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Application for Certification

Puente Power Project (P3)
Oxnard, CA

Volume II

Submitted to:
The California Energy Commission

Prepared by: AECOM

APPENDIX A

PROJECT DESCRIPTION

APPENDIX A-1

LEED BD+C V.4 CHECKLISTS

LEED v4 for ID+C: Commercial Interiors

Project Checklist

Project Name: NRG Mandalay Energy Center Proposed Control Room

Date: 3/18/2015

Y	?	N			
	1		Credit	Integrative Process	2

0	2	0	**Location and Transportation**		18
			Credit	LEED for Neighborhood Development Location	18
	1		Credit	Surrounding Density and Diverse Uses (Option 2)	8
			Credit	Access to Quality Transit	7
	1		Credit	Bicycle Facilities	1
			Credit	Reduced Parking Footprint	2

0	0	0	**Water Efficiency**		12
Y			Prereq	Indoor Water Use Reduction	Required
			Credit	Indoor Water Use Reduction	12

3	19	0	**Energy and Atmosphere**		38
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Fundamental Refrigerant Management	Required
	5		Credit	Enhanced Commissioning (Option 2)	5
	13		Credit	Optimize Energy Performance (10% improvement above prerequisite)	25
2			Credit	Advanced Energy Metering	2
	1		Credit	Renewable Energy Production	3
1			Credit	Enhanced Refrigerant Management	1
			Credit	Green Power and Carbon Offsets	2

0	8	0	**Materials and Resources**		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
	1		Credit	Long-Term Commitment	1
			Credit	Interiors Life-Cycle Impact Reduction	4
	2		Credit	Building Product Disclosure and Optimization - Environmental Product Declarations (Option 1&2)	2
	1		Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
	2		Credit	Building Product Disclosure and Optimization - Material Ingredients	2
	2		Credit	Construction and Demolition Waste Management	2

8	5	0	**Indoor Environmental Quality**		17
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
	1		Credit	Enhanced Indoor Air Quality Strategies	2
3			Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
2			Credit	Indoor Air Quality Assessment	2
	1		Credit	Thermal Comfort (Option 1)	1
2			Credit	Interior Lighting (Option 1 & 2)	2
	1		Credit	Daylight	3
			Credit	Quality Views	1
	2		Credit	Acoustic Performance	2

1	0	0	**Innovation**		6
			Credit	Innovation	5
1			Credit	LEED Accredited Professional	1

1	0	0	**Regional Priority**		4
1			Credit	Regional Priority: Specific Credit (Site Management)	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1

13	35	0	**TOTALS**	Possible Points:	110

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80+

Total Potential LEED Credits 48

LEED v4 for Operations & Maintenance: Existing Buildings

Project Checklist

Project Name: Mandalay Energy Administration Building Oxnard, CA

Date: 3/4/2015

Y	?	N				
0	**6**	**0**	**Location and Transportation**			**15**
	6		Credit	Alternative Transportation	Option 2 (assume 25% of staff participation)	15
4	**2**	**0**	**Sustainable Sites**			**10**
Y			Prereq	Site Management Policy		Required
2			Credit	Site Development-Protect or Restore Habitat	Option 1 (on site restoration)	2
			Credit	Rainwater Management		3
1			Credit	Heat Island Reduction	Option 2 (Roof)	2
1			Credit	Light Pollution Reduction	Option 1 (55 of 70 ext fixtures completed to date)	1
	1		Credit	Site Management	Option 1 (Limit turf area)	1
	1		Credit	Site Improvement Plan	(Develop a 5 year site improvement plan)	1
6	**1**	**0**	**Water Efficiency**			**12**
Y			Prereq	Indoor Water Use Reduction	Option 1 (Calculated water use)	Required
Y			Prereq	Building-Level Water Metering	(five year plan)	Required
2			Credit	Outdoor Water Use Reduction	Option 1 (no irrigation required)	2
4			Credit	Indoor Water Use Reduction	Option 2 (metered water use)	5
			Credit	Cooling Tower Water Use	(N/A)	3
	1		Credit	Water Metering	(indoor plumbing fix, and domestic hot water)	2
0	**11**	**0**	**Energy and Atmosphere**			**38**
Y			Prereq	Energy Efficiency Best Management Practices	(ASHRAE)	Required
Y			Prereq	Minimum Energy Performance	Option 1	Required
Y			Prereq	Building-Level Energy Metering		Required
Y			Prereq	Fundamental Refrigerant Management	(no CFC)	Required
	2		Credit	Existing Building Commissioning— Analysis	Option 2 (energy audit)	2
	2		Credit	Existing Building Commissioning—Implementation		2
	3		Credit	Ongoing Commissioning		3
	3		Credit	Optimize Energy Performance	(case 1 assume 76% min)	20
			Credit	Advanced Energy Metering		2
			Credit	Demand Response		3
			Credit	Renewable Energy and Carbon Offsets		5
	1		Credit	Enhanced Refrigerant Management	Option 1	1
4	**3**	**0**	**Materials and Resources**			**8**
Y			Prereq	Ongoing Purchasing and Waste Policy		Required
Y			Prereq	Facility Maintenance and Renovations Policy		Required
1			Credit	Purchasing- Ongoing	(program in place)	1
1			Credit	Purchasing- Lamps	(program in place)	1
	1		Credit	Purchasing- Facility Management and Renovation	Option 1	2
2			Credit	Solid Waste Management- Ongoing		2
	2		Credit	Solid Waste Management- Facility Management and Renovation		2
4	**10**	**0**	**Indoor Environmental Quality**			**17**
Y			Prereq	Minimum Indoor Air Quality Performance	Option 1 (replace exist units)	Required
Y			Prereq	Environmental Tobacco Smoke Control		Required
Y			Prereq	Green Cleaning Policy	Option 1	Required
	2		Credit	Indoor Air Quality Management Program		2
	2		Credit	Enhanced Indoor Air Quality Strategies	Option 1 & 2	2
	1		Credit	Thermal Comfort	Option 1	1
	2		Credit	Interior Lighting	Option 1 and 2	2
	2		Credit	Daylight and Quality Views	Option 1	4
			Credit	Green Cleaning- Custodial Effectiveness Assessment		1
1			Credit	Green Cleaning- Products and Materials		1
	1		Credit	Green Cleaning- Equipment		1
2			Credit	Integrated Pest Management	(program in place)	2
1			Credit	Occupant Comfort Survey		1
1	**0**	**0**	**Innovation**			**6**
			Credit	Innovation		5
1			Credit	LEED Accredited Professional		1
2	**1**	**0**	**Regional Priority**			**4**
1			Credit	Regional Priority: Specific Credit	(site management)	1
1			Credit	Regional Priority: Specific Credit	(indoor water use)	1
	1		Credit	Regional Priority: Specific Credit	(outdoor water use)	1
			Credit	Regional Priority: Specific Credit		1

21	**32**	**0**	**TOTALS**	Possible Points: **110**

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80+ points

Total Potential LEED Credits 53

APPENDIX A-2

CIVIL ENGINEERING DESIGN CRITERIA

APPENDIX A-2
CIVIL ENGINEERING DESIGN CRITERIA

A-2.1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that generally will be used in the design and the construction of civil engineering systems for the Puente Power Project (P3). More specific project information will be developed during the execution of the project to support detail design, engineering, material procurement specification, and construction specifications.

A-2.2 CODES AND STANDARDS

The design of civil engineering systems for the project will be in accordance with the laws and regulations of the federal government, the State of California, Ventura County, and City of Oxnard municipal ordinances, and industry standards. The current issue or edition of the documents at the time of filing the Application for Certification (AFC) for the project with the California Energy Commission (CEC) will apply, unless otherwise noted. In cases where conflicts between the cited documents exist, the requirements of more conservative documents shall apply.

A-2.2.1 Civil Engineering Codes and Standards

The following codes and standards have been identified as applicable, in whole or in part, to civil engineering design and construction of power plants.

- American Association of State Highway and Transportation Officials (AASHTO) – Standards and Specifications
- American Concrete Institute (ACI) – Standards and Recommended Practices
- American National Standards Institute (ANSI) – Standards
- American Society for Testing and Materials (ASTM) – Standards, Specifications, and Recommended Practices
- American Water Works Association (AWWA) – Standards and Specifications
- Asphalt Institute (AI) – Asphalt Handbook
- State of California Department of Transportation (Caltrans) Standard Specifications
- Concrete Reinforcing Steel Institute (CRSI) – Standards
- Factory Mutual (FM) – Standards
- National Fire Protection Association (NFPA) – Standards
- California Building Code (CBC) Standards 2013
- State of California, Division of Industrial Safety (DIS)
- Occupational Safety and Health Administration (OSHA) Standards.

A-2.2.2 Engineering Geology Codes, Standards, and Certifications

Engineering geology activities will conform to the applicable federal, state, and local laws, regulations, ordinances, and industry codes and standards.

A-2.2.2.1 Federal

- OSHA standard 29 Code of Federal Regulations 1926 Subpart P for excavations.

A-2.2.2.2 State

- The Warren-Alquist Act, Public Resources Code (PRC), Section 25000 et seq., and the California Energy Commission (CEC) Code of Regulations (CCR), Siting Regulations, Title 20 CCR, Chapter 2, require that an AFC address the geologic and seismic aspects of the site.

- The California Environmental Quality Act (CEQA), PRC Sections 21000 et seq., and the CEQA Guidelines require that potential significant effects, including geologic hazards, be identified and a determination made as to whether they can be substantially reduced.

- National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities will be required during the construction of P3. This permit will include the Storm Water Pollution Prevention Plan (SWPPP) for the construction of the Project. Discharge will be to the Pacific Ocean.

- The Mandalay Generating Station (MGS) has an existing individual NPDES permit for the discharge of once-through cooling water, process wastewater, and stormwater to the Pacific Ocean. NPDES Permit Number CA0001180 will be revised and updated for the discharge of process water and stormwater during the operation of P3.

- The Los Angeles Regional Water Quality Control Board's Waste Discharge Requirements for Discharges of Groundwater from Construction and Project Dewatering to Surface Waters in Coastal Watershed of Los Angeles and Ventura Counties will be required to discharge water from construction dewatering activities.

Requirements for the coverage under a general stormwater permit include development of a written SWPPP, implementation of control measures, and submittal of a request for permit coverage, usually referred to as the Notice of Intent (NOI). The SWPPP is a written assessment of the potential sources of pollutants in stormwater runoff, and control measures that will be implemented at the project site to minimize the discharge of these pollutants in runoff from the site. These control measures include site–specific best management practices (BMPs), maintenance plans, inspections, employee training, and reporting.

A-2.2.2.3 County and Local Regulations

A-2.2.2.3.1 City of Oxnard Regulations

P3 shall comply with the City of Oxnard Ordinances. The City of Oxnard Ordinances include, but are not limited to:

- The Zoning Ordinance. The site is in the zone "EC," Costal Energy Facilities.

- Coastal land use plan, Planning and Environmental Services.

- Coastal Zoning Ordinance, Chapter 37 of the Oxnard City Code. P3 is in the "EC (Costal Energy Facilities) Sub-zone." The purpose of the EC sub-zone is to provide areas that allow for the siting, construction, modification, and maintenance of Power-generating facilities and electrical substations consistent with policies 40 and 41 of the Oxnard Coastal Land Use Plan. Coastal-dependent energy facilities shall be encouraged to locate or expand in existing sites, and shall be permitted reasonable long-term growth, where consistent with this code. This proposed project is permitted subject to the approval of a Coastal development permit pursuant to the provisions of Article 5 (Administration). The proposed site is within the Coastal Zone Boundary.

- Development Services department standards.

- All grading shall be constructed in conformance with the latest editions of the City of Oxnard Grading Ordinance and the latest editions of the City of Oxnard Department of Public Works Standards, "Standard Specifications for Public Works Construction" (SSPWC), and the city of Oxnard Standard Land Development Specifications.

- The Water and Sewer shall be constructed in Conformance with the latest editions of the City of Oxnard Department of Public Works Standards, SSPWC, and the city of Oxnard Standard Land Development Specifications.

- California State Planning Law, Government Code Section 65302, requires each city and county to adopt a general plan, consisting of nine mandatory elements, to guide its physical development. Section 65302(g) requires that a seismic safety element be included in the general plan.

The site development activities will require certification by a Professional Geotechnical Engineer and a Professional Engineering Geologist during and following construction, in accordance with the CBC, Chapter 70. The Professional Geotechnical Engineer and the Professional Engineering Geologist will certify the placement of earthen fills and the adequacy of the site for structural improvements, as follows:

- Both the Professional Geotechnical Engineer and the Professional Engineering Geologist will address CBC Chapter 70, Sections 7006 (Grading Plans), 7009 (Cuts), 7012 (Terraces), 7013 (Erosion Control), and 7015 (Final Report).

- The Professional Geotechnical Engineer will also address CBC Chapter 70, Sections 7011 (Cuts) and 7012 (Terraces).

Additionally, the Professional Engineering Geologist will present findings and conclusions pursuant to PRC Section 25523 (a) and (c); and 20 CCR Section 1752 (b) and (c).

A-2.3 CIVIL DESIGN CRITERIA

A-2.3.1 Datum

The horizontal datum shall be Plant Grid System. The vertical datum shall be North American Vertical Datum of 1988.

A-2.3.2 Storm Sewer

- Concrete pipe should be used for the storm sewer. High-density polyethylene (HDPE) pipe can be used if preferred by the Client.
- The minimum diameter of the pipe shall be 12 inches.
- The concrete pipe should be Class III as per ASTM C-76, unless higher-strength pipe is needed for heavier loading.
- The Manning's roughness coefficient "n" for the concrete pipe will be 0.013. If HDPE pipe is used, then the roughness coefficient shall be 0.012.
- The minimum velocity of the pipe shall be 2 feet/second, and maximum velocity preferred should be 10 feet/second.
- The storm pipes shall be designed for a 10-year storm frequency.
- Rational method will be used to design the storm sewer. Storm sewer will be designed to flow by gravity flowing full.
- Catch basins shall be precast concrete.

- Ditches shall be trapezoidal, with side slope of 3:1 (H:V) preferred; but 2:1 (H:V) can be used if necessary. Ditches can be grass-lined or crushed stone.
- Storm sewer will be designed for HS20 loading unless heavier loading is applicable.

A-2.3.3 Stormwater Management Design Criteria

A-2.3.3.1 Intensity Duration Frequency Curves

The rainfall Intensity Duration Frequency (I-D-F) Curves are taken from the Design Hydrology Manual published by Ventura County Watershed Protection District, updated through December 2010. According to the manual, the site falls in K zone. Refer to Appendix A, Exhibit 2, for the I-D-F curve for the K zone. The maximum Tc (Time of Concentration) to be used for the drainage area is 30 minutes. The runoff coefficients to be used depend on the soil type. The charts have been provided in Appendix A from Exhibit 6A through 6G for the runoff coefficient to be used in the rational method (2010 Design Hydrology Manual). These charts are based on the soil type classification as defined by the Natural Resources Conservation Service (NRCS).

A-2.3.3.2 Rainfall Data for the Design of Retention Basins

The rainfall data for design of the retention basin is taken from the National Oceanic and Atmospheric Administration Atlas 14, Volume 6, Version 2. The 24-hour rainfall for the various frequencies are as follows:

- 1-year 2.08 inches
- 2-year 2.70 inches
- 5-year 3.45 inches
- 10-year 4.03 inches
- 25-year 4.75 inches
- 50-year 5.27 inches
- 100-year 5.76 inches

For design of the stormwater detention/retention basin, the method used will be Technical Release 55 (TR-55) by NRCS. The rainfall distribution type is "I." Pond pack software by Bentley will be used for design of the detention/retention basin.

Average annual rainfall for the City of Oxnard is 15.89 inches.

A-2.3.3.3 Stormwater Management Concept

A-2.3.3.3.1 Existing Condition

The MGS property currently includes MGS Units 1, 2, and 3, as well as an administration building and a shop and warehouse building. Other structures on the site include an intake structure, various tanks and stacks, and parking lots. The Pacific Ocean is to the west of the site. The site also has two active basins (North and South Basins) for wastewater retention and stormater management. There is a third basin, a former acid cleaning waste basin (East Basin), that is out of service and no longer in use. The site is relatively flat, with raised sand dunes along the Pacific Ocean that prevent the ocean water from inundating the site.

MGS Units 1 and 2 have floor drains (also known as the oily waste network) that drain to the building wastewater sump. This structure is also known as an oil/water separator. A skimmer in this sump removes the oil prior to transfer to the retention basins. From this wastewater sump, the water is discharged to either of the two active retention basins. This sump has no other discharge; therefore, the

water from the sump cannot drain directly to the Pacific Ocean. The MGS Unit 3 building and the warehouse building both have floor drains that discharge to this oily waste network.

The yard drains are on the peripheral areas of the generating units, as well as the Administration Building, shop and warehouse, parking lot, intake structure area, service and distilled water tank area. The yard drains enter one of several interconnected catch basins and manholes, which terminate in a single vault at the southern side of the boiler-wash–settling basin. This vault has permanently installed lift pumps that discharge into the boiler-wash–settling basin and/or wastewater retention basin. A manual drain valve is present in this vault, which could be opened to permit the stormwater to be discharged directly into the outfall or the Pacific Ocean. However, this valve is kept closed, except during extreme weather events, when it will be opened to discharge the stormwater to the outfall/Pacific Ocean.

Wash-down from MGS Units 1 and 2 boilers, and from Unit 3, is discharged to a sump pump on the southern side of the South basin. This sump discharges the boiler wash down to the South basin.

The North and South Basins are currently being used to store wash-down from MGS Units 1, 2, and 3; and the effluent from the oil/water separator (which collects the flow from the floor drains).

Sanitary wastewater is collected in the sanitary sewer network, and ultimately discharged to the septic tanks and septic field.

MGS has an intake structure that draws water from the Edison Canal as part of the once-through-cooling system. The water is discharged to the Pacific Ocean through an existing outfall after being used in the condensers at the MGS Units 1 and 2 building.

A-2.3.3.3.2 Proposed Condition (Construction of P3)

P3 is being proposed to be sited north of the North Basin. The project scope is to install a new GE Frame 7HA.01 single-fuel combustion turbine generator and associated auxiliaries on the vacant portion of the MGS property.

Existing gas-fired steam-generating MGS Units 1 and 2 would retire by the completeion of commissioning of P3. The existing oil/water separator will remain in place and collect the flow from floor drains from MGS Unit 3, the shop, and warehouse, as is the case under existing conditions.

A new oil/water separation system will be installed for P3 to collect the oily water from the equipment wash-downs, leakage, sample drains, and miscellaneous plant drains. All equipment that has the potential for oil leaks (including new transformers) or hazardous chemicals will be kept in the spill containment areas. Stormwater from the areas that may accumulate small amounts of oil and chemicals will be collected in a system of floor drains, equipment drains, curbed area drains, and sumps; and will be routed to a new (or existing) oil/water separator. After passing through the oil/water separator, water from the clear effluent chambers will be discharged to the existing wastewater sump via the existing oily waste network. The oil from the oil containment chambers of the oil/water separator will be collected and shipped off the site for recycling.

Similarly, the wash-down flow from MGS Unit 3 will continue to use the existing oily waste network to the existing wastewater sump. Because there will no longer be boiler wash-down flow from MGS Units 1 and 2, the boiler wash-down drain pipes from MGS Units 1 and 2 shall be plugged.

The yard drains collecting stormwater from the peripheral areas of the existing generating units (MGS Units 1, 2, and 3)—and other areas, including the Administration Building, shop and warehouse, parking lot, intake structure area, and service and distilled water tank area—will remain, and function as they are under existing conditions. The yard drains will enter one of several interconnected existing catch basins,

which terminates in the existing vault. This vault has lift pumps that will remain in the proposed condition, and will discharge stormwater into the South and/or North retention basins. A manual drain valve is present in the vault, which could be opened to permit the stormwater to be discharged directly into the outfall and the Pacific Ocean. However, this valve will be kept closed except during the extreme weather events.

The proposed P3 project area will have new catch basins, manholes, and storm sewer network, which will terminate in a new vault. This new vault will have a lift pump that will discharge the stormwater into the either the service water tank, or South and/or North detention basins via the existing MGS stormwater system. A manual drain valve will be proposed in the vault that could be opened to permit the stormwater to be discharged directly into the outfall. However, this valve will be kept closed except during the extreme weather events.

In the proposed condition, both the South Basin and the North Basin will be used to store the stormwater from the MGS drainage area, the new P3 drainage area, and other areas that currently drain in to these basins. All stormwater flow will be retained in the North and South Retention basins prior to discharge to the Pacific Ocean.

Both the North and South Retention basins are lined, and therefore practically impervious. There will be no infiltration from these basins.

A-2.3.3.4 Earthwork

The site is relatively flat. The earthwork associated with the construction of the project would be minor. Earthwork will include preparation of structures and equipment pads, pavement and hardscape areas, and trench excavations for pipelines and utility lines that are generally less than 5 feet deep.

Preliminary geotechnical investigation has been performed for the P3 project. This geotechnical investigation report was prepared by Ninyo & Moore, Geotechnical and Environmental Sciences Consultants for NRG Energy, Inc. The report is dated November 27, 2013.

Temporary slopes above the water table should be stable at an inclination of 1-1/2:1 (horizontal to vertical) for excavations deeper than 4 feet, but not more than 10 feet below existing grade. Temporary slopes shall be evaluated by a geotechnical engineer in accordance with OSHA criteria.

Groundwater was observed at a depth of approximately 9 feet below the existing grade, and the historically shallow groundwater near the site was reported at approximately 5 feet below the ground surface during the geotechnical investigation. Variations in groundwater will occur due to tidal fluctuations, seasonal precipitation, variations in ground elevations, groundwater pumping, and other factors.

APPENDIX A-3

STRUCTURAL ENGINEERING DESIGN CRITERIA

APPENDIX A-3
STRUCTURAL ENGINEERING DESIGN CRITERIA

A-3.1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that shall be used in the design and construction of the structural engineering systems and components for the Puente Power Project (P3). More specific project information will be developed during execution of the project to support detail design, engineering, material procurement specification, and construction specifications.

A-3.2 CODES AND STANDARDS

The design of structural engineering systems and components for the project will be in accordance with the laws and regulations of the federal government, the State of California, Ventura County, and City of Oxnard; California ordinances, and the industry standards. The current issue or edition of the documents at the time this Application for Certification (AFC) is filed will apply, unless otherwise noted. In cases where conflicts between the cited documents exist, requirements of the more conservative document will be used.

The following codes and standards have been identified, as applicable, to structural engineering design and construction of power plants.

- California Building Code (CBC), 2013 Edition, including all Supplements
- International Building Code (IBC), 2012 Edition
- American Institute of Steel Construction (AISC):
  - Manual of Steel Construction – 14th Edition
  - Specification for Structural Steel, American National Standards Institute (ANSI)/AISC 360-10
  - Seismic Provisions for Structural Steel Buildings, ANSI/AISC 341-10
  - Specification for Structural Joints Using American Society for Testing and Materials (ASTM) A325 or A490 Bolts
  - Code of Standard Practice for Steel Buildings and Bridges
- American Concrete Institute (ACI):
  - ACI 318-11, Building Code Requirements for Structural Concrete
  - ACI 301-10, Specifications for Structural Concrete for Buildings
  - ACI 543R-00, Design, Manufacture, and Installation of Concrete Piles
- American Society of Civil Engineers (ASCE):
  - ASCE 7-10, Minimum Design Loads for Buildings and Other Structures
- American Society of Mechanical Engineers
  - ASME STS-1, 2000 – Steel Stacks
- American Welding Society:
  - D1.1 – Structural Welding Code – Steel
  - D1.3 – Structural Welding Code – Sheet Steel
- Code of Federal Regulations, Title 29 – Labor, Chapter XVII, Occupational Safety and Health Administration (OSHA).

  - Part 1905 – Rules of practice for variances, limitations, variations, tolerances, and exemptions under the Williams-Steiger Occupational Safety and Health Act of 1970
  - Part 1910 – Occupational Safety and Health Standards
  - Part 1926 – Construction Safety and Health Regulations

- National Association of Architectural Metal Manufacturers – Metal Bar Grating Manual

- Hoist Manufacturers Institute (HMI), Standard Specifications for Electric Wire Rope Hoists (HMI 100)

- National Electric Safety Code), C2-2005

- National Fire Protection Association (NFPA Standards)
  - NFPA 850 Fire Protection for Electric Generating Plants

- Steel Deck Institute – Design Manual for Floor Decks and Roof Decks

A-3.2.1 California Energy Commission Special Requirements

Prior to the start of any increment of construction, the proposed lateral-force procedures for project structures and the applicable designs, plans, and drawings for project structures will be submitted for approval.

Proposed lateral-force procedures, designs, plans, and drawings shall be those for:

- Major project structures
- Major foundations, equipment supports, and anchorage
- Large, field-fabricated tanks
- Switchyard structures

A-3.3 STRUCTURAL DESIGN CRITERIA

A-3.3.1 Datum

Site topographic elevations will be based on an elevation survey conducted using known elevation benchmarks.

