection of stormwater samples will commence at the beginning of the storm. Continuously monitored samplers will be set-up to collected flow-weighted samples via an auto-sampler positioned at the entrance to the dry well. These collections will occur during the entire rain event. In addition, grab samples will be collected at the beginning of the vegetated pre-treatment feature and within the sedimentation well at the opening to the dry well. Samples collected with the auto-sampler plus a sub-sample of the grab sample collected at the entrance to the vegetated pre-treatment samples will be delivered to analytical laboratory with the proper chain-of-custody documentation within the required holding time of two hours. These samples will be used for analysis of the entire suite of contaminants such as metals, organics, and pesticides (see Analytical Chemistry list below). The grab samples however will be limited to the analysis of conventional water quality parameters (see Field Measurement list below).

Approximately a week later, groundwater and vadose zone samples will be collected from the four monitoring wells at each location. The groundwater samples will be delivered to analytical laboratory with the proper chain-of-custody documentation within the required holding time of two hours. The samples will be used to analyze the full suite of contaminants. In addition, the measurement of conventional water quality parameters such as pH and dissolved oxygen will be performed on all groundwater samples (see Analytical and Field Chemistry list below).

Analytical Chemistry

Laboratory measurements and associated US EPA method used for analysis:

1. Total suspended solids (EPA 160.2).
2. Pyrethroid pesticides (WPCL #53).
3. Chlorinated herbicides (EPA 8151A).
4. Total petroleum hydrocarbons (EPA 8015-diesel and gas).
5. Pyrogenic polycyclic aromatic hydrocarbons (EPA 8310).
6. Semi-volatile organics (EPA 625).
7. Volatile organics (EPA 8260B).
8. Drinking water metals (EPA 200 series).
9. General physical (EPA STDM).
10. General mineral (EPA STDM).
11. Total coliform (SM 9221).

Field measurements of conventional water quality parameters using standard field instrumentation:

1. Surface water flow
2. pH
3. Temperature
4. Electric conductivity
5. Dissolved oxygen
6. Turbidity (NTU)

Table 9 identifies how the data collected will be used to address key questions of interest.

Table 9. (Element 10) How Project Data will be Used to Address Research Questions

Research Question	**Data that will be used to address this issue**
Are the vegetated and structural pre-treatment features effective at removing contaminants and sediment from stormwater?	Differences in conventional and contaminant concentrations of stormwater samples collected at the beginning of the vegetated pre-treatment and just prior to entry into the dry well..
Does the dry well introduce contaminants into the groundwater or vadose zone?	• Differences in contaminant concentration between stormwater samples collected just prior to entering the dry well and water collected from the vadose zone and downgradient groundwater monitoring wells. • Differences in contaminant concentrations between the upgradient and downgradient water table wells.
Does passage through the vadose zone attenuate contaminant concentration in water infiltrated through the dry well?	Differences in contaminant concentration in samples collected from the downgradient vadose zone well and two groundwater monitoring wells.
Does the sedimentation well help to reduce pollutant concentrations in stormwater?	Differences in contaminant concentration in sediment samples collected from the sedimentation well and water that enters the dry well.

The monitoring plan schedule for both stormwater and groundwater are provided in Tables 10 and 11. The classes of contaminants to be analyzed under each tier are listed in the Legend for Tables 10 and 11.

Table 10. (Element 10) Stormwater Monitoring Schedule

Stormwater	**Water Year 1** (Fall 2014 - Spring 2015)				**Water Year 2** (Fall 2015 - Spring 2016**)**			
Monitoring location	Dry season	1st flush event	2nd event	3rd event	Dry Season	1st flush event	2nd event	3rd event
Vegetated pre-treatment inlet (grab sample)		Tier 4	Tier 4	Tier 4		Tier 4	Tier 4	Tier 4
Dry well inlet pipe (continuous sample)		Tier 1	Tier 1	Tier 1		Tier 2	Tier 2	Tier 1
Dry well inlet pipe (grab sample)		Conv. WQ	Conv. WQ	Conv. WQ		Conv. WQ	Conv. WQ	Conv. WQ

Table 11. (Element 10) Groundwater Monitoring Schedule

Groundwater	Water Year 1 *(Fall 2013-Spring 2014)*				Water Year 2 *(Fall 2014 – Spring 2015)*			
Monitoring well	Dry season	1st flush event	2nd event	3rd event	Dry Season	1st flush event	2nd event	3rd event
UpGr WT	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	Tier 2	Tier 1
Near VZ		Tier 1	Tier 1	Tier 1		Tier 2	Tier 2	Tier 1
Far WT 1	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2*	Tier 2*	Tier 2	Tier 1
Far WT 2	Tier 1	Tier 1	Tier 1	Tier 1	Tier 3*	Tier 3*	Tier 3	Tier 1

Legend for Tables 10 and 11.

UpGr WT: upgradient monitoring well, sample surface of water table.
Far WT1 and 2: downgradient monitoring wells, two wells triangulated 50 – 100 feet from dry well, sample surface of water table.
Near VZ: downgradient monitoring well 10 – 25 feet from dry well, samples vadose zone.
Tier 1: all analyte classes listed below (Analytical Chemistry) will be analyzed.
Tier 2: all analyte classes minus semi-volatiles will be analyzed. Semi-volatiles were selected for elimination due to the lack of detection in stormwater in the City of Elk Grove. This assessment based on a review of 5 + years of stormwater monitoring at three sites on Elk Grove and Laguna Creeks by the Sacramento Stormwater Quality Partnership. Other analytes could be eliminated in Tier 2 as well. The final decision will be based on results of 1st year's sampling.
Tier 3: Analysis of general physical, general mineral, and coliform only. If stormwater or other data from earlier sampling events suggests the need to analyze a greater number of contaminants, they will be added for testing.
Tier 4: Analysis of TSS and pyrethroids only.
Conv. WQ: pH, turbidity (NTU), conductivity, DO, temperature
Grey boxes: Samples will not be collected from these wells during the dry season. It is unlikely any water will be present.

*Tier 2 monitoring will be conducted at the primary groundwater well (the well, as determined by tracer testing, to be most influenced by the dry well); Tier 3 monitoring will be conducted at the secondary groundwater well.

10.8 Sample Handling

All samples will be collected using standard protocols (detailed in Element 11 and 12) to avoid sample contamination. Samples will be stored on ice and taken to the Water Pollution Laboratory at the Nimbus Hatchery or to the California Laboratory Services facility in Rancho Cordova within two hours from the completion of collection. Arrangements will be made to meet lab staff at either the Water Pollution Laboratory or California Laboratory Services after hours or on weekends if necessary. Chain of custody forms will be filled out and copies will be retained by the City of Elk Grove, the consultants, as well as the laboratories.

In addition, analysis of material removed from the sedimentation well will be performed. It is anticipated that the sedimentation well will require cleaning on yearly basis. At the end of each year, a sub-sample of the material removed from the sedimentation well will be analyzed for the suite of contaminants. If the level of these contaminants exceeds regulatory limits, sediment will be diverted to a Class III landfill. Otherwise, the sediment will be disposed of with normal waste. Testing will also be performed in Year 2 of sampling for sedimentation well.

10.9 Data Reduction

Field and laboratory data will be entered into spreadsheets or downloaded from loggers directly into a spreadsheet. Results will be analyzed using statistical programs (Statistica, R, or other similar) to compare contaminant concentration in water table and vadose zone wells relative to upgradient water quality, differences between stormwater, vadose zone and groundwater samples; and differences between stormwater quality before and after vegetated and structural pre-treatment features). If contaminants are found in the sediment collected from the sedimentation basin, this data will be used to determine the efficiency of removal by the vegetated pre-treatment feature. Changes over time in the concentration of contaminants in the groundwater (if any are detected) will also be evaluated. Parametric or non-parametric statistics, such as the Mann Whitney U test and Mann-Kendall test, will be used for analysis.

10.10 Controls for Variability and Bias

Managing variability in sample collection and handling will be controlled by standardizing the protocols and ensuring that all personnel involved in sample collection are properly trained and have sufficient practice to ensure that collections and field measurements have a consistent degree of accuracy and precision. Further, instruments will be calibrated prior to each sampling event to ensure accuracy.

Variability in the concentration of contaminants in stormwater samples is expected, as the size of the rain event and the timing of the event will affect the contaminants it contains. Additionally, fate and transport mechanisms will affect travel time of the constituent from its source of origin to the monitoring location. Finally, if the turbidity in the surface water is such that the sample is opaque, analytical results may not be measured without dilution or filtering; these actions could alter the analytical results.

Some natural variability in sample results between groundwater sampling events is expected. Factors that can introduce groundwater quality variability may be reduced by ensuring a consistent sampling and purging methodology. In order to ensure samples that are representative of groundwater conditions, monitoring wells are purged of at least three wet casing volumes and until indicator parameters (e.g., temperature, pH, electrical conductivity, dissolved oxygen, oxygen reduction potential, and turbidity) have stabilized prior to sample retrieval. Stabilization is defined as three consecutive readings at five minute intervals where parameters do not vary by more than 5 percent. Purged groundwater is disposed of by spreading it on the ground at a reasonable distance from the sampled well to avoid the potential for purge water to enter the well casing.

Accuracy, precision, and other related metrics of laboratory practices are also discussed in Element 11.

10.11 Contingency Plan

There is the possibility that a chemical spill may occur, allowing contaminants to enter one of the dry wells and potentially compromise the safety of groundwater. Additionally, it is possible that during the course of the project, contaminants may be detected in the groundwater. The following Contingency Plan has been developed to safeguard groundwater quality and the following actions will take place if there is a chemical spill:

1. Nearby Chemical Spill or Accident:

At the beginning of the Project, the City of Elk Grove and local Fire and Police Departments, as well as the City of Elk Grove maintenance staff will be informed of the dry well locations. They will be given a list of project personnel and their contact information; and will be requested to inform the appropriate individual if a spill occurs. Contact information will also be posted at the two well sites in case the first responder is unfamiliar with the project. The contact person can instruct emergency personnel on the methods for lowering the manual flap gate to shut off flow into the dry well. Additionally, the Project Manager will be responsible for ensuring that the shut-off valve has been properly closed.

2. Spill Equipment:

Maintaining an adequate supply of spill containment equipment is of primary importance to spill containment measures. The City of Elk Grove maintains spill kits for accidental occurrences at their Corporation Yard and the following equipment will be available in the event that a spill does occur:

a. Absorbent materials such as diatomaceous earth or sawdust for the direct absorption of spilled liquids.
b. Absorbent pads for the direct absorption of spilled liquids.
c. Sand and sand bags for constructing dams, dikes, diversions, sediment barriers or containment areas.
d. Shovels for filling sandbags.
e. Plastic sheeting for forming barriers.
f. Backhoe on standby, if necessary, to help contain the spill.
g. A vacuum-truck services provider with same day emergency response.

3. Contaminants Detected in Groundwater Above Baselines Levels during Routine Monitoring:

If contaminants are detected in one of the vadose zone monitoring well (approximately 55 feet deep) that exceeds the baseline concentration established in the upgradient well at each site by 20 percent , a meeting of the Contingency Team will be called to evaluate the situation. Because the alert level is below the regulatory level (Maximum Contaminant Level or MCL), there is not a requirement to inform authorities. However, members of the Contingency Team will include a representative from the Sacramento County Environmental Management Department's Wells Program as well as other technical experts, including the Chief of the Water Toxicology Branch at OEHHA. In addition, the vadose zone well was selected for the trigger point, not the groundwater itself, so the situation could be evaluated before potential contaminants could reach groundwater. The group will determine if it is prudent to conduct additional sampling, continue to utilize the dry well in future planned monitoring or to close down the dry well all together. Other options might be considered as well. Recommendations will be sent to the Project Team. If deemed necessary, the Technical Advisory Committee will also be contacted.

10.12 Project Timeline and Sampling Events

The timeline of the project's sampling events is summarized in Table 12, Task 3 Stormwater Quality Monitoring and Task 4 Groundwater Quality Monitoring.

Table 12. (Element 10) Project Timeline

Task	2013				2014				2015				2016				2017	
Notice of Grant Award – Summer 2012																		
Project Commencement - March 1, 2013	☆																	
Task 1. Final Site Selection, Monitoring Study Design and Permitting																		
Task 2. Dry Well and Monitoring Well Installation																		
Task 3. Stormwater Quality Monitoring (3 events per wet season)								•	••			•	••					
Task 4. Groundwater Quality Monitoring (3 events per wet season; 1 event per dry season)						•		••	••		•	•	••					
Task 5. Data Analysis and Interpretation																		
Task 6. Education, Outreach and Organizational Capacity Building																		
6a. Prepare and publish two factsheets																X		
6b. Prepare and publish an literature review								X										
6c. Draft scientific paper																	X	
6d. Lessons Learned document																	X	
6e. Presentations at meetings/conferences																		
6f. Development and maintain a project website																		
Task 7. Project Assessment and Reporting																		
7a. Submit Quality Assurance Project Plan and Monitoring Plan																		
7b. Quarterly or annual reports																		
7c. Final report																	X	
Task 8. Project Administration																		☆

Milestones: Sampling Event: ● Publications: **X** Project Start/Finish:

ELEMENT 11. SAMPLING METHODS

11.1 Sampling Methods for Stormwater and Groundwater

Table 13. (Element 11) Sampling Locations and Sampling Methods

Sampling Location	Location ID Number	Matrix	Depth (units)	Analytical Parameter
Strawberry Water Quality Basin	01	Groundwater	Vadose: 55 ft. Water table: 120 ft.	See Table of Analytes for Groundwater (Table 14)
Strawberry Water Quality Basin	01	Stormwater	0”	See Table of Analytes for Stormwater (Table 15)
Corporation Yard	02	Groundwater	Vadose: 55 ft. Water table: 120 ft.	See Table of Analytes for Groundwater (Table 14)
Corporation Yard	02	Stormwater	0”	See Table of Analytes for Stormwater (Table 15)

Table 14. (Element 11) Groundwater Analytes

Analytical Parameter	# Samples (include field duplicates) Total for Project	Sampling Standard Operating Procedure (SOP) #	Sample Volume	Containers No., Size, Type	Preservation (chemical, temperature, light protected)	Maximum Holding Time: Preparation/Analysis
Pyrethroids	74	WPCL Method 53	1 L	1, 1L, amber, Teflon lid	Preserve with extraction solvent, cool, 6° C, dark	7 days/40 days after extraction
Chlorinated herbicides	74	California Laboratory Services SOP: SEM -14 EPA 8151A	1 L	1, 1L, amber, Teflon lid	Cool, 4° C	7 days holding/40 days after extraction
Total petroleum hydrocarbons	74	California Laboratory Services SOP: SEM-09 EPA 8015	1080 mL	1, 1L, amber, glass, Teflon lid, 2, 40 mL, VOA	HCl	7 days extraction, 14 days analysis
Pyrogenic PAHs	74	California Laboratory Services SOP: VOA-11 EPA 8310	1 L	1, 1L, amber, glass, Teflon lid	Cool, 6 C, dark	7 days extraction/ 40 days analysis
Semi-volatile organics	56	California Laboratory Services SOP: VOA-08 EPA 625	1 L	1, 1L, amber, Teflon-lid, VOA	Cool, 6° C, dark	7 days holding/ 40 days for analysis
Volatile organics	74	California Laboratory	5-15 mL	3-4 VOA Vial	HCl, Cool, 4° C	Preserved 14 days holding

		Services SOP: VOA-02 EPA 8260B				
Drinking Water Metals	74	California Laboratory Services SOP: MET-02 EPA 200 series	500 mL	1, 500 mL, polyethylene, acid cleaned	HNO_3, cool, 6° C, dark	30 days
General physical	80	BAC-02, BAC-03, BAC-04, WET-19, WET-27	250 mL	1, 250 mL, amber	n/a	1 day
General mineral	80	California Laboratory Services SOPs: WET-01, WET-10, WET-23, WET-35 EPA STDM	1 L	1, 1L, poly	n/a	2 days (excluding pH)
Total coliform	80	California Laboratory Services SOP: BAC-10 EPA SM 9221	100 mL	100 mL Bacti	Dechlorinate, cool, 4° C	1 day
pH	72	Groundwater Monitoring Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Turbidity	72	Groundwater Monitoring Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
DO	72	Groundwater Monitoring Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Electrical conductivity	72	Groundwater Monitoring Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Temperature	72	Groundwater Monitoring Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Lab blanks	80	n/a	1 L	1, 1L, amber	n/a	7 days

Table 15. (Element 11) Stormwater Analytes

Analytical Parameter	# Samples (include field duplicates) Total for Project	Sampling Standard Operating Procedures (SOP No.)	Sample Volume	Containers No., Size, Type	Preservation (chemical, temperature, light protected)	Maximum Holding Time: Preparation/Analysis
TSS	13	WPCL-AA-025	1 L	1, 1L, pre-cleaned plastic or glass container	Cool, 6° C	7 days holding
Pyrethroids	13	WPCL Method 53	1 L	1, 1L, amber, Teflon lid	Preserve with extraction solvent, cool, 6° C, dark	7 days until extraction0 days after extraction
Chlorinated	13		1 L	1, 1L, amber,	Cool, 4° C	7 days holding/40

herbicides		California Laboratory Services SOP: SEM -14 EPA 8151A		Teflon lid		days after extraction
Total petroleum hydrocarbons	13	California Laboratory Services SOP: SEM-09 EPA 8015	1080 mL	1, 1L, amber, glass, Teflon lid, 2, 40 mL, VOA	HCl	7 days extraction, 14 days analysis
Pyrogenic PAHs	13	California Laboratory Services SOP: VOA-11 EPA 8310	1 L	1, 1L, amber, glass, Teflon lid	Cool, 6 C, dark	7 days extraction/ 40 days analysis
Semi-volatile organics	13	California Laboratory Services SOP: VOA-08 EPA 625	1 L	1, 1L, amber, Teflon-lid, VOA	Cool, 6° C, dark	7 days holding/ 40 days for analysis
Volatile organics	13	California Laboratory Services SOP: VOA-02 EPA 8260B	5-15 mL	3-4 VOA Vial	HCl, cool, 4° C	Preserved 14 days holding
Drinking water metals	13	California Laboratory Services SOP: MET-02 EPA 200 series	500 mL	1, 500 mL, polyethylene, acid cleaned	HNO_3, cool, 6° C, dark	28 days Cr-6; all others 6 months r.t. after acidification
General physical	13	BAC-02, BAC-03, BAC-04, WET-19, WET-27	250 mL	1, 250 mL, amber	n/a-	1 day
General mineral	13	California Laboratory Services SOPs: WET-01, WET-10, WET-23, WET-35 EPA STDM	1 L	1, 1L, poly	n/a-	2 days (excluding pH)
Total coliform	13	California Laboratory Services SOP: BAC-10 EPA SM 9221	100 mL	100 mL Bacti	Dechlorinate, cool, 4° C	24 hours
pH	36	cbec Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Turbidity	36	cbec Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
DO	36	Stormwater Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Electrical conductivity	36	Stormwater Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Temperature	36	Stormwater Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Flow	36	Stormwater Field SOP	n/a	In-situ, n/a	n/a	n/a, immediate measurement
Lab blanks	8	n/a	1 L	1, 1L, amber	n/a	7 days
Field blanks	8	n/a	1 L	1, 1L, amber	n/a	7 days

11.2 Sampling Equipment and Cleaning

A list of all field equipment used for both stormwater and groundwater monitoring is listed in Appendix 1: Field SOP. Key equipment includes a Flowtote for monitoring flow in dry and monitoring wells, global samplers to collect composite samples of stormwater, and YSI Sondes for measuring conventional water quality parameters such as oxygen and temperature.

The general practice for cleaning field equipment is to wash/rinse equipment, spray with a chlorine solution, and then rinse three times with deionized water between each sampling site. All equipment will be rinsed three times with deionized water after the chlorine rinsate is used. Protocols follow the Surface Water Ambient Monitoring Program (SWAMP) guidelines: *SOPs for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the SWAMP*, version 1.0, released October 15, 2007 (SWAMP, 2007); available for download at: http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standardoperating-procedures

11.3 Actions to be taken when problems occur and individual(s) responsible for corrective action and the documentation procedures.

Samples are collected in appropriate containers, stored on ice, and immediately transported to one of the two identified laboratories in Rancho Cordova, the Water Pollution Control Laboratory and California Laboratory Services. After hours contact information will be available for both laboratories should sampling run into the evenings or weekend hours.

Responsible individuals that will be contacted if problems arise are Melanie Carr, cbec for stormwater sampling issues and Casey Meirovitz, Luhdorff & Scalmanini for groundwater sampling. Problems will be noted in field logs.

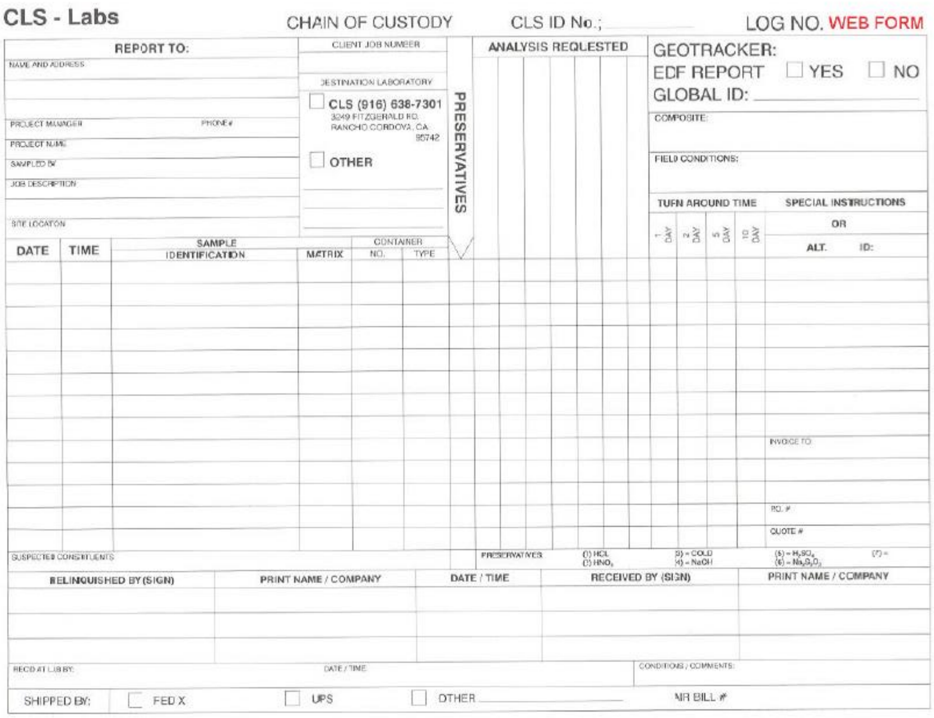
All instruments will be calibrated prior to use and are under a regular maintenance schedule. Equipment will be calibrated with an external or internal standard. If response varies by more than 10 percent, the test will be repeated using a fresh calibration standard. If the error persists, a formal troubleshooting protocol will be followed until the response falls within acceptable limits.

Element 12. Sample Handling and Custody

Details of sample handling, preservation and holding time information are contained in Tables 9 and 10, Element 11. Protocols follow 2007 SWAMP guidelines. Information not contained in these tables includes the following: a) composite samples will be collected with new Teflon tubing and will be collected into a single jar. Stormwater samples will be aliquoted into laboratory containers with appropriate preservatives on an hourly basis through the course of the rain event.

Documentation of sample handling will be maintained in field notebooks and using chain of custody forms (Figure 5). These forms will be maintained by cbec, Luhdorff & Scalmanini and the two laboratories. When samples are brought into the labs, a chain of custody form is generated, filled out, a copy remains with the lab and another copy will be given to the project staff. These forms will be retained by Melanie Carr, cbec, or Casey Meirovitz, Luhdorff & Scalmanini.

Figure 5. (Element 12) Chain of Custody Forms



CLS - Labs CHAIN OF CUSTODY CLS ID No.: LOG NO. WEB FORM

REPORT TO:
NAME AND ADDRESS
PROJECT MANAGER PHONE #
PROJECT NAME
SAMPLED BY
JOB DESCRIPTION
SITE LOCATION

CLIENT JOB NUMBER
DESTINATION LABORATORY
CLS (916) 638-7301
3249 FITZGERALD RD.
RANCHO CORDOVA, CA
95742
OTHER

PRESERVATIVES

ANALYSIS REQUESTED

GEOTRACKER:
EDF REPORT YES NO
GLOBAL ID:
COMPOSITE:
FIELD CONDITIONS:
TURN AROUND TIME
1 DAY 2 DAY 5 DAY 10 DAY
SPECIAL INSTRUCTIONS
OR
ALT. ID:

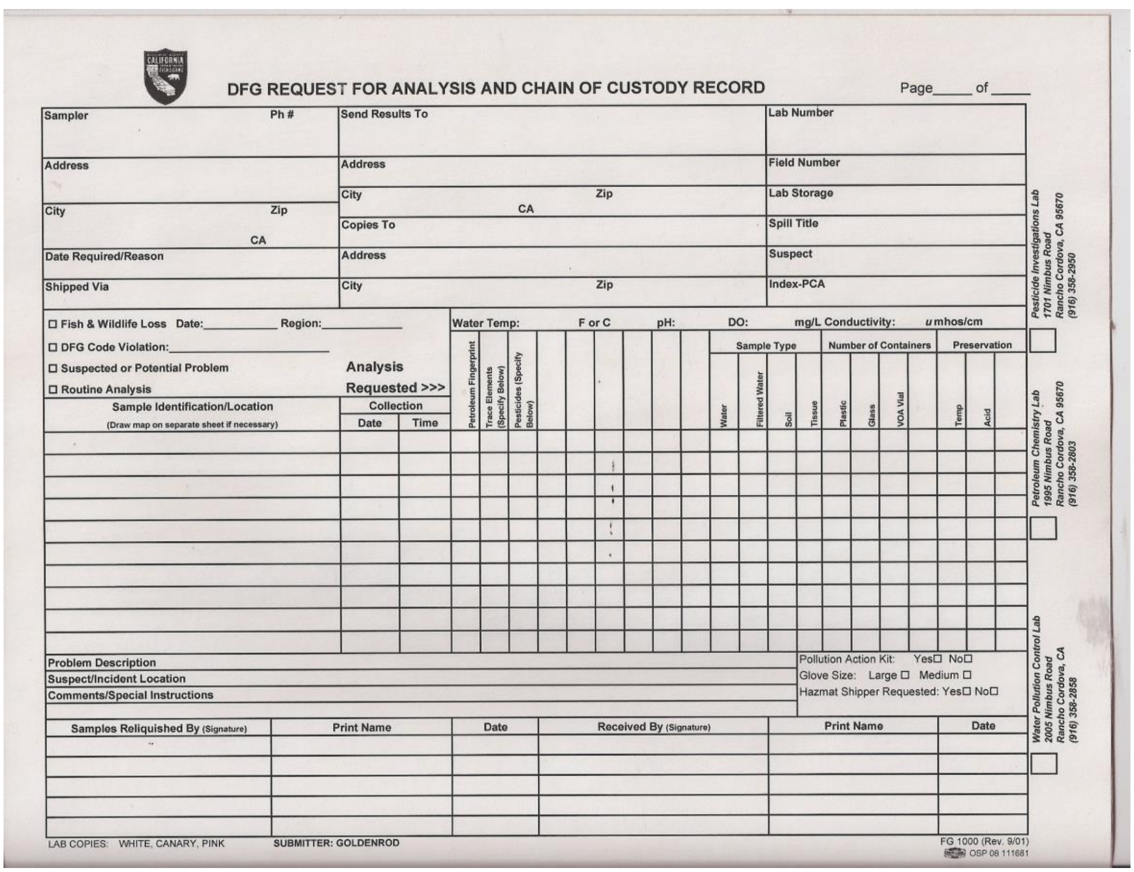
DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE

INVOICE TO
P.O. #
QUOTE #

SUSPECTED CONSTITUENTS
PRESERVATIVES (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY

RECD AT LAB BY: DATE / TIME CONDITIONS / COMMENTS:
SHIPPED BY: FED X UPS OTHER AIR BILL #



DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD Page_____ of _____

Sampler Ph #
Address
City Zip CA
Date Required/Reason
Shipped Via

Send Results To
Address
City CA Zip
Copies To
Address
City Zip

Lab Number
Field Number
Lab Storage
Spill Title
Suspect
Index-PCA

☐ Fish & Wildlife Loss Date:__________ Region:__________
☐ DFG Code Violation:__________
☐ Suspected or Potential Problem
☐ Routine Analysis

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Analysis Requested >>>

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	Sample Type: Water	Filtered Water	Soil	Tissue	Number of Containers: Plastic	Glass	VOA Vial	Preservation: Temp	Acid

Problem Description
Suspect/Incident Location
Comments/Special Instructions

Pollution Action Kit: Yes☐ No☐
Glove Size: Large ☐ Medium ☐
Hazmat Shipper Requested: Yes☐ No☐

Samples Reliquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-2950

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-2803

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA
(916) 358-2858

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01) OSP 08 111681

Element 13. Analytical Methods

13.1 Analytical Methods for Laboratory and Field

The laboratory analytical methods are described below in Table 16, and Table 17 list the specialized equipment for the laboratory analyses.