A-3.3.2 Frost Penetration

The site is in an area free of frost penetration. Bottom elevation of all foundations for structures and equipment, however, will be maintained at a minimum of 12 inches below the finished grade.

A-3.3.3 Temperatures

The design basis temperatures for civil and structural engineering systems will be as follows:

Maximum	93 degrees Fahrenheit (°F)
Minimum	35°F

A-3.3.4 Design Loads

A-3.3.4.1 General

Design loads for structures and foundations will comply with all applicable building code requirements. The State of California has adopted the 2012 IBC. The building code in effect is the 2013 CBC.

A-3.3.4.2 Dead Loads

Dead loads will consist of the weights of the structure, its components, and all equipment of a permanent nature, including tanks, bins, wall panels, partitions, roofing, drains, piping, cable trays, bus ducts, and the contents of tanks and bins measured at full operating capacity. The contents of the tanks and bins, however, will not be considered as effective in resisting structure uplift due to wind forces; but will be considered as effective for seismic forces.

A-3.3.4.3 Live Loads

Live loads will consist of uniform floor live loads and equipment live loads. Uniform live loads are assumed equivalent unit loads that are considered sufficient to provide for movable and transitory loads, such as the weights of people, portable equipment, and tools; small equipment or parts, which may be moved over or placed on the floors during maintenance operations; and planking. The uniform live loads will not be applied to floor areas that will be permanently occupied by equipment.

Lateral earth pressures, hydrostatic pressures, and wheel loads from trucks will be considered as live loads.

Uniform live loads will be in accordance with ASCE Standard 7, but will not be less than the following:

- Roofs — 20 pounds per square foot (psf)
- Floors and Platforms (steel grating and checkered plates) — 100 psf

In addition, a uniform load of 50 psf will be used to account for piping and cable trays, except that where the piping and cable loads exceed 50 psf, the actual loads will be used.

Furthermore, a concentrated load of 5 kips will be applied concurrently to the supporting beams of the floors to maximize stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Floors (elevated concrete floors) — 100 psf

In addition, elevated concrete slabs will be designed to support an alternate concentrated load of 2 kips in lieu of the uniform loads, whichever governs. The concentrated load will be treated as a uniformly distributed load acting over an area of 2.5 square feet, and will be situated in a manner to produce the maximum stress conditions in the slabs.

- Control Room Floor — 150 psf
- Stairs, Landings, and Walkways — 100 psf

In addition, a concentrated load of 2 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Pipe Racks — 50 psf

Where the piping and cable tray loads exceed the design uniform load, the actual loads will be used. In addition, a concentrated load of 8 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Hand Railings

Hand railings will be designed for a 200-pound concentrated load applied at any point and in any direction.

- Slabs-on-Grade 250 psf
- Truck-Loading Surcharge Adjacent to Structures 250 psf
- Truck Support Structures AASHTO-HS-20-44
- Special Loading Conditions Actual loadings

Laydown loads from equipment components during maintenance, and floor areas where trucks, forklifts, or other transports have access will be considered in the design of live loads.

Live loads may be reduced in accordance with the provisions of the CBC.

Posting of the floor load capacity signs for all roofs, elevated floors, platforms, and walkways will be in compliance with the OSHA Occupational Safety and Health Standard, Walking and Working Surfaces, Subpart D. Floor-load capacity for slabs-on-grade will not be posted.

A-3.3.4.4 Earth Pressures

Earth pressures will be in accordance with the recommendations contained in the project-specific geotechnical report.

A-3.3.4.5 Groundwater Pressures

Hydrostatic pressures due to groundwater or temporary water loads will be considered.

A-3.3.4.6 Wind Loads

The wind forces will be calculated in accordance with CBC 2013 with a basic wind speed of 85 miles per hour and an exposure category of "D."

A-3.3.4.7 Seismic Loads

Structures will be designed and constructed to resist the effects of earthquake loads as determined in CBC 2013. Using a site soil class of "D," the site is in Seismic Design Category E, per the CBC. The occupancy category of the structure is 3 (Special Occupancy Structure), and the corresponding importance factor is 1.25. Final seismic parameters will be obtained from the geotechnical report.

A-3.3.4.8 -Generator Loads

The gas-turbine-generator loads for pedestal and foundation design will be furnished by the equipment manufacturers, and will be applied in accordance with the equipment manufacturers' specifications, criteria, and recommendations.

A-3.3.4.9 Special Considerations for Steel Stacks

A steel stack will be designed to withstand the normal and abnormal operating conditions, in combination with wind loads and seismic loads, and will include the along-wind and across-wind effects on the stack.

The design will meet the requirements of ASME/ANSI STS-1-2000, "Steel Stacks," using the allowable stress design method, except that increased allowable stress for wind loads as permitted by AISC will not be used.

A-3.3.4.10 Special Considerations for Structures and Loads during Construction

For temporary structures, or permanent structures left temporarily incomplete to facilitate equipment installations, or temporary loads imposed on permanent structures during construction, the allowable stresses may be increased by 33 percent.

Structural backfill may be placed against walls, retaining walls, and similar structures when the concrete strength attains 80 percent of the design compressive strength (f'_c), as determined by sample cylinder tests. Restrictions on structural backfill, if any, will be shown on the engineering design drawings.

Design restrictions imposed on construction shoring removal that are different from normal practices recommended by the ACI Codes will be shown on engineering design drawings.

Metal decking used as forms for elevated concrete slabs will be evaluated to adequately support the weight of concrete plus a uniform construction load of 50 psf, without increase in allowable stresses.

A-3.4 DESIGN BASES

A-3.4.1 General

Reinforced-concrete structures will be designed by the strength design method, in accordance with the CBC and ACI 318, "Building Code Requirements for Structural Concrete."

Steel structures will be designed by the working stress method, in accordance with the CBC and the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

Allowable soil-bearing pressures for foundation design will be in accordance with the "Final Subsurface Investigation and Foundation Report" for the facility.

A-3.4.2 Factors of Safety

The factor of safety for all structures, tanks, and equipment supports will be as follows:

Against Overturning	1.50
Against Sliding	1.50 for Wind Loads 1.50 for Seismic Loads
Against Uplift Due to Wind	1.50
Against Buoyancy	1.50

A-3.4.3 Allowable Stresses

Calculated stresses from the governing loading combinations for structures and equipment supports will not exceed the allowable limits permitted by the applicable codes, standards, and specifications.

A-3.4.4 Load Factors and Load Combinations

For reinforced-concrete structures and equipment supports, using the strength method, the strength design equations will be determined based on CBC 2013, and ACI-318-11. The Allowable Stress Design load combinations of CBC 2013 will be used to assess soil-bearing pressure and stability of structures per CBC 2013.

Steel-framed structures will be designed in accordance with CBC 2013 and the AISC Specification for Structural Steel Buildings. Connections will conform to Research Council on Structural Connections of the Engineering Foundation Specification for Structural Joints.

A-3.5 CONSTRUCTION MATERIALS

A-3.5.1 Concrete and Grout

The f'_c of concrete and grout, as measured at 28 days, will be as follows:

Electrical ductbank encasement and lean concrete backfill (Class L-1)	2,000 psi
Structural concrete (Class S-1)	3,000 psi
Structural concrete (Class S-2)	4,000 psi
Structural concrete (Class S-3)	5,000 psi
Grout (Class G-1)	5,000 psi

The classes of concrete and grout to be used will be shown on engineering design drawings or indicated in design specifications.

A-3.5.2 Reinforcing Steel

Reinforcing-steel bars for concrete will be deformed bars of billet steel, conforming to ASTM A615, Grade 60.

Welded-wire fabric for concrete will conform to ASTM A185.

A-3.5.3 Structural and Miscellaneous Steel

Structural and miscellaneous steel will generally conform to ASTM A36, ASTM A572, or ASTM A992, except in special situations where higher-strength steel is required.

High-strength structural bolts, including nuts and washers, will conform to ASTM A325 or ASTM A490.

Bolts other than high-strength structural bolts will conform to ASTM A307, Grade A.

A-3.5.4 Concrete Masonry

Concrete masonry materials will comply with the CBC.

A-3.5.5 Other Materials

Other materials for construction, such as anchor bolts, shear connectors, concrete expansion anchors, and embedded metal, will conform to industry standards and will be identified on engineering design drawings or specifications.

APPENDIX A-4

MECHANICAL ENGINEERING DESIGN CRITERIA

APPENDIX A-4
MECHANICAL ENGINEERING DESIGN CRITERIA

A-4.1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that generally will be used in the design and construction of mechanical engineering systems for the Puente Power Project (P3). More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement specification, and construction specifications.

A-4.2 CODES AND STANDARDS

The design of the mechanical systems and components will be in accordance with the laws and regulations of the federal government, State of California, Ventura County, and City of Oxnard municipal ordinances, and industry standards. The current issue or revision of the documents at the time the Application for Certification for the project is filed with the California Energy Commission will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirements shall apply.

The following codes and standards are applicable to the mechanical aspects of the power facility.

- California Building Standards Code, 2013
- American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI) B31.1 Power Piping Code
- ASME Performance Test Codes
- ASME Standard TDP-1
- ANSI B16.5, B16.34, and B133.8
- American Gear Manufacturers Association
- Air Moving and Conditioning Association
- American Society for Testing and Materials (ASTM)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers
- American Welding Society
- Cooling Tower Institute
- Heat Exchange Institute (HEI)
- Hydraulic Institute Standards
- Manufacturing Standardization Society of the Valve and Fitting Industry
- National Fire Protection Association (NFPA)
- Tubular Exchanger Manufacturers Association (TEMA)

A-4.3 MECHANICAL ENGINEERING GENERAL DESIGN CRITERIA

A-4.3.1 General

The systems, equipment, materials, and their installation will be designed in accordance with the P3 Design Basis; applicable codes; industry standards; and local, state, and federal regulations; as well as the design criteria; manufacturing processes and procedures; and material selection, testing, welding, and finishing procedures specified in this section. Note that the intent of this design criteria document is for new equipment specifically provided for P3 only. It is not anticipated that modifications to existing equipment will be required; therefore, this document will not be applicable to the existing equipment.

Detailed equipment design will be provided by the equipment vendors in accordance with the performance and general design requirements, to be specified later by the project Architecture and Engineering firm. Equipment vendors will be responsible for using construction materials suited for the intended use.

A-4.3.2 Materials—General

Asbestos will not be used in the materials and equipment supplied. Where feasible, materials will be selected to withstand the design operating conditions, including expected ambient conditions, for the design life of the plant. It is anticipated that some materials will require replacement during the life of the plant due to corrosion, erosion, and so forth.

A-4.3.2.1 Pumps

Pumps will be sized in accordance with the P3 Design Basis and industry standards. Where feasible, pumps will be sized for maximum efficiency at the normal operating point.

A-4.3.2.2 Tanks

Atmospheric outdoor storage tanks, if provided, will be uninsulated except where required to maintain appropriate process temperatures or for personnel protection.

Overflow connections and lines will be provided. Maintenance drain connections will be provided for complete tank drainage.

Manholes, where provided, will be at least 24 inches in diameter and hinged to facilitate removal. Storage tanks will have ladders and cleanout doors as required to facilitate access/maintenance. Provisions will be included for proper tank ventilation during internal maintenance.

A-4.3.2.3 Heat Exchangers

Heat exchangers will be provided as components of mechanical equipment packages and may be shell-and-tube or plate-and-frame type. Heat exchangers will be designed in accordance with TEMA, HEI, or manufacturer's standards. Fouling factors will be specified in accordance with TEMA.

A-4.3.2.4 Pressure Vessels

Pressure vessels will include the following features/appurtenances:

- Process, vent, and drain connections for startup, operation, and maintenance
- Materials compatible with the fluid being handled
- A minimum of one manhole and one air-ventilation opening (e.g., handhole) where required for maintenance or cleaning access
- For vessels requiring insulation, shop-installed insulation clips spaced not greater than 18 inches on center
- Relief valves in accordance with the applicable codes

A-4.3.2.5 Piping and Piping Supports

Underground piping may be high-density polyethylene (HDPE) or polyvinyl chloride (PVC) where permitted by code, operating conditions, and fluid properties. In general, water-system piping will be HDPE or PVC where embedded or underground, and carbon steel where aboveground. Appropriately lined and coated carbon-steel pipe or ductile-iron pipe may alternately be used for buried water piping. Stainless-steel pipe may also be used above ground for various services.

Threaded joints will not normally be used in piping for lubricating oil or combustion turbine generator natural-gas service. Natural-gas–piping components will not use synthetic lubricants. Victaulic, or equal, couplings may be used for low-energy aboveground piping, where feasible. Piping systems shall have high-point vents and low-point drains.

Hose and process-tubing connections to portable components and systems will be compatible with the respective equipment suppliers' standard connections for each service.

Stainless-steel piping will be used for portions of the lubricating-oil system downstream of the filters. Carbon-steel piping may be used elsewhere.

A-4.3.2.6 Valves

A-4.3.2.6.1 General Requirements

Valves will be arranged for convenient operation from floor level where possible; and if required, will have extension spindles, chain operators, or gearing. Hand-actuated valves will be operable by one person. Gear operators will be provided on manual valves 8 inches or larger.

Valves will be arranged to close when the handwheel is rotated in a clockwise direction when looking at the handwheel from the operating position. The direction of rotation to close the valve will be clearly marked on the face of each handwheel.

The stops that limit the travel of each valve in the open or closed position will be arranged on the exterior of the valve body. Valves will be fitted with an indicator to show whether they are open or closed; however, only critical valves will be remotely monitored for position.

Valve materials will be suitable for operation at the maximum working pressure and temperature of the piping to which they are connected. Steel valves will have cast or forged steel spindles. Seats and faces will be of low-friction, wear-resistant materials. Valves in throttling service will be selected with design characteristics and of materials that will resist erosion of the valve seats when the valves are operated partly closed.

Valves operating at less than atmospheric pressure will include means to prevent air in-leakage. No provision will be made to repack valve glands under pressure.

A-4.3.2.6.2 Drain and Vent Valves

Drains and vents in 600-pound class or higher piping and 900 degrees Fahrenheit or higher service will be double-valved.

A-4.3.2.6.3 Low Pressure Water Valves

Low-pressure water valves will be the butterfly-type of ductile-iron construction. Ductile-iron valves will have ductile-iron bodies, covers, gates (discs), and bridges; the spindles, seats, and faces will be bronze. Fire protection valves will be Underwriters Laboratories–approved butterfly valves meeting NFPA requirements.

A-4.3.2.6.4 Instrument Air Valves

Instrument air valves will be the ball type of bronze construction, with polytetrafluoroethylene (PTFE) or reinforced polytetrafluoroethylene(RPTFE) seat and seal materials.

A-4.3.2.6.5 Nonreturn/Check Valves

Nonreturn/Check valves shall be designed and manufactured in accordance with ANSI standards. Bodies will have removable access covers to enable the internal parts to be examined or renewed without removing the valve from the pipeline.

A-4.3.2.6.6 Motor-Actuated Valves

Electric motor actuators will be designed specifically for the differential and static pressures, process line flowrates, operating environment, and frequency of operations for the application. Electric actuators will have self-locking features. A handwheel and declutching mechanism will be provided to allow handwheel engagement at any time, except when the motor is energized. Actuators will automatically revert back to motor operation, disengaging the handwheel upon energizing the motor. The motor actuator will be placed in a position relative to the valve that prevents leakage of liquid, steam, or corrosive gas from valve joints onto the motor or control equipment.

A-4.3.2.6.7 Safety and Relief Valves

Safety valves and/or relief valves will be provided as required by code for pressure vessels, heaters, and boilers. Safety and relief valves will be installed vertically. Piping systems that can be over-pressurized by a higher-pressure source will also be protected by pressure-relief valves. Equipment or parts of equipment that can be over-pressurized by thermal expansion of the contained liquid will have thermal relief valves.

A-4.3.2.6.8 Instrument Root Valves

Instrument root valves will be specified for operation at the working pressure and temperature of the piping to which they are connected. Test points and sample lines in systems that are 600-pound class or higher service will be double-valved.

A-4.3.2.7 Heating, Ventilating, and Air Conditioning

Heating, Ventilating, and Air Conditioning (HVAC) system design will be based on site ambient conditions as described in Section 2.0, Project Description.

Except for the HVAC systems serving the control room, lab areas, and administration areas, the systems will not be designed to provide comfort levels for extended human occupancy.

Air conditioning will include both heating and cooling of the inlet-filtered air. Air velocities in ducts and from louvers and grills will be low enough not to cause unacceptable noise levels in areas where personnel are normally located.

Fans and motors will be mounted on anti-vibration bases to isolate the units from the building structure. Exposed fan outlets and inlets will be fitted with guards. Wire guards will be specified for belt-driven fans and arranged to enclose the pulleys and belts.

Air filters will be housed in a manner that facilitates removal. The filter frames will be specified to pass the air being handled through the filter without leakage.

Ductwork, filter frames, and fan casings will be constructed of mild steel sheets stiffened with mild steel flanges and galvanized. Ductwork will be the sectional bolted type, and will be adequately supported. Duct joints will be leaktight.

Grills and louvers will be of adjustable metal construction.

A-4.3.2.8 Thermal Insulation and Cladding

Parts of the facility requiring insulation to reduce heat loss or afford personnel safety will be thermally insulated. The minimum insulation thickness for hot surfaces near personnel will be designed to limit the outside lagging surface temperature to a maximum of 140°F.

The thermal insulation will have as its main constituent calcium silicate, foam glass, fiber glass, or mineral wool, and will consist of pre-formed slabs or blankets, where feasible. Asbestos materials will be prohibited. An aluminum jacket or suitable coating will be provided on the outside surface of the insulation. Insulation system materials, including jacketing, will have a flame spread rating of 25 or less when tested in accordance with ASTM E 84.

Insulation at valves, pipe joints, steam traps, or other points to which access may be required for maintenance will be specified to be removable with a minimum of disturbance to the pipe insulation. At each flanged joint, the molded material will terminate on the pipe at a distance from the flange equal to the overall length of the flange bolts to permit their removal without damaging the molded insulation.

Outdoor aboveground insulated piping will be clad with textured aluminum of not less than 16 millimeters in thickness. At the joints, the sheets will be sufficiently overlapped and caulked to prevent moisture from penetrating the insulation.

Design temperature limits for thermal insulation will be based on system operating temperature during normal operation.

Outdoor and underground insulation will be moisture-resistant.

A-4.3.2.9 Testing

All testing shall be in accordance with ASME B31.1 Power Piping Code.

A-4.3.2.10 Welding

Welders and welding procedures will be certified in accordance with the requirements of ASME B31.1 and other applicable codes and standards, as required, before performing any welding. Indexed records of welder qualifications and weld procedures will be maintained.

A-4.3.2.11 Painting

Except as otherwise specified, equipment will receive the respective manufacturer's standard shop finish. Finish colors will be selected from among the paint manufacturer's standard colors.

Finish painting of uninsulated piping will be limited to that required by OSHA for safety or for protection from the elements.

Piping to be insulated will not be finish painted.

A-4.3.2.12 Lubrication

The types of lubrication specified for facility equipment will be suited to the operating conditions and will comply with the recommendations of the equipment manufacturers.

The initial startup charge of flushing oil will be the equipment manufacturer's standard lubricant for the intended service. Subsequently, such flushing oil will be sampled and analyzed to determine whether it

can also be used for normal operation or must be replaced in accordance with the equipment supplier's recommendations.

Rotating equipment will be splash-lubricated, force-lubricated, or self-lubricated. Oil cups will be provided as necessary. Where automatic lubricators are fitted to equipment, provision for emergency hand-lubrication will also be specified. Where applicable, equipment will be designed to be manually lubricated while in operation without the removal of protective guards. Lubrication filling and drain points will be readily accessible.

APPENDIX A-5

ELECTRICAL ENGINEERING DESIGN CRITERIA

APPENDIX A-5
ELECTRICAL ENGINEERING DESIGN CRITERIA

A-5.1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that will generally be used in the design and construction of electrical engineering systems for the Puente Power Plant (P3). More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement, and construction specifications.

A-5.2 CODES AND STANDARDS

The design of the electrical systems and components will be in accordance with the laws and regulations of the federal government, State of California, Ventura County, and City of Oxnard ordinances, and industry standards. The current issue or revision of the documents at the time of the filing of this Application for Certification will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement shall apply.

The following codes and standards are applicable to the electrical aspects of the power facility:

- American National Standards Institute (ANSI)
- American Society for Testing and Materials
- Anti-Friction Bearing Manufacturers Association
- California Building Standards Code 2013
- California Electrical Code 2011
- Insulated Cable Engineers Association
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society
- National Association of Corrosion Engineers
- National Electrical Code
- National Electrical Manufacturers Association
- National Electrical Safety Code
- National Fire Protection Association
- Underwriters Laboratories, Inc.

A-5.3 SWITCHYARD AND TRANSFORMERS

A-5.3.1 Switchyard

P3 will interconnect with the existing Southern California Edison (SCE) switchyard that is adjacent to and servicing the existing Mandalay Generating Station (MGS). The combustion turbine generator (CTG) unit will connect to the SCE switchyard via a generator step-up transformer and overhead transmission lines.

SCE will provide equipment in the switchyard (circuit breakers, disconnect switches, etc.) and make the final connections to the switchyard bus. Overhead transmission lines in the MGS property shall be provided by NRG.

All faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet IEEE requirements and will be coordinated with SCE.

Each circuit breaker will be provided with independent breaker failure relay protection schemes.

Revenue metering will be provided on the 220-kilovolt (kV) transmission line(s) to record net power to or from the switchyard.

A-5.3.2 Transformers

The generator will be connected to the 220-kV switchyard through a main step-up transformer. The step-up transformer will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.91. The main transformer will be two-winding, delta-wye, ONAN/ONAF/ONAF. The neutral point of high-voltage (HV) winding will be solidly grounded. The main step-up transformer will have metal oxide surge arrestors connected to the HV terminals, and will have manual de-energized ("no-load") tap changers located in the HV windings.

The auxiliary power to the plant will be provided by one unit auxiliary transformer. The HV side of the unit auxiliary transformer will be connected to the output of the combustion turbine generator.

A-5.4 METERING

Dedicated instrument transformers having an accuracy of 0.3 percent or better will be supplied for metering. The metering instrument transformers will be in the 220-kV switchyard at the point of interconnection to the grid.

APPENDIX A-6

CHEMICAL ENGINEERING DESIGN CRITERIA

APPENDIX A-6
CHEMICAL ENGINEERING DESIGN CRITERIA

A-6.1 INTRODUCTION

Control of the design, engineering, procurement, and construction activities on the project will be completed in accordance with various predetermined standard practices and project-specific programs/ practices. An orderly sequence of events for the implementation of the project is planned, consisting of the following major activities:

- Conceptual design
- Licensing and permitting
- Detailed design
- Procurement
- Construction and construction management
- Startup, testing, and checkout
- Project completion

The purpose of this appendix is to summarize the general design criteria for the chemical components and systems of the project. More specific design information is developed during detailed design to support equipment and erection specifications. It is not the intent of this appendix to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used.

Subsection A-6.2 summarizes the applicable codes and standards; and Subsection A-5.3 includes the general criteria for design water quality, chemical conditioning, chemical storage, and wastewater treatment.

A-6.2 DESIGN CODES AND STANDARDS

The design and specification of all work will be in accordance with the laws and regulations of the federal government and the State of California, Ventura County, City of Oxnard, California ordinances, and industry standards. Industry codes and standards partially unique to chemical engineering design to be used in design and construction are summarized below:

- American National Standards Institute B31.1 Power Piping Code
- American Society of Mechanical Engineers Performance Test Code 31, Ion Exchange Equipment
- American Society for Testing and Materials
- California Building Standards Code
- Occupational Safety and Health Administration
- Steel Structures Painting Council Standards
- Underwriters Laboratories
- American Waterworks Association
- National Association of Corrosion Engineers

Other recognized standards will be used as required to serve as design, fabrication, and construction guidelines when not in conflict with the above-listed standards.

The codes and industry standards used for design, fabrication, and construction will be the codes and industry standards in effect, including all addenda, as stated in equipment and construction purchase or contract documents.

A-6.3 GENERAL CRITERIA

A-6.3.1 Design Water Quality

A-6.3.1.1 Process Makeup Water and Potable Water

Potable water will be supplied by the City of Oxnard, and will be used for process, drinking, domestic, and shower/eyewash needs.

Anticipated water chemistry for the water supply is presented in Chapter 2, Project Description, Table 2.7-4.

A-6.3.1.2 Demineralized Water System

Makeup to the combustion turbine evaporative cooler will be a blend of potable water and high-purity demineralized water. Demineralized water will also be used for combustion turbine water washes.