Table 16. (Element 13) Laboratory Analytical Methods

Analyte	Laboratory / Organization	Project Action Limit (units, wet or dry weight)	Project Reporting Limit (units, wet or dry weight)	Analytical Method		MDLs (1)
				Analytical Method/ SOP	Modified for Method yes/no	
1. Total suspended solids	Water Pollution Control Lab, DFW	none	2.0 mg/L	EPA 160.2	No	0.3 mg/L
2. Pyrethroid pesticides	Water Pollution Control Lab, DFW	none	2-5 ng/L, depending on species	WPCL Method 53	No	1-3 ng/L
3. Chlorinated herbicides	California Laboratory Services	none	Varies: 0.2-250 µg/L	EPA 8151A	No	0.0005-1.0 µg/L
4. Total petroleum hydrocarbons	California Laboratory Services	none	Gas: 50 µg/L Diesel: 50 µg/L	EPA 8015	No	Gas: 50 µg/L Diesel: 0.05 mg/L
5. Pyrogenic polycyclic aromatic hydrocarbons	California Laboratory Services	0.15 µg/L BaP(PHG)	10 µg/L	EPA 8310	No	10 µg/L
6. Semi-volatile organics	California Laboratory Services	none	10 µg/L	EPA 625	No	10 µg/L
7. Volatile organics	California Laboratory Services	none	0.50 – 10.0 µg/L	EPA 8260B	No	0.056-2.2 µg/L
8. Drinking water metals	California Laboratory Services	Varies from 0.15 µg/L (Pb) to 1.3 mg/L (Cu)	Varies per metal: 0.17-1.35 µg/L	EPA 200 series	No	Varies per metal (0.17-1.35 ppb)
9. General physical	California Laboratory Services	none	Color: 0 Turbidity: 0.50 NTU Odor: 1 TON pH 0.000 units EC: 1.0 µS/cm	EPA STDM	No	Color: 0 Turbidity: 0.50 NTU Odor: 1 TON pH 0.000 units EC: 1.0 µS/cm
10. General mineral	California Laboratory Services	None	Alk.: 5.0 mg/L Anions: 0.1-2.0 mg/L MBAS 0.10 mg/L GM metals: 1.0 mg/L TDS: 10 mg/L	EPA STDM	No	Alk.: 5.0 mg/L Anions: 0.1-2.0 mg/L MBAS 0.10 mg/L GM metals: 1.0 mg/L

						TDS: 10 mg/L
11.T. coliform	California Laboratory Services	0	1.1 MPN/100 ml	SM 9221	No	1.1 MPN/100ml

(*) *Standard Methods for the Examination of Water and Wastewater*, 20th edition.

Table 17. (Element 12) List of Specialized Equipment for Laboratory Analyses

Analytes	**Specialized Equipment Used** (does not include standard laboratory equipment such as pH meter, balances, etc.)
TSS	Laboratory oven
Pyrethroids	Varian 3800 GC with ion trap mass spectrometer Agilent 6890 with ECD
Chlorinated herbicides	HL 5890 Series III GC with ECD
Total petroleum hydrocarbons	HP 5890 GC with flame ionization detector
Pyrogrenic PAHs	Waters HPLC with photo diode array detector
Semi-volatile organics	HP 5890 or 6890 GC with HP 5870 or 5973 MS
Volatile organics	HP 5890 or 6890 GC with HP 5870 or 5973 MS
Drinking water metals	Perkins-Elmer ICP-MS
Turbidity	Hach Model 2100 turbidimeter
Specific Conductance	YSI model 35 or equivalent conductivity meter
Minerals anions	Dionex ion chromatograph DX-120 with various ionpacs, with DS4 detection stabilizer model DS4-2, P/N 031183

The field analytical methods are depicted below in Table 18, and Table 19 list the specialized equipment for the field analyses.

Table 18. (Element 13) Field Analytical Methods

Analyte	**Responsible Party**	**Project Action Limit (units, wet or dry weight)**	**Project Quantitation Limit (units, wet or dry weight)**	**Analytical Method**	
				Analytical Method/ SOP	Modified for Method yes/no
Flow	cbec/ Luhdorff & Scalmanini	n/a	0.2 cfs	Appendix 1 Field SOPs	No
pH	cbec/, Luhdorff & Scalmanini	n/a	0.01 pH units	Appendix 1 Field SOPs	No
Turbidity	cbec/ Luhdorff & Scalmanini	n/a	0 NTU	Appendix 1 Field SOPs	No

DO	cbec/ Luhdorff & Scalmanini	n/a	0	Appendix 1 Field SOPs	No
Electrical conduct.	cbec/ Luhdorff & Scalmanini	n/a	0	Appendix 1 Field SOPs	No
Temp.	cbec/ Luhdorff & Scalmanini	n/a	0.01	Appendix 1 Field SOPs	No

Table 19. (Element 13) Field Equipment

Analysis	Instrument/Equipment
Flow	Hach Flowtote 3
Sample collection	Global WS 700 composite sampler
EC, stage, temperature	Solinst ltc juniors
DO, salinity, temp., turbidity, conductivity, pH	YSI Sonde 600 OMS sondes or Orbeco-Hellige Model 96D
Depth of water	Schlumberger Micro-Diver (DI 610)

13.2 Maintenance of Field Instruments

Data will initially be transmitted to a transducer located at the top of the sedimentation well. Data that is collected by YSI Sondes will be downloaded after each storm event to preserve the quality of the data. At the end of each collection/storm event, data will be transferred to laptop computers and entered into an Excel spreadsheet.

There is a risk of fouling of instruments due to the accumulation of fine sediment on the membranes of the probes. To minimize this problem, water flows through a pre-treatment sedimentation wells to permit settling of solids prior to entering the dry well. Additionally, the water sampler will be placed approximately 2 feet from the bottom of the 4 foot deep sedimentation basin, just below the pipe that will convey stormwater to the dry well. This location should reduce fouling yet ensure that samples can be collected from runoff.

13.3 Procedures to Follow when Failures Occur, Individuals Responsible for Corrective Action and Appropriate Documentation

Analyses will be repeated if failure occurs. Sufficient quantities of water will be collected with the expectation that some errors and repeats will be necessary. Staff at the Water Pollution Control Lab responsible for corrective action is Gail Cho. At the California Laboratory Services, Mark Smith evaluates the need for repeating the measurements.

If errors occur in the field, the field supervisor will be contacted. Melanie Carr is the cbec supervisor while Casey Meirovitz is Luhdorff & Scalmanini's supervisor. Back up equipment and instruments are available. If this equipment cannot be brought to the field site in a timely fashion, another sampling event will be scheduled so the samples can be correctly collected and analyzed.

Laboratory records are maintained by both labs that will document all analyses.

Field records and logbooks are maintained by both cbec and Luhdorff & Scalmanini for measurement performed at the well monitoring sites.

13.4 Sample Disposal Procedures and Specify Laboratory Turn-Around Times, as needed

Samples will be retained until quality control reviews are completed and data has been accepted. At that point, water samples will be disposed of in an appropriate manner, depending on the level of contamination found. It is anticipated that there will be low levels of contaminants that do not require special handling. However, if special handling is necessary, both labs have appropriate containers for disposing of contaminated material and management of toxic material. Laboratory turnaround times are 30-45 days, depending on the analyte.

13.5 Documentation for the Use/Development of Non-Standard Methods to Ensure that these Methods can Meet the Required SWAMP Measurement Quality Objectives (MQOs) and Target Reporting Limits (RLs)

The analysis of pyrethroids will be conducted using a non-standard method. This method has been developed by chemists at the Water Pollution Control Lab and results have been presented at scientific meetings and subject to peer-review. The detection limits for pyrethroids using these methods are the lowest that can currently be measured. The SOP for this method can be found in Appendix 1. The reporting limits are either 2- 5 pptr (ng/L), depending on the species of pyrethroid. Performance based measurement logs are maintained at the Water Pollution Control Lab.

ELEMENT 14. QUALITY CONTROL

14.1 Field Sampling and Analytical Quality Control

Table 20 describes the quality control of the field sampling while Table 21 depicts the analytical quality control.

Table 20. (Element 14) Field Sampling Quality Controls

Matrix: water (stormwater and groundwater)							
Sampling SOPs: Identified in Element 11.							
Analytical Parameter(s): pH, dissolved oxygen, temperature, turbidity, specific conductivity							
No. of sample locations: 2 sites, 2 samples per site for stormwater monitoring, 3-4 samples per site for groundwater monitoring (depending on time of year). Total: 14 samples							
	Number per Sampling Event	**Acceptance Limits**					
		TSS	**Flow**	**pH**	**T**	**EC**	**DO**
Equipment blanks	8 total, 1/event	0-3000	n/a	0-12	5-30°C	25-300	1-14

Lab QC		For all contaminants measured					
Field blanks	8 total, 1/event	<RL					
Trip blanks	8 total, 1/event	<RL					
Cooler temperature	< 4 C						
Field duplicate pairs	1/ sampling events	<RL					
Field splits	1/ sampling events	<RL					
Field matrix spikes	1/ sampling events	< RL					

RL = reporting limits

Table 21. (Element 14) Analytical Quality Control

<table>
<tr><td colspan="3">Matrix: water</td></tr>
<tr><td colspan="3">Sampling SOP: Identified in Element 11.</td></tr>
<tr><td colspan="3">Analytical Parameter(s): PAHs, pyrethroids, TPH, semi-volatiles, volatiles, chlorophenoxy herbicides, total coliform, general mineral, general physical</td></tr>
<tr><td colspan="3">No. of sample locations: 2 sites, 2 samples per site for stormwater monitoring, 4 samples per site for groundwater monitoring. Total: 16 samples</td></tr>
<tr><th>Laboratory QC</th><th>Frequency/Number</th><th>Acceptance Limits</th></tr>
<tr><td>Method blank</td><td>1/20 or in every batch, whichever is less</td><td>< RL</td></tr>
<tr><td>Reagent blank</td><td>Same as above</td><td>varies, depending on method (10-30% organics; 85% for metals)</td></tr>
<tr><td>Storage blank (holding blank)</td><td>For VOC only, run independent of each batch; every month</td><td>< RL</td></tr>
<tr><td>Instrument blank</td><td>Depend on method; metals, 1/10</td><td><RL</td></tr>
<tr><td>Lab. duplicate</td><td>1/20 or every batch, whichever is more frequent</td><td>RPD < 25%</td></tr>
<tr><td>Lab. matrix spike</td><td>Used for most; 1/20 or every batch</td><td>80-120% recovery</td></tr>
<tr><td>Matrix spike duplicate</td><td>1/20 or batch, whichever is more frequent</td><td>80% - 120% recovery
RPD <25% for dups</td></tr>
<tr><td>Reference Material</td><td>1/20 or per batch</td><td>Organics: 70-130% recovery for certified 50-150% recovery
Metals: 75-125% recovery
Conventional: 80-120% recovery</td></tr>
<tr><td>Surrogates</td><td>For organics only; surrogates spiked into every sample</td><td>Recovery varies depending on analyte</td></tr>
</table>

Internal standards (to improve precision; used for calculating results; used to calculate ratio to control for variation in instruments)	Most for GC/MS methods and for ICP MS; 1 standard every 20 samples	n/a, used for assessing precision
Compound confirmation	Every run	Positive compound detections must be confirmed using a method appropriate to the technique

14.2 Exceedance of Control Limits

Described below are the steps to be taken to address exceedance of control limits and how effectiveness of control actions will be determined and documented.

The following steps are taken to address an exceedance of control limits:
1. Check calculations.
2. Confirm results by re-injection or re-analysis.
3. Compare to other quality controls in batch
4. Re-extract and re-analyze if necessary.
5. Flag if necessary.

Figure 6. (Element 14) depicts the flow diagram for corrective action.

14.3 Procedures and Data Quality Indicators

Described below are procedures and formulas for calculating data quality indicators or applicable QC statistics, for example, for precision, bias, outliers and missing data.

Precision is determined by analyzing duplicate (metals) or spikes and comparing the results, using the following formula:

Relative % difference = (x - y)/((x + y)/2) x 100%

Where:

x = result of first analysis

y = result of second analysis

Note: For organic sample, a matrix spike and matrix spike duplicate will be evaluated, not the sample.

Outliers are determined by calculating the standard deviation and multiplying by 3. Values falling farther than 3 standard deviations from the mean values of the group will be highlighted as potential outliers. Analysis of the sample will be repeated to determine if the potential outlier is rejected or retained.

Due to the design of this project, we do not anticipate missing data. If a sample is contaminated, is lost due to an accident, etc., the sample collection will be repeated.

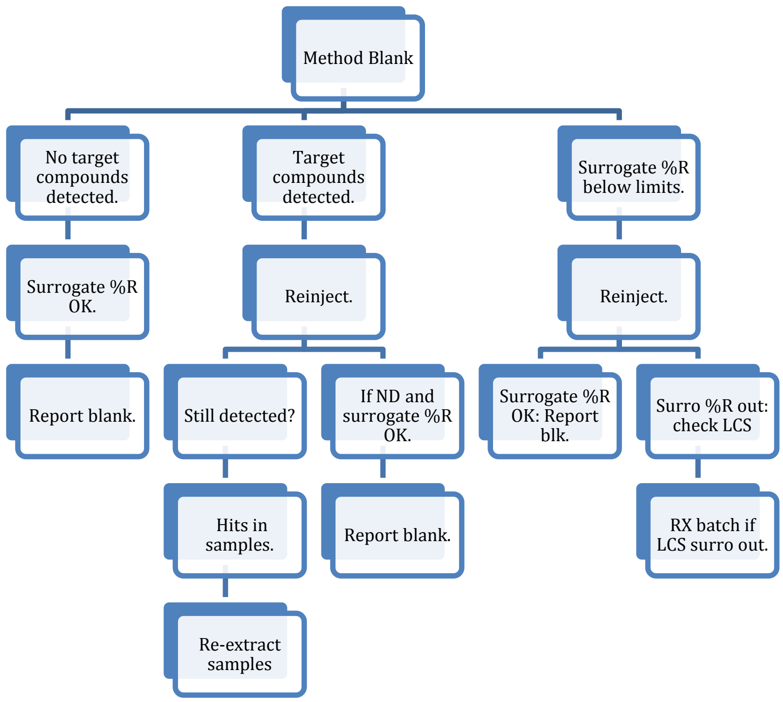
Accuracy is calculated by estimating % recovery from the spike sample**.**

% accuracy (spike recovery) = ([spike sample] – [sample])/[spike added]) x 100%

Accuracy criteria for bacterial testing will be based on presence/absence testing rather than numerical limits owing to the difficulty in preparing solutions of known bacterial concentration.

Figure 6 depicts the corrective actions in a flow diagram used by the Water Pollution Control Laboratory.

Figure 6. (Element 14) Corrective Action Flow Diagram – Water Pollution Control Laboratory



Element 15. Instrument and Equipment Testing, Inspection, and Maintenance

Element 13 contains a complete list of field instruments that require regular maintenance and calibration. All field equipment will be inspected prior to each use in the field, following the protocol identified in each SOP (see Appendix 1, Field SOPs). Instruments that will be checked are the electrodes, batteries, membranes, and any other regular maintenance activities, as specified by the manufacturer. Equipment will be checked by Melanie Carr, cbec or designated staff (stormwater sampling) and Casey Meirovitz, Luhdorff & Scalmanini or designated staff (groundwater sampling). All issues will be recorded in the Project Field Log and the resolution of the issue and date of resolution will also be recorded. Spare parts are maintained in the equipment rooms at cbec and Luhdorff & Scalmanini. If malfunctions are detected, parts will be replaced and the instrument rechecked.

Laboratory equipment at the Water Pollution Control Laboratory and California Laboratory Services is inspected annually in accordance with the SOPs (See Appendix 1, Laboratory Equipment). This annual maintenance involves checking column baseline stability, running blanks, and fine tuning of instrument, as appropriate for the method used. Regular quality control checks as well as unexpected problems are documented in the instrument logs. Resolution and its date are also recorded in these logs. Responsible parties at each laboratory are Gail Cho, Water Pollution Control Lab and Mark Smith, California Laboratory Services. In accordance with certification, both labs maintain spare parts for equipment.

Table 22 below indicates a list of specialized equipment for the laboratory analyses.

Table 22. (Element 15) List of Specialized Equipment for Laboratory Analyses

Analytes	**Specialized Equipment Used** (does not include standard laboratory equipment such as pH meter, balances, etc.)
TSS	Oven
Pyrethroids	Varian 3800 GC with ion trap mass spectrometer Agilent 6890 with ECD
Chlorinated herbicides	HL 5890 Series III GC with ECDill
Total petroleum hydrocarbons	HP 5890 GC with flame ionization detector
Pyrogrenic PAHs	Waters HPLC with photo diode array detector
Semi-volatile organics	HP 5890 or 6890 GC with HP 5870 or 5973 MS
Volatile organics	HP 5890 or 6890 GC with HP 5870 or 5973 MS
Drinking water metals	Perkins-Elmer ICP-MS
Turbidity	Hach Model 2100 turbidimeter
Specific Conductance	YSI model 35 or equivalent conductivity meter
Minerals anions	Dionex ion chromatograph DX-120 with various ion-pacs, with DS4 detection stabilizer model DS4-2, P/N 031183

ELEMENT 16. INSTRUMENT AND EQUIPMENT CALIBRATION AND FREQUENCY

Field and laboratory equipment will be calibrated before samples are measured. Methods for calibrating instruments using a series of blanks, spikes, and control samples are described in detail in Element 14. In addition, Element 14 identifies how deficiencies will be resolved and documented.

All equipment calibration procedures will be performed in accordance to their respective SOPs.

Standard procedure for this calibration of instruments involves:
1. Ensuring instrument has stable baseline.
2. Check that instrument blanks are clean.
3. Calibrate instrument.
4. Run calibration verification.
5. Run continuing calibration verification (same standard as mid-point to ensure instrument is not drifting).
6. If calibration check verification fails, recalibrate, then re-analyze samples.

ELEMENT 17. INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies and acceptable consumables are identified in the attached SOPs. Gail Cho is responsible for inspection at the Water Pollution Control Lab and Mark Smith is the responsible party at California Laboratory Services.

Element 18. Non-Direct Measurements (Existing Data)

Non-direct measurements will be utilized by the project team as follows:

- Peer-reviewed of literature: This information/data will be used to prepare the literature review as well as for comparative purposes. Results generated by this project will be compared to those of other scientists to aide in the interpretation of the project results. Data from other studies will be carefully evaluated for study design, analytical techniques, statistical methods, and inferences drawn. Project staff will use professional judgment and experience as peer-reviewers to interpret the data and results of others.
- Government Reports: This information will be evaluated to help interpret results from this project.
- Driller's logs: Logs from water wells drilled in the City of Elk Grove area will be reviewed to gain a greater understanding of the possible types of lithology anticipate encountered at the two study sites. This information will be used to identify the appropriate depth for all wells that are constructed.

Data from the literature is evaluated using professional judgment. Many of the project team members participating in this study have published research results in peer-reviewed journals and have served as reviewers for various journals as well as the US EPA. The validity of data and its interpretation is evaluated on a case-by-case basis. Considerations include chemical methods of analysis used in the study, statistical methods of analysis, study design, and validity of interpretation of results. If questions regarding any aspect of the studies falls outside of the project team's expertise, outside experts, such as faculty at UC Davis, will be consulted.

Element 19. Data Management

All results of analyses, as well as field notes, will be entered into Microsoft Office software (primarily Excel). Data will be maintained by various project team members, as described in Element 9. Data will be managed following SWAMP guidelines (See Table 23 [7]) for data management. Electronic and hand-written data will be managed using standard techniques such as computers, external hard drives, and department servers. Data will be managed and back-up at a minimum of four locations; at each consultant's office, at the City of Elk Grove, and at OEHHA. Hand-written data such as field sheets and logs will be filed in three separate places; at each consultant's office and at OEHHA.

Field data, including data from loggers, will be maintained in original form (raw data) throughout the duration of the project. Data will be entered into or transferred to an Excel spreadsheet. All entries will be double checked. All files will be backed up onto a company/department server every night. Melanie Carr, cbec, Casey Meirovitz Luhdorff & Scalmanini and OEHHA are the project staff directly responsible for data management along with Connie Nelson for the City of Elk Grove.

At appropriate intervals, data will be entered into CEDEN and GAMA. Staff will work with the Central Valley Regional Data Center (Michael L. Johnson, LLC) to obtain advice on formatting and entering data into CEDEN.

[7] Posted at: http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2013/04/SWAMP_SOP_Field_Data_Verification_v2_1.pdf

Table 23. (Element 19) Laboratory Data Verification Checklist

Analyst/Technician:	Analytical/Prep Method No.:
Analysis/Prep Date:	Test Name:
Analysis/Prep Time:	
Supervisor Review:	
Part A: Analytical Chemistry Checklist	
☐ Sample IDs match on all paperwork ☐ Sample matrix verified and documented ☐ Test method and project requested target analytes verified and documented ☐ Reporting units are correct ☐ Method Detection Limit (MDL) verified with low level Quality Control (QC)standard ☐ Sample preservation verified and documented ☐ Sample preparation holding time met ☐ Sample analysis holding time met ☐ Analytical sensitivity present ☐ Correlation coefficient within limits ☐ Calibration standards within historical limits ☐ Internal standards within limits ☐ Dilution factors and concentration calculations verified ☐ Check for over-range samples performed ☐ Laboratory blanks < MDL, or within method prescribed project specific limits ☐ QC recoveries within project specific limits ☐ Matrix spike (MS) recoveries within project specific limits ☐ Surrogate spike recoveries within limits ☐ Analytical precision within limits ☐ Required number of laboratory QC samples used and sample concentration range bracketed	
Part B: Additional Supervisor or Laboratory Project Manager Checks	
☐ All required analyses were performed and data were reported. ☐ Electronic Data Deliverables (EDD) format is correct and all required entries are present. ☐ Verify correctness of sequence of reported collection, preparation and analysis times. ☐ Project-required MDLs were met and demonstrated through MDL or Practical Quantitation Limit (PQL) checks and method blanks. ☐ Clear case narrative provided with indication of any non-conformance and corrective action taken. ☐ Verify accuracy of all data entries and completeness of document. ☐ Check of reasonable results (e.g., pH not >14) ☐ Conduct comparison checks ☐ Check for reversals and inter-parameter relationships (total > dissolved, results of Conductivity vs. Total Dissolved Solids (TDS)) ☐ Ionic balance checks performed and within limits (if permitted by test list) ☐ Check field blanks and field precision recovery, if identified in the batch. Ensure project Data Quality Objectives are met.	

Group C: Assessment and Oversight

Element 20. Assessments and Response Actions

20.1 Assessment of Labs and Field Crews

In the field, data/field technicians are responsible for flagging data that does not meet QA/QC criteria and alerting relevant supervisor. The Project QA Officer will monitor the collection of both stormwater and groundwater sample collection and field analyses two times during the sample collection period (October – May) of each year. The review will involve observations and comparisons of the practices implemented in the field compared to those identified in the relevant SOPs. If discrepancies are noted, they will be corrected immediately, if possible. If not, a memorandum will be prepared and discussed with the field staff as well as the project team leads for each consultant (stormwater and groundwater). If the deviations are considered significant or could impair the analysis or quality of the data, the sample collection will be repeated at a subsequent rain event.

Project assessments will be conducted by the Quality Assurance Officer (QAO) of each laboratory prior to submission to the project team. These assessments will include evaluation of all QA/QC protocols, sample handling and tracking, and procedures to verify the proper functioning of analytical equipment.

20.2 Communication

The Project Manager will notify and coordinate surface water sampling crew of field assessments five days prior to upcoming rain events that are anticipated to be of sufficient size to warrant sample collection. Groundwater sampling crew will be notified once sampling has occurred to follow with vadose zone and groundwater collections. During dry seasons, the groundwater sampling crew will make their own determination as to the best date to collect samples and notify Project QA Officer and Project Manager.

The Project QA Officer will notify laboratories prior to collection dates. The laboratory assessment may occur at any point before samples are delivered.

Both assessments will involve an evaluation of procedures, personnel, equipment and facility requirements found in this Quality Assurance Project Plan. An assessment form will be prepared prior to both field and laboratory evaluations by QA Officer.

20.3 Assessment Summary

Following assessments, the Project QA Officer will compile notes into a single document. The assessment summary will detail findings, observations, and recommendations with references to this Quality Assurance Project Plan or other applicable requirements. The summary will address:

- A review of analytical and field data for complete and accurate documentation.
- Appropriate chain of custody procedures.
- Compliance with analytical holding times.
- Compliance with required laboratory QA controls, spikes, and duplicate results that meet the measurement quality objectives.
- Identification of outliers or flagged data that may require duplication or special handling.

The Project QA Officer may require additional assessments or stop field crew or laboratories from continuing work if a major problem is detected.

Documentation will be archived in accordance with specifications identified in Element 9: Documents and Records. All reports and memorandums related to field and analytical data procedures and quality will be filed electronically with the City of Elk Grove, OEHHA, and the relevant consultant.

20.4 Assessment Response

Project team member and laboratories must comply with the corrective actions recommended by the Project QA Officer. The assessed organization must then document corrective actions (training, facility upgrades, or instrument improvements) required by the Project QA Officer. Any decisions to alter or adjust protocols will be made in consultation with the Project Director and Manager.

ELEMENT 21. REPORTS TO MANAGEMENT

The following table describes the type of quality assurance reports to be completed, the deliverable dates and responsible parties.

Table 24. (Element 21) Quality Assurance Management Reports

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Dates(s)	Person(s) Responsible for Report Preparation	Report Recipients
Quarterly progress reports	Quarterly	45 days after the end of the quarter	Barbara Washburn/ Connie Nelson	Darren Wilson, Connie Nelson, Fernando Duenas, Melanie Carr, Chris Bowles, Casey Meirovitz, Vicki Kretsinger-Grabert, Darren Wilson, Kelley List
Audit memorandums	As needed	n/a	Barbara Washburn/ Connie Nelson	Same as above
Draft final report	Once	November 1, 2016	Barbara Washburn/ Connie Nelson	Same as above
Final report	Once	February 1, 2017	Barbara Washburn/ Connie Nelson	Same as above

GROUP D: DATA VALIDATION AND USABILITY

ELEMENT 22. DATA REVIEW, VERIFICATION AND VALIDATION REQUIREMENTS

The data quality objectives for accuracy, precision, recovery, and reporting limits identified in Element 7, will be used as the criteria to review data. Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Data validation is an analyte and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Quarterly reports will summarize data verification and validation.

The verification process involves:

- Record, log and documentation activities, including drilling, field work and, sample collection.
- Chain of Custody forms.
- Description of analytical work performed.

The validation of data involves:

- Reviewing quality control limits and determining if they were met by the laboratories and field measurements (i.e., completeness, holding times, laboratory duplications, certified reference materials, laboratory control samples, laboratory and field blanks, field QC samples, and reporting limits).
- Determining if the data meets criteria and is appropriate for use.
- Summarize report of findings, including any deficiencies that should be considered during further analysis as well as any correction/updates to the data.

ELEMENT 23. METHODS FOR VERIFICATION AND VALIDATION

Validation will be performed by determining if precision and accuracy limits are met, using methods described in Element 14 (there are no additional SOPs). Verification of data will be performed by Melanie Carr for data collected by cbec and by Casey Meirovitz for data collected by Ludhorff and Scalmanini. Laboratory data validation and verification will be performed by Gail Cho, Water Pollution Control Lab and by James Chiang, California Laboratory Services (refer to Table 23). The laboratory QA Officer (Cho and Chiang) will communicate results of methods and data validation to project QA Officer, who will communicate results to M. Carr and C. Meirovitz, leads for stormwater and groundwater quality analysis.

Blank contamination will be checked to determine if laboratory contamination has influenced results. Method blanks will be processed through the entire analytical procedure. If field samples are contaminated from laboratory procedures, a false positive result could be produced and the sample would be unusable.

Accuracy will also be checked to determine if the measurement represents the true value of the sample. If a sample overestimates or underestimates a value, a false positive or negative result could be produced. Accuracy is verified with laboratory control samples, spikes, matrix spikes, etc.

Precision reflects degree to which a repeated measure reports the same results each time an analysis is performed. It is reported as the relative percent difference (RPD). Good precision provides confidence that the analytical process is consistently measuring the target analyte.

When any of these QA measures are found to be a problem, corrective action is usually initiated at the analytical laboratories (see Figure 4, Element 14). However, if laboratory or field limits are not met, discussions with appropriate project staff will be held to assess remedies. Initial reconciliation and corrections, if necessary, will be performed by the Project Q/A Officer, James Chiang, President, California Laboratory Services , and Gail Cho, QA Officer, Water Pollution Control Lab. Final determination on how the data will be used will be made through discussions with project team members of cbec, Ludhorff and Scalmanini, OEHHA, and City of Elk Grove.

ELEMENT 24. RECONCILIATION WITH USER REQUIREMENTS

Analysis of data will be performed using standard research methods. Initially descriptive statistics will be used to summarize the data. Scatter plots and box and whisker plots will be made to visualize the data, looking both at trends over time, differences between sampling sites, differences between upgradient and downgradient groundwater quality, and differences between stormwater and groundwater, pre- and post- pre-treatment. More formal analysis will be conducted, using statistical software (R or Statistica) to assess the significance of the differences. Parametric and non-parametric statistics will be used to assess:

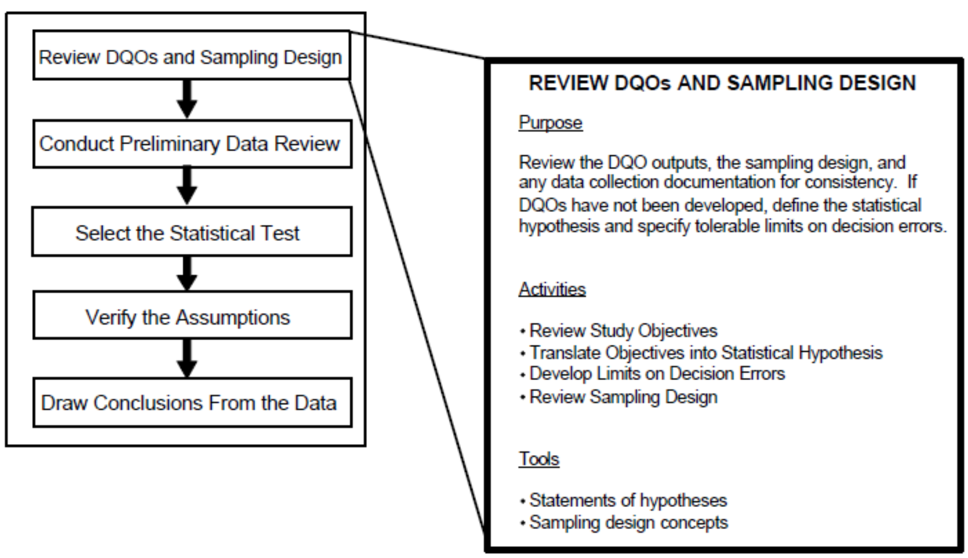
- Differences between upgradient and downgradient groundwater quality.
- Differences between the quality of water in the vadose zone and aquifer.
- Effects of different land use types on stormwater and groundwater quality.
- Changes in the quality of stormwater over the course of a water year.
- Changes in the quality of vadose zone water and groundwater over the two year study period.
- Effects of water quality pre-treatment feature on reducing contaminants entering dry wells.

Uncertainty will be evaluated through the use of statistical tests to determine the probability that observed differences are significant. Data will be presented with error bars and symbols to indicate significant differences. Graphs will indicate health protective standards for comparative purposes. Assumptions made during the analysis, as well as limitations of data, will be clearly identified in figures, tables, and reports.

Data that does not meet the measurement quality objectives will be flagged. Rejected data will not be included in the data analyses.

Results of the resolution of the data verification/validation process will be described in detail in the project data logs and summarized in annual progress reports, final report, and other written or online materials produced. Figure 7 identifies the data analysis process.

Figure 7. (Element 24) Data Analysis Procedure



Legend:
Data Quality Objective (DQO)

It is not clear how this data will be used in the context of the SWAMP umbrella. SWAMP by definition focuses on monitoring ambient surface water conditions. This study will produce groundwater as well as effluent data. Indirectly, results of this study will be useful to SWAMP because a failure to minimize the hydrologic changes associated with urbanization will result in continued degradation of water quality and aquatic habitat. If dry wells are found to be safe to use as an infiltration (LID) practice, then the quality of surface water downstream of locations in which dry wells are deployed should improve.

Appendix 1. Standard Operating Procedures (SOPs)

Appendix 1 is a standalone document. Each SOP is individually identified in the Table of Contents.

Note: The California Laboratory Services has agreed to meet all SWAMP requirements for MQO and QA/QC.

Appendix 2. Constituents to be Measured and Regulatory or Health Limits

Contaminant	California MCL (ppm)	California PHG (ppb)
Total Suspended Solids (EPA 160.2)		
TSS		
Pyrethroid Pesticides (WPCL PYR_WATER)		
Bifenthrin		
Cyfluthrin		
Cypermethrin		
Deltamethrin		
Esfenvalerate		
Fenvalerate		
Fenpropathrin		
Lambda-cyhalothrin		
Permethrin		
Chlorinated Herbicides (EPA 8151A)		
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.07	20
Dalapon		790
2,4-DB		
Dichloroprop		
Dinoseb	0.007	14
MCPA		
MCPP		
Pentachlorophenol		0.3
2,4,5-T		
2,3,5-TP (Silvex)	0.05	25
Triclopyr		
Triclopyr TEA		
surr: 2,4-DCAA		
TPH (EPA 8015M)		
Diesel		

Motor Oil		
Hydraulic oil		
Mineral oil		
Kerosene		
JP-5/JP-8		
Total extractable hydrocarbons		
Stoddard solvent		
Transformer oil		
Diesel range organics (C10-C28)		
TPH - Diesel		
TPH - Crude oil		
surr: o-Terphenyl		
surr: o-Chlorotoluene (Gas)		
PAHs (EPA 8310)		
Acenapthene		
Acenapthylene		
Anthracene		
Benzo(a)anthracene		
Benzo(a)pyrene	0.0002	0.007
Benzo(b)fluoranthene		
Benzo(g,h,hi)perylene		
Benzo(k)fluoranthene		
Chrysene		
Dibenz(a,h)anthracene		
Fluoranthene		
Fluorene		
Indeno(1,2,3-cd)pyrene		
Naphthalene		
Phenanthrene		
Pyrene		
Semi-Volatile Organics (EPA 625)		
Phenol		

bis(2-Chloroethyl)ether		
2-Chlorophenol		
1,3-Dichlorobenzene		
1,4-Dichlorobenzene	0.005	6
Benzyl Alcohol		
1,2-Dichlorobenzene	0.6	600
2-Methylphenol		
Bis(2-chloroisopropyl)ether		
4-Methylphenol		
N-Nitroso-di-n-propylamine		
Hexachloroethane		
Nitrobenzene		
Isophorone		
2-Nitrophenol		
2,4-Dimethylphenol		
Benzoic acid		
bis-(2-Chloroethoxy)methane		
2,4-Dichlorophenol		
1,2,4-Trichlorobenzene	0.005	
Naphthalene		
4-Chloroaniline		
Hexachlorobutadiene		
4-Chloro-3-methylphenol		
2-Methylnaphthalene		
Hexachlorocyclopentadiene	0.05	50
2,4,6-Trichlorophenol		
2,4,5-Trichlorophenol		
2-Chloronaphthalene		
2-Nitroaniline		
Dimethyl phthalate		
Acenaphthylene		
2,6-Dinitrotoluene		

3-Nitroaniline		
Acenaphthene		
2,4-Dinitrotoluene		
4-Nitrophenol		
Dibenzofuran		
2,4-Dinitrotoluene		
Diethyl phthalate		
4-Chlorophenyl-phenyl ether		
Fluorene		
Nitroaniline		
4,6-Dinitro-2-methylphenol		
N-nitrosodiphenylamine		
4-Bromophenylphenyl ether		
Hexachlorobenzene		0.03
Pentachlorophenol	0.001	
Phenanthrene		
Anthracene		
Di-n-butyl phthalate		
Fluranthene		
Pyrene		
Butyl benzyl phthalate		
Benzo(a)anthracene		
Chrysene		
bis(2-Ethylhexyl)phthalate		
Di-n-octyl phthalate		
Benzo(b)fluoranthene		
Benzo(k)fluoranthene		
Benzo(a)pyrene	0.0002	
Indeno(1,2,3-cd)pyrene		
Dibenz(a,h)anthracene		
Benzo(g,h,i)perylene		
alpha-BHC		

beta-BHC		
delta-BHC		
gamma-BHC (Lindane)	0.0002	0.032
Heptachlor	0.00001	0.008
Aldrin		
Heptachlor epoxide	0.00001	0.006
Dieldrin		
4,4'-DDE		
Endrin	0.002	1.8
4,4'-DDD		
Endosulfan sulfate		
4,4'-DDT		
Volatile Organic Compounds (EPA 8260B)		
Acetone		
Benzene	0.001	0.15
Bromobenzene		
Bromochloromethane		
Bromodichloromethane		
Bromoform		
Bromomethane		
2-Butanone		
n-Butylbenzene		
sec-Butylbenzene		
tert-Butylbenzene		
Carbon disulfide		
Carbon tetrachloride	0.0005	0.1
Chlorobenzene		200
Chloroethane		
2-Chloroethylvinyl ether		
Chloroform		
Chloromethane		
o-Chlorotoluene		

p-Chlorotoluene		
Dibromochloromethane		
1,2-Dibromo-3-chloropropane		0.0017
1,2-Dibromoethane (EDB)		
Dibromomethane		
1,2-Diclorobenzene	0.6	
1,3-Dichlorobenzene		
1,4-Dichlorobenzene	0.005	
Dichlorodifluromethane (Freon 12)		
1,1-Dichloroethane	0.005	3
1,2-Dichloroethane	0.0005	0.4
1,1-Dichloroethene		
cis-1,2-Dichloroethene		
trans-1,2-Dichloroethene		
1,2-Dichloropropane		0.5
1,3-Dichloropropane		
2,2-Dichloropropane		
1,1-Dichloropropene		
cis-1,3-Dichloropropene		
trans-1,3-Dichloropropene		
Ethylbenzene		300
1,1,2-Trichloro-1,2,2-trifluoroethane		
Hexachlorobutadiene		
2-Hexanone		
Isopropylbenzene		
p-Isopropyltoluene		
Methylene chloride		
4-Methyl-2-pentanone		
Methyl tert-butyl ether (MTBE)	0.013	13
naphthalene		
n-Propylbenzene		
Styrene	0.1	0.5

1,1,1,2-Tetrachloroethane		
1,1,2,2-Tetrachloroethane	0.001	0.1
Tetrachloroethene		
Toluene	0.15	150
1,2,3-Trichlorobenzene		
1,2,4-Trichlorobenzene	0.005	5
1,1,1-Trichloroethane	0.200	1000
1,1,2-Trichloroethane	0.005	0.3
Trichloroethene		
Trichloroflurormethane	0.15	
1,2,3-Trichloropropane		0.0007
1,2,4-Trimethylbenzene		
1,3,5-Trimethylbenzene		
Vinyl Acetate		
Vinyl Chloride	0.0005	0.05
Xylenes (total)	1.750	1800
o-Xylene		
Di-isopropyl ether		
Ethyl tert-butyl ether		
tert-Amyl methyl ether		
tert-Butyl alcohol		
surr: 1,2-Dichloroethane-d4		
surr: Toluene-d8		
surr: 4-Bromofluorobenzene		
Metals (EPA 200 series)		
Aluminum	0.2	600
Antimony	0.006	20
Arsenic	0.01	0.004
Barium	1	2,000
Beryllium	0.004	1
Cadmium	0.005	0.04
Chromium	0.05	0.02

Cobalt		
Copper	1.3	300
Lead	0.015	0.2
Manganese		
Molybdenum		
Nickel	0.1	12
Selenium	0.05	30
Silver		
Thallium	0.002	0.1
Vanadium		
Zinc		
General Minerals and Physical		
SM 2320B		
Total Alkalinity		
Bicarbonate as CaCO3		
Carbonate as CaCO3		
Hydroxide as CaCO3		
EPA 300.0		
Chloride		
Fluoride		1,000
Nitrate as NO3	45	
Nitrate as N		10,000 as N
Sulfate as SO4		
EPA 120.1		
Specific Conductance		
SM 5540 C		
Methylene blue active substances		
EPA 200.7/2340B		
Calcium		
Magnesium		
Potassium		
Sodium		

Boron		
Hardness as $CaCO_3$		
SM 4500-H B		
pH		
SM 2540C		
Total Dissolved Solids		
SM 2120B		
Color		
EPA 140.1		
Threshold odor number		
EPA 180.1		
Turbidity		
Biological (SM 9221)		
Total coliform		

Appendix 3. Summary of Data from Sacramento Stormwater Quality Partnership

City of Elk Grove Receiving Water Monitoring

Relevant data from the Sacramento Stormwater Quality Partnership within the City of Elk Grove is summarized within this section. Samples were collected from three (3) locations in two creek systems within the City limits.

Site Locations

Location ID	Location	Latitude	Longitude
EGCK01	Elk Grove Creek at Laguna Springs Drive	38.41270	-121.35410
LC01	Laguna Creek at Franklin	38.44707	-121.44449
LC02	Laguna Creek at Hwy 99	38.43052	-121.39798

Key Findings

The following tables highlight selected contaminants from existing data. Action limits related to drinking water are also identified. Highlighted areas denote contaminants which have exceeded limits established by the identified source.

USEPA IRIS reference dose assumes 70 kg body weight, 2 liters per day drinking water consumption, and 20 percent relative source contribution. An additional uncertainty factor of 10 is used for Class C carcinogens.

Cal/EPA Cancer Potency Factor as a drinking water level assumes 70 kg body weight and 2 liters per day drinking water consumption.

Table 1. Elk Grove Creek at Laguna Springs Drive. Select organophosphate pesticides, chlorinated pesticides and triazine. All other tested contaminants were non-detects. Data collected between 2/2/04 – 2/24/08 (n = 1-13 depending on contaminant). Samples were taken as both grab and flow composite samples.

Contaminant	Concentration	Units	Limit	Units	Source
Chlorpyrifos	0.015	µg/L	21	µg/L	USEPA IRIS Reference Dose
Diazinon	0.04 – 0.34	µg/L	6	µg/L	California DHS Action Level for Drinking Water
Malathion	0.03 – 0.13	µg/L			
Prometon	0.14	µg/L			
Prowl	0.08 – 0.11	µg/L			
Simazine	0.09 - 1	µg/L	4	µg/L	California PHG for Drinking Water

Table 2. Laguna Creek at Franklin Boulevard. Data collected between 10/31/08 – 11/18/08 (n = 1). All samples taken as grab samples.

Contaminant	Results	Units	Limit	Units	Source
1-Methylnaphthalene	0.0122	µg/L			
2,6-Dimethylnaphthalene	0.009	µg/L			
2-Methylnaphthalene	0.0212	µg/L	28	µg/L	USEPA IRIS Reference Dose
Bicarbonate as CaCO3	39	mg/L			
Bifenthrin	0.004	mg/kg			
Biphenyl	0.0113	µg/L			
Chrysene	0.0096	µg/L	0.4	µg/L	California PHG
Copper (Dissolved)	5.3	µg/L	1300	µg/L	California Primary MCL
Copper (Total)	9.4	µg/L			
Dissolved Solids (Total)	85	mg/L	500	µg/L	California Secondary MCL
E. Coli	30000	MPN/100 mL	0		US EPA Federal MCL Goal
Fecal Coliform	50000	MPN/100 mL	0		US EPA Federal MCL Goal
Fluoranthene	0.0075	µg/L	280	µg/L	USEPA IRIS Reference Dose
Iron (Total)	1800	µg/L	300	µg/L	California Secondary MCL
Lead (Dissolved)	0.14	µg/L	2	µg/L	California PHG for Drinking Water
Lead (Total)	2	µg/L			
Malathion	0.1161	µg/L			
Mercury, Methyl	0.198	ng/L	70	ng/L	USEPA IRIS Reference Dose
Naphthalene	0.0069	µg/L	170	µg/L	California DHS Action Level for Drinking Water
Nitrate+Nitrite as N	0.64	mg/L	10	mg/L	California Primary MCL (Nitrate as N)
Phenanthrene	0.0074	µg/L			
Phosphorus	0.26	mg/L			
Pyrene	0.0086	µg/L	210	µg/L	USEPA IRIS Reference Dose
Suspended Solids	16	mg/L			
Turbidity	23	NTU			
Zinc (Dissolved)	15	µg/L	2100	µg/L	USEPA IRIS Reference Dose
Zinc (Total)	28	µg/L			

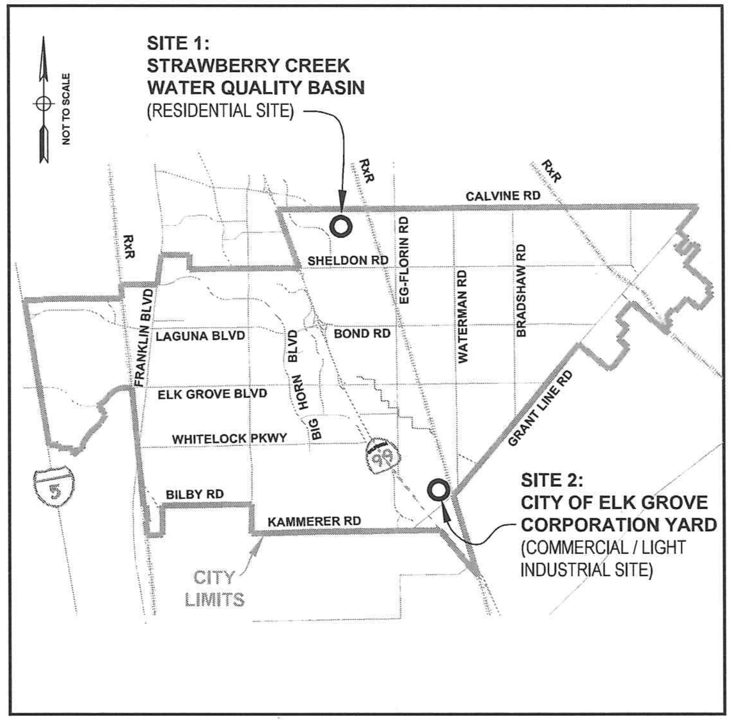
Table 3. Laguna Creek at Highway 99. Data collected between 12/14/08 – 5/1/08 (n = 2-19 depending on contaminant). Samples were taken as grab or flow composite samples.

Contaminant	**Results**	**Units**	**Limit**	**Units**	**Source**
1-Methylnaphthalene	ND – 0.0095	µg/L			
1-Methylphenanthrene	ND – 0.0096	µg/L			
2,3,5-Trimethylnaphthalene	ND – 0.00258	µg/L			
2,6-Diethylnaphthalene	ND – 0.0052	µg/L			
2-Methylnaphthalene	ND – 0.0073	µg/L	28	µg/L	USEPA IRIS Reference Dose
Acenaphthene	ND – 0.0044	µg/L	420	µg/L	USEPA IRIS Reference Dose
Acenaphthylene	ND – 0.0071	µg/L			
Allethrin	ND – 5.4	ng/L			
Anthracene	ND – 0.0053	µg/L	2100	µg/L	USEPA IRIS Reference Dose
Benz(a)anthracene	ND – 0.0056	µg/L	0.04	µg/L	California PHG for benzo(a)pyrene
Benzo(a)pyrene	ND – 0.0124	µg/L	0.2	µg/L	California Primary MCL
Benzo(b)fluoranthene	ND – 0.008	µg/L	0.04	µg/L	California PHG for benzo(a)pyrene
Benzo(e)pyrene	ND – 0.0093	µg/L			
Benzo(g,h,i)perylene	ND – 0.0165	µg/L			
Benzo(k)fluoranthene	ND – 0.00409	µg/L			
Bicarbonate as CaCO3	26 – 110	mg/L			
Bifenthrin	ND – 10.8	µg/L			
Biphenyl	ND – 0.0044	µg/L			
Calcium	7300 – 14900	µg/L			
Chlorpyrifos	ND – 0.21	µg/L	21	µg/L	USEPA IRIS Reference Dose (c)
Chrysene	ND – 0.0204	µg/L	0.4	µg/L	California PHG for benzo(a)pyrene
Copper (Dissolved)	1.6 – 8.62	µg/L	1300	µg/L	California Primary MCL
Copper (Total)	2.6 – 16.4	µg/L			
Cyfluthrin	ND – 0.75	µg/L			
Cypermethrin	ND – 0.21	µg/L			
Deltamethrin/Tralomethrin	ND – 0.42	µg/L			
Diazinon	ND – 1	µg/L	6	µg/L	California DHS Action Level for Drinking Water
Dibenz(a,h)anthracene	ND – 0.0043	µg/L	0.0085	µg/L	Cal/EPA Cancer Potency Factor as a drinking water level

Dibenzothiophene	ND – 0.0156	µg/L			
Dissolved Solids (Total)	51 - 180	mg/L	500	µg/L	California Secondary MCL
E. Coli	20 – 22000	MPN/100 mL	0		USEPA Federal MCL Goal
Esfenvalerate	ND – 0.0061	µg/L			
Esfenvalerate/Fenvalerate	ND – 0.0051	µg/L			
Fecal Coliform	40 – 50000	MPN/100 mL	0		USEPA Federal MCL Goal
Fenpropathrin	ND – 0.0068	µg/L			
Fenvalerate	ND – 0.0065	µg/L			
Fluoranthene	ND – 0.0051	µg/L	280	µg/L	USEPA IRIS Reference Dose (c)
Indeno (1,2,3-cd)pyrene	ND – 0.0072	µg/L	0.04	µg/L	California PHG for benzo(a)pyrene & OEHHA PEFs
Iron (Dissolved)	ND – 99	µg/L	300	µg/L	California Secondary MCL
Iron (Total)	ND – 2900	µg/L	300	µg/L	California Secondary MCL
L-Cyhalothrin	ND – 0.59	µg/L			
Lead (Dissolved)	0.14 – 0.344	µg/L	2	µg/L	California PHG for Drinking Water
Lead (Total)	0.52 – 3.85	µg/L	2	µg/L	California PHG for Drinking Water
Magnesium (Total)	3350 – 7560	µg/L			
Malathion	ND – 0.6279	µg/L			
Mercury (Total)	1.59 – 8.49	µg/L	2	µg/L	California Primary MCL
Mercury (Methyl)	0.085 – 0.334	ng/L	70	ng/L	USEPA IRIS Reference Dose (C)
Naphthalene	ND – 0.0118	µg/L	170	µg/L	California DHS Action Level for Drinking Water
Nitrate + Nitrite as N	ND – 0.87	mg/L	10	mg/L	California Primary MCL (Nitrate as N)
Permethrin, Total	ND – 6.7	µg/L			
Perylene	ND – 0.00824	µg/L			
Phenanthrene	ND – 0.0122	µg/L			
Phosphorus (Total)	0.1 – 0.41	mg/L			
Phosphorus as P	0.11 – 0.28	mg/L			
Pyrene	ND – 0.0324	µg/L	210	µg/L	USEPA IRIS Reference Dose (C)
Total Suspended Solids	7 – 220	mg/L			
Tau-Fluvalinate	ND – 0.0028	µg/L			
Tetramethrin	ND – 0.0028	µg/L			

Total Kjeldahl Nitrogen	0.63 – 1.9	mg/L			
Total Organic Carbon	6.3 – 25	mg/L			
TPH as Diesel	ND – 140	µg/L	56 - 140	µg/L	USEPA Superfund Provisional Reference Dose (c)
TPH as Motor Oil	ND – 660	µg/L			
TPH Quantitated as Diesel Fuel	ND – 395	µg/L			
TPH Quantitated as Motor Oil	ND – 946	µg/L			
Turbidity	8.7 – 98	NTU			
Zinc (Dissolved)	ND – 2	µg/L	2100	µg/L	USEPA IRIS Reference Dose (c)
Zinc (Total)	5 – 50.1	µg/L			

Appendix 4. Improvement Plans for Monitoring Wells and Dry Wells



PROJECT LOCATIONS

CITY OF ELK GROVE, CA

IMPROVEMENT PLANS FOR:

INVESTIGATION BORINGS / MONITORING WELLS IMPROVEMENTS PROJECT WDR019

UTILITY	COMPANY / CONTACT		TELEPHONE
PROJECT MANAGER	CITY OF ELK GROVE	CONNIE NELSON	916-478-3638
DRAINAGE	CITY OF ELK GROVE	FERNANDO DUENAS	916-627-3434
CABLE TV	AT&T BROADBAND	ASTRID WILLARD	916-453-6136
CABLE TV	COMCAST	STEVE ABELIA	916-830-6757
ELECTRIC	S.M.U.D.	JACK GRAHAM	916-732-6643
FIRE	COSUMNES COMMUNITY SERVICES DISTRICT	SHEILA WOLCOTT	916-405-7100
GAS	PG&E	MIKE WILLIAMS	916-386-5013
PARKS & RECREATION	COSUMNES COMMUNITY SERVICES DISTRICT	STEVE SIMS	916-947-1831
PHONE	FRONTIER COMMUNICATION	EVA MOREDOCK	916-691-5615
PHONE	SUREWEST	GRETCHEN HILLDEBRAND	916-691-5615
SEWER	SACRAMENTO AREA SEWER DISTRICT	ROB ESPINOZA	916-876-6386
TRANSIT	e-TRAN	JEAN FOLETTA	916-687-3030
WATER	ELK GROVE WATER SERVICE	BRUCE KAMILOS	916-585-9385
WATER	SACRAMENTO COUNTY WATER AGENCY	IMELDA TABBADA	916-874-4261
U.S.A.	UNDERGROUND SERVICE ALERT	811 or 1-800-227-2600	

Know what's **below.**
Call before you dig.