Minimum demineralized water quality will be as follows:

- Total organic carbon – 0.100 milligrams per liter (mg/L)
- Silica as SiO_2 – 0.010 mg/L
- Specific conductance – 0.1 microSiemen per centimeter (μS/cm)
- pH – 6.5 to 7.5

A-6.3.1.3 Construction Water

Water for use during construction will be supplied by the existing Mandalay Generating Station (MGS) water system.

A-6.3.1.4 Fire Protection Water

The source of water for fire protection will be the existing MGS fire-water system. The system will be expanded as required for the new generating unit.

A-6.3.2 Chemical Conditioning

A-6.3.2.1 Cycle Chemical Conditioning

There is no steam-generating unit associated with the simple-cycle plant.

A-6.3.2.2 Circulating Water System Chemical Conditioning

There is no condenser cooling-water requirement for the simple cycle plant.

A-6.3.2.3 Selective Catalytic Reduction (SCR)

Ammonia (19 percent by volume) will be supplied to the new SCR from the existing MGS Units 1 and 2 aqueous ammonia receiving and storage system and storage tank. A new forwarding pump and piping will be installed to convey the ammonia solution to the new SCR.

A-6.3.3 Chemical Storage

A-6.3.3.1 Storage Capacity

The existing MGS aqueous ammonia storage tank have a capacity of 15,000 gallons for the storage of aqueous ammonia for the SCR system.

A-6.3.3.2 Containment

Chemical storage tanks containing toxic fluids will be surrounded by curbing. Curbing and drain-piping design will allow a full-tank capacity spill without overflowing the curbing. For multiple tanks in the same curbed area, the largest single tank will be used to size the curbing and drain piping. For outdoor chemical containment areas, additional containment volume will be included for stormwater.

A-6.3.3.3 Closed Drains

Waste piping for volatile liquids and wastes with offensive odors will use closed drains to control noxious fumes and vapors.

A-6.3.3.4 Coatings

Tanks, piping, and curbing for chemical storage applications will be provided with a protective coating system. The specific requirements for selection of an appropriate coating will be identified prior to equipment and construction contract procurements.

A-6.3.4 Wastewater Treatment

Cleaning wastes from pre-operational and operational chemical cleaning of the gas turbine will be collected, treated, and disposed offsite by the chemical cleaning contractor.

Potentially oil-contaminated stormwater and process drains will be collected at a central location, and routed through an oil/water separator. Oily waste will be pumped out of the oil/water separator and trucked offsite. The water from the oil/water separator will be routed to the existing oily waste water system, and to the North and South Pond via the existing waste water sump.

Other plant low-volume process wastewater and stormwater from non-contaminated areas will be collected and conveyed to the existing oily waste water system, and to the North and South Pond via the existing waste water sump.

A system will be installed to provide the ability to reuse storm water collected from the new P3 project area to the MGS Service Water Tank. Excess stormwater will discharge to the existing Norh and South Ponds. Stormwater and wastewater will be discharged from the basins to the ocean through the existing outfall.

APPENDIX A-7

PRELIMINARY DRAINAGE CALCULATIONS

PRELIMINARY STORMWATER MANAGEMENT REPORT

FOR

PUENTE POWER PROJECT

LOCATED AT:

393 NORTH HARBOR BOULEVARD

CITY OF OXNARD, VENTURA COUNTY, CALIFORNIA

PROJECT NUMBER 31380

DOCUMENT NUMBER 12-05-500-001

PREPARED FOR

NRG

URS Corporation
510 Carnegie Center
Princeton, New Jersey 08540-6241

URS

CALCULATION COVER SHEET

Calculation No.			
Prel	Final	Void	Revision
X			C

CLIENT	NRG
PROJECT TITLE	PUENTE POWER PROJECT, CITY OF OXNARD, CALIFORNIA
SUBJECT/FEATURE	STORM WATER MANAGEMENT REPORT

Discipline: Civil

Project No.: 31380

No. of Sheets: -

CALCULATION OBJECTIVE: To calculate the peak pre and post development storm water flow rates for various storm frequencies and the amount of storm water that can be stored in the North and South Basins.

RESULTS/CONCLUSIONS: In summary, the basins can handle the storm water flow for 1 and 2 year storm in the proposed condition after the construction of P3 project based on the available information at present. Detail calculations shall be performed during the detail design for this project using the actual drainage areas, impervious areas and all other parameters used in this calculations to verify the results presented here for this conceptual design. .

ASSUMPTIONS/OPEN ITEMS:

*The computation is based on the available drawings provided by the client.

* Where detail topographic information was not available, approximate methods were used to estimate the drainage boundary.

* As the site is adjacent to the Pacific Ocean, quantity control in the basins will not be required.

* It is assumed that the proposed Puente Power Project (P3) site is flat and the grades will be around 14.0+/- based on the MLLW (1955) datum.

* The existing MGS Unit 1 & 2 area which currently drains to the North & South basins will continue to drain to these basins in the proposed condition.

* The drainage area used in this report shall be confirmed based on new topographical survey which will be performed during the detail design. All parameters used in the computations will be verified based on actual conditions during the detail design period.

*City of Oxnard and County of Ventura standards will be used as guidance; however, the project site does not discharge to City or County stormwater systems. Quantity control criteria will not be followed since project discharges to Pacific Ocean in accordance with MGS NPDES Permit Number CA0001180. Quality control criteria is set forth in the NPDES permit by LARWQCB

URS

CALCULATION COVER SHEET

Calculation No.

Prel	Final	Void	Revision
X			C

CLIENT NRG

Discipline: Civil

PROJECT TITLE PUENTE POWER PROJECT, CITY OF OXNARD, CALIFORNIA

Project No.: 31380

SUBJECT/FEATURE STORM WATER MANAGEMENT REPORT

No. of Sheets: -

FOR CALCULATIONS GENERATED BY COMPUTER PROGRAMS

Verified on Master Software List ☒

Computer Name **Program** __**Pond**__ Pack by Bentley **Rev.**__10_____

REV. NO.	REVISION REASON	PREP. BY	DATE	CHECK BY	DATE	APPROV. BY	DATE
A	Preliminary storm water management report issued for review	HNP	1/19/15				
B	Preliminary storm water management report incorporating comments	HNP	3/25/15				
C	Preliminary Stormwater management report incorporating client's comments	HNP	4/06/15				
	.						

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STORMWATER MANAGEMENT NARRATIVE

1.0 SCOPE OF WORK

This Storm Water Management Report has been prepared to evaluate the effects of developing the proposed Puente Power Project (P3) within the existing Mandalay Generating Station (MGS) site. Peak storm water flows for various storm frequencies were computed for the combined site of existing MGS and the new proposed addition of P3. In addition, the two existing retention basins were evaluated to assess whether they can handle the combined storm water flow from the existing MGS site and the new P3 site and how much storm water can be stored.

2.0 PROJECT DESCRIPTION

The proposed Puente Power Project (P3) will consist of a new natural-gas–fired generation facility and other ancillary systems. The proposed project consists of installing a new General Electric (GE) Frame 7HA.01 single fuel combustion turbine generator and associated auxiliaries on a vacant portion of the property owned by NRG at its existing Mandalay Generating Station (MGS) site. The two existing gas fired steam generating units at MGS would be retired shortly before the new peaking facility enters into service. The new P3 unit is to be constructed wholly within the existing MGS site. The P3 will redevelop approximately 3.26 +/- acres of the MGS site that are currently unused.

The MGS property is located at 393 North Harbor Boulevard in the City of Oxnard, Ventura County, California 93035. The MGS site on the USGS quadrangle Map of OXNARD, CA and OXNARD OE W, CA map.

The site is surrounded by the Pacific Ocean to the west, McGrath Lake State Park to the north, industrial uses to the south and agricultural and industrial uses to the east.

The existing MGS property, including the 3.26 +/- acre portion to be developed for the proposed project, is situated on relatively level ground at an elevation of approximately 14+/- (MLLW 1955 datum). The property is bordered by the sand dunes and an artificial berm that was constructed in the 1970s to protect the facility from flooding. The top of the dunes and berm are at an elevation of approximately 25 feet MSL or more.

The site is underlain by eolian and alluvial deposits consisting predominantly of sand and silty sand with some interbedded sandy silt and clay. (Ninyo & Moore, 2013)

Groundwater levels near the site are influenced by tidal fluctuation, precipitation, irrigation and groundwater pumping. During a recent geotechnical investigation, groundwater was detected at approximately 9 feet below ground surface (bgs) (Ninyo & Moore, 2013) and historically have been reported as high as 5 feet below grade surface.

At present, MGS includes Units 1 & 2, Unit 3, other auxiliary equipments, intake structure, Shop and Warehouse building, Administration building and other miscellaneous structures. MGS Units 1 & 2 will retire before the P3 becomes operational. MGS has an existing stormwater collection system that consists of storm drains and sump pumps. Stormwater is conveyed to the existing basins where it is

combined with process wastewater then discharged to the ocean via the existing oufall structure or discharged directly to the ocean.

Stormwater runoff from approximately 3.26 -acre P3 site currently does not drain into these basins. Since there is no stormwater collection system in this part of the MGS property, stormwater historically has ponded and infiltrated. With development of P3 a new stormwater drainage system will be installed and stormwater from the P3 site will be collected and conveyed either to service water tank or to existing storm drains by pumping. The North and South Basins will be used for storing water and also for discharging waste water from P3 and Unit 3.

3.0 DESIGN BASIS

The project proposes to meet the requirements of the Ventura County and City of Oxnard storm water management criteria, although the site does not discharge to the City or County stormwater systems. As the site is adjacent to the Pacific Ocean, the Quantity criteria will not be implemented. P3 will comply with the Quality criteria set forth in NPDES Permit Number CA0001180. Stormwater from the curbed areas which has the potential to come into contact with pollutants such as oils and greases will be directed to the new oil-water separator. The effluent from the oily water separator will be eventually discharged to North & South Basin. The detail routing of the effluent pipe shall be determined during detail design.

4.0 HYDROLOGIC AND HYDRAULIC METHODOLOGY

Stormwater runoff for the project has been calculated by utilizing the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) TR-55 Method, Urban Hydrology for Small Watersheds. The software program Pond Pack Version 10 by Bentley was used to compute the pre- and post-development peak rates of runoff. This program also calculates the peak discharge rates (Qout) and storage volume required for various storm year frequencies. This program is widely accepted throughout the United States. Other programs may be used if required or suggested by the permit reviewing authorities.

5.0 EXISTING HYDROLOGIC CONDITIONS

The proposed site where the new P3 will be constructed is open land at present. The area has mostly barren soil with limited vegetation. The site is mostly flat and most of the storm water percolates in the ground.

The MGS has an existing stormwater collection system that consists of stormwater collection pipes, sump pumps, an oil-water-separator, and the North and South Basins. Storm drains convey stormwater into a storm water sump. The storm water sump has three pumps which discharges into the retention basins. The storm water is normally pumped into the retention basins and only during periods of prolonged high rain runoff is the stormwater discharge routed directly to the ocean.

The following soil types for the drainage analysis were obtained from the USDA NRCS Web Soil Survey.

The following table lists the existing or pre-construction hydrologic parameters for the site:

TABLE 1 - HYDROLOGIC SOIL GROUP

SOIL TYPE NAME	HYDROLOGIC SOIL GROUP
CnB –Coastal Beaches	Not listed in the TR-55 Manual but assumed as Soil Group "B" in this calculation as the soil is sandy and silty sand per geotechnical report

The following table lists the existing or pre-construction hydrologic parameters:

TABLE 2 – PRE-CONSTRUCTION HYDROLOGIC PARAMETERS FOR THE DETENTION BASINS AREA

SUBWATERSHED	DRAINAGE AREA (AC)	WEIGHTED CURVE NUMBER (CN)	TIME OF CONCENTRATION (MIN)
DRAINAGE AREA TO THE DETENTION BASIN	**12 .068**	**95**	12

6.0 POST-CONSTRUCTION HYDROLOGIC CONDITIONS

In the Post Construction condition, the existing Mandalay Generating Station site will continue to be collected by the existing drainage system and conveyed to the North and South basins. The new P3 project area will drain to the North and South Basins through a new storm water network and newly proposed storm water pump station. The storm sewer from the lift station will be either directed to service water tank or to the existing storm sewer. Before directing the storm sewer to existing storm sewer network, the capacity of the existing storm sewer shall be checked. If the existing storm sewer/ pumping station cannot handle the flow from the new P3 area, new force main shall be proposed. Eventually, the flow from the P3 area will end up in North and South Basin. Detail routing to be worked out during the detail design. For the P3 drainage area boundary, refer to drawing 31380-P029-MAN-SKETCH 12. For conceptual grading and drainage plan, refer to drawing 31380-P029-MAN-SKETCH 11. Both the North and South Basins are currently lined with HDPE liners. Therefore, the storm water will not infiltrate into the ground.

The North Basin has top of basin elevation of 17.4 feet while the South Basin has the top of basin of 18.34 feet. The North Basin's maximum elevation of 17.4 feet will control the combined storage capacity.

The bottom of the basin for the South basin is at elevation 10 feet. The water quality design storm is assumed to be the 85th percentile, 24-hour storm event, which is approximately 1.3 inches for the P3 site (Larry Walker Associates and Geosytnec Consultants, 2011).

The storm water from the North & South Basin flows to the weir chamber which is located at the eastside of the South Basin. The South Basin drains to the weir Chamber by a 2" Schedule 80 Pipe. The North Basin also drains to the Weir chamber but the details of conveyance are not known. The weir chamber drains to the underground 108" diameter circulating water discharge pipe. As MGS Units 1 & 2 will not be operational when P3 is under operation, there will be ample capacity for the 108" diameter pipe to receive the flow from the North & South Basin.

It is assumed that there will be no quantity control requirement, since discharge will be substantially less than the current discharge limit of 255.3 million gallons per day for once-through cooling water and process wastewater. With the current scheme of draining the basin through the weir chamber, the basins can accommodate 1 & 2 year storm for the existing MGS and the P3 area.

The following table lists the post-construction hydrologic parameters for the detention basins:

TABLE 2 – POST-CONSTRUCTION HYDROLOGIC PARAMETERS FOR THE DETENTION BASINS AREA

SUBWATERSHED	DRAINAGE AREA (AC)	WEIGHTED CURVE NUMBER (CN)	TIME OF CONCENTRATION (MIN)
DRAINAGE AREA TO THE DETENTION BASIN	**15 .33**	**94**	**12**

7.0 STORMWATER MANAGEMENT FEATURES

The existing North & South Basins are designed to handle the stormwater runoff from approximately 15.33 acres in the proposed condition. The following table exhibits the proposed detention basins features:

TABLE 3- DETENTION BASIN CONTROL DEVICES

Name	DESCRIPTION
Principal Outlet Structure	Weir Chamber located on the East side of the South Basin. It receives flow from the South & North basin. The South basin has 2" dia. PVC pipe. The North basin outlet not known.
Lowest top of the basin	17.40 feet (north basin)
Outlet Culvert	2" PVC Pipe (South Basin). North basin through a pipe(size not known)
Maximum water level in the pond for 2 year storm	17.32 feet
Top of basin	At an elevation 17.40(in North basin)

8.0 WATER QUANTITY MANAGEMENT

The following tables present the summary of hydrologic results for the pre and post-construction conditions for the storm water drainage areas.

TABLE 4 – STORMWATER MANAGEMENT PEAK DISCHARGE FLOWS FOR THE DETENTION BASINS

DESCRIPTION	1-yr storm event	2-yr storm event	5yr storm event
Pre-Construction Conditions (12.06 ac)			
Pre-Construction Peak Inflow – CFS	12.60	17.32	23.00
Pre-Construction Peak Discharge – CFS	12.60	17.32	23.00
Post-Construction Conditions (15.33 ac)			
Post Construction Peak Inflow – CFS	15.11	21.13	28.38
Post Construction Peak Discharge – CFS	0.14	0.16	0.16
Maximum Water Elevation - ft	15.77	17.22	Over 17.40
Maximum Storage - acre- feet	1.706	2.433	2.536 (up to 17.40)

9.0 CONCLUSION:

In summary, the combined North and South Basin will handle the storm water flow up to 1 and 2 year storm based on the drainage area layout in the sketch 12 for this project and the impervious areas and parameters used in this calculation. This calculation shall be updated and revised during the detail design using the actual drainage areas, impervious areas and parameters.

Job File: R:\31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN PRE.PPW
Rain Dir: R:\31380\Engineering\Civil\calc\Puente Power Plant\

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PUENTE POWER PROJECT (PRE-CONSTRUCTION)

==========

Project Date: 4/6/2015
Design Engineer: Himansu N. Patel, P.E.
Project Title: Puente Power Project
Project Comments:
This computation is for the pre-development peak flow for the Mandalay Generating Station before the Construction of Puente Power project(P3 area is not included in this calculations.

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Type.... Master Network Summary Page 1.01
Name.... Watershed
File.... R:\31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN PRE.PPW

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Puente

Return Event	Total Depth in	Rainfall Type	RNF ID
Pre 1	2.0800	Synthetic Curve	TypeI 24hr
Pre 2	2.7000	Synthetic Curve	TypeI 24hr
Pre 5	3.4500	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Qpeak hrs	Qpeak cfs
*OUT 10	JCT	1	1.568	10.0000	12.60
*OUT 10	JCT	2	2.170	10.0000	17.32
*OUT 10	JCT	5	2.907	10.0000	23.00
PRE DEVELOPMENT	AREA	1	1.568	10.0000	**12.60**
PRE DEVELOPMENT	AREA	2	2.170	10.0000	**17.32**
PRE DEVELOPMENT	AREA	5	2.907	10.0000	**23.00**

Type.... Design Storms Page 2.01
Name.... Puente

File.... R:\31380\Engineering\Civil\calc\Puente Power Plant\

DESIGN STORMS SUMMARY

Design Storm File,ID = Puente

Storm Tag Name = Pre 1

Data Type, File, ID = Synthetic Storm TypeI 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.0800 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 2

Data Type, File, ID = Synthetic Storm TypeI 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 2.7000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 5

Data Type, File, ID = Synthetic Storm TypeI 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 3.4500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Type.... Tc Calcs Page 3.01
Name.... PRE DEVELOPMENT

File.... R:\31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN PRE.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2000 hrs

Total Tc: .2000 hrs

Tc Equations used...

==== User Defined ==

Tc = Value entered by user

Where: Tc = Time of concentration

Type.... Runoff CN-Area Page 4.01
Name.... PRE DEVELOPMENT

File.... R:\31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN PRE.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Impervious area	98	9.772			98.00
Gravel	85	.366			85.00
Grass/sand Poor condition grass cov	79	1.930			79.00
COMPOSITE AREA & WEIGHTED CN --->		12.068			94.57 (95)

::

Job File: R:\31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH
Job File: R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW
Rain Dir: R:31380\Engineering\Civil\calc\Puente Power Plant\

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PUENTE POWER PROJECT (POST DEVELOPMENT)

==========

Project Date: 4/06/2015
Design engineer: Himansu N. Patel, P.E.

Project Title: **Puente Power Project, City of Oxnard, California**

Project Comments:

This Calculation is made to determine the post development peak flows for various storm frequency years. The North & South basins receives flows from the existing Unit 1& 2 area, Unit 3 area and the new Puente Power Project(P3). This calculation is based on the conceptual grading and drainage plan prepared for this project. The impervious areas and the drainage areas are as shown on the drawing. This computation is based on the best estimation of various items required for the calculations. In the absence of the required information, various resources are used to compute and assumptions were made to compute this calculation.

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Type.... Master Network Summary Page 1.01
Name.... Watershed
File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Puente

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 1	2.0800	Synthetic Curve	TypeI 24hr
Dev 2	2.7000	Synthetic Curve	TypeI 24hr
Dev 5	3.4500	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10	JCT	1	1.875	21.1500	.14		
*OUT 10	JCT	2	2.629	24.1000	.16		
*OUT 10	JCT	5		13.5500	.16		
POST DEVELOPMENT AREA		1	1.880	10.0000	15.11		
POST DEVELOPMENT AREA		2	2.633	10.0000	21.13		
POST DEVELOPMENT AREA		5	3.561	10.0000	28.38		
PUENTE NS	IN POND	1	1.880	10.0000	15.11		
PUENTE NS	IN POND	2	2.633	10.0000	21.13		
PUENTE NS	IN POND	5	3.561	10.0000	28.38		
PUENTE NS	OUT POND	1	1.875	21.1500	.14	**15.77**	1.706
PUENTE NS	OUT POND	2	2.629	24.1000	.16	**17.22**	**2.433**
PUENTE NS	OUT POND	5		13.5500	.16	**17.40**	**2.536**

Type.... Design Storms Page 2.01
Name.... Puente

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\
Title... Project Date: 4/06/15

DESIGN STORMS SUMMARY

Design Storm File,ID = Puente

Storm Tag Name = Dev 1

Data Type, File, ID = Synthetic Storm Type I 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.0800 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2

Data Type, File, ID = Synthetic Storm Type I 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 2.7000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5

Data Type, File, ID = Synthetic Storm Type I 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 3.4500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Type.... Tc Calcs Page 3.01
Name.... POST DEVELOPMENT

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2000 hrs

==========
Total Tc: .2000 hrs

Type.... Runoff CN-Area Page 4.01
Name.... POST DEVELOPMENT

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Impervious area concrete, buildings	98	10.980			98.00
Gravel Paving	85	2.434			85.00
Grass/Sand , Poor condition garss c	79	1.914			79.00
COMPOSITE AREA & WEIGHTED CN --->		15.328			93.56 (94)

::

Type.... Vol: Elev-Area Page 5.01
Name.... PUENTE NS

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
10.00	-----	.1675	.0000	.000	.000
11.00	-----	.1815	.5234	.174	.174
11.30	-----	.1858	.5509	.055	.230
12.00	-----	.2500	.6513	.152	.382
13.00	-----	.3059	.8324	.277	.659
14.00	-----	.3558	.9916	.331	.990
15.00	-----	.4108	1.1489	.383	1.373
16.00	-----	.4707	1.3212	.440	1.813
17.00	-----	.5357	1.5085	.503	2.316
17.40	-----	.5652	1.6512	.220	2.536

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Type.... Outlet Input Data Page 6.01
Name.... Outlet structure

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 10.00 ft
Increment = .10 ft
Max. Elev.= 17.40 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Culvert-Circular	C0	--->	TW	10.000	17.400
Weir-Rectangular	W0	--->	TW	17.400	17.400

TW SETUP, DS Channel

Type.... Outlet Input Data Page 6.02
Name.... Outlet structure

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	.1700 ft
Upstream Invert	=	10.00 ft
Dnstream Invert	=	9.70 ft
Horiz. Length	=	30.00 ft
Barrel Length	=	30.00 ft
Barrel Slope	=	.01000 (ASSUMED) ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0120
Ke	=	.2000 (forward entrance loss)
Kb	=	.282958 (per ft of full flow)
Kr	=	.2000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0045
Inlet Control M	=	2.0000
Inlet Control c	=	.03170
Inlet Control Y	=	.6900
T1 ratio (HW/D)	=	1.104
T2 ratio (HW/D)	=	1.192
Slope Factor	=	-.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...
At T1 Elev = 10.19 ft ---> Flow = .03 cfs
At T2 Elev = 10.20 ft ---> Flow = .04 cfs

Type.... Outlet Input Data Page 6.03
Name.... Outlet structure

File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE NORTH SOUTH BASIN.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = W0
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 17.40 ft
Weir Length = 180.00 ft
Weir Coeff. = 3.200000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 40
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .00 cfs
Max. Q tolerance = .00 cfs

```
   Type.... Pond Routing Summary                                  Page 7.01
   Name.... PUENTE NS    OUT   Tag: Dev  1                     Event: 1 yr
   File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE  NORTH SOUTH
BASIN.PPW
   Storm... TypeI   24hr   Tag: Dev  1

                      LEVEL POOL ROUTING SUMMARY

    HYG Dir          = R:31380\Engineering\Civil\calc\Puente Power Plant\
    Inflow  HYG file = work_pad.hyg - PUENTE NS    IN  Dev  1
    Outflow HYG file = work_pad.hyg - PUENTE NS    OUT Dev  1

    Pond Node   Data = PUENTE NS
    Pond Volume Data = PUENTE NS
    Pond Outlet Data = Outlet structure

    No Infiltration

    INITIAL CONDITIONS
    ---------------------------------
    Starting WS Elev   =    10.00 ft
    Starting Volume    =     .000 ac-ft
    Starting Outflow   =      .00 cfs
    Starting Infiltr.  =      .00 cfs
    Starting Total Qout=      .00 cfs
    Time Increment     =    .0500 hrs


    INFLOW/OUTFLOW HYDROGRAPH SUMMARY
    ====================================================
    Peak Inflow       =     15.11 cfs    at   10.0000 hrs
    Peak Outflow      =       .14 cfs    at   21.1500 hrs
    ----------------------------------------------------
    Peak Elevation    =     15.77 ft
    Peak Storage =          1.706 ac-ft
    ====================================================


    MASS BALANCE (ac-ft)
    --------------------------
  + Initial Vol  =        .000
  + HYG Vol IN   =       1.880
  - Infiltration =        .000
  - HYG Vol OUT  =       1.875
  - Retained Vol =        .005
                  ----------
    Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

```
   Type.... Pond Routing Summary                                  Page 7.02
   Name.... PUENTE NS    OUT   Tag: Dev  2                    Event: 2 yr
   File.... R:31380\Engineering\Civil\calc\Puente Power Plant\PUENTE  NORTH SOUTH
BASIN.PPW
   Storm... TypeI   24hr   Tag: Dev  2

                      LEVEL POOL ROUTING SUMMARY

    HYG Dir          = R:31380\Engineering\Civil\calc\Puente Power Plant\
    Inflow  HYG file = work_pad.hyg - PUENTE NS    IN  Dev  2
    Outflow HYG file = work_pad.hyg - PUENTE NS    OUT Dev  2

    Pond Node   Data = PUENTE NS
    Pond Volume Data = PUENTE NS
    Pond Outlet Data = Outlet structure

    No Infiltration

    INITIAL CONDITIONS
    ---------------------------------
    Starting WS Elev   =    10.00 ft
    Starting Volume    =     .000 ac-ft
    Starting Outflow   =      .00 cfs
    Starting Infiltr.  =      .00 cfs
    Starting Total Qout=      .00 cfs
    Time Increment     =    .0500 hrs


    INFLOW/OUTFLOW HYDROGRAPH SUMMARY
    ================================================
    Peak Inflow       =     21.13 cfs    at   10.0000 hrs
    Peak Outflow      =       .16 cfs    at   24.1000 hrs
    ------------------------------------------------
    Peak Elevation    =     17.22 ft
    Peak Storage =          2.433 ac-ft
    ================================================


    MASS BALANCE (ac-ft)
    --------------------------
  + Initial Vol  =        .000
  + HYG Vol IN   =       2.633
  - Infiltration =        .000
  - HYG Vol OUT  =       2.629
  - Retained Vol =        .005
                  ----------
    Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

ATTACHMENT "A" LIST OF REFERENCES AND DRAWINGS

1. Mandalay Energy Center , Simple cycle project Grading & Drainage Plan, Drawing no. 31380-P029-MAN-Sketch 11

2. Mandalay Energy Center , Simple cycle project Drainage Area Plan, Drawing no. 31380-P029-MAN-Sketch 12

3. Storm Drainage Improvement Utilities Plan Unit 1 & 2 Area, Sheet C-1, Drawing No. 5244823-1

4. 5100887-8 Flood Protection Dike

5. North & Acid retention basins, plan & Section Sheet C-3

6. Utilities West of Main Structure Drawing 550016-14

7. Appendix "A" the civil Design Criteria describing the stormwater management Concept

8. Topographic survey prepared in April 2011 by Saddleback Surveys inc.
9. Larry Walker Associates and Geosyntec Consultans, 2011.Ventura County Technical Guidance Manual for Stormwater Quality Control Measures. July 13. http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/ventura_ms4/VenturaTGM/Ventura%20Stormwater%20TGM%20Final%207-13-11.pdf

SKETCH 11

TRUE N
PLANT GRID N
23°34'15"

PLANT NORTH

NATURAL

E 8+00
E 7+00
E 6+00
E 5+00
E 4+00
E 3+00
E 2+00
E 1+00
E 0+00

E 5 + 00

PATROL ROAD
EXISTING
FLOOD PROTECTION DIKE
PAVEMENT
SLOPE TO BEACH
10' WIDE A.C.