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SEPTEMBER 2013

ABBREVIATIONS LIST:

- AB – aggregate base
- brk – break
- dia – diameter (ø)
- (E) – existing
- gd – ground
- inv. – invert
- PVC – polyvinyl chloride
- sch – schedule
- SD – storm drain
- SRI – Silica Resources Incorporated
- (Typ) – typical
- w/ – with

SHEET INDEX:

NO.	REVISION	BY	DATE

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS
500 FIRST STREET
WOODLAND, CALIFORNIA
PHONE: (530) 661-0109

DESIGNED: .
DRAWN: .
CHECKED: .

PROFESSIONAL GEOLOGIST
CASEY DONALD MEIROVITZ
No. 9074
STATE OF CALIFORNIA

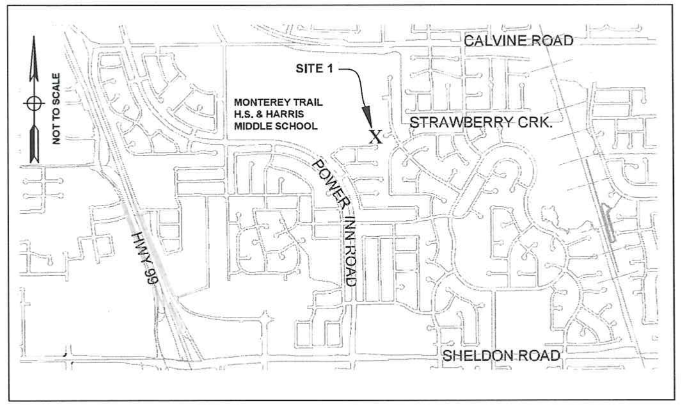
INVESTIGATION BORINGS / MONITORING WELLS
IMPROVEMENTS PROJECT

TITLE SHEET

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

SHEET: 1 OF 5

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

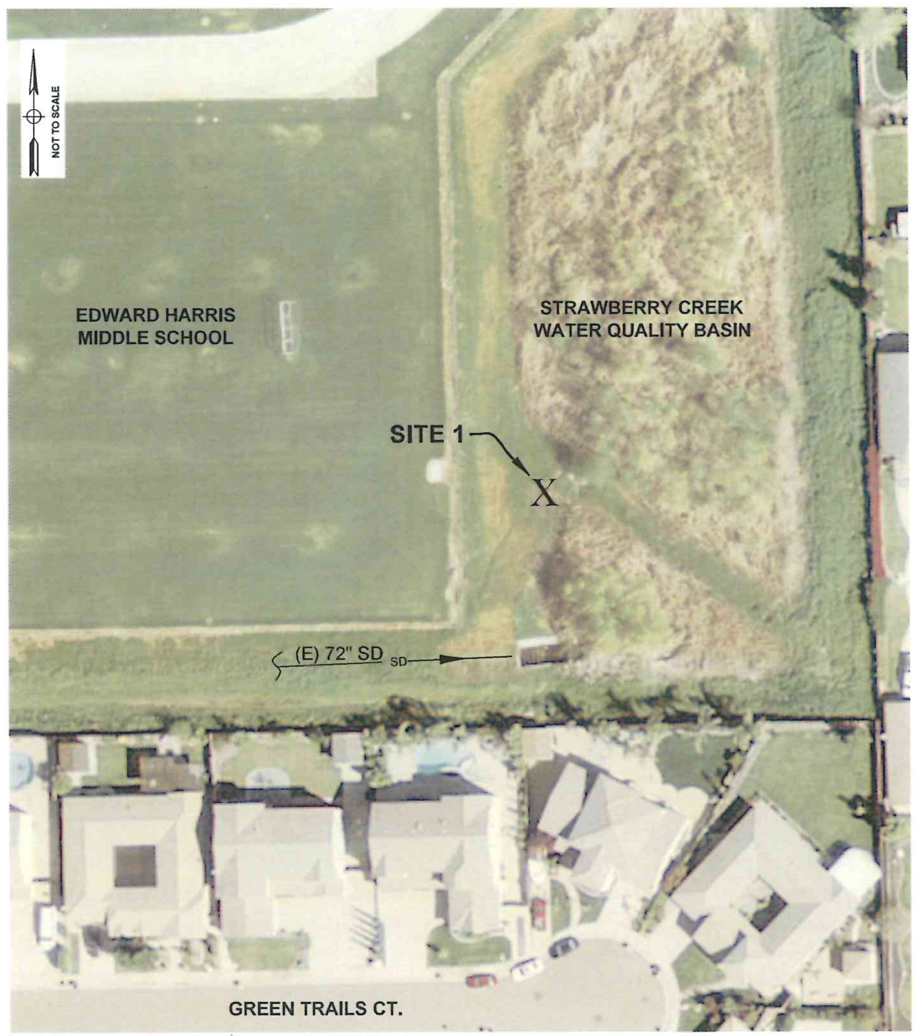


SITE 1 - VICINITY MAP

STRAWBERRY CREEK WATER QUALITY BASIN

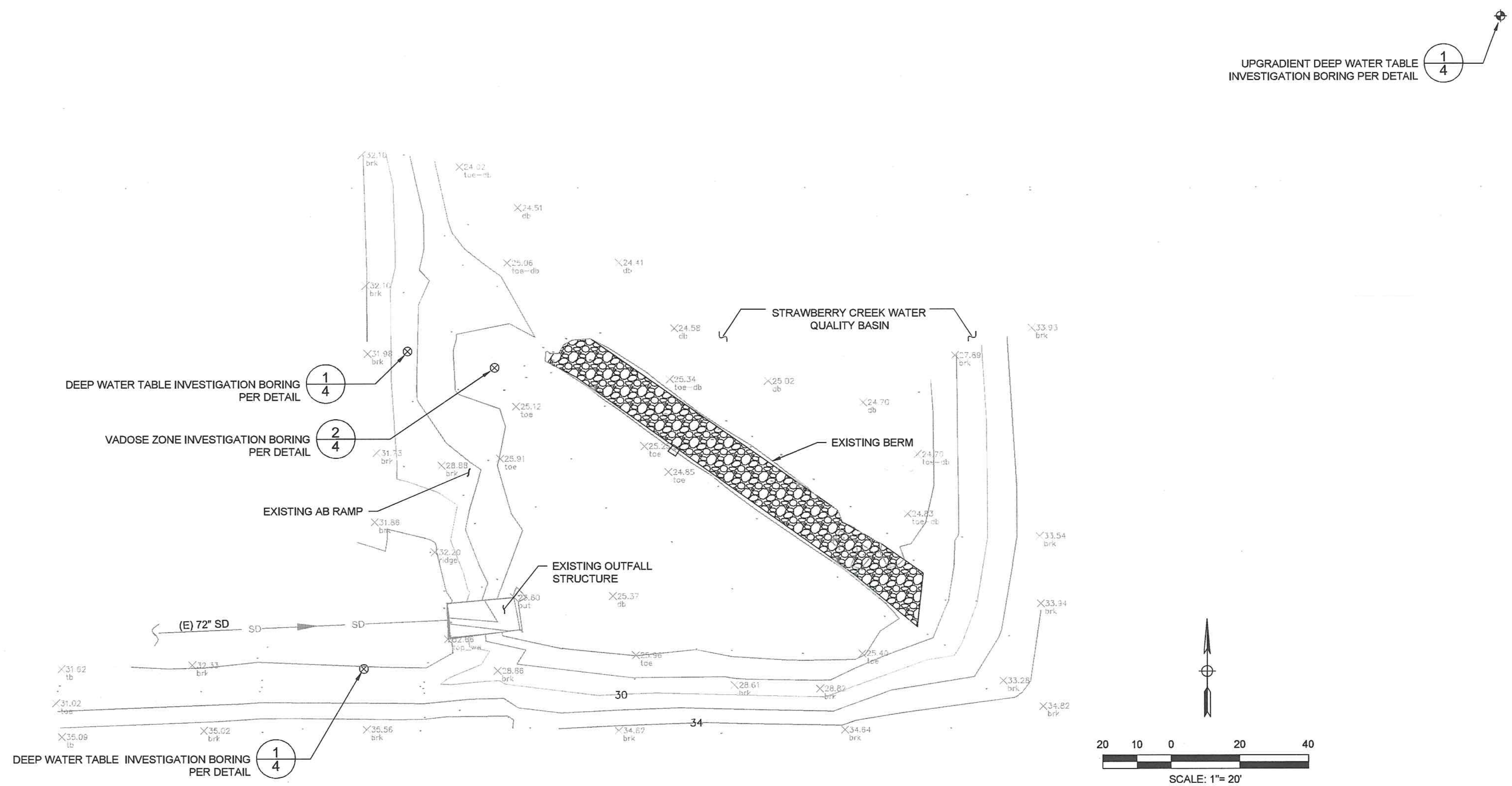
NOTES:

1. CONTRACTOR TO VERIFY EXISTING UTILITIES PRIOR TO COMMENCEMENT OF WORK.
2. INVESTIGATION BORING LOCATIONS TO BE CONFIRMED BY DESIGN ENGINEER PRIOR TO CONSTRUCTION.



SITE 1 - AERIAL VIEW

STRAWBERRY CREEK WATER QUALITY BASIN



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SEPTEMBER 2013

SITE 1 - LAYOUT PLAN

STRAWBERRY CREEK WATER QUALITY BASIN

NO.	REVISION	BY	DATE

LUHDORFF & SCALMANINI CONSULTING ENGINEERS
500 FIRST STREET
WOODLAND, CALIFORNIA
PHONE: (530) 661-0109

DESIGNED: .
DRAWN: .
CHECKED: .

PROFESSIONAL GEOLOGIST
CASEY DONALD MEIROVITZ
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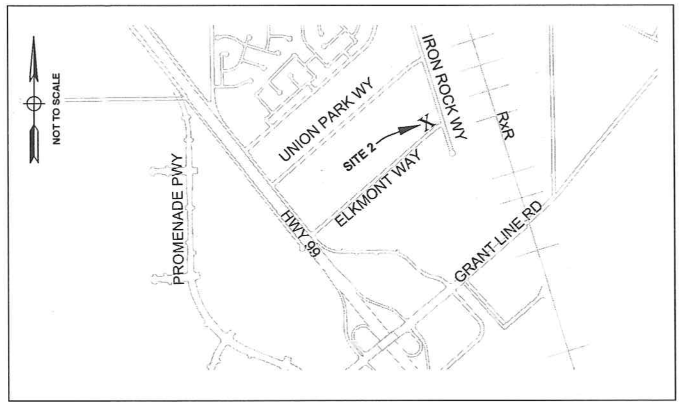
STATE OF CALIFORNIA

INVESTIGATION BORINGS / MONITORING WELLS IMPROVEMENTS PROJECT
SITE 1: STRAWBERRY CREEK WATER QUALITY BASIN VICINITY MAP, AERIAL VIEW & SITE LAYOUT PLAN

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"= 20' VERT: N/A
PROJECT No.: WDR019
SHEET: 2 OF 5

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

Aerial: 10SFH39055, Xref: Straw Base Exploded, COEG_Composite_Street Map

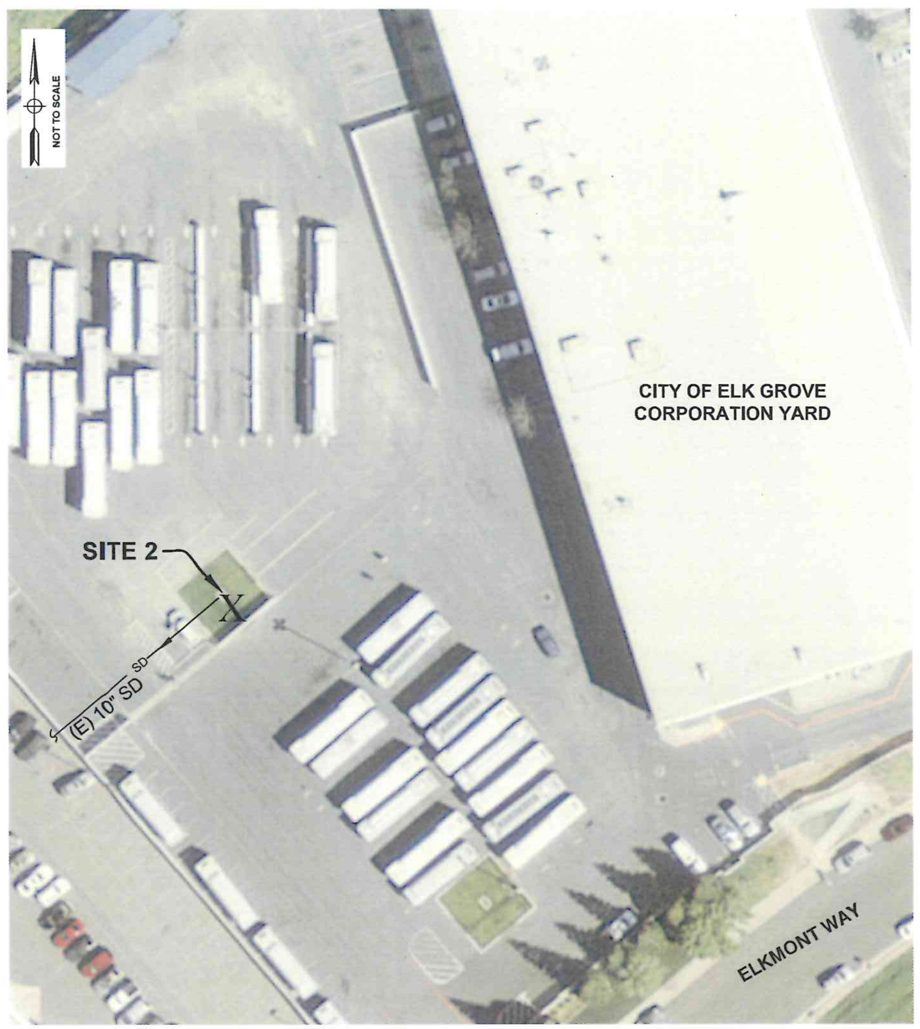


SITE 2 - VICINITY MAP

10250 IRON ROCK WAY

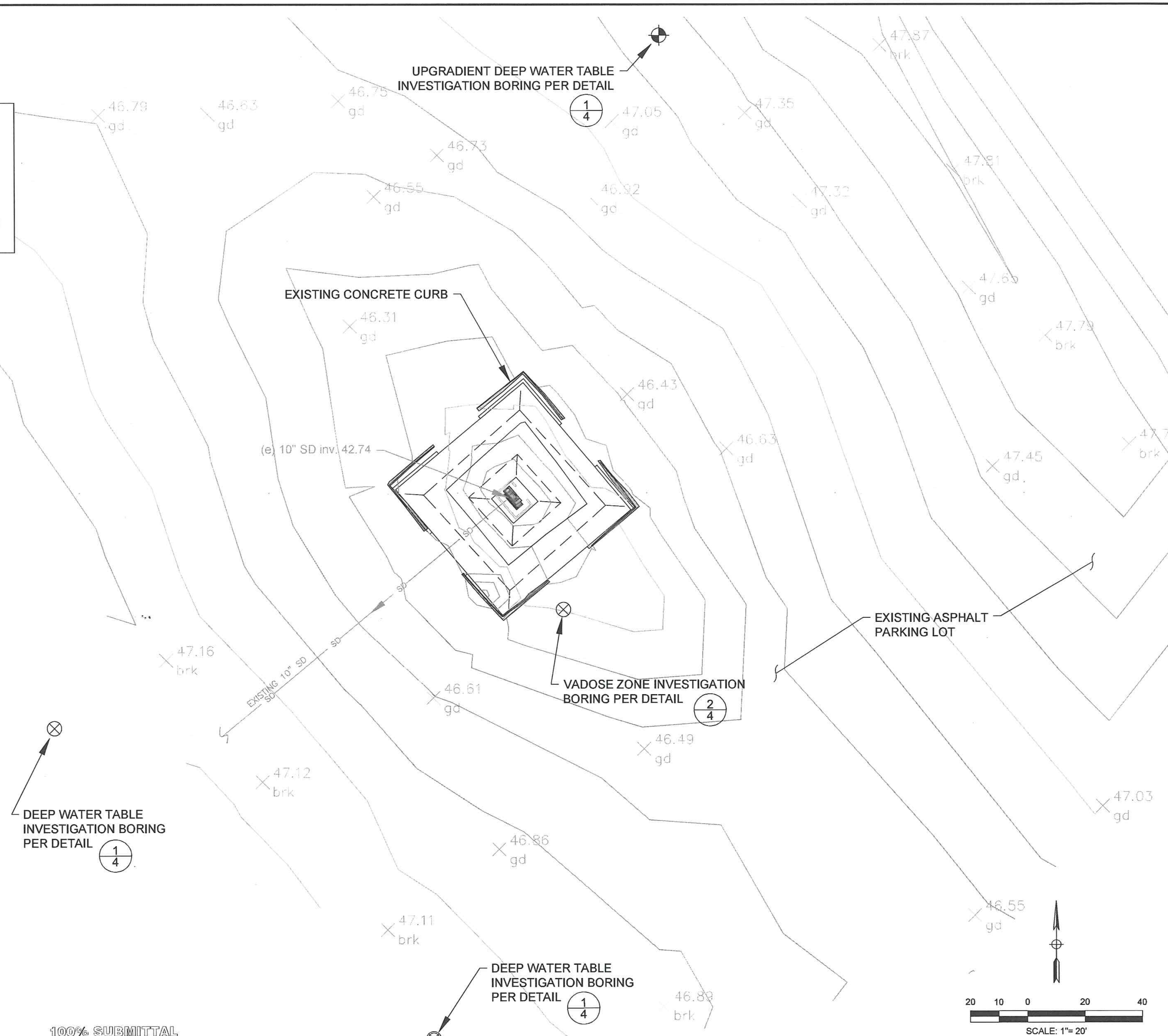
NOTES:

1. CONTRACTOR TO VERIFY EXISTING UTILITIES PRIOR TO COMMENCEMENT OF WORK.
2. INVESTIGATION BORING LOCATIONS TO BE CONFIRMED BY DESIGN ENGINEER PRIOR TO CONSTRUCTION.
3. PROTECT EXISTING IRRIGATION SYSTEM IN PLACE.



SITE 2 - AERIAL VIEW

10250 IRON ROCK WAY



SITE 2 - LAYOUT PLAN

10250 IRON ROCK WAY

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SEPTEMBER 2013

PROFESSIONAL GEOLOGIST
CASEY DONALD MEIROVITZ
No. 9074
STATE OF CALIFORNIA

NO.	REVISION	BY	DATE

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS
500 FIRST STREET
WOODLAND, CALIFORNIA
PHONE: (530) 661-0109

DESIGNED: .
DRAWN: .
CHECKED: .

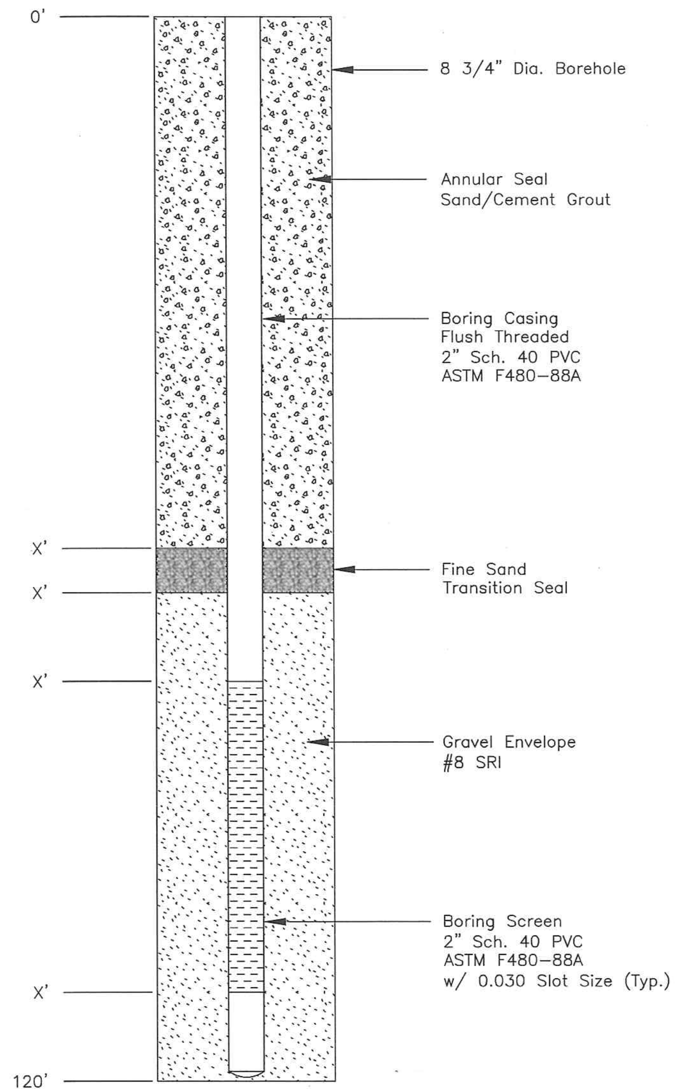
INVESTIGATION BORINGS / MONITORING WELLS
IMPROVEMENTS PROJECT
SITE 2: CITY OF ELK GROVE CORPORATION YARD
VICINITY MAP, AERIAL VIEW & SITE LAYOUT PLAN

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"=20' VERT: N/A
PROJECT No.: WDR019

SHEET: 3 OF 5

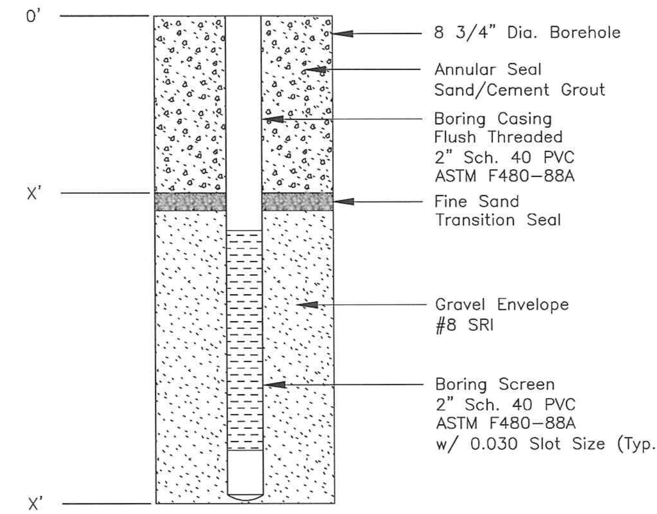
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

Aerial: 10SFH420495, Xref: cbec - CORP2, COEG_Composite_Street Map



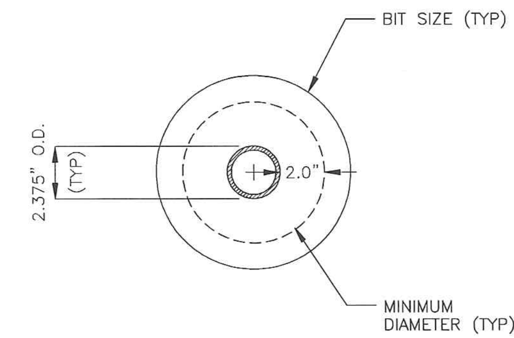
1 UPGRADIENT/ DEEP WATER TABLE INVESTIGATION BORING

NOT TO SCALE



2 VADOSE ZONE INVESTIGATION BORING

NOT TO SCALE



3 INVESTIGATION BORING PLAN VIEW

NOT TO SCALE

INVESTIGATION BORING DIMENSIONS

MIN. DIAMETER	6.375"
BIT SIZE	8-3/4"

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SEPTEMBER 2013

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0 1 2 3 4

LUHDORFF & SCALMANINI CONSULTING ENGINEERS
500 FIRST STREET
WOODLAND, CALIFORNIA
PHONE: (530) 661-0109

DESIGNED: .
DRAWN: .
CHECKED: .