EXIST. GAS METER
LEACHING FIELD
EXIST. 20" GAS LINE
INV. EL.11'-0"
W.P. ℄ EL.10'-6"
SEPTIC TANKS
ROAD (AC)
NEW 10" H.P. GAS LINE (2-10-GH)
ASSUMED EXISTING DRAINAGE AREA LIMIT
SURFACE FLOW DIRECTION TYP.
TO EXISTING STORM DRAIN SYSTEM
TO SERVICE WATER TANK
AMMONIA AREA
PAD EL.14.0
PAD PERIMETER GRADE EL.13.50 TYP.
NEW ASPHALT ACCESS ROAD EL. 13.0'
STORM DRAIN
CB
MH
DRAINAGE AREA ADDITION 142000 SF
NEW PUMP STATION
MAINTAIN EXISTING DRAINAGE PATTERNS
W.P. S 7+22.00'
E 1+67.00'
℄ EL.14'-6"
ROAD E.1+50
E 1+09.00'
EXIST. DRAINAGE AREA 525700 SF
Pt. MANDALAY
SAND DUNES
END OF WALL S 7+67.00'
S 7+67 ±
24"ø RCP TO OUTFALL STRUCTURE
OUTFALL STRUCTURE
115' ±
S 0 + 00
S 5 + 00
S 10 + 00
S 15 + 00
S 4+00
S 5+00
S 6+00
S 7+00
S 8+00
S 9+00
S 10+00
S 11+00
S 12+00
S 13+00
S 14+00
S 15+00
S 16+00
S 15+56.29

SWITCHYARD
ASPHALT ACCESS ROAD
COVERED PARKING
SHOP & WHSE.
PARKING LOT
ADMIN. BLDG.
INTAKE CANAL
INTAKE STRUCTURE
UNITS 1 AND 2
UNIT 2
UNIT 1
AIR RECEIVERS
WATER TREATMENT
DIST. WATER TANKS
OILY WATER LINE
STORM SEWER
ACID CLEANING WASTE STORAGE BASIN
CIRCULATING WATER DRAIN PIPE
SOUTH BASIN
NORTH BASIN
FORCE MAIN
UNITS 1 AND 2 STACK
STACK & FOUNDATION
PUMP STATION
HOSE HOUSE
EXISTING OIL SEPARATOR
NEW 10" H.P. GAS LINE (2-10-GH)
SLOPE
BEACH ROAD

NOTE:

HORIZONTAL DATUM ON THIS SKETCH = PLANT DATUM

VERTICAL DATUM ON THIS SKETCH = NAVD88 (AS CONVERTED BELOW).

VERTICAL DATUM ELEVATIONS WERE CONVERTED FROM MLLW TO NAVD88 AS FOLLOWS:

EXISTING PLANT REFERENCE DRAWING NO. 550001-5 (SITE PREPARATION PLAN) WAS USED AS A BASIS FOR CONVERSION. THE REFERENCE DRAWING WAS ORIGINATED IN THE 1950S AND ELEVATIONS PROVIDED ARE IN MLLW DATUM (ASSUMED 1955). A CONVERSION TO MSL (ASSUMED NGVD1929) WAS PROVIDED ON THE DRAWING AS FOLLOWS: MLLW - 2.57' = MSL.

THE RESULTING MSL VALUE WAS THEN INPUT INTO THE US ARMY CORPS OF ENGINEERS CONVERSION SOFTWARE CORPSCON VERSION 6.0.1 AND CONVERTED TO NAVD88. THE DIFFERENCE RESULTED IN THE ADDITION OF 2.415' WHEN CONVERTING FROM NGVD29 TO NAVD88.

THEREFORE, (MLLW - 2.57' + 2.415) = NAVD88= MLLW-0.155

THIS CONVERSION METHOD MUST BE VERIFIED BY A LICENSED SURVEYOR IN THE STATE OF CALIFORNIA PRIOR TO DESIGN PHASE OF PROJECT.

20' 0 20' 40' 60'
SCALE: 1" = 40'

REFERENCE DRAWINGS (RASTER SCALED IMAGES USED FOR DRAWING BACKGROUND):

5244823-1 STORM DRAINAGE IMPROVEMENT UTILITIES PLAN UNIT 1 & 2 AREA (SHEET C-1)
5100887-8 FLOOD PROTECTION DIKE
MANDALAY UNDERGROUND - NATURAL GAS UNDERGROUND PIPELINE INSPECTION CHECKLIST

REVISION APPROVAL RECORD					
DISCIPLINE	BY	DATE	DISCIPLINE	BY	DATE
ARCH.			MECHANICAL		
BUILDING SERVICES			PIPING		
CIVIL			PROCESS		
ELECTRICAL			QA / QC		
ENVIRON.			STRUCTURAL		
GEN. ARRANG.					
I & C					

REV	BY	DATE	REVISIONS	BY	CHKR
A		01/19/15	PRELIMINARY-FOR REVIEW	GK	HP
B		03/06/15	PRELIMINARY - FOR REVIEW. ROTATED GAS TURBINE AND SCR 180 DEG	GK	HP
C		04/06/15	REVISED AS PER CLIENT'S COMMENTS		

DRAWING STATUS				
ISSUED	REV	DATE	SDE	PEM
PRELIMINARY	C	04/06/15		
APPROVED FOR CONSTRUCTION				

NOT APPROVED FOR CONSTRUCTION UNLESS SIGNED AND DATED. DESTROY ALL PRINTS BEARING EARLIER DATE AND/OR REV.NO.

PROJECT NO.: 31380
DRAWN: GK DATE: 01/19/15
CHECKED: HP DATE: 01/19/15
SCALE: 1" = 40'-0"

FIGURE 2.7-1

URS
URS ENERGY & CONSTRUCTION, Inc.
510 CARNEGIE CTR.
PRINCETON, NJ 08540
(609) 720-2000

PUENTE POWER PLANT
SIMPLE CYCLE PLANT
SITE GRADING AND DRAINAGE PLAN

DWG. NO. 31380-P029-MAN-SKETCH 11 REV C

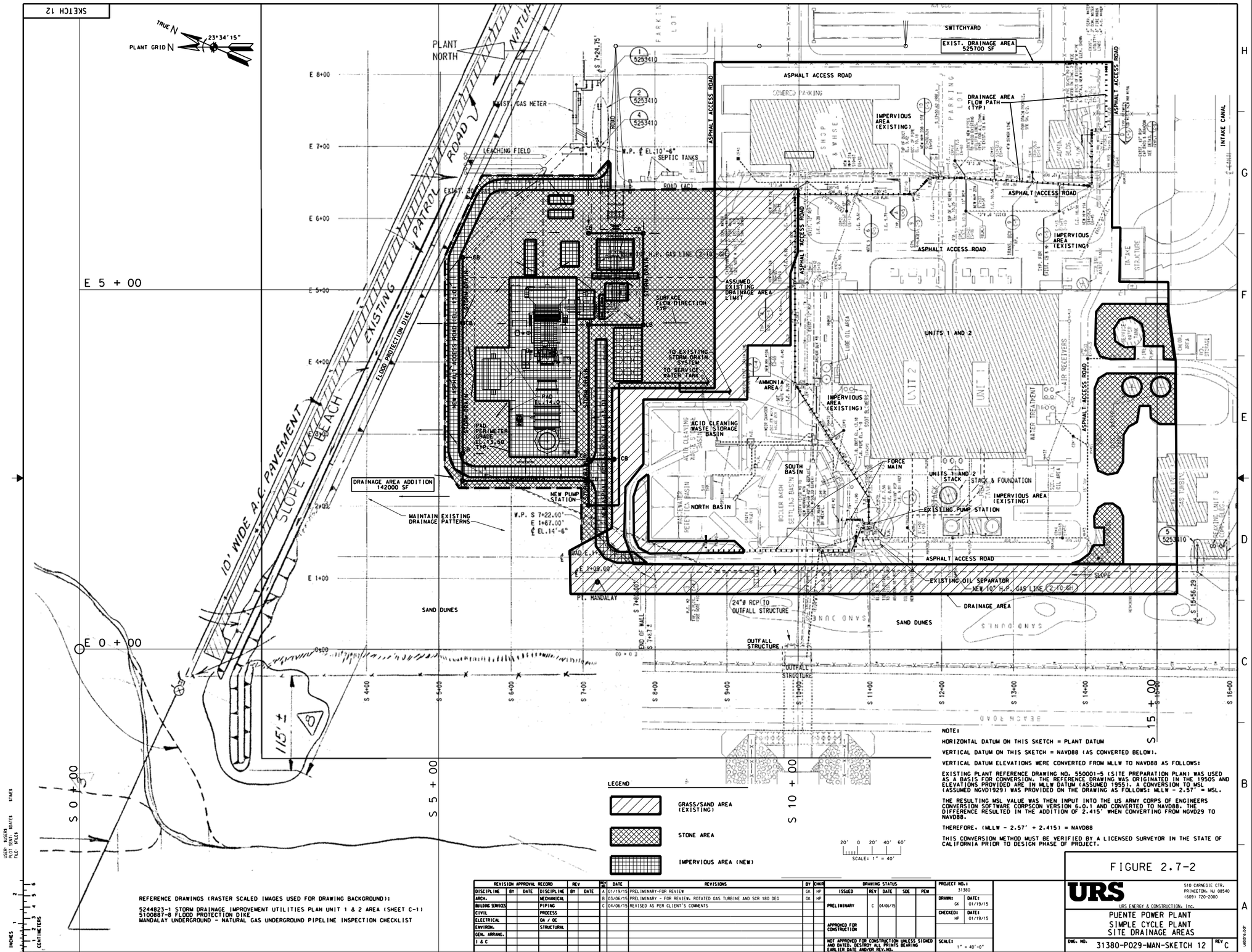
USER: WOSEN
PLOT SCALE: 1.0000 '/ INCH
PLOT DATE: 4/7/2015
FILE: XREFS

INCHES 1 2 3 4 5 6
CENTIMETERS 1 2 3 4 5 6

8 7 6 5 4 3 2 1
H G F E D C B A

CVL_Sketch 11_V8.dgn 4/7/2015 9:21:46 AM

SKETCH 12



NOTE:

HORIZONTAL DATUM ON THIS SKETCH = PLANT DATUM

VERTICAL DATUM ON THIS SKETCH = NAVD88 (AS CONVERTED BELOW).

VERTICAL DATUM ELEVATIONS WERE CONVERTED FROM MLLW TO NAVD88 AS FOLLOWS:

EXISTING PLANT REFERENCE DRAWING NO. 550001-5 (SITE PREPARATION PLAN) WAS USED AS A BASIS FOR CONVERSION. THE REFERENCE DRAWING WAS ORIGINATED IN THE 1950S AND ELEVATIONS PROVIDED ARE IN MLLW DATUM (ASSUMED 1955). A CONVERSION TO MSL (ASSUMED NGVD1929) WAS PROVIDED ON THE DRAWING AS FOLLOWS: MLLW - 2.57' = MSL.

THE RESULTING MSL VALUE WAS THEN INPUT INTO THE US ARMY CORPS OF ENGINEERS CONVERSION SOFTWARE CORPSCON VERSION 6.0.1 AND CONVERTED TO NAVD88. THE DIFFERENCE RESULTED IN THE ADDITION OF 2.415' WHEN CONVERTING FROM NGVD29 TO NAVD88.

THEREFORE, (MLLW - 2.57' + 2.415') = NAVD88

THIS CONVERSION METHOD MUST BE VERIFIED BY A LICENSED SURVEYOR IN THE STATE OF CALIFORNIA PRIOR TO DESIGN PHASE OF PROJECT.

LEGEND

- GRASS/SAND AREA (EXISTING)
- STONE AREA
- IMPERVIOUS AREA (NEW)

20' 0 20' 40' 60'
SCALE: 1" = 40'

REFERENCE DRAWINGS (RASTER SCALED IMAGES USED FOR DRAWING BACKGROUND):

5244823-1 STORM DRAINAGE IMPROVEMENT UTILITIES PLAN UNIT 1 & 2 AREA (SHEET C-1)
5100887-8 FLOOD PROTECTION DIKE
MANDALAY UNDERGROUND - NATURAL GAS UNDERGROUND PIPELINE INSPECTION CHECKLIST

REVISION APPROVAL RECORD					
DISCIPLINE	BY	DATE	DISCIPLINE	BY	DATE
ARCH.			MECHANICAL		
BUILDING SERVICES			PIPING		
CIVIL			PROCESS		
ELECTRICAL			QA / QC		
ENVIRON.			STRUCTURAL		
GEN. ARRANG.					
I & C					

REV	DATE	REVISIONS	BY	CHKR
A	01/19/15	PRELIMINARY-FOR REVIEW	GK	HP
B	03/06/15	PRELIMINARY - FOR REVIEW. ROTATED GAS TURBINE AND SCR 180 DEG	GK	HP
C	04/06/15	REVISED AS PER CLIENT'S COMMENTS		

DRAWING STATUS				
ISSUED	REV	DATE	SDE	PEM
PRELIMINARY	C	04/06/15		
APPROVED FOR CONSTRUCTION				
NOT APPROVED FOR CONSTRUCTION UNLESS SIGNED AND DATED. DESTROY ALL PRINTS BEARING EARLIER DATE AND/OR REV.NO.				

PROJECT NO.: 31380
DRAWN: GK DATE: 01/19/15
CHECKED: HP DATE: 01/19/15
SCALE: 1" = 40'-0"

FIGURE 2.7-2

URS
510 CARNEGIE CTR.
PRINCETON, NJ 08540
(609) 720-2000
URS ENERGY & CONSTRUCTION, Inc.

PUENTE POWER PLANT
SIMPLE CYCLE PLANT
SITE DRAINAGE AREAS

DWG. NO. 31380-P029-MAN-SKETCH 12 REV C

USER: ROGERS
PLOT SCALE: 1.000
PLOT STYLE TABLE: STAGES
PLOT SCALE: 1.000
INCHES 1 2
CENTIMETERS 1 2 3 4 5 6

CVL_Sketch 12_V8.dgn 4/7/2015 9:29:41 AM

APPENDIX A-8

DRAFT STORM WATER POLLUTION PREVENTION PLAN FOR CONSTRUCTION

PRELIMINARY DRAFT
STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PUENTE POWER PROJECT

Prepared for

NRG Energy Center Oxnard LLC
393 North Harbor Boulevard
Oxnard, CA 93035

URS Project No. 28068537

April 9, 2015

URS

Post Montgomery Tower
One Montgomery Street, Suite 900
San Francisco, California 94104

Storm Water Pollution Prevention Plan

For:
Puente Power Project

Prepared for (Owner):
NRG Energy Center Oxnard LLC
393 North Harbor Boulevard
Oxnard, CA 93035
xxx, LRP, (xxx) xxx-xxxx

Contractor: TBD
Name: TBD
Address: TBD
Phone: TBD

Project Site Location/Address:
393 North Harbor Boulevard
Oxnard, CA 93035

SWPPP Prepared by:
URS Corporation
Post Montgomery Tower
One Montgomery Street, Suite 900
San Francisco, CA 94104
Jil Finnegan, P.E., QSD
SWPPP Preparation Date: April 2015

SWPPP Amended by:
Name:
Address:
Phone:

SWPPP Amendment Date:

Estimated SWPPP Project Dates:
Start of Work: October 2, 2018
Completion of Project: Estimated June 1, 2020

WDID: _____

Qualified SWPPP Developer

Approval and Certification of the Storm Water Pollution Prevention Plan

Project Name: Puente Power Project

"This Storm Water Pollution Prevention Plan and Attachments were prepared under my direction to meet the requirements of the California Construction general Permit (SWRCB Order No. 2009-009-DWQ, as amended by Orders 2010-0014-DWQ and 2012-0006-DWQ). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

QSD Signature

Date

Jil Finnegan
QSD Name

21796
QSD Certificate Number

P.E., QSD, URS Corporation
Title and Affiliation

(415) 243-3742
Telephone Number

jil.finnegan@aecom.com
Email

Legally Responsible Person

Approval and Certification of the Storm Water Pollution Prevention Plan:

Project Name: Puente Power Project

"I certify under penalty of law that this document and all Attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

TBD

Legally Responsible Person, Company, and Title

Signature of Legally Responsible Person or Approved Signatory — Date

Signature of Legally Responsible Person or Approved Signatory — Telephone Number

Authorization of Approved Signatories

Name of Personnel	Project Role	Company	Signature	Date
TBD				

LRP's Signature — Date

Amendment Log

Project Name: Puente Power Project

Amendment No.[1]	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By	QSD Certificate Number

[1] LRP or Approved Signatory Certification of each amendment recorded in this table will be signed and kept in Appendix C, SWPPP Amendments.

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Tables

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Appendices

Acronyms

ATS	Active Treatment System
BAT	Best Available Technology
BCT	Best Conventional Pollution Control Technology
BMP	best management practice
CASQA	California Stormwater Quality Association
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	Chain-of-custody
COI	Change of Information
CSMP	Construction Site Monitoring Program
EPA	United States Environmental Protection Agency
in/hr	inches per hour
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LRP	Legally Responsible Person
MB	Method Blank
MGS	Mandalay Generating Station
mL	milliliter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	mean sea level
NAL	Numeric Action Level
NOAA	National Ocean and Atmospheric Administration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
PRDs	Permit Registration Documents
QA/QC	Quality Assurance/Quality Control
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
REAP	Rain Event Action Plan
RPD	Relative Percent Difference
RUSLE	Revised Universal Soil Loss Equation
RWQCB	Regional Water Quality Control Board
SMARTS	Stormwater Multi-Application and Report Tracking System
SWAMP	Surface Water Ambient Monitoring Program
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
VOA	volatile organic analysis
WDID	Waste Discharge Identification Number

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this Storm Water Pollution Prevention Plan (SWPPP) for construction activities at the NRG Energy Center Oxnard LLC (NRG) Puente Power Project (Project) is to outline the requirements of storm water management for compliance with the California General Permit for *Storm Water Discharges Associated with Construction and Land Disturbance Activities* (General Permit), State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, as amended by Orders No. 2010-0014-DWQ and 2012-0006-DWQ; General Permit No. CAS000002, as a **Risk Level 1** Project. This plan shows or explains how and where construction activities that could affect storm water quality will be conducted on the site.

The Project entails the construction of a new 262-megawatt generation facility on a vacant brownfields site within the existing boundaries of the Mandalay Generating Station (MGS) owned by NRG California South LLP. The Project will develop approximately 3 acres of the 36-acre MGS property. Construction laydown, parking and office areas are all on the MGS site property. During construction, the Project will use approximately 5.7 acres for construction laydown, offices, and parking. Approximately 0.9 acre of the 5.7 acres is currently paved. The Project site is located in the City of Oxnard, Ventura County, California (Appendix B, Figure 1).

1.2 DOCUMENT ORGANIZATION

The SWPPP provides a summary of the regulatory requirements in Section 1. Section 2 includes a description of the Project, site conditions, and potential pollutants. Section 3 of the document describes the Best Management Practices (BMPs) that have been preliminarily identified for use during construction of the Project. Section 4 summarizes Risk Level 1 inspection requirements, and Section 5 provides the detailed Construction Site Monitoring Program.

1.3 SWPPP OBJECTIVES

This SWPPP has been prepared to comply with California's General Permit. The SWPPP has been developed by and will be amended or revised by a Qualified SWPPP Developer (QSD).

The SWPPP is designed to address the following objectives identified in the General Permit (Section XIV.A):

1. All pollutants and their sources, including sources of sediment associated with construction, construction site erosion and all other activities associated with construction activity will be controlled.

2. Where not otherwise required to be covered under a Regional Water Quality Control Board (RWQCB) permit, non-storm water discharges[1] will be identified and either eliminated, controlled, or treated.

[1] Discharges are defined as storm water or non-storm water fluids that flow to waters of the United States via a pipe, channel, ditch, or through surface runoff.

3. Site BMPs are effective and will result in the reduction or elimination of pollutants in storm water discharges and authorized non-storm water discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard.

4. Calculations and design details, as well as BMP controls for site run-on, are complete and correct.

5. Stabilization BMPs installed to reduce or eliminate pollutants after construction will be completed.

Additional objectives of the SWPPP include the following:

1. Post-construction BMPs will be identified. These are those measures to be installed during construction that are intended to reduce or eliminate pollutants after construction is completed (post-construction BMPs are required for all sites by Section XIII.B).

2. Methods to implement BMP inspection, visual monitoring, and Construction Site Monitoring Program (CSMP) requirements will be identified.

1.4 PERMIT REGISTRATION DOCUMENTS

To obtain coverage under the Construction General Permit, project-related Permit Registration Documents (PRDs) must be submitted to the SWRCB via the Stormwater Multi-Application and Report Tracking System (SMARTS) by the Legally Responsible Person (LRP) (General Permit Sections I.D.36, II.B). The PRDs must be submitted, and fees paid, 14 days prior to the start of construction.

The following PRDs are required for this project, and copies of these PRDs are included in Appendix B:

1. Notice of Intent (NOI);
2. Risk Assessment (Construction Site Sediment and Receiving Water Risk Determination);
3. Site Map;
4. Post-construction Water Balance Calculator;
5. Annual Fee; and
6. Signed Certification Statement.

The SWPPP is also filed electronically and submitted to the SWRCB as a PRD.

Once it is obtained, the project Waste Discharge Identification Number (WDID) confirmation will also be included in Appendix B for reference.

1.5 SWPPP AVAILABILITY AND IMPLEMENTATION

The General Permit (Section XIV.C) requires the SWPPP be available at the construction site during working hours while construction is occurring, and shall be made available upon request

by a state or municipal inspector. When the SWPPP is kept in a vehicle that leaves the site, up-to-date copies of the pertinent Site Map shall be left with on-site crew members.

The General Permit (Section IV.G.1) also requires that a copy of the permit be kept at the construction site. Select portions of the General Permit are included in Appendix A.

Implementation of the SWPPP begins when the first construction activity begins, and remains in force until final Project stabilization is achieved, the Notice of Termination (NOT) has been filed, and the Regional Water Board office approves the conditions for termination of coverage.

1.6 SWPPP AMENDMENTS

SWPPPs are developed based on site-specific features and construction activities. This SWPPP shall be amended or revised by a QSD when any of the following occur:

- Whenever there is a change in construction or operations that may affect the discharge of pollutants to surface waters or groundwater;
- If any condition of the General Permit is violated. If the RWQCB determines that a General Permit violation has occurred, this SWPPP shall be amended and implemented within 14 calendar days after notification by the RWQCB;
- If the general objective of reducing or eliminating pollutants in storm water discharges has not been achieved;
- When there is a change in the responsible parties including the LRP, QSD, Approved Signatory or Qualified SWPPP Practitioner (QSP);
- When deemed necessary by NRG; or
- If the SWRCB amends the General Permit and the amendments affect the Project risk level.

This plan must be carefully reviewed by NRG's contractors prior to construction. The SWPPP may need to be amended to include all relevant contact information for the contractor's storm water compliance team, any necessary modifications to the erosion control plans (prior to or throughout construction), or any other changes deemed necessary by the contractor or NRG.

The General Permit requires that SWPPP be amended or revised by a QSD (Section XIV.A), and that the SWPPP include a listing of the date of initial preparation and the date of each amendment. Amendments must be signed by a QSD (Section VII.B.6). Amendments to the SWPPP will be dated, directly attached to the SWPPP in Appendix E or in redline strike-out in the areas amended, and logged in the Amendment Log found at the beginning of this SWPPP. Copies of LRP approvals of amendments are included in Appendix C.

1.7 RETENTION OF RECORDS

The General Permit (Sections I.J.69 and IV.G) requires that all dischargers maintain a paper or electronic copy of required records for 3 years from the date generated or date submitted, whichever is last.

Compliance records (e.g., the SWPPP and monitoring data) will be available at the construction site while construction activities are under way. Upon request, these documents will be made available, within a reasonable time, to the RWQCB, SWRCB, or U.S. Environmental Protection Agency (EPA), for the purpose of determining compliance with the General Permit.

After the construction period, SWPPP compliance documents will be kept in the NRG project offices for 3 years.

1.8 REQUIRED NON-COMPLIANCE REPORTING

The General Permit identifies several areas of non-compliance reporting. It is the responsibility of the permittee to properly document reportable discharges or other violations of the General Permit. Exceedances and violations will be reported using SMARTS, and include the following:

1. Numeric Action Level (NAL) exceedances (sampling data uploaded to SMARTS within 10 days and NAL Exceedance Report uploaded upon request of the RWQCB).

2. Discharges that contain a hazardous substance in excess of reportable quantities established in 40 Code of Federal Regulations (CFR) §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

In the event of an exceedance of an NAL or other noncompliance (i.e., non-storm water discharge), a subsequent site evaluation will be performed to identify the source of the noncompliance and documented in the SWPPP (Section V.C.4). This reporting will be accomplished using the forms included in Appendix D.

1.9 ANNUAL REPORT

The General Permit requires that all permittees whose projects have been active for more than three months prepare, certify, and electronically submit an Annual Report no later than September 1 of each year. Reporting requirements are identified in Section XVI of the General Permit, and include (but are not limited to) providing a summary of the following:

1. Sampling and analysis results, including coordinates of sampling locations (obtained from Google Maps or similar), laboratory reports, analytical methods and reporting limits, and chain-of-custody (COC) forms;

2. Corrective actions and compliance activities;

3. Violations of the General Permit;

4. Date, time, place, and name(s) of the inspector(s) for all sampling, inspections, and field measurement activities;

5. Visual observation and sample collection exception records; and

6. Training documentation of all personnel responsible for General Permit compliance activities.

SWPPP implementation records generated throughout the year will be maintained in a central file and will be included in the annual report.

1.10 CHANGES TO PERMIT COVERAGE

The General Permit (Section II.C) allows a permittee to reduce or increase the total acreage covered under the General Permit when a portion of the project is complete, and/or conditions for termination of coverage have been met; when ownership of a portion of the project is sold to a different entity; or when new acreage is added to the project.

To change the acreage covered, the permittee must electronically file modifications to PRDs (revised NOI, site map, SWPPP revisions as appropriate, and certification that new landowners have been notified of applicable requirements to obtain permit coverage (including name, address, phone number, and e-mail address of new landowner) in accordance with requirements of the General Permit within 30 days of a reduction or increase in total disturbed area.

All updates and amendments to the PRDs submitted via SMARTS will be included in Appendix E or in redline strikeout in the area amended.

1.11 NOTICE OF TERMINATION

To terminate coverage under the General Permit, a NOT must be submitted electronically via SMARTS. A "final site map" and photos are required to be submitted with the NOT. Filing a NOT certifies that all General Permit requirements have been met. The NOT is submitted when the construction project is complete, and within 90 days of meeting all General Permit requirements for termination and final stabilization (Section II.D).

The requirements for termination and final stabilization include the following:

- The site will not pose any additional sediment discharge risk than it did prior to construction activity.

- All construction-related equipment, materials, and temporary BMPs no longer needed are removed from the site.

The NOT must demonstrate through photos, Revised Universal Soil Loss Equation (RUSLE) results, or results of testing and analysis, that the Project meets all of the requirements of Section II.D.1 of the General Permit by one of the following methods:

- 70 percent final cover method (no computational proof required); or

- RUSLE/RUSLE2 method (computational proof required); or
- Custom method (discharger demonstrates that site complies with final stabilization).

The NOT will be submitted when the construction Project is complete and all requirements for termination and final stabilization have been achieved (anticipated to be June 2020).

2.1 SITE AND PROJECT DESCRIPTION

The Project will replace two aging gas-fired steam-generating units at the existing MGS with a new state-of-the-art General Electric Frame single-fuel combustion turbine generator and associated auxiliaries on previously disturbed vacant brownfield land within the existing boundaries of MGS in Oxnard, Ventura County, California in the Ventura Watershed. All construction laydown and parking areas will be within the existing MGS site.

The existing MGS facility is in an industrial area that includes oil drilling and processing operations, and power-generating and transmission facilities.

2.1.1 Site Description

The Project is located approximately 750 feet inland of the Pacific Ocean on nearly flat, sandy soil covered by scrub. The site is bordered by sand dunes and the Pacific Ocean to the west, McGrath Lake State Park and land owned by SunCal to the north, industrial uses to the north, south, and east, and agricultural uses farther to the east. The existing MGS property was graded during the development of the MGS in the 1950s, and is currently at approximately elevation 14 feet mean lower low water (MLLW). The top of the dunes to the west of the Project ranges from approximately elevation 20 to 30 feet MLLW. An artificial berm was constructed along the northern and eastern edges of the property in the early 1970s to protect the facility from flooding. The top of the engineered berm is at an elevation of approximately 20 feet MLLW.

Groundwater levels near the site are influenced by tidal fluctuation, precipitation, irrigation, and groundwater pumping. During a recent geotechnical investigation, groundwater was detected at approximately 9 feet below ground surface (Ninyo & Moore, 2013), and historically has been reported as high as 5 feet below ground surface.

2.1.2 Geology

The site soil is mapped by the Natural Resources Conservation Service (NRCS, accessed March 2015) as Coastal Beaches. It is underlain by eolian and alluvial deposits consisting predominantly of sand and silty sand with some interbedded sandy silt and clay (Ninyo & Moore, 2013). This soil is profiled as typically having 0 to 2 percent slopes with fine sand from 0 to 6 inches and coarse sand from 6 to 60 inches. The soil material consists of young eolian (wind-blown) deposits derived from beach sand. This soil type is poorly drained, frequently flooded, and very slight to moderately saline. Coastal beach soil is not considered prime farmland.

2.1.3 Surface Hydrogeology

MGS currently manages storm water discharges in compliance with the Discharge Prohibitions, Effluent Limitations, and Receiving Water limitation specified in the Los Angeles Regional Water Quality Control Board Order No. 94-131, NPDES No. CA0001180, and the MGS Storm Water Pollution Prevention Plan (SWPPP) (NRG, 2014).

MGS currently does not separate process wastewater from storm water runoff. The storm water and process wastewater from MGS is currently collected in two retention basins. The storm water drains discharge to a storm water sump equipped with three pumps that discharge into the two existing retention basins. The retention basins discharge to the ocean in accordance with the discharge requirements of the MGS' existing NPDES permit. During periods of prolonged high-precipitation events, storm water runoff may be routed directly to the ocean. Due to beach dunes west of the site, there is no direct storm water runoff from the MGS property to the ocean. All discharge to the ocean is controlled by the existing MGS outfall structure.

The project site is in the area regulated by the Los Angeles Regional Water Quality Control Board (LARWQCB). As defined by the LARWQCB, the MGS property and project site are in the coastal watershed of Ventura County.

As defined in the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994) (Basin Plan), beneficial uses of Ventura County coastal waters are industrial supply, navigation, water-contact recreation, non-contact water recreation, commercial and sport fishing, marine habitat, wildlife habitat, rare, threatened, or endangered species, and shellfish harvesting.

The City of Oxnard is in the Oxnard Plain, which has a mild, Mediterranean-style climate, with cool, wet winters, and mild, dry summers. Temperatures rarely fall below freezing in winter. Average rainfall is approximately 15 inches per year. Winter storms associated with the warm Mediterranean climate move inland from the Pacific Ocean and drop precipitation over the region, with greater amounts generally falling in the first quarter of the year (January through March) than the last quarter (October through December) (FCGMA, 2013).

2.1.4 Environmentally Sensitive Areas

Field studies conducted in and around the Project site did not identify any special-status plant species within the Project limits.

2.1.5 Project Description

The Project construction is to begin on October 2, 2018 with grading activities anticipated to be completed in two months. Following grading, construction of the generating facility will begin and is expected to be completed by June 1, 2020 for commercial operations.

The generating facility will be constructed on a 3.26 acre portion of the MGS site. A craft trailer and fabrication shop will be located on 0.5 acres and an overflow materials storage and laydown area will occupy an additional one acre. Estimated acreage of currently unpaved areas within the MGS property that will be used to support construction activities is approximately 4.8 acres. Trenching will be required to install new utilities; other than the trenching that will be done within the 3.26 acre site, most of the utility trenching will be along paved portions of the MGS property. The estimated footprint for the utility trenching is approximately 0.45 acre. In addition, approximately 0.9 acres of existing paved area within the MGS property will be used for construction parking.

Construction activities will include: site preparation, grading, excavations for foundations, pile driving, erection of the new plant.

After construction is complete, approximately one acre will be covered by impervious surfaces (e.g., the new facility and pavement)

2.2 FINDINGS OF THE CONSTRUCTION SITE SEDIMENT AND RECEIVING RISK DETERMINATION

Construction site risk determinations are the key part of establishing the minimum permit requirements for a construction project. A project's risk level governs the applicable minimum BMPs, monitoring requirements, reporting requirements, and the effluent standards used to assess monitoring data and the project compliance.

There are two major steps to determining risk for traditional construction projects:

- Sediment Risk – the relative amount of sediment that can be discharged, given the project and location details; and

- Receiving Water Risk – the risk sediment discharges pose to the receiving waters.

The results of the sediment and receiving water risk assessment (provided in Appendix B) has designated this project as **Risk Level 1**. Individual risk factors were determined using the EPA Rainfall Erosivity Factor Calculator (R Factor) and the SWRCB Sediment Risk Factor Worksheet within SMARTS for K and LS Factors The risk level may need to be reevaluated if there are changes in the Project start or end dates or in the overall Project area.

2.3 STORM WATER RUN-ON FROM OFFSITE AREAS

The General Permit (Section XIV.A.4) requires that the SWPPP address calculations, design details, and BMPs to control and minimize site run-on to disturbed areas. Due to perimeter berms and sand dunes, the MGS site does not experience run-on.

2.4 CONSTRUCTION SCHEDULE

The overall Project construction schedule is from October 2, 2018 through June 1, 2020, with final stabilization projected to be achieved by June 1, 2020.

A schedule for the Project and associated SWPPP BMPs is provided in Appendix F.

2.5 POTENTIAL CONSTRUCTION SITE POLLUTANT SOURCES

The General Permit requires that permittees conduct an assessment and create a list of potential pollutant sources, and identify areas of the site where BMPs are necessary to reduce or prevent pollutants in discharges (General Permit Attachment C – Section B.5).

The following is a list of construction materials that may be used and activities performed that will have the potential to contribute pollutants, other than sediment, to storm water runoff:

- Vehicle fluids, including oil, grease, petroleum, and coolants;
- Asphaltic emulsions associated with asphalt-concrete paving operations;
- Cement and curing agents;
- Base material;
- BMP materials;
- Paint for pavement markings;
- Solvents, thinners, and acids;
- Construction waste/debris;
- Septic Waste;
- General Litter; and
- Vehicle fueling and maintenance.

The following is a list of construction activities that have the potential to contribute sediment to storm water discharges:

- Clearing and grubbing operations;
- Trenching for utility installations;
- Grading operations;
- Asphalt and concrete demolition;
- Soil import or export operations;
- Driving on unpaved roads;
- Pile driving;
- Concrete pouring and curing;
- Concrete washout; and
- Dust Control.

2.6 IDENTIFICATION OF NON-STORM WATER DISCHARGES

The General Permit requires (Section XIV.A.2 “SWPPP Requirements”) that dischargers identify all non-storm water discharges (where not otherwise required to be under a Regional Water Quality permit), and that discharges be eliminated, controlled, or treated.

Select non-storm water discharges are authorized by the General Permit provided they meet the following conditions:

- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge does not violate any provision of the General Permit.
- The discharge is not prohibited by the applicable Basin Plan.

- The SWPPP specifies and the Project implements BMPs required by the General Permit to prevent or reduce the contact of non-storm water discharge with construction materials or equipment.

- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.

- The discharge is monitored and meets the applicable Numeric Action Levels (NALs).

- The sampling information is reported in the Annual Report.

Authorized non-storm water discharges that may occur during the course of construction include:

- Water used for dust control.

All discharges of non-storm water from the site will be monitored for compliance with applicable NALs. Any non-storm water discharges exceeding NALs and/or not meeting the requirements noted above will be reported to the RWQCB.

The BMPs described in this document are designed to meet the BAT/BCT standards to reduce or eliminate storm water pollution, as required by the General Permit. BMPs are to be implemented to the appropriate level and in a proactive manner during all seasons until final site stabilization has been achieved and the Notice of Termination filed.

BMPs are described in Section 3.2 of this SWPPP. California Storm Water Quality Association BMP fact sheets (CASQA 2009) are provided in Appendix G. BMPs preliminarily identified to be implemented during construction are illustrated on Figure 2.

The contractor will review the BMP implementation details included in this SWPPP prior to and throughout construction of this project.

3.1 BMP IMPLEMENTATION AND SEQUENCING

BMPs must be implemented, modified, and maintained to reflect the phase of construction and the weather conditions. In order to be effective, some BMPs must be installed before the site is disturbed (e.g., to provide protection during subsequent operations).

All BMPs shall be in place year-round on an as-needed basis. Disturbed areas of the construction site will be stabilized with erosion control measures within 14 days after the last day of disturbance (i.e., inactive for 14 days or more). Tracking controls and perimeter sediment controls, including controls along the physical site perimeter, and the BMPs preliminarily identified below will be implemented and maintained throughout the duration of construction activities.

BMPs will generally be implemented with the following sequencing:

Before Construction

- Delineate site perimeter to prevent disturbing areas outside the Project limits.

Construction Entrances

- Stabilize site entrances, exits, and access roads prior to initiation of construction activities or construction vehicle traffic entering or exiting the project site, or overflow site.

Perimeter Control

- Install silt fencing on the northern and western limits of the Project area.
- Install perimeter controls at storage and laydown area prior to storing materials onsite.
- During construction, install additional run-off control measures as needed to minimize movement of sediment and other constituents.

Work Areas

- Maintain work sites in a neat and clean condition.
- Store construction and waste materials in designated areas that are protected from rainfall and contact with storm water run-off. Dispose of construction waste in designated areas, and keep storm water from flowing onto or off of storage areas.
- Perform activities in a manner to keep potential pollutants from coming into contact with storm water to eliminate or avoid exposure. When exposure cannot be avoided, prevent contaminated storm water from being transported off site.
- Remove and properly dispose of litter and debris at least weekly.

Equipment Fueling and Maintenance

- Designate a vehicle and equipment fueling and maintenance area within the paved portions of the site more than 100 feet from Edison Canal.
- Obtain clean-up materials. Mobile spill kits are to be provided on all fueling trucks. Use drip pads or absorbent pads when refueling equipment on the construction site. No unattended fueling will be allowed. Store fuels offsite.
- Prevent spills and clean up spilled materials. Clean up spills using dry cleanup methods. Soil that becomes contaminated during refueling will be excavated, removed immediately, and replaced with uncontaminated soil.

Clearing and Grubbing

- Phase clearing and grading to limit exposed area to that which can be protected. Only clear land that will be actively under construction in the near term.
- Begin clearing and grubbing after installing applicable run-off control measures. Install additional control measures, as needed, as work progresses.
- Install stabilized construction entrances and exits at storage and laydown area.
- Implement erosion control BMPs to provide temporary stabilization of disturbed soils for inactive portions of the site. An inactive area is an area of the Project that has been disturbed, and is not scheduled to be re-disturbed for at least 14 days.

3.2 CONSTRUCTION SITE BMPS

Construction site BMPs, or temporary BMPs, are applied during construction activities to reduce the pollutants in storm water discharges throughout construction. There are six categories of BMPs suitable for temporary erosion and sediment control on construction sites. They are:

- Soil Stabilization (Erosion Control) Practices;
- Sediment Control Practices;
- Tracking Control Practices;
- Wind Erosion Control;
- Non-storm water Management; and
- Waste Management Practices.

It is generally accepted that practices that perform well by themselves can be complemented by other practices to raise the collective level of erosion control effectiveness and sediment retention. Effective erosion and sediment control planning relies on a system of BMPs. The Project will include an effective combination of erosion and sediment control measures.

Temporary erosion and sediment control materials, equivalent to 10 percent of the installed quantities, will be maintained onsite during active construction, to allow for rapid response to failures.

All BMPs shall be in place throughout the construction period on an as-needed basis. Erosion and sediment control measures are required year-round.

The following BMPs are anticipated for construction activities. Additional BMPs may also be implemented as determined appropriate by the QSD, QSP or delegate and added to this SWPPP as an amendment.

3.2.1 Erosion Control

Erosion control BMPs are a source control practice that protects the soil surface and prevents soil particles from being detached by rainfall, flowing water, or wind. For erosion controls to be effective, it is important that provisions for both temporary and permanent controls (final stabilization) be implemented.

The following BMPs have been preliminarily identified for use for erosion control as part of the Project construction work:

- EC-1, Scheduling;
- EC-5, Soil Binders; and

Selected erosion control BMP details are provided in Appendix G, and are described below.

Scheduling (EC-1)

Planning is used to reduce the amount and duration of soil and potential pollutants exposed to wind, rain, run-off, and vehicle tracking. Planning is also important when working in the vicinity of a drainage system.

To the extent feasible, construction activities will be scheduled taking local climate (rainfall, wind, etc.) into consideration.

Soil Binders (EC-5)

Soil binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are material applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils.

Soil binders may be used on graded areas that will be inactive for a short period of time, on soil stockpiles, temporary haul roads, and storage and laydown areas as needed.

3.2.2 Sediment Control

Sediment control BMPs are treatment control practices that trap soil particles after they have been detached and moved by rain, flowing water, or wind. Sediment controls are intended to complement and enhance the erosion control measures, and reduce sediment discharges from construction sites.

All sediment control devices require continued maintenance to function properly. Excess sediment not removed reduces capacity and efficiency. All of the necessary equipment and materials used to repair sediment control devices must be readily available for emergencies or situations requiring a quick response.

During construction, storm water run-off shall be directed away from disturbed areas. Properly installed diversions (BMPs SE-6 and/or SE-8), or silt fences (with the toe embedded into the soil) (BMP SE-1) will be used to limit the discharge of sediment and pollutants from the site. Perimeter sediment controls, including controls along the physical site perimeter (BMPs SE-1 and SE-5) shall be implemented and maintained. Slope protection (BMP SE-5) fiber rolls will be installed to minimize sediment run-off from disturbed slopes or areas. There are no active storm drain inlets in or near the Project limits.

The following sediment control BMPs have been preliminarily identified for use as part of the Project construction work:

- Silt Fences (SE-1);
- Fiber Rolls (SE-5);
- Gravel Bag Berm (SE-6);
- Street Sweeping and Vacuuming (SE-7); and
- Sandbag Barrier (SE-8).

Selected sediment control BMP details are provided in Appendix G, and are described below.

Silt Fences (SE-1)

A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet-flow run-off. Silt fences allow sediment to settle from run-off before water leaves the construction site. Silt fences are generally ineffective in locations where the flow is concentrated, and are only applicable for sheet- or overland flows.

Fiber Rolls (SE-5)

Fiber rolls (also called fiber logs or straw wattles) are tube-shaped erosion-control devices filled with straw, flax, rice, coconut-fiber material, or composted material. Each roll is wrapped with UV-degradable polypropylene netting for longevity, or with 100 percent biodegradable materials like burlap, jute, or coir. Fiber rolls help to slow, filter, and spread overland flows, which helps to prevent erosion and minimizes rill and gully development. Fiber rolls also help reduce sediment loads to receiving waters by filtering run-off and capturing sediments.

The Project will use only 100 percent biodegradable, certified weed-free fiber rolls free of plastic monofilament netting on disturbed areas, in accordance with the following:

Table 1
Fiber Roll Installation Requirements

Slope Percentage	Sheet-Flow Length Not to Exceed
0 – 25%	20 feet
25 – 50%	15 feet
>50%	10 feet

Additional fiber rolls will be used around the perimeters of storage and laydown areas.

Gravel Bag Berm (SE-6)

A gravel bag berm or gravel bag barrier consists of a single row of stacked gravel-filled bags that are installed end-to-end to form a barrier across a slope. It is designed to intercept and slow the flow of sediment-laden sheet flow run-off. Sandbag and gravel bag barriers allow sediment to settle from run-off before water leaves a disturbed soil area. Gravel bags can be used where flows are moderately concentrated—such as ditches, swales, and storm drain inlets—to divert and/or detain flows.

Street Sweeping and Vacuuming (SE-7)

Street sweeping and vacuuming are practices that remove tracked soil particles from paved roads to prevent the sediment from entering a storm drain or watercourse. Street sweeping and vacuuming are implemented when sediment is tracked from the project site onto public or private paved roads, typically at points of egress.

Street sweeping of paved roads and surfaces within the work limits (and beyond the work limits as impacts require) will occur as needed during construction work days. Wet vacuuming will be required if sweeping is ineffective.

Sandbag Barrier (SE-8)

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbags have limited porosity, and sandbag barriers pond sheet flow run-off, allowing sediment to settle out.

3.2.3 Tracking Control

The construction site will be managed to minimize the amount of dirt, mud, or dust that is generated, and can thus be tracked or blown off the site. Entrances/exits from the construction limits to the paved roads will be inspected daily and swept as necessary to minimize tracking.

Stabilized Construction Entrance/Exit (TC-1)

A stabilized construction entrance is a designated point of access (ingress and egress) to a construction site that is stabilized to reduce tracking of sediment (mud and dirt) onto public roads by construction vehicles. Stabilized construction entrances limit the migration of sediment from the construction site.

All heavy vehicles and trucks will enter and exit the site and staging areas via a stabilized construction entrance.

Entrance/Outlet Tire Wash (TC-3)

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under-carriages, and to prevent sediment from being transported onto public roadways. Wash water will be collected and infiltrated onsite.

If tracking is a continued problem, then the entrance will be equipped with a wheel wash facility to remove excess soil and debris from truck tires before leaving the site.

3.2.4 Wind Erosion Control

Construction sites can generate large areas of soil disturbance and open space for wind to pick up dust particles. Dust control measures reduce dust generated from disturbed soil surfaces.

Wind Erosion Control (WE-1)

Heavily traveled earthen access areas will be sprinkled twice daily, or more often, by a water truck for dust suppression. Care will be taken to sprinkle additional areas of exposed soil as necessary during windy periods. Only the minimum amount of water will be used; no run-off will result from this practice. Oil or other petroleum-based products will not be used for dust control because the oil may migrate into drainage ways or seep into the soil.