PROFESSIONAL GEOLOGIST
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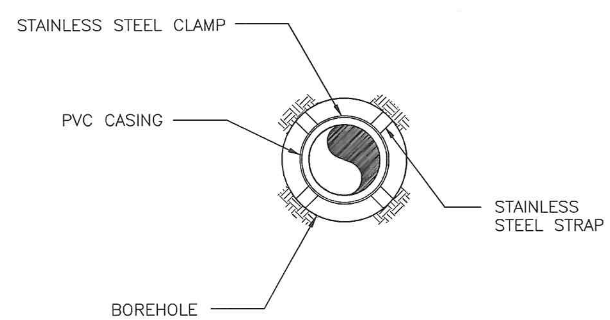
No. 9074
STATE OF CALIFORNIA

INVESTIGATION BORINGS / MONITORING WELLS
IMPROVEMENTS PROJECT
INVESTIGATION BORINGS PROFILES

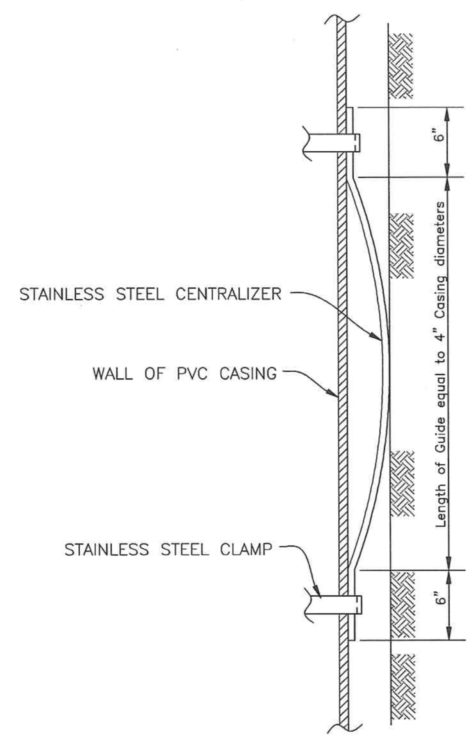
DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

SHEET: 4 OF 5

Xrefs: 13-05-29 Bond-Grantline Base; 13-05-29 Bond-Grantline ROW; CDEG_Composite_Street Map; WDR019_cbec - STRAW: cbec - CORP2; Straw Base Exploded



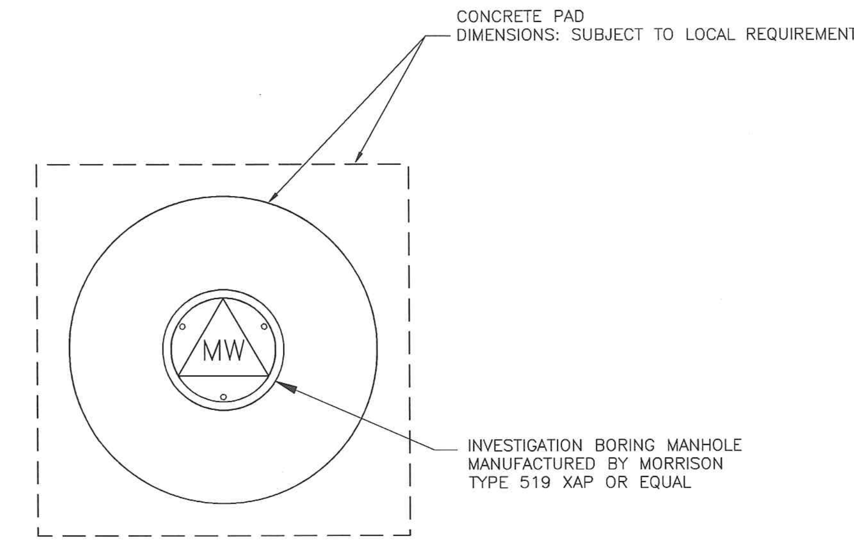
PLAN



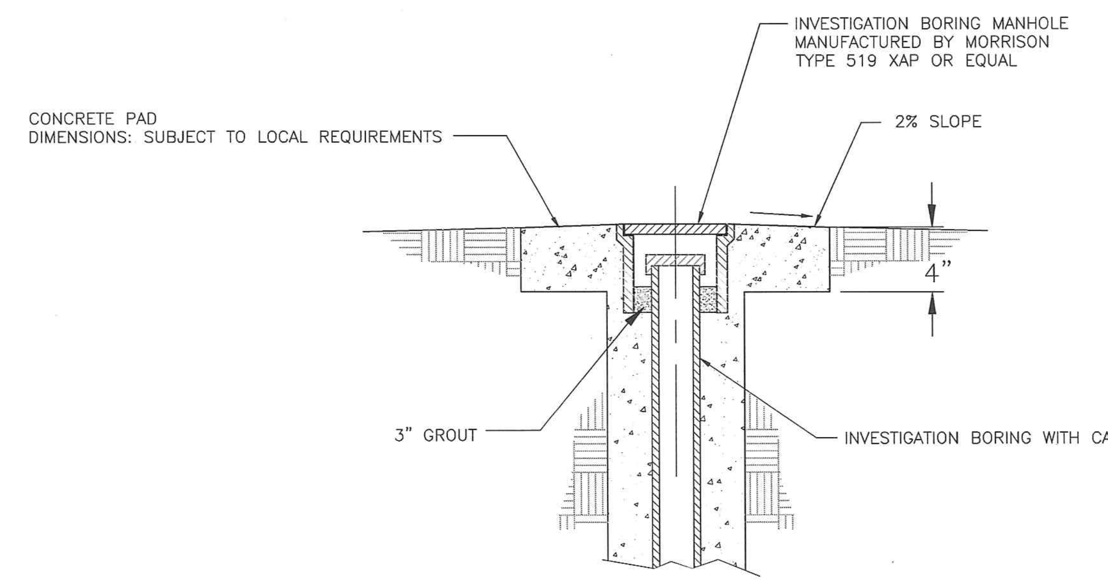
PROFILE

1 CENTRALIZER DETAIL

NOT TO SCALE



PLAN



FLUSH-MOUNT PROFILE

2 INVESTIGATION BORING SURFACE COMPLETION DETAILS

NOT TO SCALE

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SEPTEMBER 2013

PROFESSIONAL GEOLOGIST
CASEY DONALD MEIROVITZ
No. 9074
STATE OF CALIFORNIA

NO.	REVISION	BY	DATE

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS
500 FIRST STREET
WOODLAND, CALIFORNIA
PHONE: (530) 661-0109

DESIGNED: .
DRAWN: .
CHECKED: .

INVESTIGATION BORINGS / MONITORING WELLS
IMPROVEMENTS PROJECT
INVESTIGATION BORINGS
STANDARD CONSTRUCTION DETAILS

DATE: SEPTEMBER 2013
SCALE:
HORIZ: N/A
VERT: N/A
PROJECT No.: WDR019

SHEET: 5 OF 5

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
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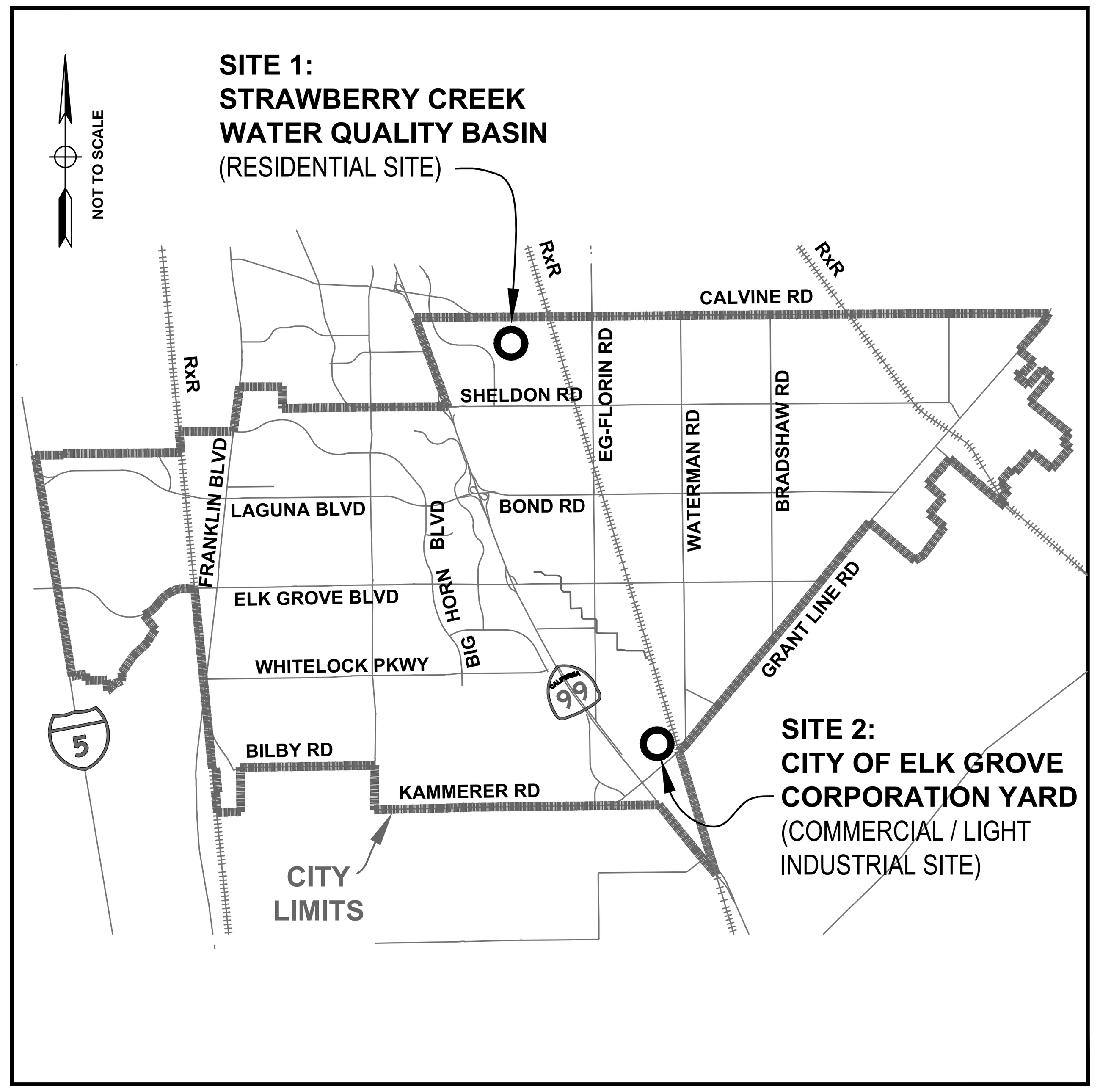
Xrefs: 13-05-29 Bond-Grantline Base; 13-05-29 Bond-Grantline ROW; CDFG_Composite_Street Map; WDR019_cbec -- STRAW: cbec -- CORP2; Straw Base Exploded



PROJECT LOCATIONS

CITY OF ELK GROVE, CA

CITY OF ELK GROVE

DEPARTMENT OF PUBLIC WORKS

8401 LAGUNA PALMS WAY • ELK GROVE, CALIFORNIA 95758

IMPROVEMENT PLANS FOR:

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT WDR019

SHEET INDEX:

UTILITY	COMPANY / CONTACT		TELEPHONE
PROJECT MANAGER	CITY OF ELK GROVE	CONNIE NELSON	916-478-3638
DRAINAGE	CITY OF ELK GROVE	FERNANDO DUENAS	916-627-3434
CABLE TV	AT&T BROADBAND	ASTRID WILLARD	916-453-6136
CABLE TV	COMCAST	STEVE ABELIA	916-830-6757
ELECTRIC	S.M.U.D.	JACK GRAHAM	916-732-6643
FIRE	COSUMNES COMMUNITY SERVICES DISTRICT	SHEILA WOLCOTT	916-405-7100
GAS	PG&E	MIKE WILLIAMS	916-386-5013
PARKS & RECREATION	COSUMNES COMMUNITY SERVICES DISTRICT	STEVE SIMS	916-947-1831
PHONE	FRONTIER COMMUNICATION	EVA MOREDOCK	916-691-5615
PHONE	SUREWEST	GRETCHEN HILLDEBRAND	916-691-5615
SEWER	SACRAMENTO AREA SEWER DISTRICT	ROB ESPINOZA	916-876-6386
TRANSIT	e-TRAN	JEAN FOLETTA	916-687-3030
WATER	ELK GROVE WATER SERVICE	BRUCE KAMILOS	916-585-9385
WATER	SACRAMENTO COUNTY WATER AGENCY	IMELDA TABBADA	916-874-4261
U.S.A.	UNDERGROUND SERVICE ALERT	811 or 1-800-227-2600	

To Be Supplemented By:
City of Elk Grove Improvement Standards & Standard Drawings, Latest Edition
City of Elk Grove Standard Construction Specifications, Latest Edition
State of California Department of Transportation, Standard Plans & Specifications, 2006

811
Know what's below.
Call before you dig.

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SEPTEMBER 2013

APPROVED BY:

RICHARD R. CARTER, P.E. - #C55382 — DATE
CAPITAL PROGRAM MANAGER

SUBMITTED BY:

JENNIFER MAXWELL, P.E. - #C54366 — DATE
CIP SERVICE MANAGER

REVIEWED BY:

JOHN R. SCOTT — DATE
CONTRACT MANAGER, MAINTENANCE & OPERATIONS

PREPARED BY:

FERNANDO DUENAS, P.E. - #C64070 — DATE
DESIGN ENGINEER

NO.	REVISION	BY	DATE

WILLDAN Engineering
9281 Office Park Circle ~ Suite 100
Elk Grove, CA 95758 916.478.6002

DESIGNED: .
DRAWN: .
CHECKED: .

REGISTERED PROFESSIONAL ENGINEER
JENNIFER MAXWELL
No. C54366
CIVIL
STATE OF CALIFORNIA

CITY OF ELK GROVE
DEPARTMENT OF PUBLIC WORKS
8401 LAGUNA PALMS WAY
ELK GROVE, CALIFORNIA 95758
916.683.7111

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT

TITLE SHEET

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

SHEET: 1 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

Images: 10SFH390555.tif; 10SFH420495.tif; 10SFH465525.tif; 10SFH465540.tif; cbec logo.tif; logo sml black and white.bmp; 10SFH465540.tif; logo sml black and white.tif; logo sml black and white.tif;
Xrefs: 13-05-29 Bond-Grantline Base; 13-05-29 Bond-Grantline ROW; COEG_Composite_Street Map; WDR019_cbec - STRAW; Straw Base Exploded; cbec - CORP2

CITY OF ELK GROVE GENERAL NOTES:

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CITY OF ELK GROVE STANDARD CONSTRUCTION SPECIFICATIONS AND IMPROVEMENT STANDARDS. WHERE INCONSISTENCIES EXIST, THE LATEST EDITION SHALL TAKE PRECEDENCE.
2. PUBLIC SAFETY AND TRAFFIC CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH SECTION 6-13 OF THE STANDARD CONSTRUCTION SPECIFICATIONS AND AS DIRECTED BY THE CITY INSPECTOR. SAFE VEHICULAR AND PEDESTRIAN ACCESS SHALL BE PROVIDED AT ALL TIMES DURING CONSTRUCTION.
3. THE CONTRACTOR SHALL NOTIFY THE CITY OF ELK GROVE CONSTRUCTION INSPECTION OFFICE TWO WORKING DAYS PRIOR TO THE COMMENCEMENT OF WORK. THE CONTRACTOR SHALL NOT START ANY GRADING UNTIL THE CITY COMPLETES A PRE-CONSTRUCTION MEETING. PLEASE CALL (916) 478-2212 TO SCHEDULE A PRE-CONSTRUCTION MEETING.
4. THE CITY OF ELK GROVE IS A MEMBER OF THE UNDERGROUND SERVICE ALERT (U.S.A.) ONE-CALL PROGRAM. THE CONTRACTOR OR ANY SUB-CONTRACTOR FOR THIS CONTRACT SHALL NOTIFY MEMBERS OF U.S.A. TWO WORKING DAYS IN ADVANCE OF PERFORMING AND EXCAVATION WORK BY CALLING 811 OR 1-800-227-2600.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION. ALL SUCH MONUMENTS OR MARKERS DESTROYED DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
6. EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH SECTION 11 OF THE CITY OF ELK GROVE IMPROVEMENT STANDARDS.
7. THE TYPES, LOCATIONS, SIZES, AND/OR DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE IMPROVEMENT PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE TYPES, EXTENT, SIZES, LOCATIONS, AND DEPTHS OF SUCH UNDERGROUND UTILITIES. A REASONABLE EFFORT HAS BEEN MADE TO LOCATE AND DELINEATE ALL KNOWN UNDERGROUND UTILITIES. HOWEVER, THE ENGINEER CAN ASSUME NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF ITS DELINEATION OF SUCH UNDERGROUND UTILITIES, NOR FOR THE EXISTENCE OF OTHER BURIED OBJECTS OR UTILITIES WHICH MAY BE ENCOUNTERED, BUT ARE NOT SHOWN ON THESE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE EXACT LOCATION, SIZE AND DEPTH OF ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION, WHICH MAY INCLUDE POTHOLING.

CITY OF ELK GROVE DRAINAGE NOTES:

1. ALL CONSTRUCTION AND MATERIALS FOR DRAINAGE SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE CITY OF ELK GROVE IMPROVEMENT STANDARDS AND STANDARD CONSTRUCTION SPECIFICATIONS. WHERE DISCREPANCIES EXIST, APPROPRIATE NOTES SHALL BE ADDED TO THE PLANS, TAKING PRECEDENCE OVER THE STANDARD CONSTRUCTION SPECIFICATIONS.
2. THE MINIMUM COVER REQUIREMENTS DURING CONSTRUCTION FOR TEMPORARY CONSTRUCTION VEHICLE LOADING SHALL BE 4-FEET FOR METAL AND PLASTIC PIPE AND 3-FEET FOR REINFORCED CONCRETE PIPE.
3. THE CONTRACTOR SHALL PLACE THE PROPER STRENGTH PIPE IF TRENCH CONDITIONS ENCOUNTERED DIFFER FROM THE DESIGN TRENCH.
4. STORM DRAIN PIPES IN THE PUBLIC RIGHT-OF-WAY (ROW) AND DRAINAGE EASEMENTS SHALL CONFORM TO THE STANDARD CONSTRUCTION SPECIFICATIONS:
   - DRAINAGE PIPE MATERIAL SHALL CONFORM TO SECTION 36 AND SECTION 50 (EXCLUDING 50-20, WHICH IS NOT ALLOWED).
   - DRAINAGE MANHOLES SHALL CONFORM TO SECTION 39.
5. STORM DRAIN PIPES SHALL BE TESTED IN CONFORMANCE WITH THE STANDARD CONSTRUCTION SPECIFICATIONS:
   - DRAINAGE PIPES, INCLUDING DRAIN INLET LATERALS, SHALL BE TESTED IN CONFORMANCE WITH SECTION 38-9.
   - STORM DRAIN MANHOLES SHALL BE TESTED IN CONFORMANCE WITH SECTION 39-4.01.
6. RESILIENT CONNECTORS, IN CONFORMANCE WITH SECTION 39-2.01 AND STANDARD DRAWING (STD. DWG.) SD-7 OF THE STANDARD CONSTRUCTION SPECIFICATIONS, ARE REQUIRED BETWEEN PRE-CAST MANHOLE AND PIPE AND BETWEEN PRE-CAST DROP INLET AND PIPE. WATER STOPS ARE REQUIRED FOR PIPE TO CAST-IN-PLACE MANHOLE / DROP INLET CONNECTIONS.
7. EROSION CONTROL STRUCTURES (STD. DWGS. SD-26, SD-27, SD-28.1, SD-28.2, SD-28.3 AND SD-28.4) SHALL BE CLASS B CONCRETE, NOT GROUTED COBBLE.
8. ALL DRAINAGE INLETS IN THE PUBLIC ROW AND DRAINAGE EASEMENTS SHALL HAVE A PERMANENT STORM DRAIN MESSAGE "NO DUMPING - FLOW TO CREEK" OR OTHER APPROVED MESSAGE CONSISTENT WITH SECTION 11-15 AND STD. DWGS. SQ-10.1 AND SQ-10.2 OF THE CITY OF ELK GROVE IMPROVEMENT STANDARDS.

CITY OF ELK GROVE EROSION & SEDIMENT CONTROL NOTES:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH THE CITY OF ELK GROVE IMPROVEMENT STANDARDS, CURRENT EDITION (OCTOBER 2007), AND THE CITY OF ELK GROVE EROSION AND SEDIMENT CONTROL GUIDELINES, DATED OCTOBER 2007.
2. EROSION CONTROL BEST MANAGEMENT PRACTICES (BMPs) SHALL BE INSTALLED AND MAINTAINED ALL YEAR ROUND.
3. ALL DRAINAGE INLETS IMMEDIATELY DOWNSTREAM OF THE WORK AREAS AND WITHIN THE WORK AREAS SHALL BE PROTECTED WITH SEDIMENT CONTROL AND INLET FILTER BAGS, YEAR ROUND. INLET FILTER BAGS SHALL BE REMOVED FROM THE DRAINAGE INLETS UPON ACCEPTANCE OF THE PUBLIC IMPROVEMENTS BY THE CITY.
4. ALL STABILIZED CONSTRUCTION ACCESS LOCATIONS SHALL BE CONSTRUCTED PER STANDARD DRAWING SQ-1. WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES PAVED AREAS, THE STABILIZED ACCESS SHALL BE MAINTAINED ON A YEAR ROUND BASIS UNTIL THE COMPLETION OF THE CONSTRUCTIONS.
5. ALL AREAS DISTURBED DURING CONSTRUCTION, BY GRADING, TRENCHING, OR OTHER ACTIVITIES, SHALL BE PROTECTED FROM EROSION.
6. SENSITIVE AREAS AND AREAS WHERE EXISTING VEGETATION IS BEING PRESERVED SHALL BE PROTECTED WITH CONSTRUCTION FENCING. SEDIMENT CONTROL BMPs SHALL BE INSTALLED WHERE ACTIVE CONSTRUCTION AREAS DRAIN INTO SENSITIVE OR PRESERVED VEGETATION AREAS.
7. SEDIMENT CONTROL BMPs SHALL BE PLACED ALONG THE PROJECT PERIMETER WHERE DRAINAGE LEAVES THE PROJECT. SEDIMENT CONTROL BMPs SHALL BE MAINTAINED YEAR ROUND UNTIL THE CONSTRUCTION IS COMPLETE OR THE DRAINAGE PATTERN HAS BEEN CHANGED AND NO LONGER LEAVES THE SITE.
8. THE FOLLOWING AREAS ON ALL PROJECTS ARE TO RECEIVE HYDROSEEDING OR OTHER EROSION CONTROLS:
   - FOR RESIDENTIAL PROJECTS; LOT FRONT YARDS BEHIND THE SIDEWALK - THE FIRST 18 FEET OR TOP OF SLOPE (WHICHEVER IS GREATER).
   - FOR RESIDENTIAL PROJECTS; SIDEYARDS BEHIND THE SIDEWALK - THE FIRST 7.5 FEET OR TOP OF SLOPE (WHICHEVER IS GREATER).
   - FOR ALL COMMERCIAL PROJECTS; ALL NON ACTIVE DISTURBED SOIL AREAS MUST BE STABILIZED.
   - SLOPES - ALL SLOPES GREATER THAN 10:1
9. ALL NON-ACTIVE DISTURBED SOIL AREAS MUST BE STABILIZED WITH EROSION CONTROLS WITHIN 14 CALENDAR DAYS OR PRIOR TO A FORECASTED RAIN EVENT (WHICHEVER COMES FIRST).

CITY OF ELK GROVE SUPPLEMENTAL NOTES:

1. WHENEVER THE WORK AREA IS ADJACENT TO A TRAFFIC LANE AND THERE IS A CUT, DITCH OR TRENCH MORE THAN 2 INCHES DEEP, THE CONTRACTOR SHALL MAINTAIN CONTINUOUS BARRICADES SPACED AT APPROXIMATELY 20-FOOT INTERVALS FOR THE FIRST 100 FEET FROM THE BEGINNING OF THE CUT, DITCH OR TRENCH, AND APPROXIMATELY 50-FOOT INTERVALS THEREAFTER. IF THE CUT, DITCH OR TRENCH IS MORE THAN TEN FEET FROM A TRAFFIC LANE, THE BARRICADE SPACING MAY BE GREATER BUT SHALL NOT EXCEED 200 FEET.
2. UNLESS SPECIFICALLY SET FORTH AS SPECIAL PROVISIONS, ALL MARKED LANES OF TRAFFIC SHALL BE UNOBSTRUCTED IN EACH DIRECTION DURING THE PEAK TRAFFIC HOURS OF 7:00 TO 8:00 A.M. AND 3:30 TO 6:00 P.M. A TRAFFIC LANE SHALL BE CONSIDERED UNOBSTRUCTED IF IT IS SURFACED WITH ASPHALT AND IS AT LEAST TEN FEET WIDE.
3. A TRAFFIC CONTROL PLAN SHALL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE CITY OF ELK GROVE CONSTRUCTION INSPECTION FOR REVIEW AT LEAST 15 DAYS PRIOR TO COMMENCEMENT OF ANY WORK. AN ENCROACHMENT PERMIT OR PLAN APPROVAL MUST FIRST BE OBTAINED PRIOR TO ANY WORK COMMENCING WITHIN THE CITY RIGHT-OF-WAY.

ABBREVIATIONS LIST:

AB - aggregate base
ac- acre
brk - break
cfs - cubic feet per second
CLR - clearance
dia - diameter (ø)
DI - drain inlet
(E) - existing
Elev - elevation
ft - feet
fps - feet per second
gd - ground
inv. - invert
min - minimum/ minutes
N.A.P.O.T.C. - not a part of this contract
O.C. - on center
PVC - polyvinyl chloride
RC- reinforced concrete pipe
SD - storm drain
(Typ) - typical
w/ - with

100% SUBMITTAL
SEPTEMBER 2013

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

C:\Users\abanwait\Documents\EG Files\EG Projects\Active Projects\WDR019_Dry Well Low Impact\PI WDR019_Dry Wells as Low Impact Development.dwg |Layout: 02 Notes |abanwait|9/9/2013 4:36 PM

NO.	REVISION	BY	DATE

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9281 Office Park Circle ~ Suite 100
Elk Grove, CA 95758 916.478.6002

DESIGNED: .
DRAWN: .
CHECKED: .