Stockpiles may be covered with plastic, mats, blankets, mulches, or sprayed with water. It may also be prudent to surround the base of a soil stockpile with a row of fiber rolls or other sediment barrier. Another means to reduce the potential for wind erosion of stockpiles is to keep the

height of stockpiles low, and to adjust the shape and orientation of the stockpiles to reduce the area of exposure to the prevailing wind.

3.2.5 Non-Storm Water Management

Anticipated non-storm water surface discharges will not enter any receiving water or storm drain without proper filtration or equivalent treatment, and must be discharged in accordance with the provisions of the General Permit.

Water Conservation Practices (NS-1)

Water conservation practices are activities that use water in a manner that avoids causing erosion, and the transport of pollutants offsite. These practices can also reduce non-storm water discharges. Excess water used in the construction site will be directed to areas where it can soak into the ground or be collected and reused. Repair leaking water trucks.

Vehicle and Equipment Cleaning (NS-8)

Vehicle and equipment cleaning within the Project work limits shall only be allowed on a designated, paved area located at least 100 feet from Edison Canal.

Vehicle and Equipment Fueling (NS-9)

This BMP consists of measures and practices to minimize or eliminate the discharge of fuel spills and leaks into the storm drain system or to watercourses.

Use offsite fueling stations as much as possible. Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment off site for fueling.

Conduct all fueling activities within an asphalt-paved designated area with secondary containment, located at least 100 feet from Edison Canal. Maintain drip pans and absorbent spill clean-up materials on mobile fueling vehicles. Fueling must be performed on level-grade areas. Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended. Do not “top off” fuel tanks.

Vehicle and Equipment Maintenance (NS-10)

Vehicles and heavy machinery are a potential source of pollutants such as petroleum products, antifreeze, and exhaust and waste oil containing heavy metals. Pollutants may enter storm water run-off by means of direct contact with machine parts, and by contact with spills on surfaces and the ground.

Construction equipment will require both gasoline and diesel fuel. Welding machines will use diesel or unleaded fuel. Maintenance and fuel storage will be conducted within designated maintenance areas to enable careful management. During long periods (more than 1 month) of storage and during maintenance, drip pans will be placed under vehicles and equipment that are prone to leakage. During the rainy season, plastic tarps will be placed over exposed equipment when not in use for long periods (more than 21 days) to prevent contact with storm water.

All onsite vehicles will be monitored for leaks and will receive preventive maintenance to reduce leakage. Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately, or problem vehicles or equipment should be removed from the Project site.

Pile Driving Operations (NS-11)

Driven piles are typically constructed of precast concrete, steel or timber. The proper control and use of equipment, materials, and waste products associated with pile driving operations can reduce or eliminate the discharge or potential pollutants.

Pile driving equipment will use drip pans or absorbent pads during operations, maintenance, cleaning, fueling, and storage. When not in use, pile driving equipment will be stored away from storm water flow paths and drainage courses. Hammers and other hydraulic attachments will be protected from run-on and runoff by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain.

Concrete Curing (NS-12)

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of storm water and non-storm water exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines.

The Project will avoid the overspraying of curing compound and will minimize drift by applying the curing compounds close to the concrete surfaces. Additionally, cure water will be directed to collection areas for evaporation or other means of appropriate removal.

3.2.6 Waste Management Practices

Construction site wastes must be properly managed and disposed of to reduce the risk of pollution from materials such as hazardous wastes. Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for storm water run-off to mobilize construction site wastes, and contaminate surface- or groundwater.

Temporary waste storage areas will be designated on the site. Non-hazardous construction wastes (e.g., vegetation, trash, and construction debris) will be collected from throughout the site once a day and deposited in central piles at the designated waste storage areas. Waste disposal containers will be covered at the end of every business day and during rain. All waste materials will be removed from the storage areas by the Contractor or a licensed subcontractor weekly and transported to an offsite landfill or to the appropriate recycling facility. The disposal of excess material off site will comply with all federal, state, and local regulations. Hazardous wastes will be temporarily stored in a separate, dedicated storage area and managed in accordance with BMP WM-6 and all applicable federal, state, and local regulations.

Material Delivery and Storage (WM-1)

Material delivery and storage procedures and practices are designed for the proper handling and storage of materials. These procedures and practices minimize or eliminate the discharge of these materials to storm water drainage systems or watercourses.

Many materials used in construction can contribute pollutants to storm water run-off. Examples of such materials include vehicle fuels, oils, and antifreeze. Construction materials that have the potential to contribute pollutants should be stored in a manner to prevent or minimize contact with storm water. All construction materials will be delivered to and stored in designated areas at the construction site. The main loading, unloading, and access areas should be located away from storm drain inlets and channels. The Contractor will construct enclosures or flow barriers (berms) around these areas to prevent storm water flows from entering storm drains or receiving waters, and to control the discharge of sediments and other pollutants.

Material Use (WM-2)

Material use procedures and practices are employed to prevent the discharge of construction materials to storm water drainage systems or watercourses.

Project material use will be conducted in accordance with BMP WM-2 provided in Appendix G.

Stockpile Management (WM-3)

Stockpile management procedures and practices are designed to reduce or eliminate pollution of storm water from stockpiles of topsoil and concrete materials. These procedures include locating stockpiles away from drainages, providing cover, perimeter sediment barriers, and wind erosion control measures.

Project stockpiles will be located at least 50 feet from Edison Canal and storm water drainage courses and will have perimeter protection. All stockpiles will be covered if they are inactive for 14 or more days.

Spill Prevention and Control (WM-4)

Spill prevention and control procedures and practices are implemented to prevent and control spills in a manner that minimizes or prevents discharge to storm water drainage systems or watercourses at construction sites. Spill prevention and prompt appropriate spill response reduce the potential for polluting receiving waters with spilled contaminants. Spills of concern include chemicals and hazardous wastes such as fuels, lubricants, and solvents.

Refer to Section 3.3 for additional information regarding spill prevention and control.

Solid Waste Management (WM-5)

Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to drainage systems or watercourses associated with the stockpiling or

removal of construction activity wastes by providing designated waste collection areas and containers, arranging for regular disposal, and personnel training.

Solid wastes and debris will be managed in accordance with BMP WM-5.

Hazardous Waste Management (WM-6)

Hazardous waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants at construction sites and facilities to storm water drainage systems or watercourses through proper material use, waste disposal, and personnel training.

Hazardous wastes will be sent to a permitted treatment or disposal facility.

Concrete Waste Management (WM-8)

Concrete waste management procedures and practices are designed to minimize or eliminate the discharge of materials associated with concrete work that have the potential to raise discharge water pH levels outside of the permitted range.

Dry and wet concrete materials will be stored under cover at least 100 feet from Edison Canal. The washout of concrete trucks shall occur only in designated areas where washout will not reach storm water. If necessary, a temporary lined pit or bermed area will be used to capture and contain washout.

Septic/Sanitary Waste Management (WM-9)

Sanitary/septic waste management procedures and practices are designed to minimize or eliminate the discharge of sanitary/septic waste materials to watercourse by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

The Project will use portable toilets during construction; these must be located at least 100 feet from Edison Canal and shall be serviced weekly. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning. Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants.

3.3 SPILL PREVENTION AND CONTROL

Spills and leaks are some of the largest sources of storm water pollutants and are, in most cases, avoidable. Avoiding spills and leaks is preferable to cleaning them up after they occur. Heavy equipment and vehicles should be inspected daily (or as often as possible) for leaks, and should be repaired as necessary (BMP NS-10).

The contractor shall assign and train spill response personnel.

Despite precautions, spills may still occur at the site. Spills shall never be cleaned up by hosing off the area. If spills occur, they should be controlled as follows:

Minor Spills

Minor spills typically involve small quantities of oil, gasoline, etc., that can be controlled by the first responder at the discovery of the spill. To control minor spills:

1. Contain the spill;

2. Recover spilled materials (if possible);

3. Clean the contaminated area and dispose of contaminated materials; and

4. Temporarily store hazardous wastes in a separate, dedicated storage area, and manage in accordance with BMP WM-6 and all applicable federal, state, and local regulations.

Medium-Sized Spills

Medium-sized spills still can be controlled by the first responder, along with the aid of other personnel such as laborers and foremen. This response may require the cessation of other activities. Spills should be cleaned up immediately, as follows:

1. Notify the Project foreman immediately.

2. Contain the spread of the spill (using sand bags or other barriers).

3. If the spill has occurred on a paved or impermeable surface, clean it up using dry methods (absorbent materials, cat litter, and/or rags). Contain the spill by encircling it with absorbent materials.

4. If the spill has occurred on an unpaved or permeable surface, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.

5. If the spill has occurred during a rain event, cover the area if possible.

Significant/Hazardous Spills

For large spills or spills involving hazardous materials that cannot be controlled by Project personnel, the following steps should be taken:

1. The Foreman should notify the Project Superintendent immediately and follow up with a written incident report.

2. The Project Superintendent will notify local emergency response personnel by dialing 911. Additionally, the Project Superintendent will notify the appropriate County officials. It is the Project Superintendent's responsibility to have all of the emergency telephone numbers at the construction site.

3. For spills of Federal Reportable Quantity (as established under 40 CFR Parts 110, 117, or 302), the Project Superintendent will notify the National Response Center by telephone at (800) 424-8802, and the California Office of Emergency Services. Within 14 days, the Project Superintendent will submit a written description of the release to EPA Region IX, including the date, circumstances of the incident, and steps taken to prevent another release.

4. Retain the services of a Spill Cleanup Contractor or HazMat Team immediately. Construction personnel should not attempt to clean up the spill until the appropriate and qualified staff have arrived at the site.

5. Other agencies that may need to be contacted include the Fire Department, Highway Patrol, Department of Toxic Substances Control, etc.

3.4 BMP INSTALLATION GUIDELINES

All Project BMPs shall be installed in accordance with the manufacturer's recommendations and in general conformance with the BMP Fact Sheets provided in Appendix G.

3.5 POST-CONSTRUCTION BMPS

The Project proposes to install pavement and crushed rock as a final stabilization measure. Due to the increase in impervious area due to the Project (estimated to be approximately one acre)the Preliminary drainage calculations indicate that the existing basins have adequate capacity to handle post-construction storm water runoff.

The control measures identified in this SWPPP are designed to minimize the transport of pollutants to receiving waters. The performance of the measures is dependent on how the measures are operated and maintained. To provide for the continued performance of the measures, they must be inspected and maintained before, during, and after storm events.

This section describes procedures for BMP inspection and maintenance, implementation of the rain event action plans, training, and responsible parties.

4.1 BMP INSPECTION AND MAINTENANCE

For Risk Level 1projects, the General Permit (Attachment C, Section G.5) requires regular BMP inspections and maintenance and that completed inspection checklists be maintained with the on-site SWPPP.

The General Permit requires that BMPs be maintained regularly during the course of normal construction activities and that the following minimum inspections and maintenance are performed of all BMPs for Risk Level 1 projects:

- Daily monitoring of tracking control BMPs;
- Routine weekly inspections;
- Within 2 business days (48 hours) before each qualifying rain event;
- Daily inspections during extended rain events; and
- Within 2 business days (48 hours) after each qualifying rain event.

BMP inspections associated with rain events are discussed further in Section 5.

The General Permit (Attachments C; Section G.3) requires dischargers to begin implementing maintenance and corrective actions within 72 hours (3 days) of any deficiencies identified during inspections. SWPPP amendments should be prepared by the QSD if warranted by the problem encountered and corrective action required.

Only qualified personnel shall conduct inspections of the construction site. This may include a QSD, QSP, or someone trained and delegated by the QSP. Inspections are intended to ensure the proper installation of BMPs, and identify the effectiveness of the BMPs in minimizing the effects of storm water run-off. Inspections are also intended to indicate repairs, maintenance requirements, or design changes that need to be implemented as soon as field conditions allow. All of the necessary equipment, personnel, and materials to repair the BMPs must be readily available for emergencies or situations requiring a quick response.

If it is not possible to safely access an area during inclement weather, the inspector shall list the result of visual inspections at the relevant discharge point or downgradient location, and describe projected required maintenance activities.

Inspection reports will be prepared weekly; and before, during (every 24 hours), and after all storm events. They will include the date of the inspection and information on weather, site information, observations, descriptions of the inspected BMPs and any damages or deficiencies noted, and the corrective actions that were taken, such as BMPs that were fixed or additional

BMPs that were implemented, and the inspectors name, title, and signature. Inspection reports will be kept for 3 years after completion of the final date of stabilization.

Inspection forms to be used are provided in Appendix H. Completed inspection forms will be included in Appendix H.

4.2 RAIN EVENT ACTION PLANS

Rain Event Action Plans are not required for Risk Level 1 projects.

4.3 TRAINING

The General Permit (Section VII) requires that all elements of the SWPPP be developed by a QSD and implemented by a QSP. The QSP may delegate tasks to trained employees, provided adequate supervision and oversight is provided.

All personnel at the site will receive training appropriate for their individual roles and responsibilities on the Project on SWPPP implementation, BMP inspection and maintenance, and record keeping. When properly trained, site personnel are more capable of managing materials properly, preventing spills, and implementing control practices efficiently and correctly.

The following measures will be followed to ensure the SWPPP is effectively implemented, BMP inspections are performed, BMP maintenance and repair are performed, and appropriate records are prepared and retained:

- Before beginning construction activities—and periodically during construction—appropriate contractor personnel will receive training to implement the SWPPP effectively, perform BMP inspections, perform BMP maintenance and repair, and keep records. Non-storm water discharges and general contractor activity BMPs will also be covered during training. Training will focus generally on the components and goals of the SWPPP; and specifically on the implementation, inspection, and maintenance of the storm water pollution control BMPs.

- Individuals responsible for overseeing, revising, and amending the SWPPP will also document the training.

- All appropriate new employees and contractors will be trained by staff familiar with the SWPPP requirements before they work at the site. Contractors will be responsible for informing their subcontractors about SWPPP requirements.

- BMP drawings, fact sheets, or other specifications will be copied and distributed to contractors and site personnel engaged in the activity in question, and/or installation/ maintenance of BMPs.

- Site inspectors observing improper construction measures, or pollution caused by absent or ineffective BMPs or by inappropriate actions of site personnel, will inform responsible

personnel of proper BMP implementation, along with conducting any needed follow-up inspections.

All training activities (formal and informal) will be documented, and training documents will be retained as a record of training activities in SWPPP Appendix J. Training documentation will also be submitted in the Annual Report.

4.4 RESPONSIBLE PARTIES AND OPERATORS

4.4.1 Responsible Parties

Responsible parties for the implementation of this SWPPP are provided in Table 2. Approved signatories who are responsible for SWPPP implementation and have the authority to sign permit-related documents are identified at the start of this SWPPP.

Table 2
Responsible Parties Contact Information

Name	Company/Title	Responsibility	Phone Number
TBD	NRG / Project Manager	Legally Responsible Party	TBD
TBD	TBD	QSD	TBD
TBD	TBD	QSP	TBD

Duties of the QSP include but are not limited to the following:

- Ensuring all BMPs are implemented, inspected, and properly maintained;
- Performing non-storm water and storm water visual observations and inspections;
- Performing non-storm water storm water sampling and analysis when required;
- Performing routine inspections and observations;
- Delegating these inspections and activities to an appropriately trained employee, but ensuring adequacy and adequate deployment;
- Coordinating with the Contractor to ensure that all the necessary corrections and repairs are made immediately, and that the project complies with the SWPPP, the General Permit, and approved plans at all times; and
- Notifying the Superintendent immediately of offsite discharges or other non-compliance events.

4.4.2 Contractor List

The General Permit (Section VII.B.5) requires that the SWPPP include a list of names of all contractors, subcontractors, and individuals who will be directed by the QSP.

An updated list of all contractors, subcontractors, and individuals responsible for implementation of the SWPPP shall be available on site with the on-site copies of the SWPPP. Included on the list are the telephone numbers (including emergency contact numbers), work addresses, and specific areas of responsibility.

Table 3
Contractors and Subcontractors

Contractor/ Subcontractor Name and Address	Contact Person/Phone Number	Activity/Responsibility	Start Date	End Date
TBD	TBD	TBD	TBD	TBD

5.1 PURPOSE

This Section provides the CSMP for the Project. The CSMP plan describes the monitoring requirements for visual observations and sample collection and analysis. The CSMP plan also includes details about sample collection frequency; sample constituents; sample collection methodologies; and field quality assurance/quality control (QA/QC).

The General Permit requires that a written, site-specific CSMP be developed by each discharger prior to the commencement of construction activities, and be revised as necessary to reflect project revisions. This CSMP was developed to meet the specific requirements and objectives identified in the General Permit for a Risk Level 1 project.

Each construction site must have a QSP to oversee the implementation of the CSMP, including the BMP inspections, rain-event-triggered inspections, and the collection of water quality samples. The QSP may delegate any or all of these activities to an employee trained to do the tasks, but the QSP must supervise the delegated tasks.

5.2 OBJECTIVES OF THE CSMP

The objectives of the CSMP are:

- To demonstrate that the site is in compliance with the applicable discharge prohibitions;
- To determine whether non-visible pollutants are present at the construction site, and are causing or contributing to exceedances of water quality objectives;
- To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in storm water discharges and authorized non-storm water discharges; and
- To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in storm water discharges and authorized non-storm water discharges.

5.3 SUMMARY OF MONITORING REQUIREMENTS FOR RISK LEVEL 1

Monitoring required at construction sites includes visual monitoring (inspections) and sampling and analysis. Risk Level 1 sites are required to conduct routine visual inspections of BMPs; visual monitoring of the site related to qualifying storm events; visual monitoring of the site for non-storm water discharges; and sampling and analysis of any non-storm water discharges.

Table 4 summarizes the monitoring and sample collection requirements for the Project. The requirements are then discussed in detail in the following sections.

Table 4
Summary of Risk Level 1 Monitoring Requirements

Type of Monitoring		When/What
Visual Monitoring and Inspections	Routine BMP inspections	Weekly for all BMPs and daily for trackout controls year-round
	Pre-rain inspection of likely precipitation event (50% or greater chance of rain)	Within 2 business days prior to each likely precipitation event. Inspect entire site and all BMPs.
	During-rain inspection of a qualifying rain event	Every 24 hours during extended storm events during normal business hours and when safe to do so. Inspect entire site and all BMPs.
	Post-rain inspection of a qualifying rain event	Within 2 business days after each qualifying rain event. Inspect entire site and all BMPs.
	Non-storm water discharge inspection	Quarterly. Inspect entire site and all BMPs.
Discharge Water Quality Sampling and Analysis	Non-visible pollutants (i.e., due to a spill/BMP failure)	Within the first 2 hours of discharge from site: collect one or more samples of run-off affected by the spilled or released materials (contaminated discharge) and one or more samples of run-off that is unaffected by the spilled or released materials (uncontaminated discharge).
	Non-storm water discharges	Sample whenever a non-storm water discharge occurs at each discharge location. If the non-storm water discharge may contain non-visible pollutants, follow requirements above.
	Site run-on	Sample when run-on occurs at each location if there is reason to believe it may contribute to an exceedance of effluent limits. Note: Project does not anticipate any run-on due to perimeter dikes and dunes.
	Other	RWQCB or Total Maximum Daily Loads may require other monitoring.

Notes:
Sample locations and the number of samples shall be representative of discharges from the site overall as determined by the QSP or their delegated representative.
BMPs = Best Management Practices
NALs = Numeric Action Level
RWQCB = Regional Water Quality Control Board

5.4 WEATHER AND RAIN EVENT TRACKING

Visual monitoring and inspection are required for all qualifying storm events. Per Table 4, the pre-rain inspection is triggered when there is a likely precipitation event (50 percent or greater chance of rain). A minimum of 48 hours of dry weather is used to distinguish between separate storm events.

The QSP or designee will daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the weather forecasts. These forecasts can be obtained by entering the project zip code at http://www.srh.noaa.gov/. Weather reports will be printed and maintained with the SWPPP in Appendix K.

The Superintendent or delegated contractor employee shall collect and log daily rain gauge readings from a rain gauge to be installed onsite prior to the initiation of construction activities. Daily readings will be recorded on the Rain Gauge Log in Appendix K.

The QSP or designee will notify the Superintendent when there is a 50 percent chance of rain and the Superintendent will notify the QSP when a rain event has resulted in 1/2 inch of rain.

5.5 MONITORING LOCATIONS

Visual observations will be made throughout the site, with particular attention to locations where there is potential for run-on from offsite areas, locations where there is disturbed soil, storage areas, and potential offsite discharge locations.

Risk Level 1 sites are not required to collect storm water discharge samples. The General Permit (Attachment C, Section 7) does, however, require the collection of non-storm water and non-visible pollutant discharges. The locations for the collection of these types of samples is dependent on the discharge location.

The General Permit does not require collection of samples or conducting visual observations during dangerous weather conditions (flooding, electrical storms, etc.) or outside of scheduled construction site business hours. If personnel at the site are unable to collect required samples or visual observations because of dangerous weather conditions, an explanation will be provided in the Annual Report.

5.6 VISUAL MONITORING AND INSPECTIONS

All construction sites are required to conduct visual monitoring (inspections). Visual monitoring includes inspections of BMPs; inspections before, during and after qualifying rain events; and inspection for non-storm water discharges. Visual inspections are required for the duration of the Project, with the goal of confirming that appropriately selected BMPs have been implemented, are being maintained, and are effective in preventing potential pollutants from coming in contact with storm water.

5.6.1 Routine BMP Inspections

The General Permit requires that routine BMPs be inspected weekly, with the exception that trackout controls be inspected daily. If deficiencies are identified during BMP inspections, repairs or design changes to BMPs will be initiated within 72 hours of identification, and will be completed as soon as possible.

All BMP inspections will be documented on an inspection checklist. The inspection checklist form includes the following information:

- Inspection date and date the inspection report was written;
- Weather information, including presence or absence of precipitation, estimate of the beginning of qualifying storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall in inches;
- Site information, including stage of construction, activities completed, and approximate area of the site exposed;
- A description of the BMPs evaluated and any deficiencies noted;
- A description of noticeable odors or visible sheen on the surface of discharges, if any;
- Any corrective actions required, including any necessary changes to the SWPPP and the projected implementation dates;
- Photographs taken during the inspection, if any; and
- Inspector's name, title, and signature.

If the construction site is safely accessible during inclement weather, observations of all BMPs will be listed; otherwise, the results of visual inspections at all relevant outfalls, discharge points, and downstream locations will be listed in the field log.

The checklist for the visual inspection field log is included in Appendix H and a copy of completed checklists will be kept in this appendix.

5.6.2 Qualifying Rain Event Inspections

The General Permit defines a qualifying rain event as one that produces 1/2 inch or more of precipitation at the time of discharge. There must be a 48-hour or greater period between rain events.

The General Permit requires that the construction site be inspected within 2 days prior to a predicted qualifying rain event, daily during rain events, and within 2 days after a qualifying rain event. These inspections are only required during normal business hours of the construction site.

Records will be kept of all qualifying rain event inspections. Records will be maintained on site, and will document the following information:

- Personnel performing the observations;
- Observation dates (time and date);
- Weather conditions (including the rain gauge reading for the qualifying rain event);
- Locations observed; and
- Corrective actions that will be taken in response to observations.

5.6.2.1 Pre-Rain Inspections

Pre-rain inspections will be initiated after consulting NOAA for a qualifying rain event with 50 percent or greater probability of precipitation, which is the point at with the SWRCB considers rain likely. These forecasts can be obtained by entering the Project zip code at http://www.srh.noaa.gov/.

The purpose of the pre-rain event inspection is to make sure the site and the BMPs are ready for the predicted rain. The pre-rain event inspection will cover storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources; BMPs to identify whether they have been properly implemented per the SWPPP; and storm water storage and containment areas to detect leaks and ensure maintenance of adequate freeboard. Pre-rain event inspections will also note the presence or absence of floating and suspended materials, surface sheens, discolorations, turbidity, odors, and sources of any observed pollutants within stored storm water.

5.6.2.2 During-Rain Inspection for Qualifying Rain Events

Daily inspection is required during extended, qualifying rain events during normal business hours and when it is safe to do so. Because it may not initially be known if the storm will be a qualifying event (produces 1/2 inch or more of precipitation), the QSP or designee will err on the side of caution and perform daily inspections until it is clearly evident that it will not be a qualifying event. The purpose of the daily inspections is to identify any discharge locations and the discharge of any stored or contained rainwater; to determine if BMPs functioned as designed; and to identify if any additional BMPs are required. If sediment discharges are identified, BMPs should be enhanced as feasible to stop the discharge

The visual inspection field log (Appendix H) is used to record this information.

5.6.2.3 Post-Rain Inspection for Qualifying Rain Events

Post-rain inspections are only required for qualifying rain events. The post-rain event inspection will cover potential storm water discharge locations; the discharge of stored or contained storm water that is derived from and discharged subsequent to a qualifying rain event; and BMPs to determine if they were adequately designed, implemented, and effective. After assessing BMPs, it will be noted on the inspection form whether BMPs need maintenance.

The visual inspection field log (Appendix H) is used to record this information.

5.6.3 Non-Storm Water Discharges Inspections

The General Permit requires that Risk Level 1 construction sites be inspected quarterly for the appropriate management of materials that could result in non-storm water discharges if they come into contact with storm water or the presence of non-storm water discharges that could be occurring. The purpose of these inspections is to detect unauthorized non-storm water discharges and observe that authorized non-storm water discharges are in compliance with water quality criteria (refer to Section 5.9). Non-storm water discharge inspections are only required during normal business hours of the construction site. Records will be kept of all inspections, and maintained on site.

Quarterly inspections will include the entire Project site and document the following:

- Presence or indications of unauthorized and authorized non-storm water discharges and their sources;
- Pollutant characteristics of the non-storm water discharge (floating and suspended material, sheen, discoloration, turbidity, odor, etc.);
- Personnel performing the observations;
- Dates and approximate time each drainage area and non-storm water discharge was observed; and
- Response taken to observations.

The visual inspection field log (Appendix H) is used to record this information. If there are non-storm water or non-visible pollutant discharges, samples will be collected and analyzed per below.

5.7 DISCHARGE WATER QUALITY SAMPLING LOCATIONS

The QSP or designee will collect samples for pH, turbidity, and non-visible pollutant analyses from the discharge sampling locations depending on the type of discharge. The samples collected will be representative of the flow and characteristics of the discharge.

5.7.1 Non-storm Water Discharge Sampling Locations

Risk Level 1 dischargers are required to sample effluent at all points where non-storm water, including authorized non-storm water, is discharged off-site. If the non-storm water discharge may contain non-visible pollutants, the samples must be sent to a state certified laboratory for analysis as discussed below.

5.7.2 Non-Visible Pollutants Sampling Locations

Non-visible pollutants are pollutants associated with a specific site or activity that can have a negative impact on water quality, but cannot be seen through observation (for example, chlorine). The General Permit does not authorize pollutants of such discharges.

Potential sources of pollutants from construction materials include sediment, fuels and oils from vehicles, litter and debris, and wastes from temporary bathroom facilities. Many of these parameters are detectable from visual observations, and therefore would not need to be tested as non-visible pollutants. Fuels, oils, and lubricants can be identified by a rainbow surface sheen and odor. Litter, debris, and wastes from temporary bathroom facilities can also be seen. However, construction activities could also contribute non-visible pollutants such as chlorine or battery acid.

When exposure of construction materials to storm water is eliminated, storm water pollution from construction materials is prevented, and sampling and analysis requirements are limited. Covered construction materials, or those that are in their final constructed form, do not need to be monitored. However, materials that are stored exposed to precipitation and may generate run-off will be considered for non-visible pollutant monitoring.

Risk Level 1 projects are required to collect water quality samples if there is a BMP breach, malfunction, leak, spill, exposure of storm water to construction materials, or other reason to believe non-visible pollutants are present in the discharge water based on visual monitoring. Water quality samples will be collected at the discharge location and will be analyzed for the non-visible pollutants that may have been discharged from the site, as identified by the site pollutant source assessment made by the QSP or SWPPP compliance inspector. A run-off sample will also collected that has not come into contact with these materials (i.e., an uncontaminated sample) for comparison.

Sample collection for non-visible pollutant testing must follow the protocols described below. Chemical laboratory analyses will be performed by a state-certified analytical laboratory.

A list of potential non-visible pollutants based on the anticipated construction activities are provided in Table 5. Parameters to be analyzed for pollutants will be selected by the QSP based on sources of pollution that have been determined to be potentially present in the storm water leaving the construction site.

For each potential pollutant source, test for one of the water quality indicator constituents. Bolded constituents have the lowest analysis cost.

Table 5
Potential Non-visible Pollutants Sources and Water Quality Indicator Constituents

Activity	Potential Pollutant Source	Water Quality Indicator Constituents Laboratory Analysis
Vehicle & Equipment Use	Battery	**pH**, sulfuric acid, cadmium, nickel, lithium, and lead
Sanitary/Septic Waste (Portable Toilet)	Waste stream	Coliform, **pH**, ammonia, surfactants (MBAs)
Wheelwash water	Residual concrete	**pH**
Concrete work	Masonry products	**pH,** alkalinity
Concrete curing	Non-pigmented curing compounds	**pH,** alkalinity, acidity, volatile organic compounds, semi-volatile organic compounds

5.8 ANALYTICAL METHODS

All laboratory analyses for visible and non-visible pollutants will be conducted according to analytical procedures specified in 40 CFR Part 136, unless other analytical procedures have been specified in the General Permit or by the RWQCB.

5.8.1 Non-Storm Water and Non-Visible Pollutant Discharge Analysis

Samples of non-storm water discharges, including authorized non-storm water discharges, and any discharges with potential non-visible pollutants will be sent to a state-certified laboratory for analysis.

Table 6 list parameters, test methods, container types, and water quality objectives for selected pollutants that may be submitted for laboratory analysis.

5.9 ANALYTICAL DATA EVALUATION

The General Permit prohibits the storm water discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4. The results of any non-storm water discharge, authorized non-storm water discharge, or storm water discharge potentially contaminated with non-visible pollutants that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the Regional Water Board and other agencies as required by 40 C.F.R. §§ 117.3 and 302.4.

Table 6
Analytical Method, Sample Size and Container Requirements
for Non-Storm Water and Non-Visible Pollutants

Parameter	Test Method	Minimum Sample Volume	Container Type
Diesel or Motor Oil	EPA 8015B	2 liters	Glass Amber
Oil and Grease	EPA 1664A	2 liters	Glass Amber
Gasoline and additives	EPA 8260B	3 x 40 mL	VOA glass
Metals (Cadmium, Lead, Lithium, Nickel)	EPA Method 6010B	250 mL	250 mL polypropylene, HNO_3
Total Coliform	EPA 1604	500 ml	Polypropylene
Sulfuric Acid	EPA 300.1	250 mL	Glass or poly
Chlorine	SM4500-CLG	0.05 mg/L	Glass Amber
Alkalinity	SM2320B	100 mL	250 mL polypropylene
Acidity	SM2310B	100 mL	250 mL polypropylene
Volatile Organic Compounds	EPA 8260B	3 x 40 mL	VOA glass, HCl
Semi-volatile Organic Compounds	EPA 8270	1 liter	Glass Amber

Notes:
EPA = U.S. Environmental Protection Agency
mg/L = milligrams per liter
mL = milliliter
HNO_3 = Nitric acid
VOA = volatile organic analysis
SM = standard method

5.10 SAMPLING PROTOCOLS

The General Permit requires dischargers to designate and train personnel to collect, maintain, and ship water quality samples in accordance with the Surface Water Ambient Monitoring Program (SWAMP) 2008 Quality Assurance Program Plan, which is available at http://www.swrcb.ca.gov/water_issues/programs/swamp/tools.shtml#qa. Adherence to SWAMP sampling guidance and proper development of a sampling plan provides for consistent, reproducible, and accurate results. For some constituents, especially trace metals, trace organics, and organic carbon, sampling protocols are very important, because contamination of samples with incorrect sampling protocols may occur. Contamination may occur because of sample location (e.g., sediment disturbances, equipment exhaust), incorrect sampling techniques, and incorrect sample handling.

Field crews will be trained in appropriate field collection methods. A "clean technique" approach will be used that includes the following protocols.

- Water quality samples will be collected only in analytical-laboratory–provided sample containers. Samples will be collected in the appropriate type of sample container, and be of adequate volume to conduct the required measurements or laboratory analyses.

- Clean, powder-free nitrile gloves will be worn for collection of samples.

- Gloves will be changed whenever something not known to be clean has been touched.

- Prior to sample collection, all equipment in contact with the sample (e.g., bucket, tubing) will be decontaminated—except for laboratory-provided sample containers—using a trisodium phosphate -soapy water wash, distilled water rinse, and final rinse with distilled water. (Wash and rinse water will be disposed of appropriately; i.e., not discharged to the storm drain or receiving water).

- To reduce potential contamination, sample collection personnel will adhere to the following rules while collecting samples:

    - No smoking;
    - Never sample near a running vehicle;
    - Do not park vehicles in the immediate sample collection area (even non-running vehicles);
    - Do not eat or drink during sample collection; and
    - Do not breathe, sneeze, or cough in the direction of an open sample container.

Grab samples should be collected to be representative of the run-off stream. The following guidelines will be used during sample collection:

- For small streams and flow paths, simply dip the bottle facing upstream until full.

- For larger streams that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle. Make sure that the opening of the bottle is facing upstream to avoid any contamination by the sampler.

- For larger streams that cannot be safely waded, pole-samplers may be needed to safely access the representative flow.

- Avoid collecting samples from ponded, sluggish, or stagnant water.

- Avoid collecting samples directly downstream from a bridge, because the samples can be affected by the bridge structure or run-off from the road surface.

Samples will typically be collected by dipping the collection container in the run-off flow path. However, depending upon the specific test that is required, some bottles may contain preservatives. These bottles will not be dipped into the stream, but filled indirectly from a collection container. Sample preservation will be in accordance with the current edition of Standard Methods for the Examination of Water and Wastewater (American Public Health Association).

5.11 SAMPLE COLLECTION FOR LABORATORY ANALYSIS

For non-storm water discharges, authorized non-storm water discharges, and discharges potentially contaminated by non-visible pollutants, laboratory analysis will be done.

5.11.1 Field Equipment List

Certified commercially clean sample containers will be obtained from the contract analytical laboratory prior to field mobilization. Other materials and equipment necessary for sampling and documentation will also be obtained.

Field equipment includes the following items.

- Bubble wrap;
- Clear tape;
- Cooler for sample shipping;
- Custody seals;
- De-ionized water;
- Field forms such as the field log and COC;
- Ice (or blue icepack, if provided by laboratory);
- Laboratory provided sample containers;
- Paper towels;
- Plastic bags (clean, zip-type, nonvented, colorless polyethylene); and
- Sample labels.

The following personal protective equipment will also be taken to the field.

- Powder-free, non-talc, class-100 latex, polyethylene, or polyvinyl chloride gloves;
- Safety glasses; and
- Steel-toed boots, if required.

Samples will be stored on ice at 4 degrees Celsius in coolers immediately following collection. Freezing samples is not permitted.

5.11.2 Sample Collection Methods

Whenever possible, samples will be collected facing upstream and upwind to minimize introduction of contamination. Personnel will wear clean, non-talc gloves while handling samples. If another object or substance is touched, gloves will be changed before handling samples again. To avoid contamination, sample containers will be filled by collecting water directly into laboratory provided, pre-cleaned sample bottles.

5.11.3 Sample Labeling

Sample labels or COCs will contain all of the following information:

- Project Name;
- Sample identification name (or number);
- Date of sampling;
- Time of sample collection;
- Analyses to be performed (be as specific as possible);
- Preservatives, if applicable; and
- Sample matrix (i.e., soil, water, sediment, etc.).

5.11.4 Sample Shipping

After sample collection, the following steps should be taken:

1. Check cap tightness and verify the integrity of the sample labels.

2. Wrap glass containers, if any, in protective packing material such as bubble wrap, and place several layers of bubble wrap on bottom of sample cooler.

3. If using wet ice, line cooler with open garbage bag and double-bag, and seal loose ice to prevent melting ice from soaking the packing material.

4. If using ice packs, place packs in zip-seal plastic bag, and line cooler with open garbage bag.

5. Place the samples right-side-up in a cooler with ice cubes, double-bagged, using zip-seal plastic bag or blue ice for delivery to the laboratory.

6. Tie the garbage bag.

7. Drop samples off at the specified laboratory prior to close of business.

If samples are to be shipped by FedEx, the following steps should also be taken:

1. Enclose sample documentation (i.e., completed COCs) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, each cooler will have its own documentation.

2. Pack shipping containers with additional packing material and seal the coolers with signed and dated custody seals so that if the cooler is opened, the custody seal will be broken. Place clear tape over the custody seal to prevent damage to the seal.

3. Ship samples with standard overnight delivery to the laboratory within holding times.

Ship samples for laboratory analysis to the analytical laboratory immediately. Many analytical methods have short hold-times before which the analysis must be started. Hold times are

measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless otherwise required by the analytical laboratory).

5.11.5 Chain-of-Custody

Traceability of the samples will be maintained from the time the samples are collected until laboratory data are issued. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. Typically, the COC is a three-part, carbonless form. In the event that a single-sheet COC is provided, the sampler will make a photocopy prior to placing the COC into the cooler for shipment.

The COC form will be used to document the transport and receipt of samples from the field to the laboratory. The sampler will be responsible for filling out the COC form. The COC will be signed by the sampler or the field person responsible for sample handling at the time that the sampler relinquishes the samples to anyone else. One COC form will be completed for each cooler of samples collected daily, and if samples are not hand-delivered, the COC will be placed in a zip-seal bag, sealed, and taped to the inside of cooler lid.

Information required on a COC includes the following:

- Sample identification name (or number);
- Site identification for the sample;
- Date and time the sample was collected;
- Chemical analyses being requested (indicated by placing an "X" under the appropriate analytical method);
- Total number of containers being sent to the laboratory for each sample;
- Sample preservative used;
- Initials or name of the field sampling personnel; and
- COC number.

If any samples are to be placed on hold at the laboratory, this must be clearly indicated on the COC in the comments section.

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last (pink) copy of the three-part COC form, document the method of shipment, and send the original (white) and the second (yellow) copy of the COC form with the samples. If a single-paper form is provided by the laboratory, the COC will be photocopied and the original sent with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form and retain the second copy. The original COC forms will remain with the samples until the data are reported by the laboratory. The analytical laboratory may dispose of the samples in an appropriate manner 60 to 90 days after data reporting.

QA/QC activities are associated with the generation and assessment of the field measurements and analytical data. The purpose of a QA/QC program is to produce data of known quality that satisfy the project objectives. The QA/QC program will:

- Provide a mechanism for ongoing control and evaluation of the measurement of data quality, and

- Provide measures of data quality in terms of precision, accuracy, representativeness, completeness, and comparability. These criteria are used to determine if the data can be used for their intended purpose.

This section presents specific QA/QC criteria for collected water by providing guidance for the data quality objectives, the laboratory QA/QC criteria, the field QA/QC criteria, and the analytical data quality evaluation.

5.12 DATA QUALITY OBJECTIVES

The definitions and objectives of the precision, accuracy, representativeness, completeness, and comparability parameters are described below.

- **Precision** measures the reproducibility of repetitive measurements. Precision will be assessed by calculating the relative percent differences (RPDs) between a series of duplicate measurements.

- **Accuracy** is a statistical measurement of correctness and includes components of both random and systematic error. Therefore, accuracy reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ beyond acceptable limits from the true value. Analytical accuracy is typically measured by determining the percent recovery of known concentrations of target analytes that are spiked into a sample before extraction.

- **Representativeness** is a function of the investigative objectives and will be achieved in part by the use of standard sampling and analytical procedures. It is also influenced by the sample collection design.

- **Completeness** is calculated by method and matrix for a sampling program. The number of valid, unqualified results divided by the number of possible individual analyte results from samples collected, expressed as a percentage, determines the completeness of the data set.

- **Comparability** is the confidence with which one data set can be compared with other data sets. Standard methods for sampling and analysis will be used to assure comparability.

5.13 FIELD QA/QC CRITERIA

The field sampling team will follow the QA/QC procedures discussed in this section.

5.13.1 Field QA Procedures

Field QA will be maintained by using well-maintained and calibrated field instruments, following specified sampling procedures, and maintaining strict documentation procedures. Samples will be accounted for by maintaining strict COC procedures.

5.13.2 Field QC Samples

The following QC samples are collected when samples are submitted to an analytical laboratory to assess the contamination and precision that can be associated with the field sampling procedures.

- **Field Duplicates** are used to represent the precision of the entire sampling and analysis system. Field duplicates consist of a second sample collected at the same location as the original sample. Duplicate samples will be collected in immediate succession, using identical sampling techniques, and treated in an identical manner during storage, transportation, and analysis.

- **Equipment Blanks** are used to check for contamination from the sampling equipment. Equipment blanks consist of a sample of blank reagent water poured into the sampling device, collected in the sample container, and transported to the laboratory for analysis. For this sampling effort, no reusable sampling equipment is used (e.g., tubing, sampling devices, etc.); therefore, equipment blanks will not be necessary. If non-dedicated sampling equipment is used, an equipment blank would be required.

When submitting samples to an analytical laboratory, field QC samples will be collected and analyzed at the minimum frequency of 5 percent.

5.14 LABORATORY QA/QC CRITERIA

The QA/QC guidelines are derived from the analytical methods and the laboratory QA/QC manual. The laboratory will follow the QA/QC procedures discussed in this section.

5.14.1 Laboratory QA Procedures

Samples will be analyzed within the specified holding times, meet the sample preservation requirements, and meet the COC requirements. Analyses will be performed under laboratory-derived accuracy and precision objectives as stated in the laboratory QA/QC manual.

The laboratory will follow standard operating procedures, maintain accurate documentation of sample analysis procedures, and maintain COC from sample receipt to sample reporting. Laboratory instrumentation will be calibrated according to EPA guidance and/or manufacturer's specifications.

5.14.2 Laboratory QC Samples

The following QC samples will be analyzed routinely to evaluate the instrumentation and methods used to analyze the samples collected for this Project.

- Method Blanks (MBs) are samples composed of the reagents used in preparing a sample for analysis in the quantities actually used in the analysis. MBs are used to assess the potential for contamination due to the analytical procedure.

- Laboratory Control Spikes (LCSs) and LCS Duplicates (LCSDs) are aliquots of reagent water spiked with known concentrations of target analytes. The LCS/LCSD recoveries and RPDs are used to assess the accuracy and precision of the analytical procedure.

- Matrix Spikes (MSs) and MS Duplicates (MSDs) are field samples that are spiked with known concentrations of target analytes. The MS/MSD recoveries and RPDs are used to assess the heterogeneity of the sample matrices.

The laboratory QC samples will be analyzed on a per-batch basis, as recommended by analytical method guidance and the laboratory QA/QC manual.

5.15 ANALYTICAL DATA QUALITY EVALUATION

The overall data quality will be assessed through the laboratory and field QC samples. A data quality evaluation will be performed that includes the following steps:

- COC review to ensure that all requested analyses were performed, and all samples were accounted for in the reports;
- Holding time compliance check; and
- Laboratory and field QC sample review.

Sample results will be qualified that did not meet holding-time requirements, or are associated with QC sample results that are outside control limits.

California Stormwater Quality Association (CASQA). 2009. Stormwater Best Management Practice Handbook, Construction. January. Last updated 9/30/2004. Online at: http://www.cabmphandbooks.com/Construction.asp.

FCGMA (Fox Canyon Groundwater Management Agency), 2013. Annual Report for Calendar Year.

LARWQCB (Los Angeles Regional Water Quality Control Board), 1994. Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties. June 13.

LARWQCB (Los Angeles Regional Water Quality Control Board), 2001. Waste Discharge Requirements for Mandalay Generating Station Order No. 01-057. NPDES No. CAS0001180.

Natural Resources Conservation Service. 2015. Web Soil Survey website. Online at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed March 2015.

Appendix A

Construction General Permit

The complete Construction General Permit can be found at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf

Appendix B

Submitted Permit Registration Documents

NOI, Risk Assessment (Construction Site Sediment and Receiving Water Risk Determination); Site Map (including vicinity map); Post-Construction Water Balance

Water Boards Storm Water Multiple Application & Report Tracking System

Help Logout

You are logged-in as: **Jil Finnegan - URS Corporation.**
If this account does not belong to you, please log out.

Navigate To:

NOTICE OF INTENT - Risk

The Notice of Intent (NOI) is organized into different tabs. Please complete all applicable tabs before submitting the form. If you want to complete the NOI at a later time, please click on "Save & Exit".

WDID:
Owner: Finnegan Enterprises
7940 Winthrope Street Oakland CA 94605
Status: Not Submitted
Certified Date:
Processed Date:
NOT Effective Date:
Permit Type: Construction
Site: Oxnard
393 North Harbor Boulevard Oxnard CA 93035

Owner Info | Developer Info | Site Info | Risk | Addtl Site Info | Post Construction | Billing Info | Attachments | Certification | Requirements | Inspections | Print | Status History | Linked Users | NOTs | COIs

SEDIMENT RISK FACTOR WORKSHEET
Instructions: Enter R,K and LS factor values. System will calculate watershed erosion estimates and site sediment risk factor
A. Sediment Risk

A) R Factor Value:(What's this?)	116.21 * Erovisity Calculator
B) K Factor Value (weighted average, by area, for all site soils)(What's this?) ***If not using the SWRCB map(Populate K Factor) upload your analysis on the Attachment Tab prior to submitting to the SWRCB.	0.1 * Populate K Factor
C) LS Factor (weighted average, by area, for all slopes)(What's this?) ***If not using the SWRCB map(Populate LS Factor) upload your analysis on the Attachment Tab prior to submitting to the SWRCB.	0.27 * Populate LS Factor
Watershed Erosion Estimate (=R*K*LS) in tons/acre	3.18
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >/= 15 and <75 tons/acre High Sediment Risk: >/= 75 tons/acre	Low

RECEIVING WATER (RW) RISK FACTOR WORKSHEET
A. Watershed Characteristics

A.1.(a) Does the disturbed area discharge directly or indirectly to a 303(d) listed waterbody impaired by sediment? OR A.1.(b) Is the disturbed area located within a sub-watershed draining to a 303(d) listed waterbody impaired by sediment? OR A.2. Is the disturbed area located within a planning watershed draining to a waterbody with designated beneficial uses of COLD, SPAWN AND MIGRATORY?	Populate Receiving Water Risk No * Yes = High, No = Low Statewide Map of High Receiving Water Risk Watersheds	Low

C. Combined Risk Level Matrix

		Sediment Risk: Low	Medium	High
Receiving Water Risk	Low	Level1	Level2	
	High		Level2	Level3

Project Sediment Risk:	Low
Project Receiving Water Risk:	Low
Project Combined Risk:	Level1

Save & Exit | Save & Continue

Fields marked with * are mandatory fields.

EPA United States Environmental Protection Agency

Water: Stormwater

LEW Results

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Start Date:	10/02/2018
End Date:	06/01/2020
Address:	393 North Harbor Boulevard, Oxnard, CA
Latitude:	34.1984718
Longitude:	-119.24285459999999

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF **116.21** HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **10/02/2018 - 06/01/2020**.

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements**.

Start Over

Last updated on Monday, July 28, 2014

U:\GIS\NRG_Ventura\Projects\Fig1_Vicinity_SWPPP.mxd 3/26/2015 3:24:01 PM

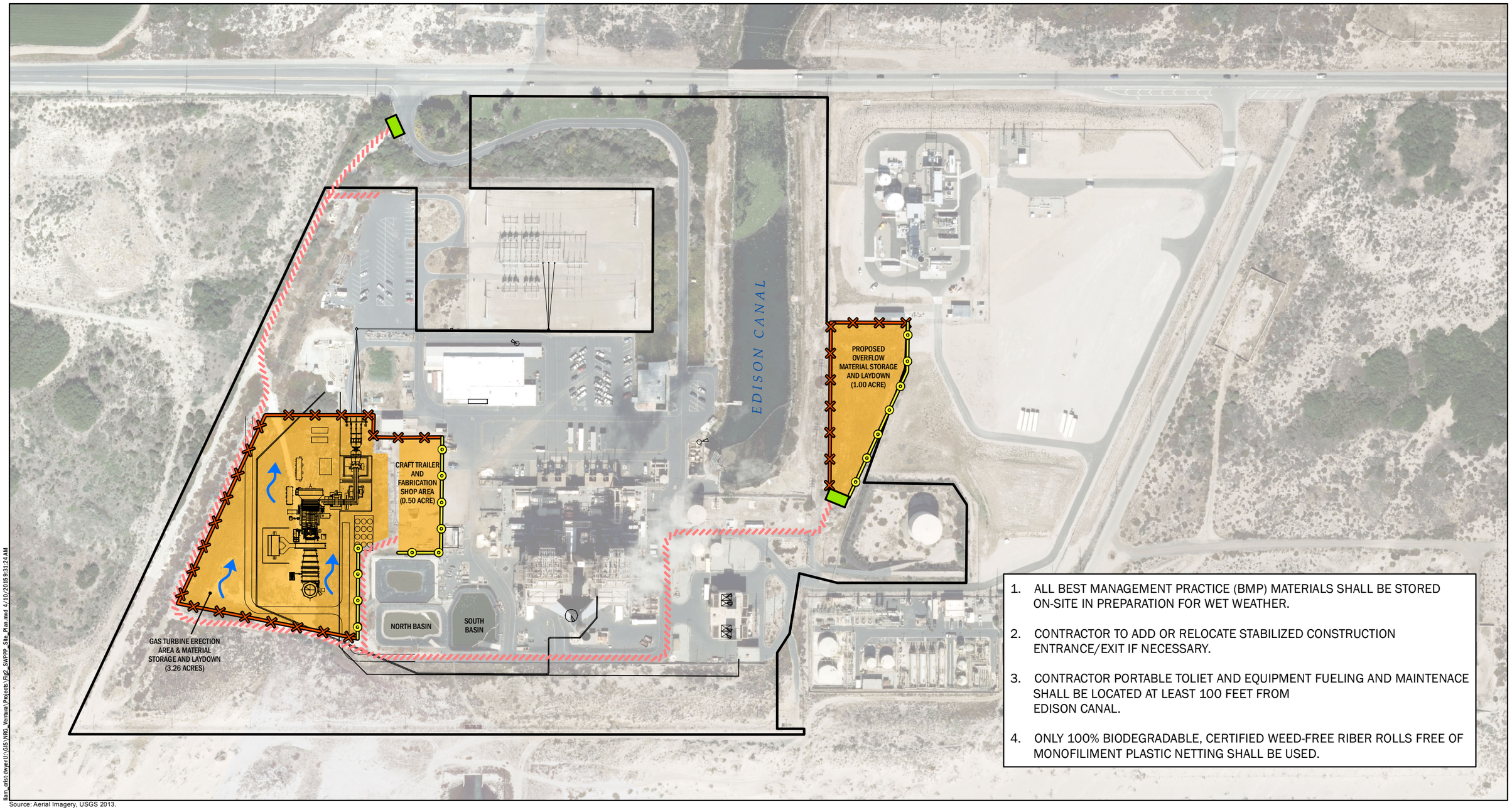
Source: ESRI Basemap

SITE VICINITY MAP

■ Puente Power Project Site

NRG
Puente Power Project
April 2015 Oxnard, California

FIGURE 1



Source: Aerial Imagery, USGS 2013.