REGISTERED PROFESSIONAL ENGINEER
JENNIFER MAXWELL
No. C54366
CIVIL
STATE OF CALIFORNIA

CITY OF ELK GROVE
DEPARTMENT OF PUBLIC WORKS
8401 LAGUNA PALMS WAY
ELK GROVE, CALIFORNIA 95758
916.683.7111

CITY OF ELK GROVE CALIFORNIA

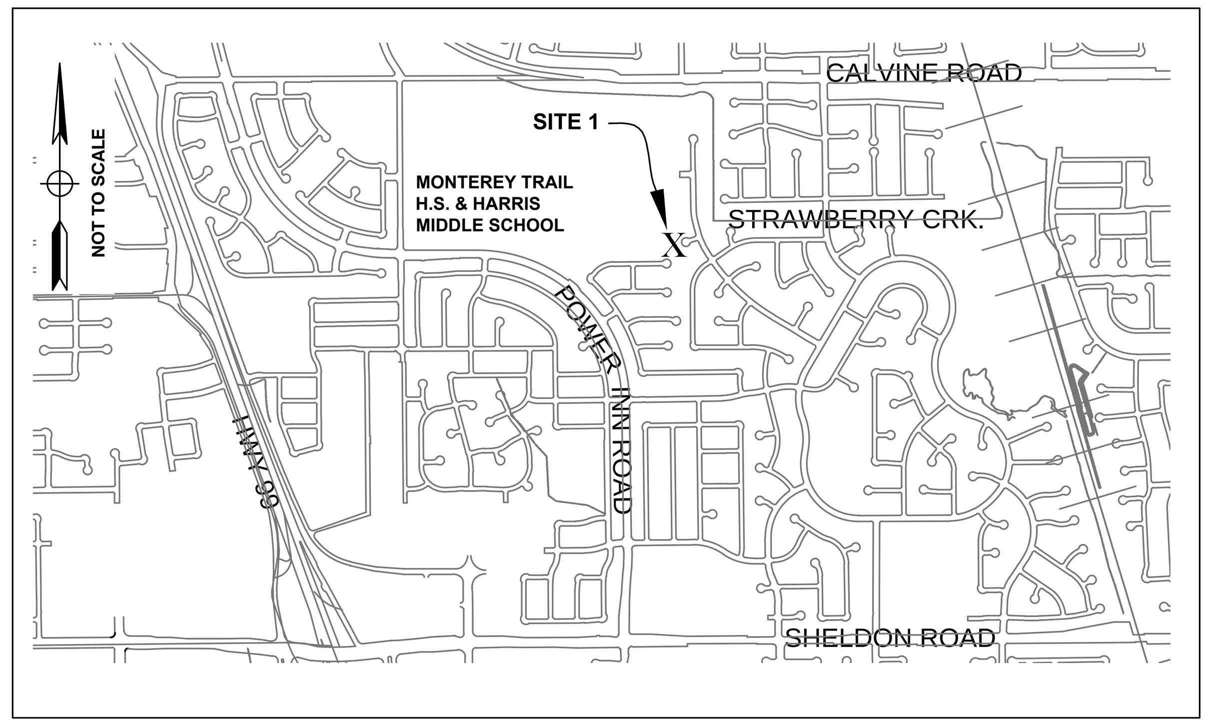
DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT

ABBREVIATIONS LIST & GENERAL NOTES

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

SHEET: 2 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4



NOTES:

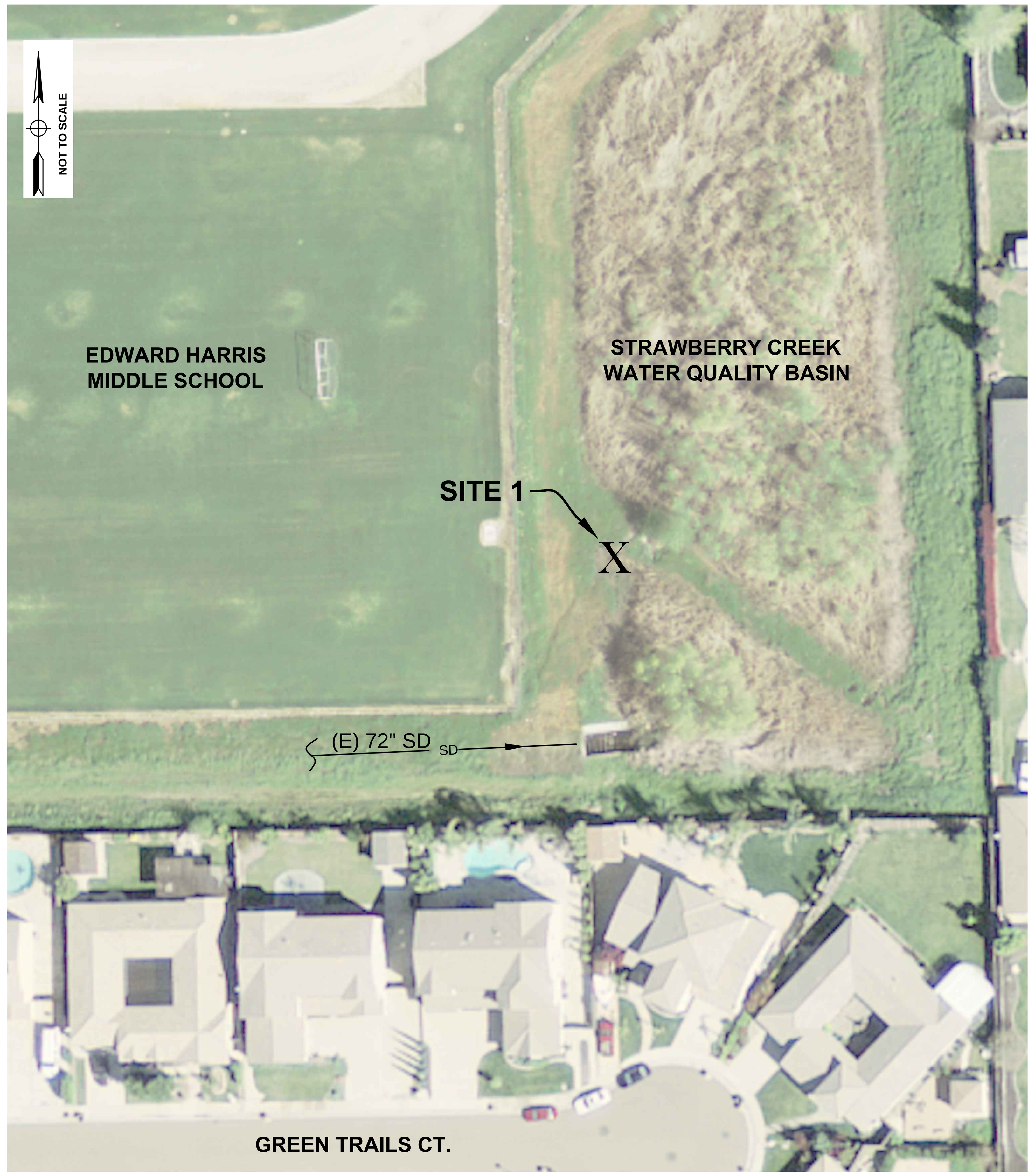
1. CONTRACTOR TO VERIFY EXISTING UTILITIES PRIOR TO COMMENCEMENT OF WORK.
2. CONTACT DESIGN ENGINEER TO DETERMINE EXACT LOCATION OF DRY WELL AND SEDIMENTATION WELL PRIOR TO CONSTRUCTION.

SITE 1 - VICINITY MAP

STRAWBERRY CREEK WATER QUALITY BASIN

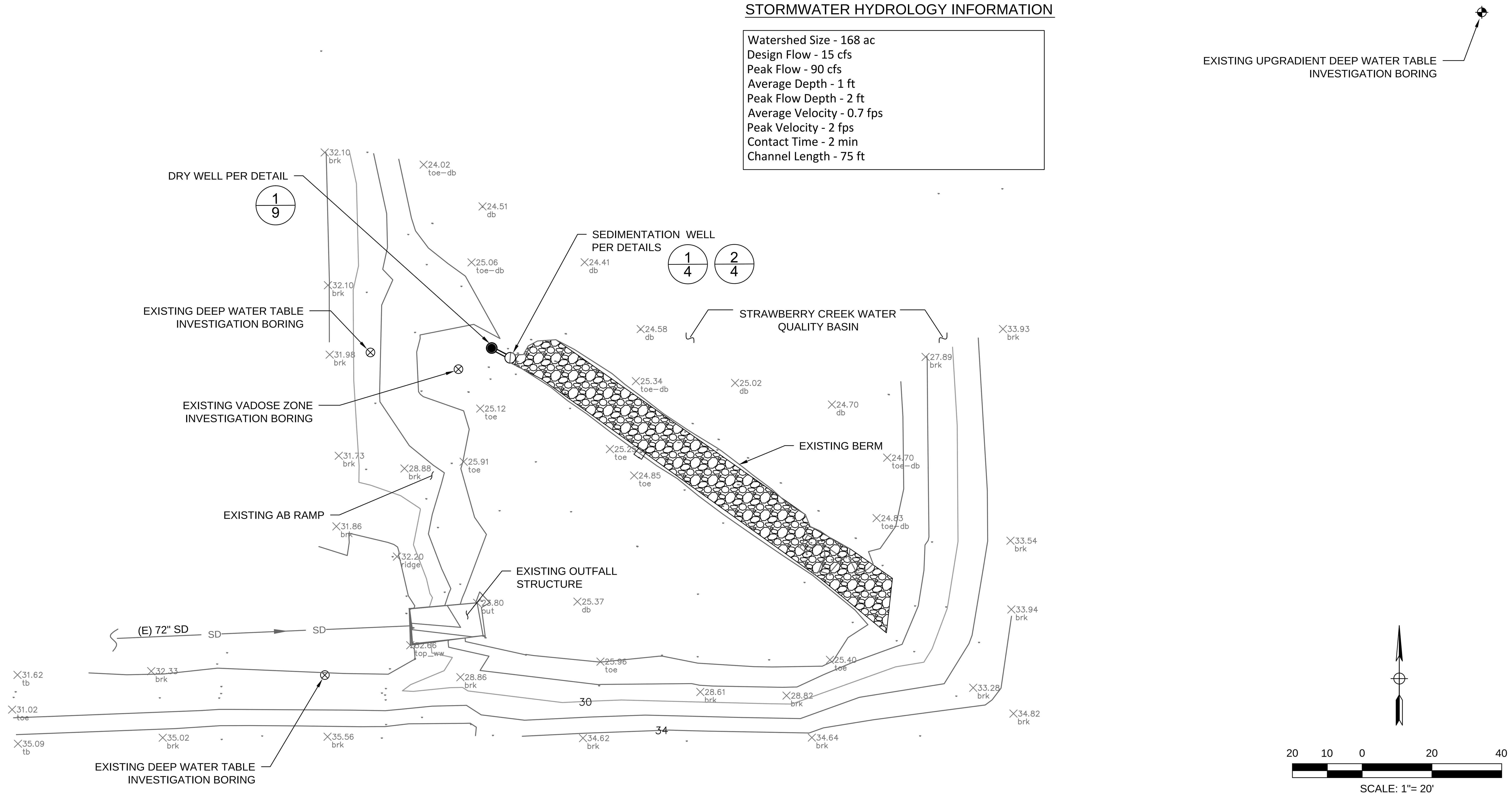
STORMWATER HYDROLOGY INFORMATION

Watershed Size - 168 ac
Design Flow - 15 cfs
Peak Flow - 90 cfs
Average Depth - 1 ft
Peak Flow Depth - 2 ft
Average Velocity - 0.7 fps
Peak Velocity - 2 fps
Contact Time - 2 min
Channel Length - 75 ft



SITE 1 - AERIAL VIEW

STRAWBERRY CREEK WATER QUALITY BASIN



100% SUBMITTAL
SEPTEMBER 2013

SITE 1 - LAYOUT PLAN

STRAWBERRY CREEK WATER QUALITY BASIN

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

NO.	REVISION	BY	DATE

WILLDAN Engineering
9281 Office Park Circle ~ Suite 100
Elk Grove, CA 95758 916.478.6002

DESIGNED: .
DRAWN: .
CHECKED: .

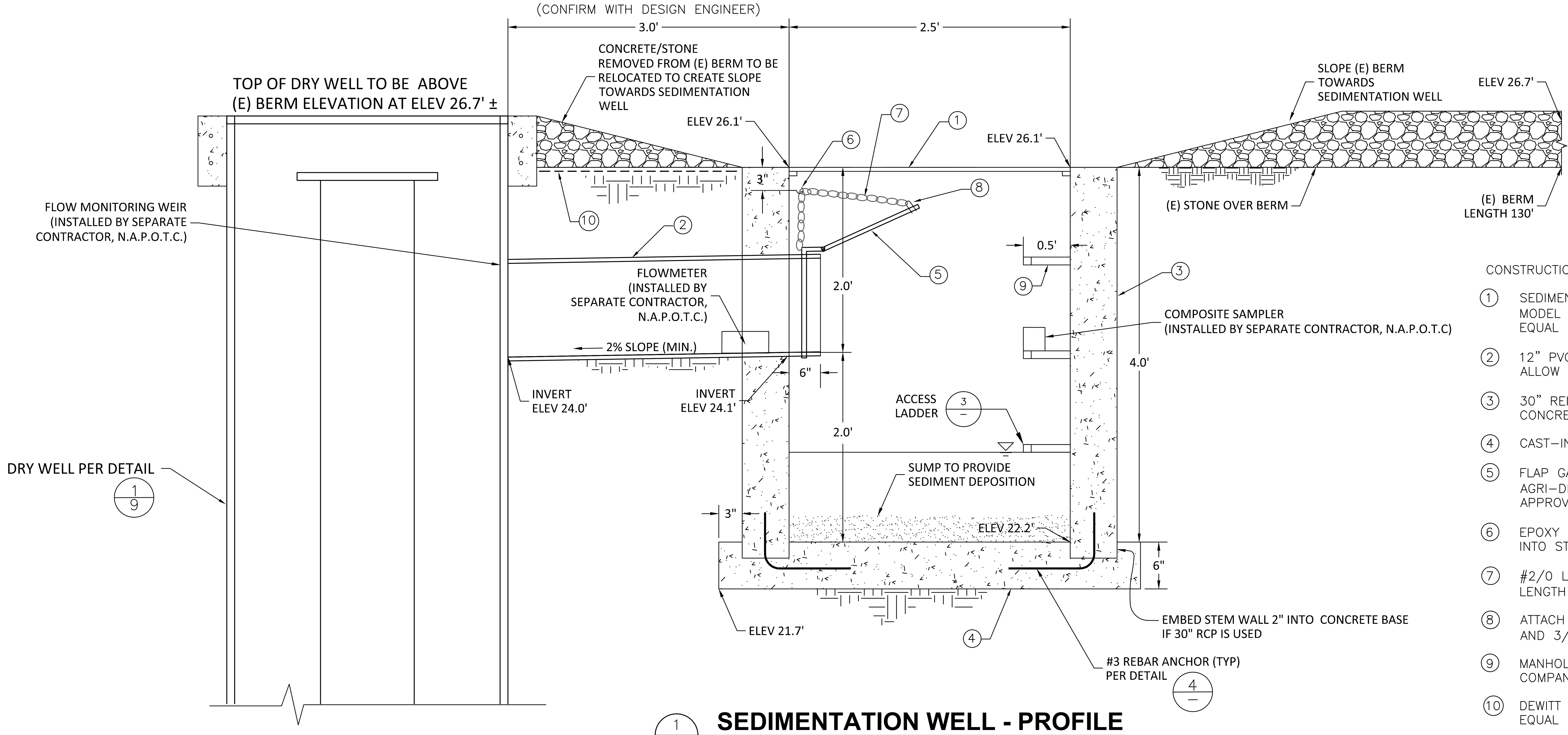
REGISTERED PROFESSIONAL ENGINEER JENNIFER MAXWELL No. C54366 CIVIL STATE OF CALIFORNIA

CITY OF ELK GROVE
DEPARTMENT OF PUBLIC WORKS
8401 LAGUNA PALMS WAY
ELK GROVE, CALIFORNIA 95758
916.683.7111

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT
SITE 1: STRAWBERRY CREEK WATER QUALITY BASIN
VICINITY MAP, AERIAL VIEW & SITE LAYOUT PLAN

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"= 20' VERT: N/A
PROJECT No.: WDR019
SHEET: 3 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

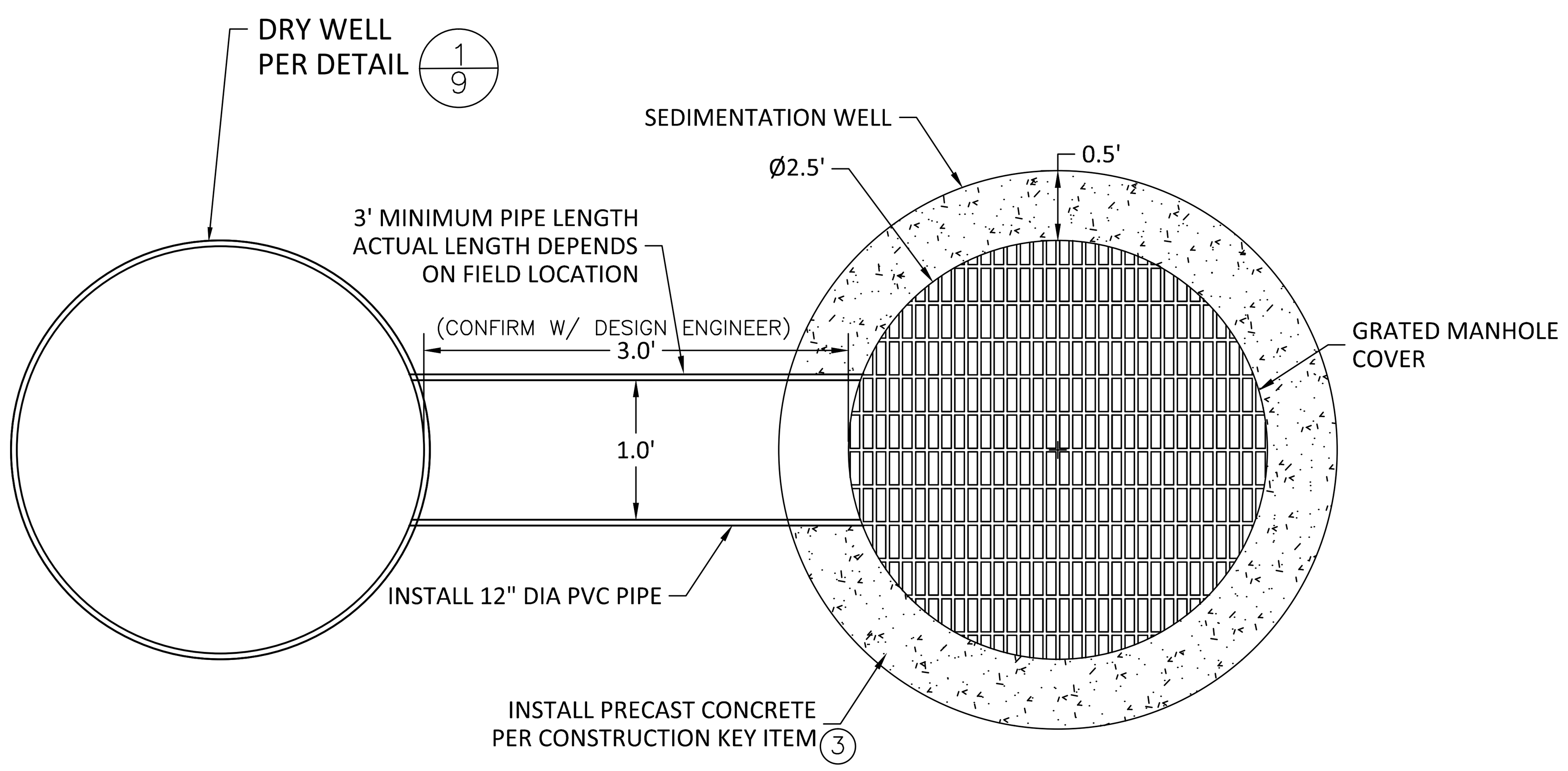


SEDIMENTATION WELL - PROFILE

NOT TO SCALE

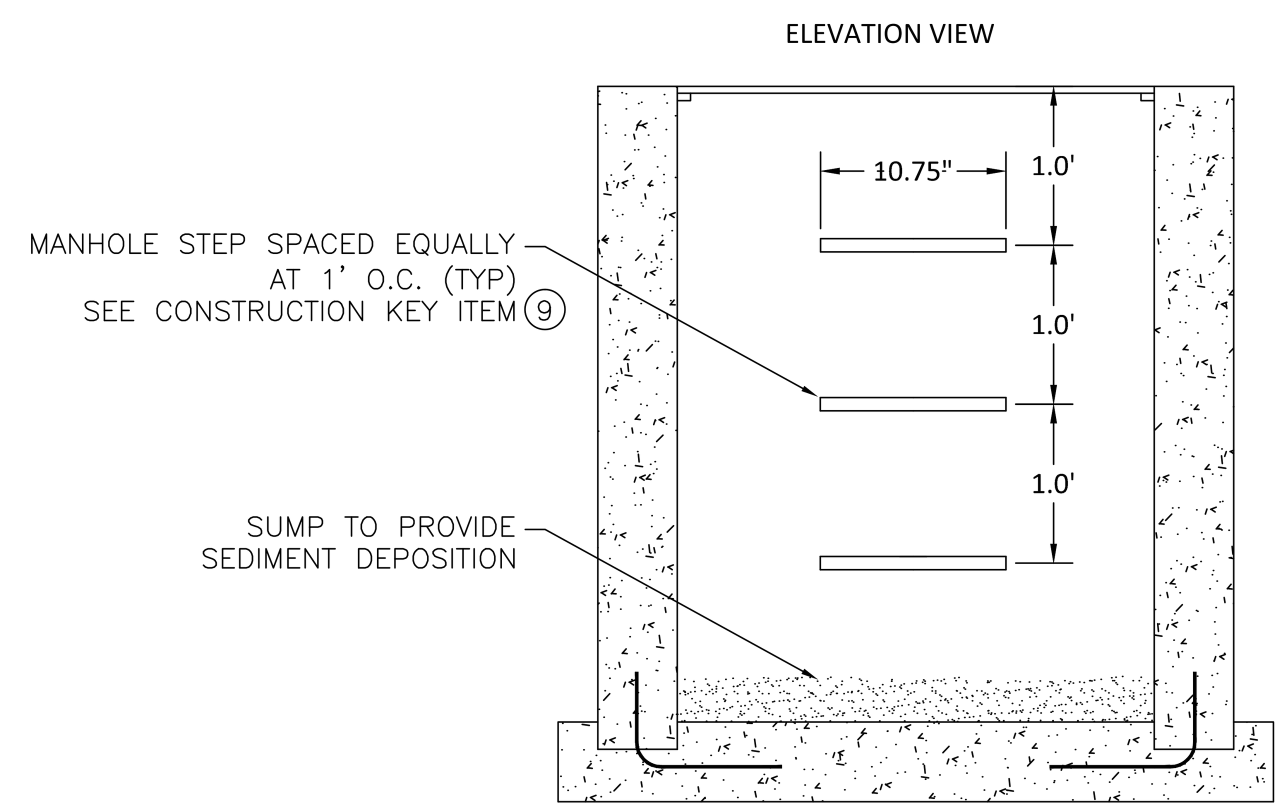
CONSTRUCTION KEY:

1. SEDIMENTATION WELL FRAME & GRATE SHALL BE MODEL #D-6032 BY D&L FOUNDRY AND SUPPLY OR APPROVED EQUAL
2. 12" PVC PIPE – EXTEND 6" INTO SEDIMENTATION WELL TO ALLOW FOR FLAP GATE INSTALLATION
3. 30" REINFORCED CONCRETE PIPE OR CAST-IN-PLACE CONCRETE
4. CAST-IN-PLACE CONCRETE BASE
5. FLAP GATE SHALL BE A 12" HEAVY DUTY FLAP GATE BY AGRI-DRAIN CORPORATION MODEL #FG12HD OR APPROVED EQUAL
6. EPOXY 4-7/8" STAINLESS STEEL SCREW "J" HOOK BOLT INTO STILLING WELL
7. #2/0 LINK CHAIN W/ STAINLESS STEEL WELDED LINKS LENGTH OF CHAIN TO BE 10' MINIMUM AND CUT TO FIT IN FIELD
8. ATTACH CHAIN TO FLAP GATE PLATE WITH U-BOLT SCREW AND 3/8" SPRING LINK
9. MANHOLE STEP AVAILABLE THROUGH AMERICAN STEP COMPANY OR APPROVED EQUAL
10. DEWITT CO. NON-WOVEN GEOTEXTILE FABRIC OR APPROVED EQUAL



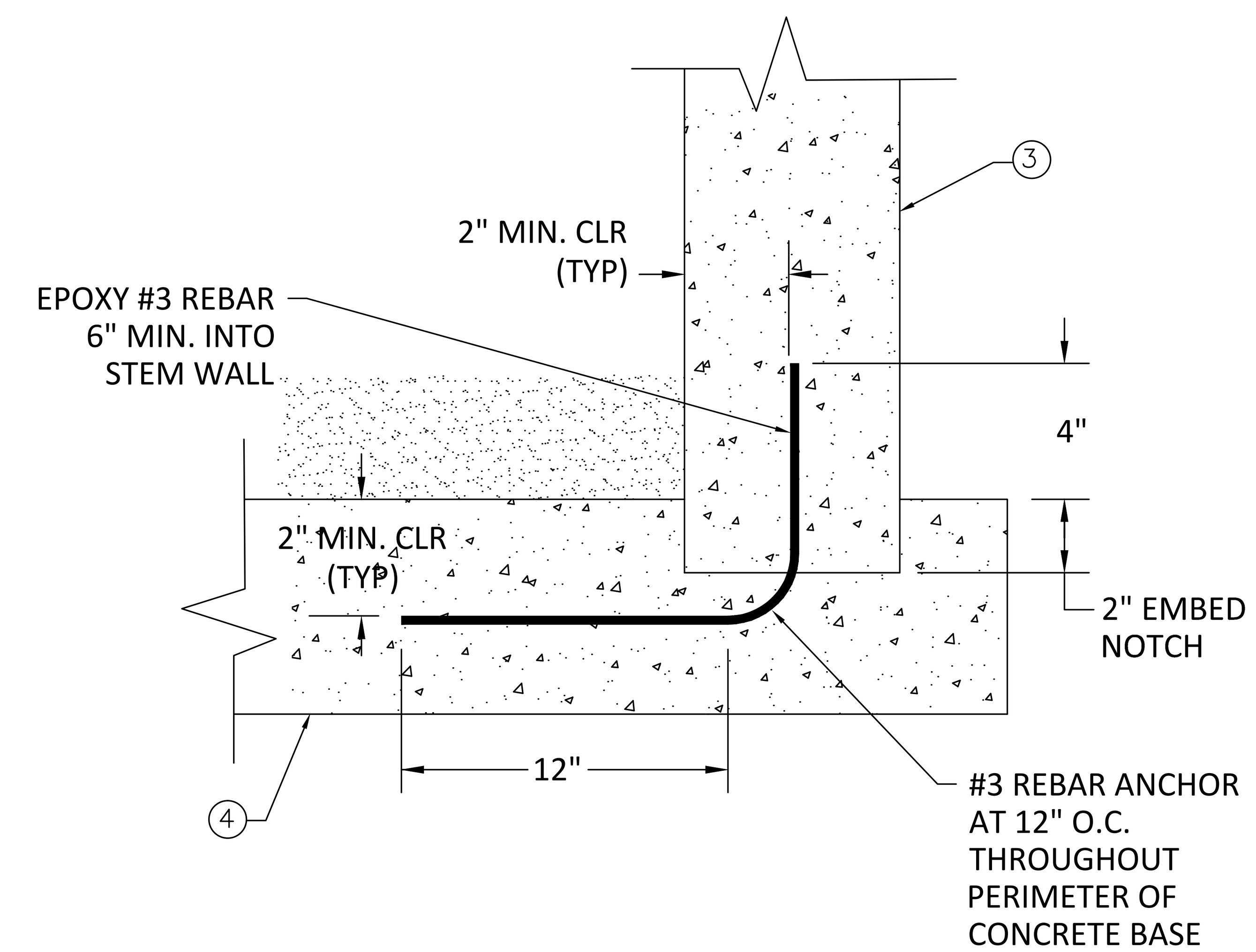
SEDIMENTATION WELL PLAN VIEW

NOT TO SCALE



ACCESS LADDER

NOT TO SCALE



ANCHOR DETAIL

NOT TO SCALE

100% SUBMITTAL
SEPTEMBER 2013

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

NO.	REVISION	BY	DATE

cbec eco engineering

cbec, inc. eco engineering
2544 Industrial Blvd.
West Sacramento, CA 95691

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DRAWN: .
CHECKED: .

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CITY OF ELK GROVE CALIFORNIA

DRY WELLS AS LOW IMPACT DEVELOPMENT
IMPROVEMENTS PROJECT
SITE 1: STRAWBERRY CREEK WATER QUALITY BASIN
SURFACE FLOW & WATER QUALITY PLAN, ELEVATION & DETAILS

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

SHEET: 4 OF 9

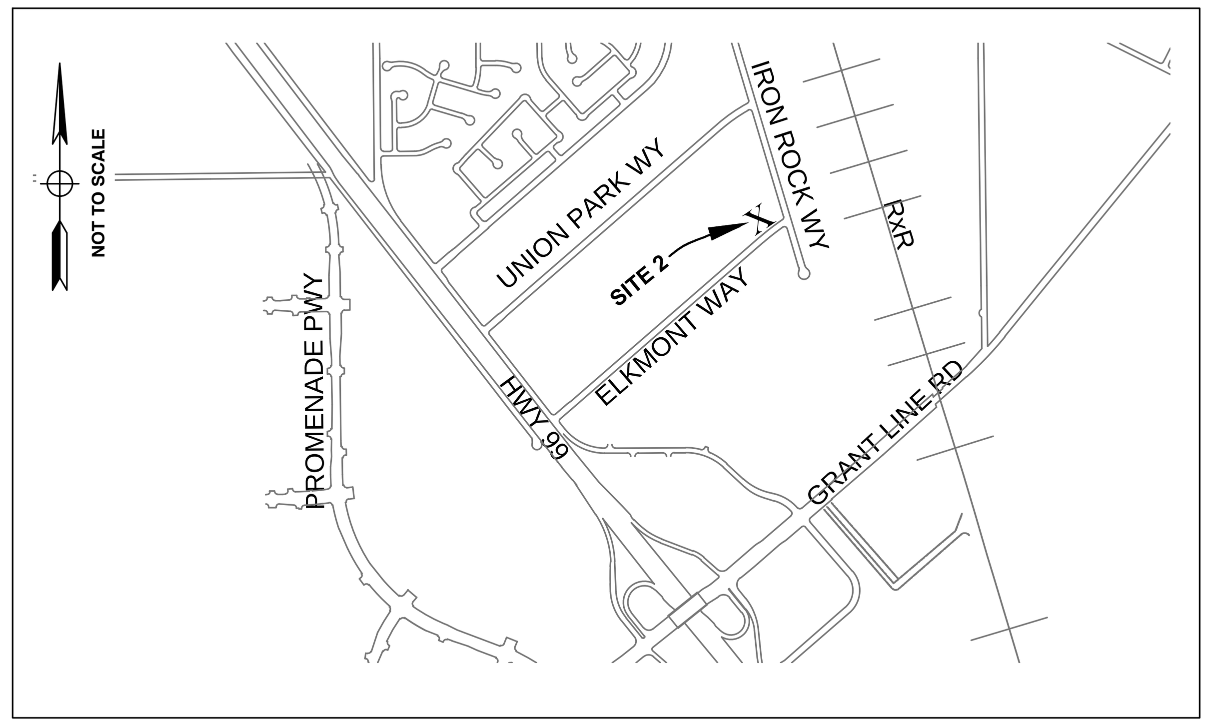
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

0 1 2 3 4

Xrefs:
C:\Users\abanwait\Documents\EG Files\EG Projects\Active Projects\WDR019_Dry Well Low Impact\P\WDR019_Sheet 4_cbec - STRAW.dwg |Layout: Sheet 4 |abanwait|9/9/2013 4:37 PM

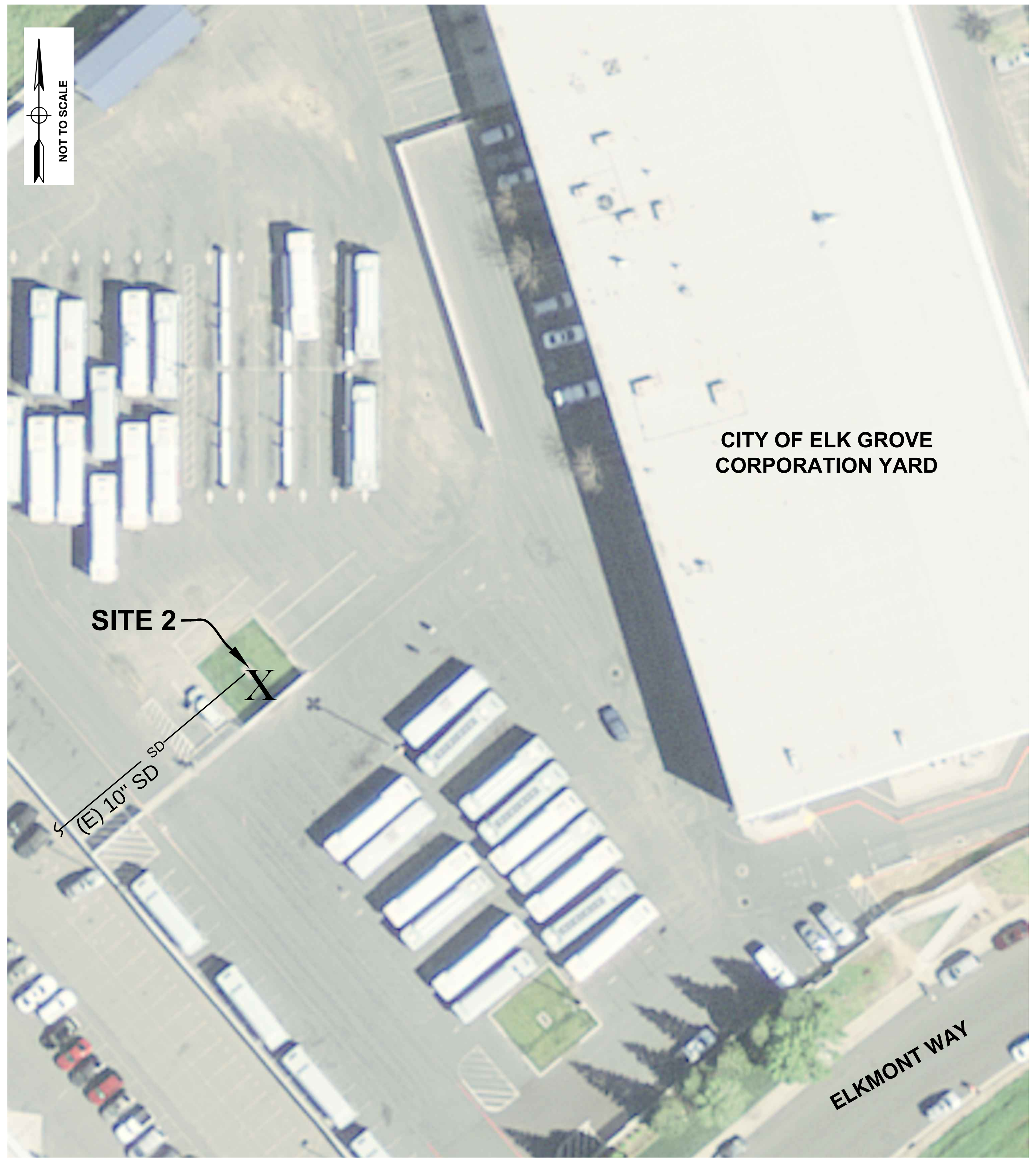
NOTES:

1. CONTRACTOR TO VERIFY EXISTING UTILITIES PRIOR TO COMMENCEMENT OF WORK.
2. CONTACT DESIGN ENGINEER TO DETERMINE EXACT LOCATION OF DRY WELL AND SEDIMENTATION WELL PRIOR TO CONSTRUCTION.
3. PROTECT EXISTING IRRIGATION SYSTEM IN PLACE.



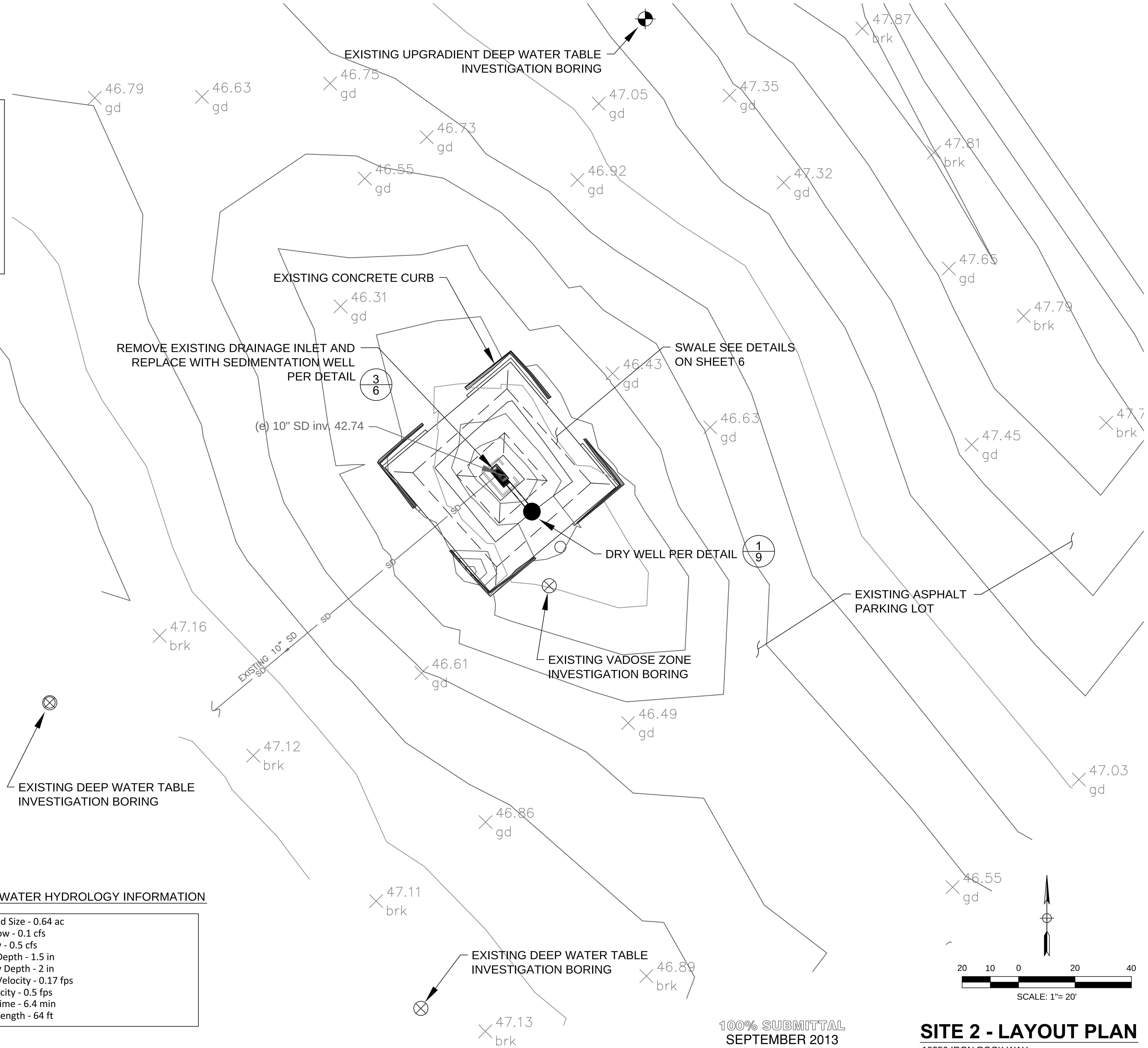
SITE 2 - VICINITY MAP

10250 IRON ROCK WAY



SITE 2 - AERIAL VIEW

10250 IRON ROCK WAY



STORMWATER HYDROLOGY INFORMATION

Watershed Size - 0.64 ac
Design Flow - 0.1 cfs
Peak Flow - 0.5 cfs
Average Depth - 1.5 in
Peak Flow Depth - 2 in
Average Velocity - 0.17 fps
Peak Velocity - 0.5 fps
Contact Time - 6.4 min
Channel Length - 64 ft

100% SUBMITTAL
SEPTEMBER 2013

SITE 2 - LAYOUT PLAN

10250 IRON ROCK WAY

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

NO.	REVISION	BY	DATE

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Elk Grove, CA 95758 916.478.6002

DESIGNED: .
DRAWN: .
CHECKED: .

REGISTERED PROFESSIONAL ENGINEER JENNIFER MAXWELL No. C54366 CIVIL STATE OF CALIFORNIA

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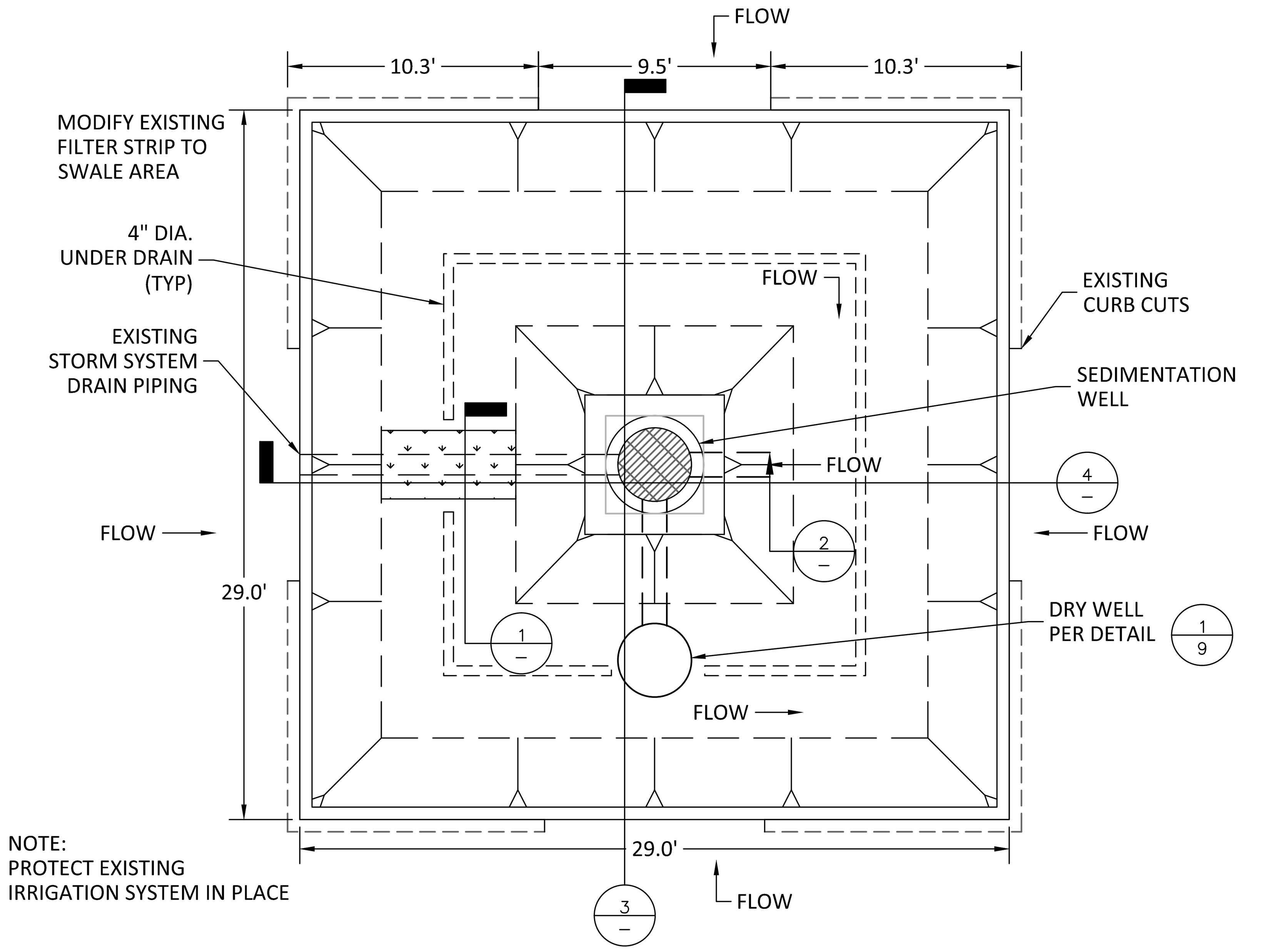
916.683.7111

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT
SITE 2: CITY OF ELK GROVE CORPORATION YARD
VICINITY MAP, AERIAL VIEW & SITE LAYOUT PLAN

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"=20' VERT: N/A
PROJECT No.: WDR019
SHEET: 5 OF 9

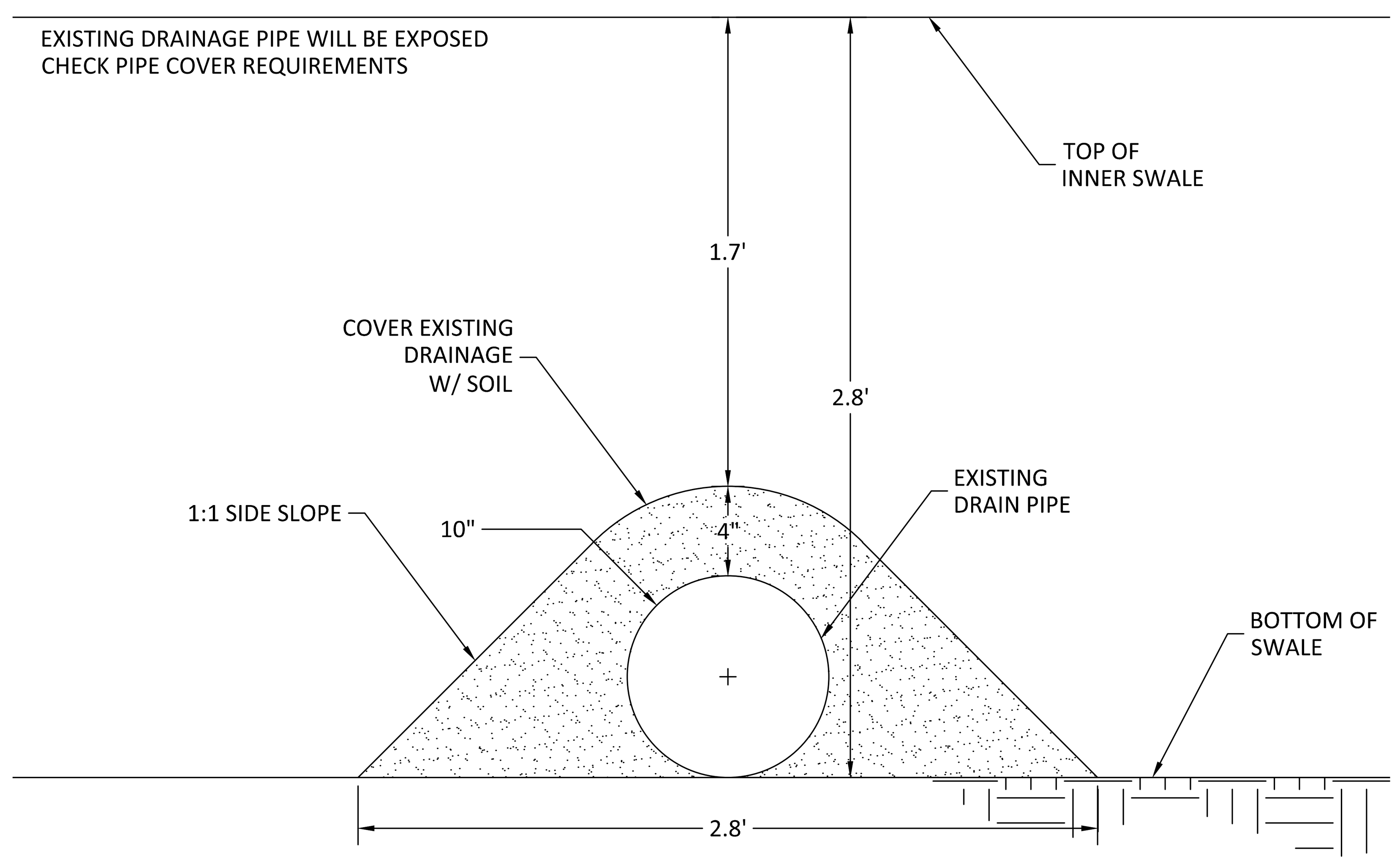
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

Xrefs: 13-05-29 Bond-Grantline Base; 13-05-29 Bond-Grantline ROW; COEG_Composite_Street Map; WDR019_cbec -- STRAW; Straw Base Exploded; cbec -- CORP2
C:\Users\abarwald\Documents\EG Files\EG Projects\Active Projects\WDR019_Dry Well Low Impact\P\ WDR019_Dry Wells as Low Impact Development.dwg |Layout: 05 SITE 2 |abarwald|9/9/2013 4:38 PM



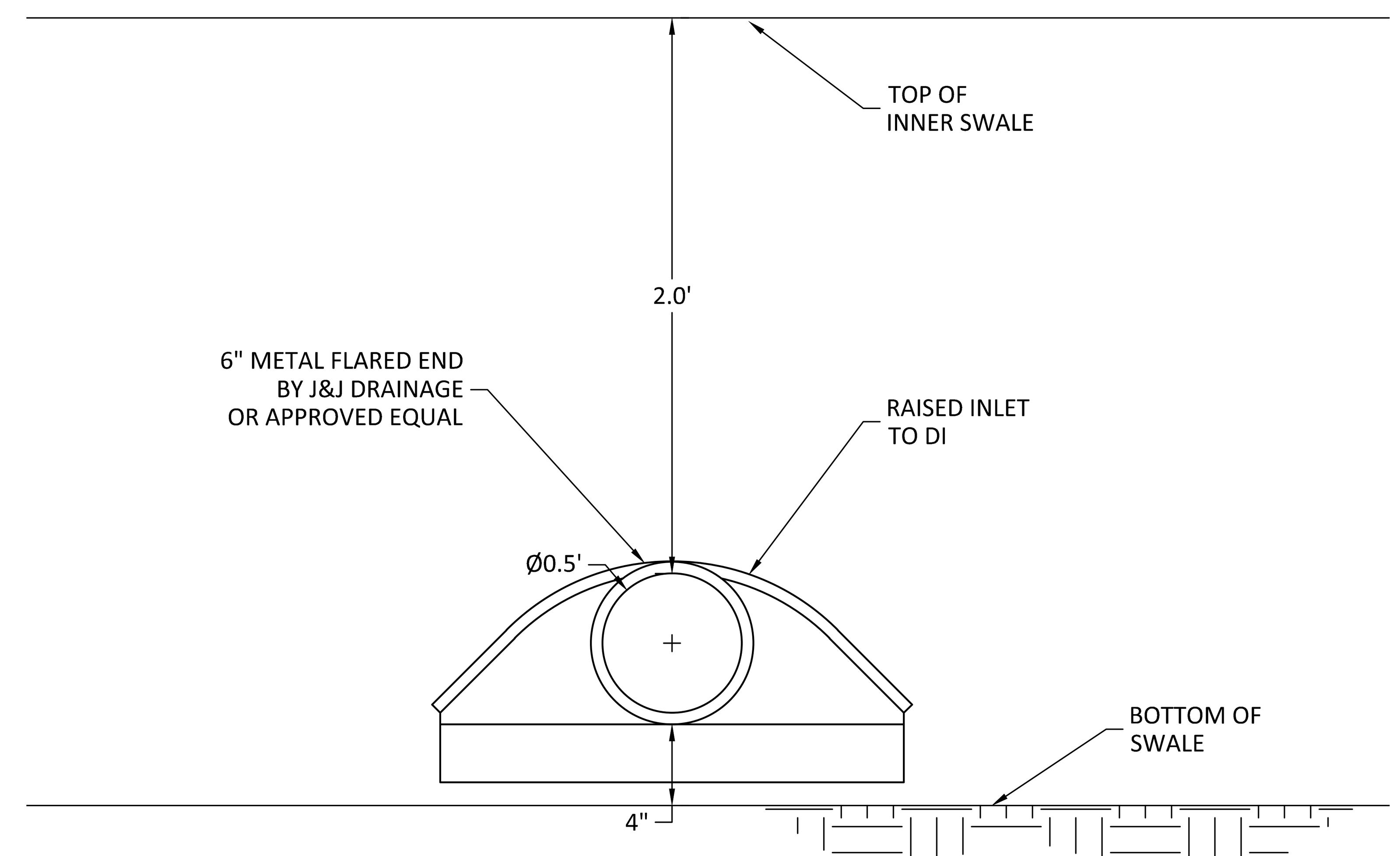
SWALE AREA PLAN VIEW

NOT TO SCALE



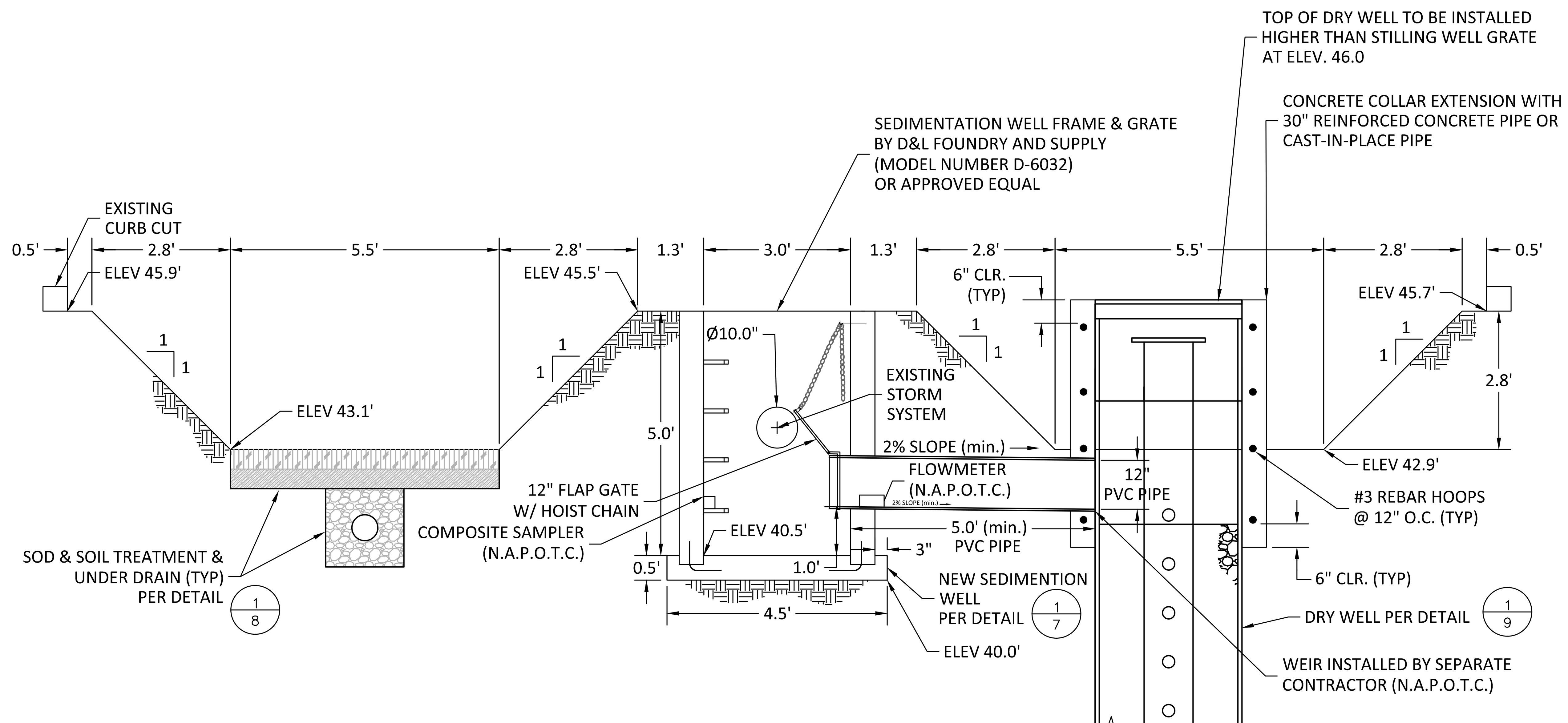
1 BERM AT EXISTING DRAIN PIPE

NOT TO SCALE



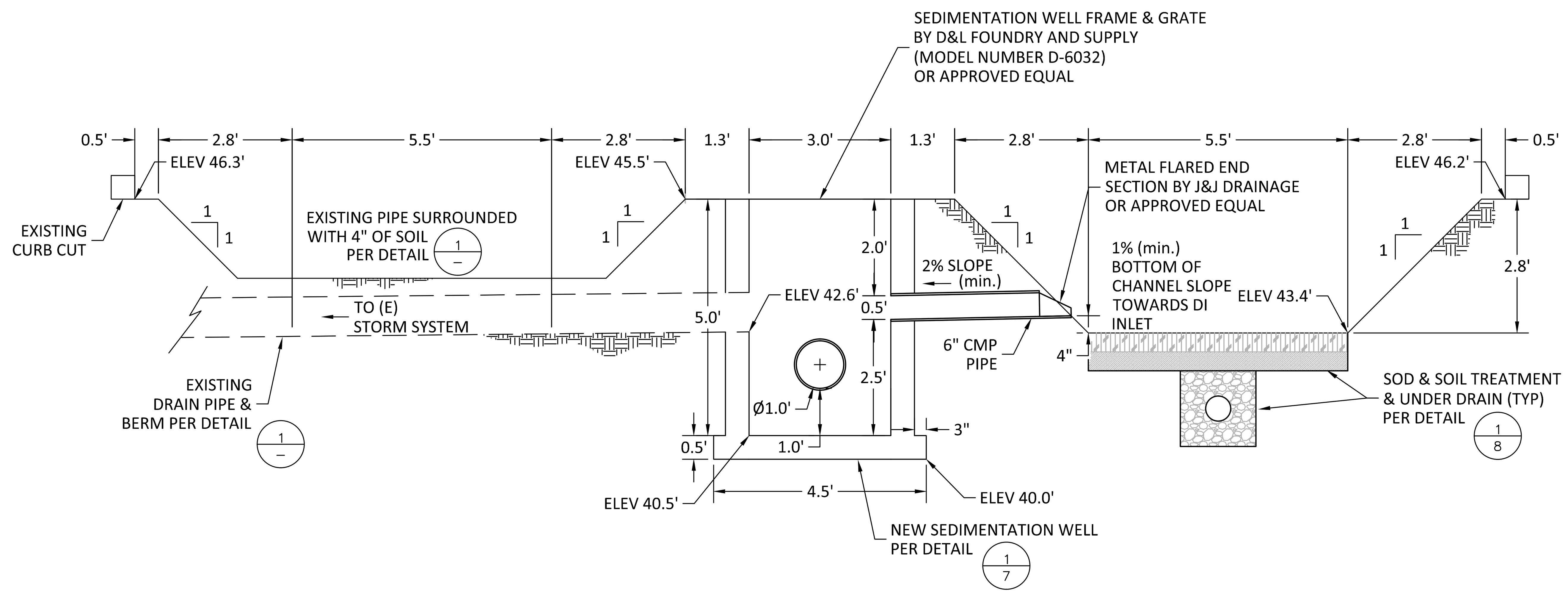
2 SWALE - ELEVATION SEDIMENTATION WELL INLET

NOT TO SCALE



3 SWALE - ELEVATION SOUTHWESTERN VIEW

NOT TO SCALE



4 SWALE - ELEVATION NORTHWESTERN VIEW

NOT TO SCALE

100% SUBMITTAL
SEPTEMBER 2013

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

NO.	REVISION	BY	DATE

cbec eco engineering
cbec, inc. eco engineering
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West Sacramento, CA 95691

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DRAWN: .
CHECKED: .

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916.683.7111

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT

SITE 2: CITY OF ELK GROVE CORPORATION YARD
SURFACE FLOW & WATER QUALITY PLAN, ELEVATION & DETAILS

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
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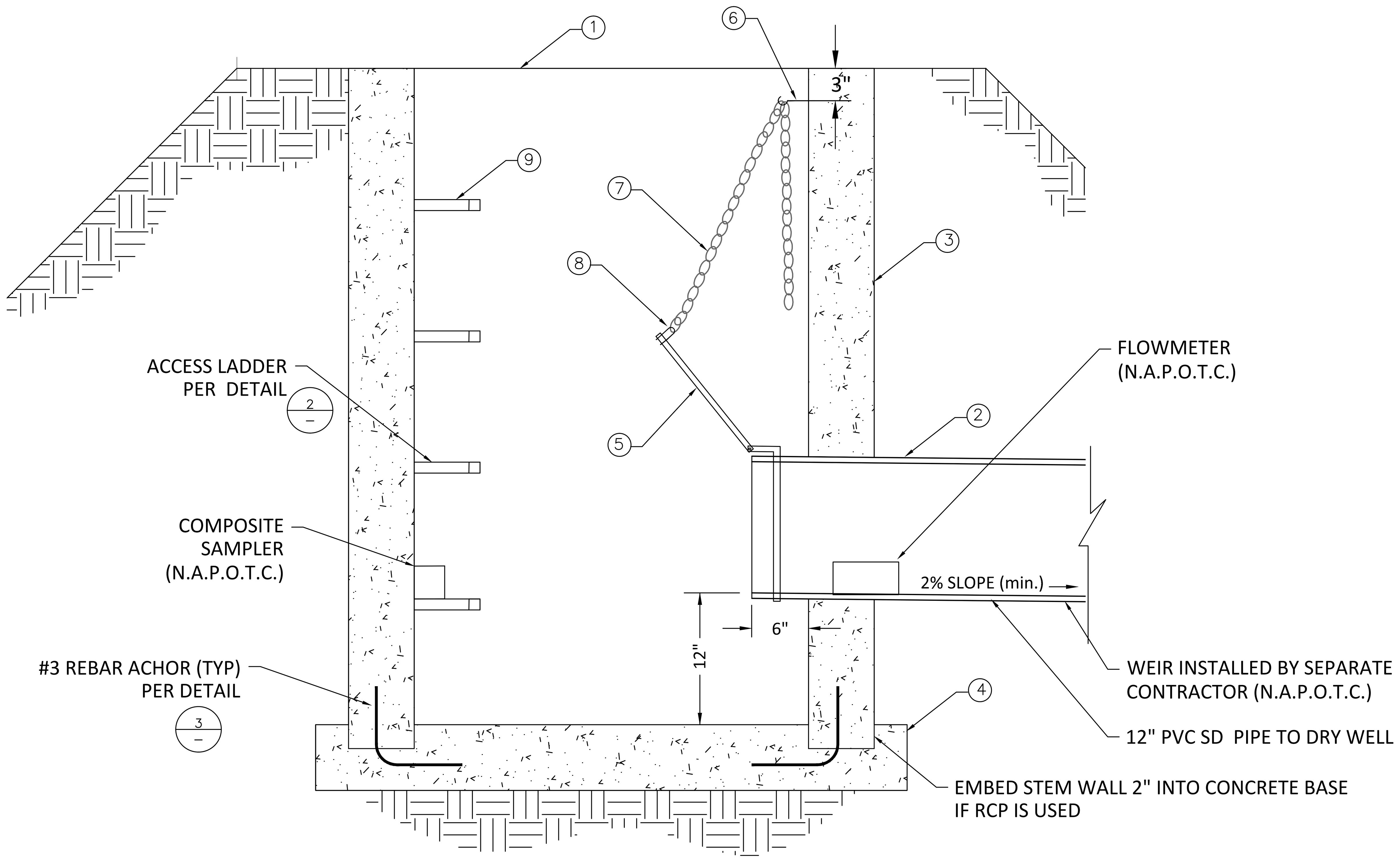
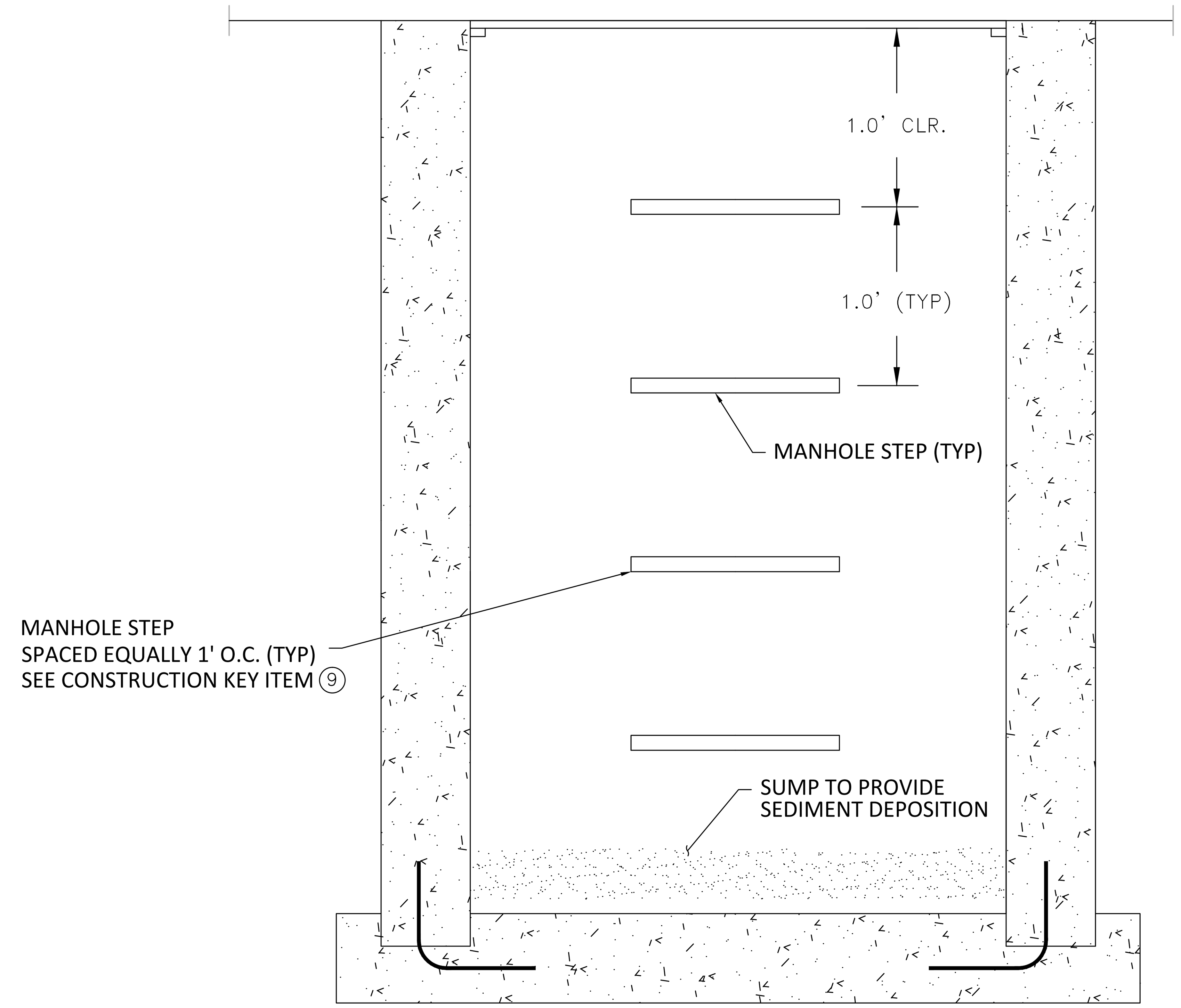


1 SEDIMENTATION WELL - PROFILE

NOT TO SCALE

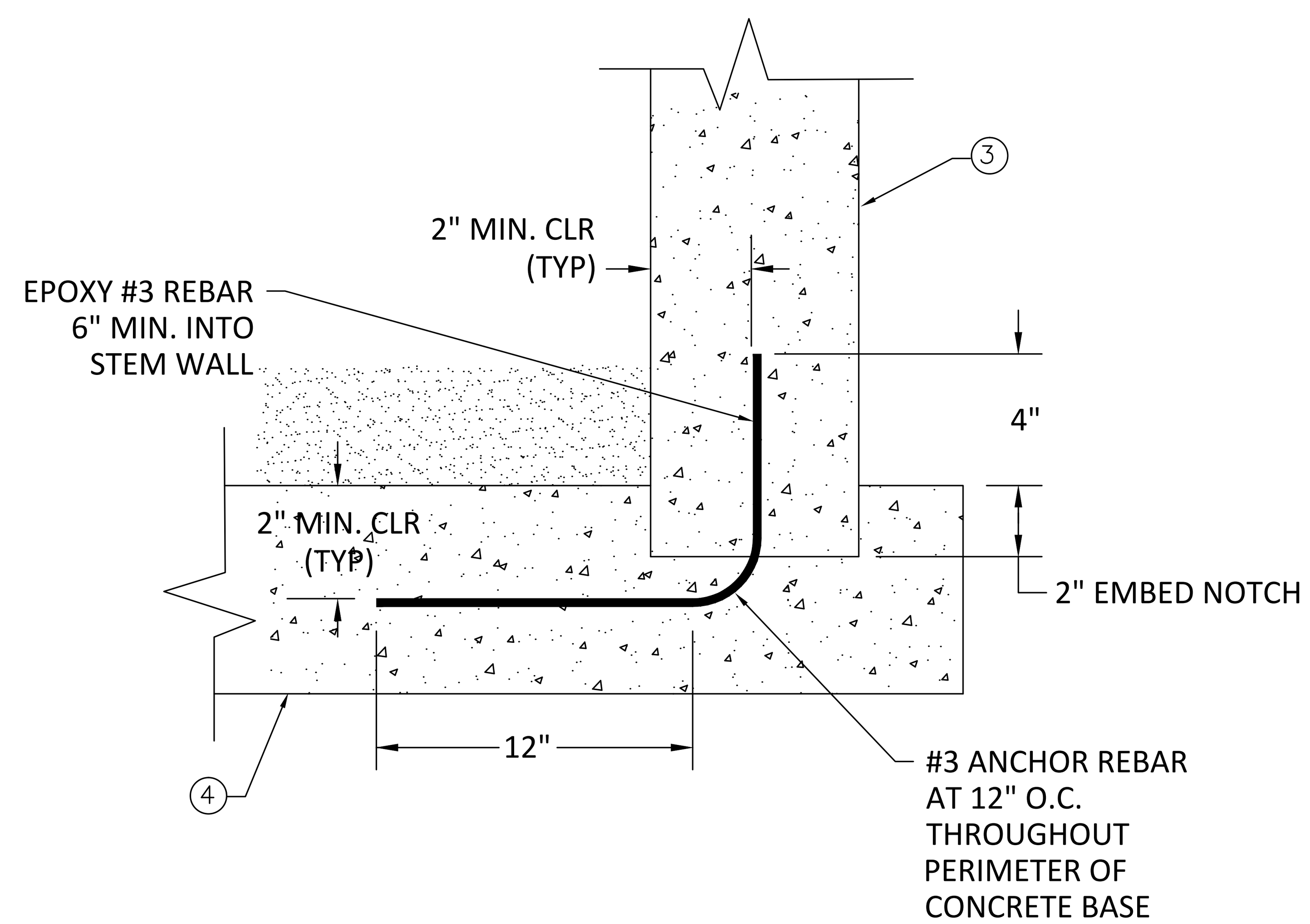
CONSTRUCTION KEY:

1. MANHOLE RING & GRATE SHALL BE MODEL #D-6032 AVAILABLE THROUGH D&L SUPPLY OR APPROVED EQUAL
2. 12" PVC PIPE – EXTEND 6" INTO SEDIMENTATION WELL TO ALLOW FOR FLAP GATE INSTALLATION
3. 30" REINFORCED CONCRETE PIPE OR CAST-IN-PLACE CONCRETE
4. CAST-IN-PLACE CONCRETE BASE
5. FLAP GATE SHALL BE A 12" HEAVY DUTY FLAP GATE PER AGRI-DRAIN CORPORATION MODEL #FG12HD OR APPROVED EQUAL
6. EPOXY 4-7/8" STAINLESS STEEL SCREW "J" HOOK BOLT INTO STILLING WELL
7. #2/0 LINK CHAIN W/ STAINLESS STEEL WELDED LINKS LENGTH OF CHAIN TO BE 10' MINIMUM AND CUT TO FIT IN FIELD
8. ATTACH CHAIN TO FLAP GATE PLATE WITH U-BOLT SCREW AND 3/8" SPRING LINK
9. MANHOLE STEP AVAILABLE THROUGH AMERICAN STEP COMPANY OR APPROVED EQUAL



2 ACCESS LADDER

NOT TO SCALE



3 ANCHOR DETAIL

NOT TO SCALE

100% SUBMITTAL
SEPTEMBER 2013

NO.	REVISION	BY	DATE

cbec eco engineering

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2544 Industrial Blvd.
West Sacramento, CA 95691

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DRAWN: .
CHECKED: .

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CITY OF ELK GROVE CALIFORNIA

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT

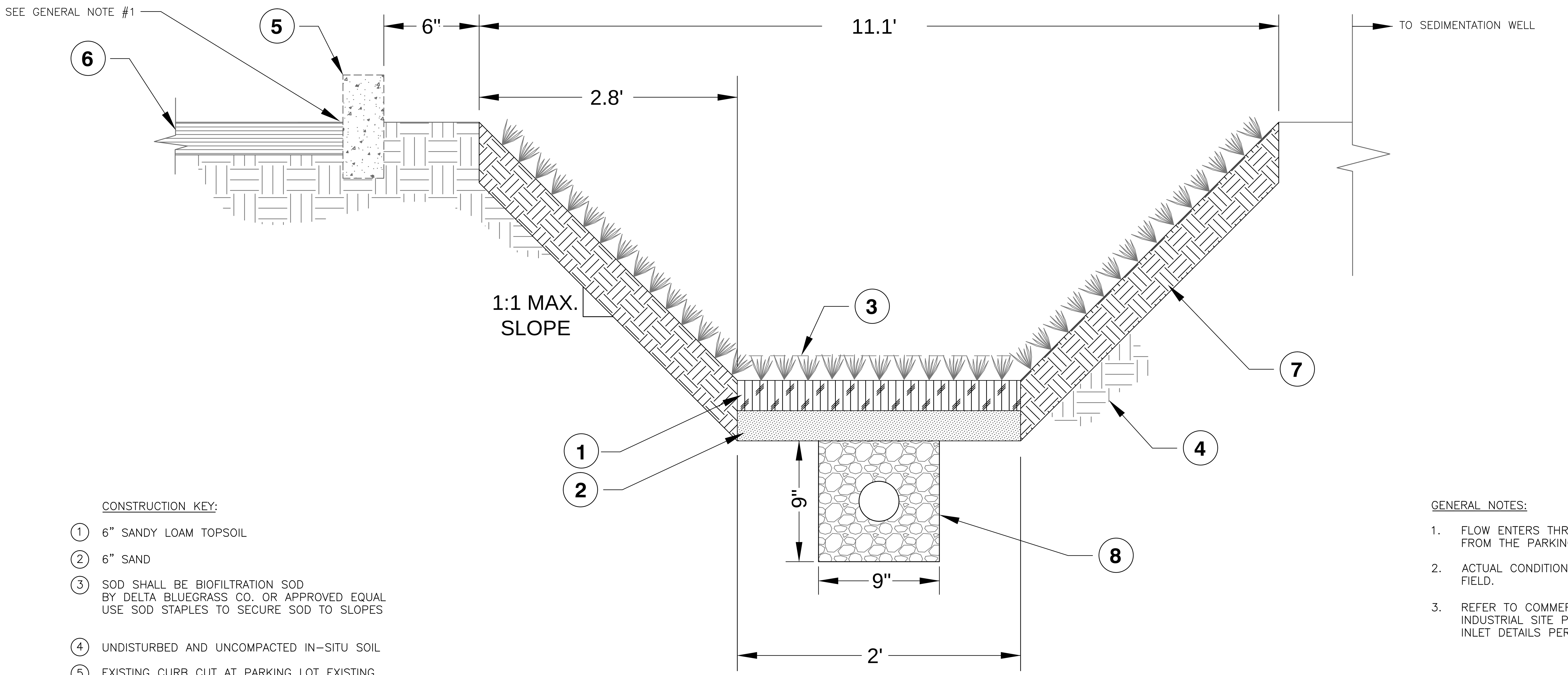
SITE 2: CITY OF ELK GROVE CORPORATION YARD

DRAINAGE INLET DETAIL

DATE: SEPTEMBER 2013
SCALE: HORIZ: N/A VERT: N/A
PROJECT No.: WDR019
SHEET: 7 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT



CONSTRUCTION KEY:

1. 6" SANDY LOAM TOPSOIL
2. 6" SAND
3. SOD SHALL BE BIOFILTRATION SOD BY DELTA BLUEGRASS CO. OR APPROVED EQUAL USE SOD STAPLES TO SECURE SOD TO SLOPES
4. UNDISTURBED AND UNCOMPACTED IN–SITU SOIL
5. EXISTING CURB CUT AT PARKING LOT EXISTING CONCRETE CURB (BEYOND)
6. EXISTING AC PARKING LOT
7. 6" DEEP AMENDED / CONDITIONED SOIL
8. 4" SDR 35 PVC PERFORATED DRAIN PIPE IN 9" COARSE AGGREGATE ENVELOPE (3/4" CRUSHED & WASHED ROCK) USE DEWITT CO. NON–WOVEN GEOTEXTILE FABRIC OR APPROVED EQUAL AROUND PIPE AND GRAVEL

GENERAL NOTES:

1. FLOW ENTERS THROUGH SLOTTED CURB FROM THE PARKING LOT.
2. ACTUAL CONDITIONS MAY VARY. ADJUST IN FIELD.
3. REFER TO COMMERCIAL / LIGHT INDUSTRIAL SITE PLAN FOR DRAINAGE INLET DETAILS PER SHEET 5.

1 / – **SWALE DETAIL**
NOT TO SCALE

100% SUBMITTAL
SEPTEMBER 2013

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

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NO.	REVISION	BY	DATE

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cbec, inc. eco engineering
2544 Industrial Blvd.
West Sacramento, CA 95691

DESIGNED: .
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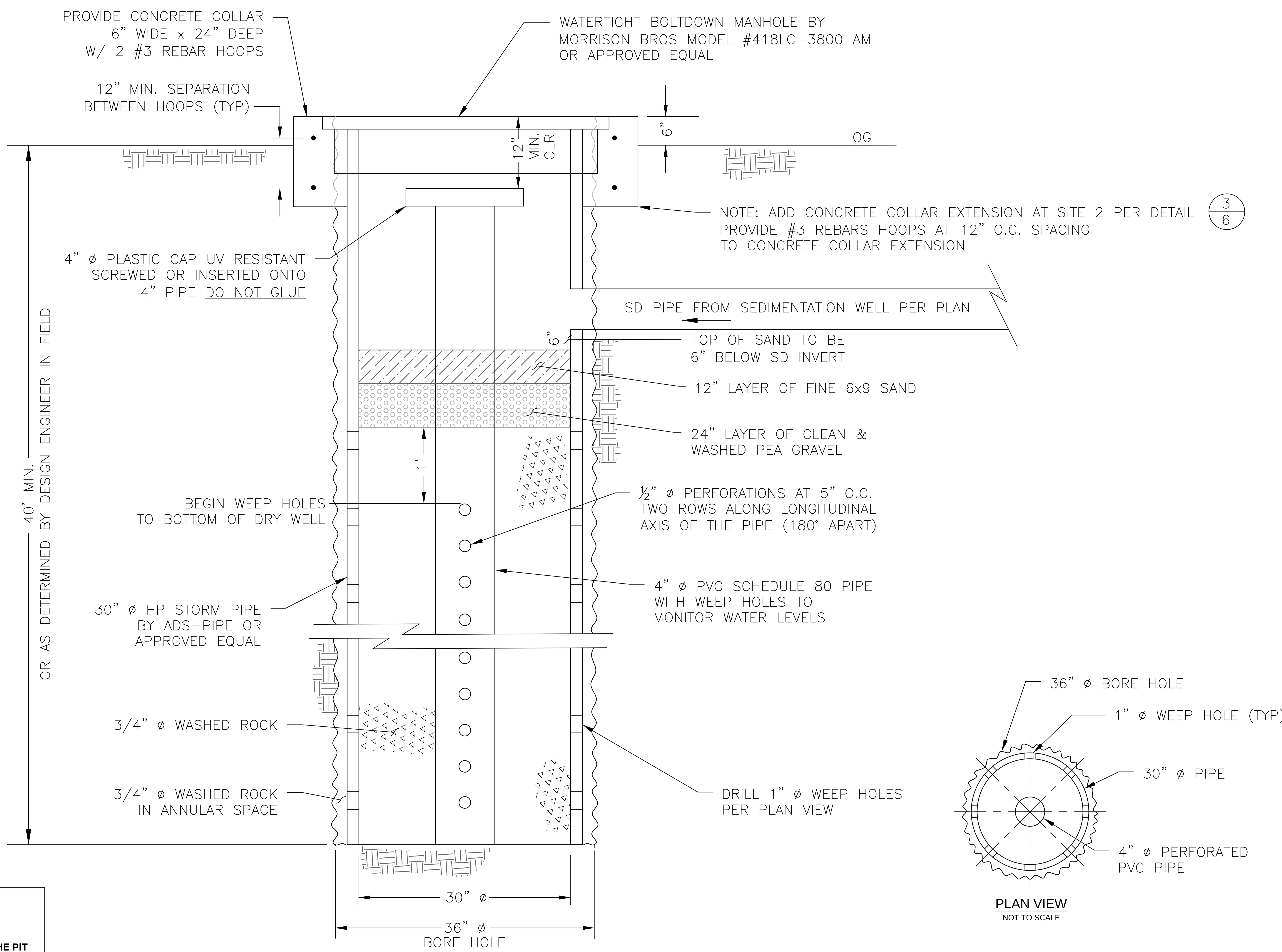
CITY OF ELK GROVE CALIFORNIA

DRY WELLS AS LOW IMPACT DEVELOPMENT IMPROVEMENTS PROJECT
SITE 2: CITY OF ELK GROVE CORPORATION YARD
SWALE DETAIL

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"=20' VERT: N/A
PROJECT No.: WDR019
SHEET: 8 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4



NOTES:

1. ROCK MUST COME FROM CLEAN SOURCES AND MUST BE THOROUGHLY WASHED BEFORE PLACEMENT.
2. GRAVEL PURCHASED FROM A SUPPLIER MUST BE WASHED AT THE PIT OR PLANT PRIOR TO DELIVERY TO THE DRY WELL SITE.
3. BEFORE PLACEMENT OF ROCK CONTACT DESIGN ENGINEER TO VERIFY WASHED ROCK CONDITION.

1 – DRY WELL DETAIL

NOT TO SCALE

100% SUBMITTAL
SEPTEMBER 2013

NO.	REVISION	BY	DATE

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Elk Grove, CA 95758 916.478.6002

DESIGNED: .
DRAWN: .
CHECKED: .

REGISTERED PROFESSIONAL ENGINEER
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CITY OF ELK GROVE CALIFORNIA

DRY WELLS AS LOW IMPACT DEVELOPMENT
IMPROVEMENTS PROJECT

DRY WELL DETAIL

DATE: SEPTEMBER 2013
SCALE: HORIZ: 1"=20' VERT: N/A
PROJECT No.: WDR019

SHEET: 9 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

WDR019 - UNDERGROUND INJECTION CONTROLS AS LOW IMPACT DEVELOPMENT

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