Stabilized Construction Entrance/Exit
Construction Access on Existing Roads
Construction and Laydown Areas
Mandalay Generating Station Property
Silt Fence
Fiber Roll
Existing Surface Water Flow Direction

0 125 250 Feet

SITE PLAN

NRG
Puente Power Project
April 2015 Oxnard, California

FIGURE 2

I:\am_cris\dwg\ri\GIS\NRG_Ventura\Projects\Fig2_SWPPP_Site_Plan.mxd 4/10/2015 9:31:24 AM

Appendix C

LRP SWPPP Amendment Certifications

Legally Responsible Person

Approval and Certification of Amendment No. _____to the Storm Water Pollution Prevention Plan:

Project Name: Puente Power Project

"I certify under penalty of law that this document and all Attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Legally Responsible Person, Company, and Title	
Signature of Legally Responsible Person or Approved Signatory	Date
Signature of Legally Responsible Person or Approved Signatory	Telephone Number
LRP's Signature	Date

Appendix D

NAL Exceedance Site Evaluations

PROJECT

SWPPP NON-COMPLIANCE REPORT

Dischargers who cannot certify compliance with the permit and/or who have had other instances of non-compliance, excluding exceedances of water quality standards, shall notify the RWQCB within 30 days.

Inspector name: _____

Inspector phone number: _____

Non-compliance identification date: _____

Description of non-compliance:

_____

_____

_____

_____

Initial assessment of any impact caused by the non-compliance:

_____

_____

_____

Actions required to achieve compliance:

_____

_____

_____

_____

Time schedule of remediation activities:

_____

_____

_____

When compliance will be achieved:

_____

_____

PROJECT

SWPPP REPORTABLE QUANTITY RELEASE REPORTS

Section 3 of the SWPPP provides a description of procedures for preventing and cleaning up spills of varying magnitude. Complete the following form on any occasion that a Reportable Quantity spill (as established under 40 CFR Parts 110, 117, or 302 – see references below) occurs on site.

DATE OF SPILL	TYPES OF MATERIAL SPILLED	APPROX. QUANTITY	AGENCIES NOTIFIED	DATE

[1] 40 CFR Part 110 addresses the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Clean Water Act.

[2] 40 CFR Part 117 addresses the determination of such quantities of hazardous substances that may be harmful pursuant to Section 311(b)(3) of the Clean Water Act.

[3] 40 CFR Part 302 addresses the designation, reportable quantities, and notification requirements for the release of substances designated under Section 311(b)(2)(A) of the Clean Water Act.

Appendix E

Submitted Amendments to PRDs

Appendix F

Construction and SWPPP Activities Schedule

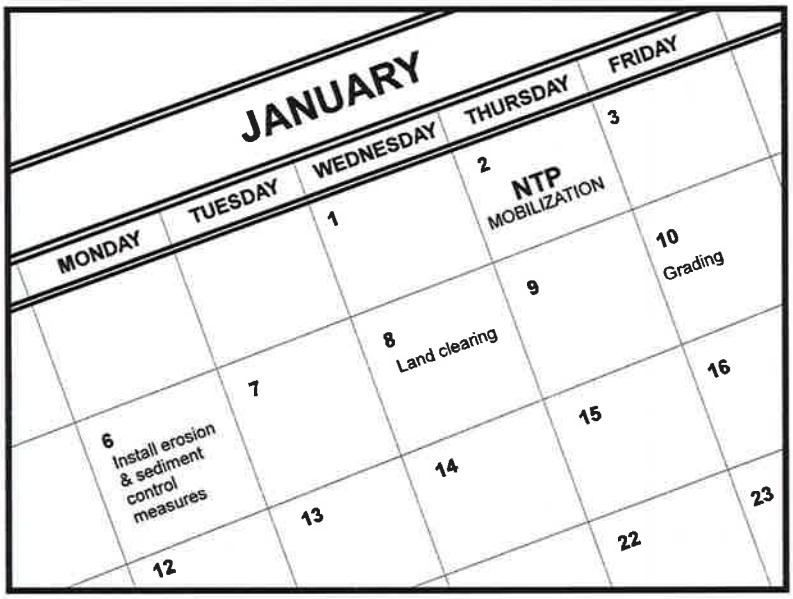
Construction and SWPPP Activities Schedule

Activity		Estimated Date(s)	Comments
Contractor Mobilization		October 2, 2018	
Pre-Construction BMP Installation	Perimeter Controls (EC, SE, and TC)	October 2018 - Prior to initiation of any soil disturbing activity	
	Waste Management (WM)	October 2018	
	Non-Stormwater (NS)	October 2018 – Prior to onsite equipment or vehicle use	
	Wind Erosion (WE)	October 2018	
During Construction BMP Installation	Perimeter Controls (EC, SE, and TC)	October 2018 – June 2020	
	Waste Management (WM)	October 2018 – June 2020	
	Non-Stormwater (NS)	October 2018 – June 2020	
	Wind Erosion (WE)	October 2018 – June 2020	
Submit Annual Report for 2018/2019		September 2019	
Complete Construction, Remove Temporary BMPs, and Implement Final Site Stabilization		May and June 2020	
Achieve Final Site Stabilization		June 2020	
Submit Annual Report for 2019/2020		July 2020	
File Notice of Termination		Within 90 days of Project completion	

Appendix G

CASQA BMP Handbook Fact Sheets

Scheduling EC-1



Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase

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of construction. Clearly show how the rainy season relates to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

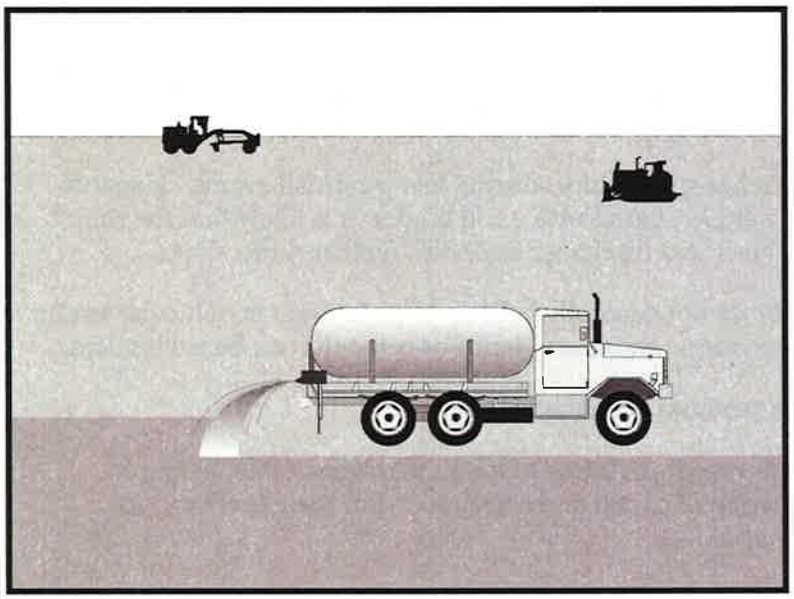
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Soil Binders EC-5



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Soil binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring temporary protection. Because soil binders, when used as a stand-alone practice, can often be incorporated into the soil, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are commonly used in the following areas:

- Rough graded soils that will be inactive for a short period of time
- Soil stockpiles
- Temporary haul roads prior to placement of crushed rock
- Compacted soil road base
- Construction staging, materials storage, and layout areas

Limitations

- Soil binders are temporary in nature and may need reapplication.

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- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- Plant-material-based soil binders do not generally hold up to pedestrian or vehicular traffic across treated areas as well as polymeric emulsion blends or cementitious-based binders.
- Soil binders may not sufficiently penetrate compacted soils.
- Some soil binders are soil texture specific in terms of their effectiveness. For example, polyacrylamides (PAMs) work very well on silt and clayey soils but their performance decreases dramatically in sandy soils.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of some chemical soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup.

Implementation

General Considerations

- Soil binders should conform to local municipality specifications and requirements.
- Site soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces. Soil binders should not pollute stormwater when cured. Obtain a Material Safety Data Sheet (MSDS) from the manufacturer to ensure non-toxicity.
- Stormwater runoff from PAM treated soils should pass through one of the following sediment control BMP prior to discharging to surface waters.
  - When the total drainage area is greater than or equal to 5 acres, PAM treated areas should drain to a sediment basin.
  - Areas less than 5 acres should drain to sediment control BMPs, such as a sediment trap, or a series of check dams. The total number of check dams used should be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam should be spaced evenly in the drainage channel through which stormwater flows are discharged off site.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.

- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this Fact Sheet. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application is related to the functional longevity of the binder, which can be affected by subgrade conditions, surface type, climate, and maintenance schedule.
- Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

Plant-Material-Based (Short Lived, <6 months) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	40	45	50	60	70

Psyllium: Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together, but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

Starch: Starch is non-ionic, cold water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material-Based (Long Lived, 6-12 months) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

- For clayey soil: 5 parts water to 1 part emulsion
- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

Acrylic Copolymers and Polymers: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound typically requires 12 to 24 hours drying time. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

Liquid Polymers of Methacrylates and Acrylates: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with the manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:1 to 1:1	10.0 – 20.0

Poly-Acrylamide (PAM) and Copolymer of Acrylamide: Linear copolymer polyacrylamide for use as a soil binder is packaged as a dry flowable solid, as a liquid. Refer to the manufacturer's recommendation for dilution and application rates as they vary based on liquid or dry form, site conditions and climate.

- Limitations specific to PAM are as follows:

- Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
- The specific PAM copolymer formulation must be anionic. Cationic PAM should not be used in any application because of known aquatic toxicity problems. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, should be used for soil applications.
- PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
- PAM should not be used as a stand-alone BMP to protect against water-based erosion. When combined with mulch, its effectiveness increases dramatically.

Hydro-Colloid Polymers: Hydro-Colloid Polymers are various combinations of dry flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

Gypsum: This is a formulated gypsum based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.

- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd² or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd².

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate installed costs:

Soil Binder	Cost per Acre (2000)[1]	Estimated Cost per Acre (2009)[2]
Plant-Material-Based (Short Lived) Binders	$700-$900	$770-$990
Plant-Material-Based (Long Lived) Binders	$1,200-$1,500	$1,320-$1,650
Polymeric Emulsion Blend Binders	$700 -$1,500	$770-$1,650
Cementitious-Based Binders	$800-$1,200	$880-$1,350

1. Source: Erosion Control Pilot Study Report, Caltrans, June 2000.

2. 2009 costs reflect a 10% escalation over year 2000 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	**Plant Material Based (Long Lived)**	**Polymeric Emulsion Blends**	**Cementitious-Based Binders**
Relative Cost	Low	Moderate to High	Low to High	Low to Moderate
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

References

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

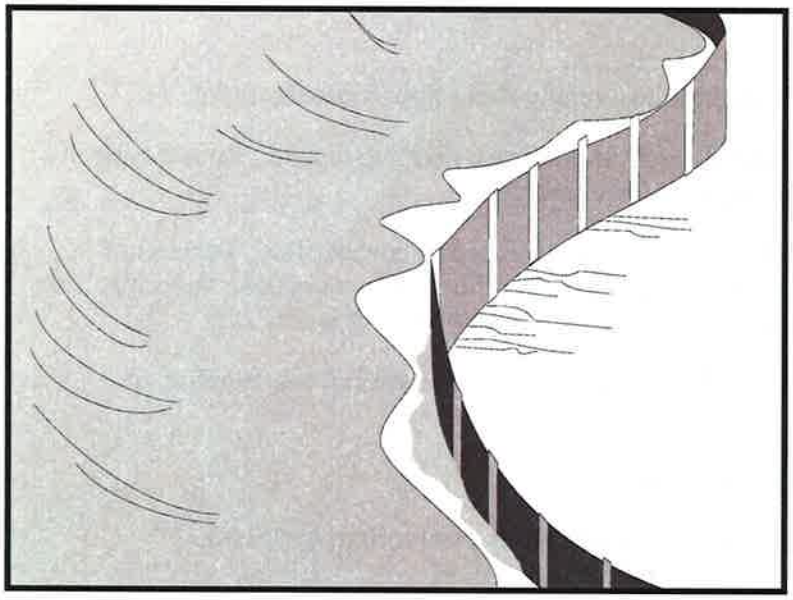
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Silt Fence

SE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-10 Storm Drain Inlet Protection

SE-14 Biofilter Bags

Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (SE-10). Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

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Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Do not use in locations where ponded water may cause a flooding hazard. Runoff typically ponds temporarily on the upstream side of silt fence.
- Do not use silt fence to divert water flows or place across any contour line. Fences not constructed on a level contour, or fences used to divert flow will concentrate flows resulting in additional erosion and possibly overtopping or failure of the silt fence.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Not effective unless trenched and keyed in.
- Not intended for use as mid-slope protection on slopes greater than 4:1 (H:V).
- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.
- The maximum slope perpendicular to the fence line should be 1:1.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft^2 of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.

- Silt fences should remain in place until the disturbed area is permanently stabilized, after which, the silt fence should be removed and properly disposed.
- Silt fence should be used in combination with erosion source controls up slope in order to provide the most effective sediment control.
- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

Design and Layout

The fence should be supported by a plastic or wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Woven geotextile material should contain ultraviolet inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 °F to 120 °F.

- Layout in accordance with attached figures.
- For slopes steeper than 2:1 (H:V) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to sensitive receiving waters or Environmentally Sensitive Areas (ESAs), silt fence should be used in conjunction with erosion control BMPs.

Standard vs. Heavy Duty Silt Fence

Standard Silt Fence

- Generally applicable in cases where the slope of area draining to the silt fence is 4:1 (H:V) or less.
- Used for shorter durations, typically 5 months or less
- Area draining to fence produces moderate sediment loads.

Heavy Duty Silt Fence

- Use is generally limited to 8 months or less.
- Area draining to fence produces moderate sediment loads.
- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fence fabric has higher tensile strength.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
  - Posts are metal (steel or aluminum)

Materials

Standard Silt Fence

- Silt fence material should be woven geotextile with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The

reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491.

- Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

Heavy-Duty Silt Fence

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts or bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement for health and safety purposes.

Installation Guidelines – Traditional Method

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench.

- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.

- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with native material and compacted.

- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where, due to specific site conditions, a 3 ft setback is not available, the silt fence may be constructed at the

toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and more difficult to maintain.

- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case should the reach exceed 500 ft.
- Cross barriers should be a minimum of $^1/_3$ and a maximum of ½ the height of the linear barrier.
- See typical installation details at the end of this fact sheet.

Installation Guidelines - Static Slicing Method

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 inches into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the gerotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
    - Ease of installation (most often done with a 2 person crew). In addition, installation using static slicing has been found to be more efficient on slopes, in rocky soils, and in saturated soils.
    - Minimal soil disturbance.
    - Greater level of compaction along fence, leading to higher performance (i.e. greater sediment retention).
    - Uniform installation.
    - Less susceptible to undercutting/undermining.

Costs

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.
- In tests, the slicing method required 0.33 man hours per 100 linear feet, while the trenched based systems required as much as 1.01 man hours per linear foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.

- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.
- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

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Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

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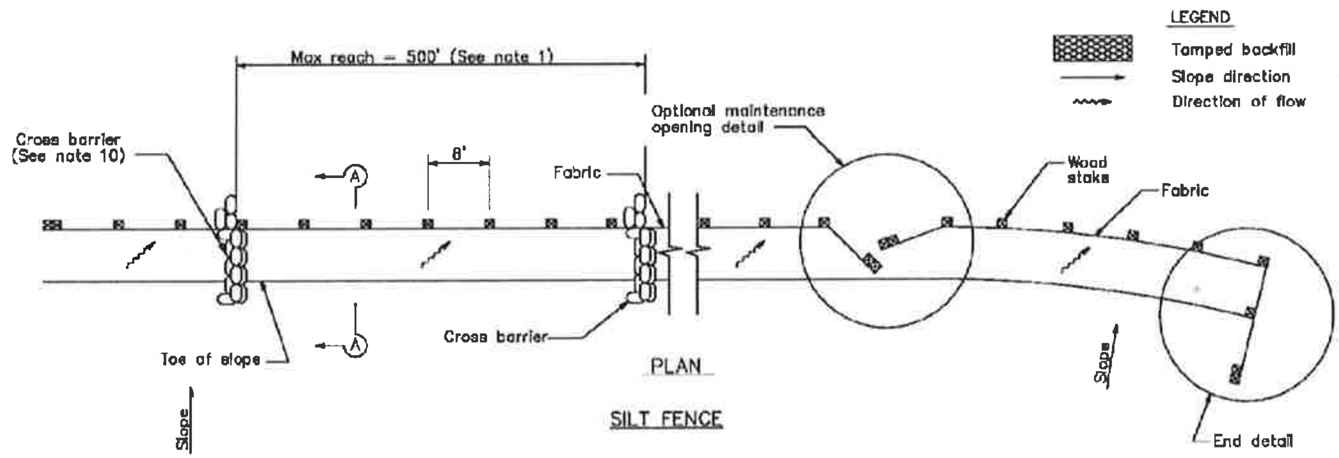
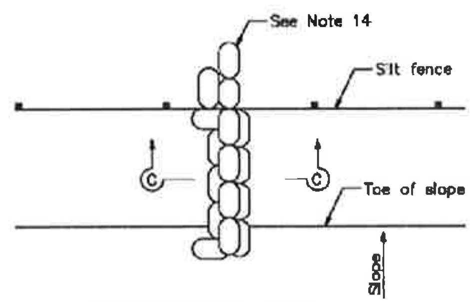
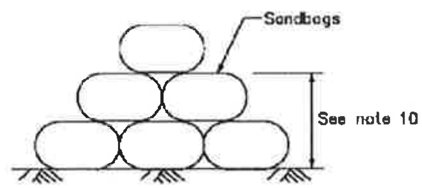


SILT FENCE



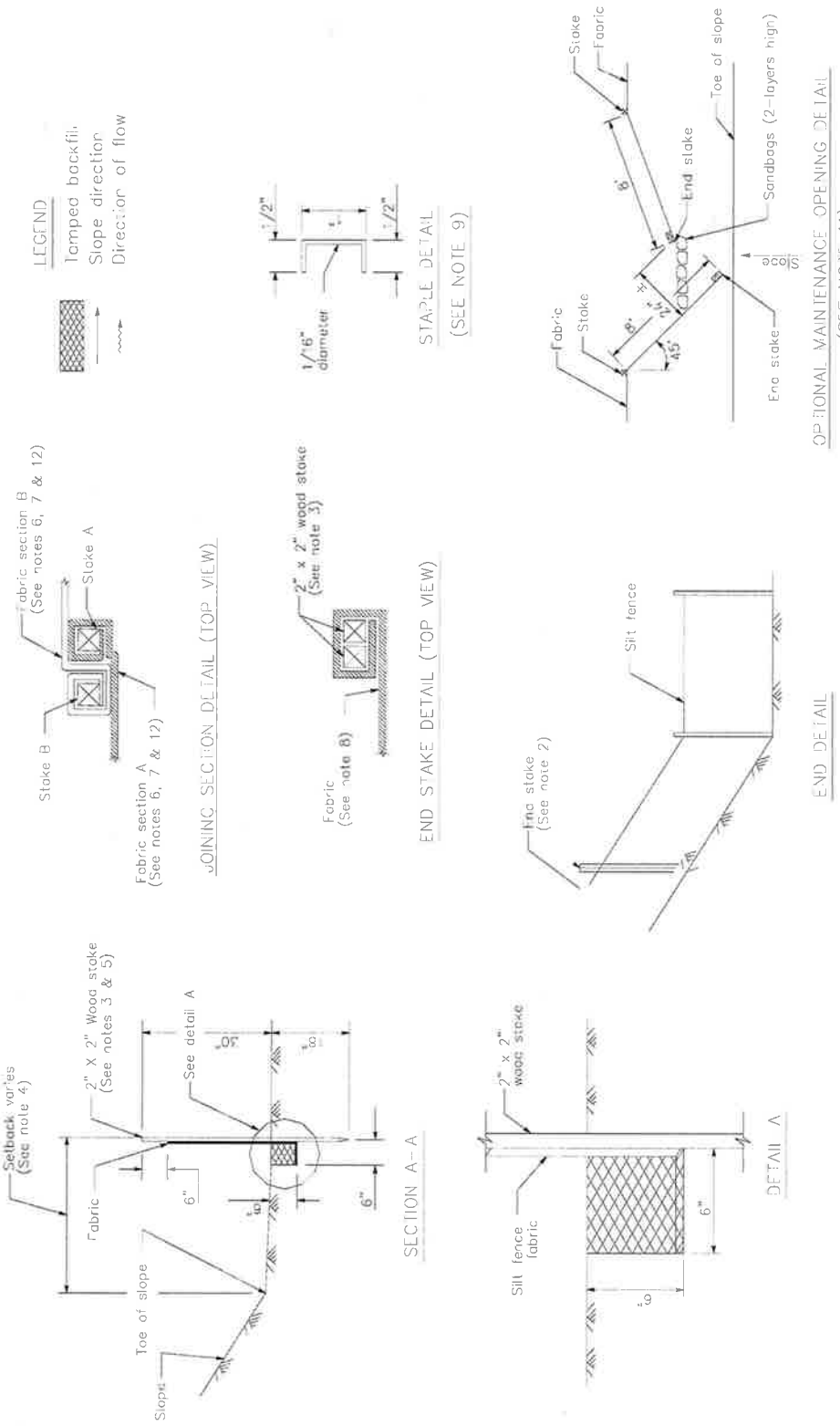
CROSS BARRIER DETAIL



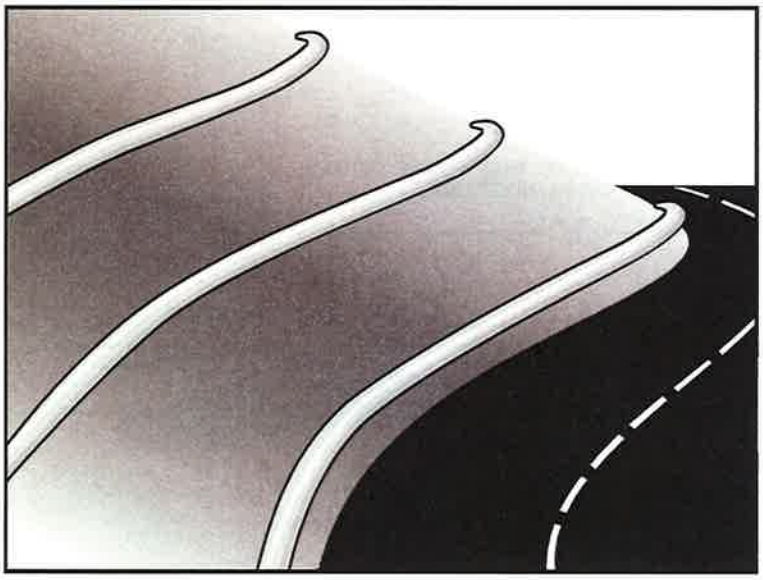
SECTION C–C

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. The last 8'-0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'-0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.
14. Add 3-4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1/16" diameter
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
Toe of slope
End stake
Sandbags (2-layers high)
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
Fabric
6"
Toe of slope
Slope
SECTION A-A
2" x 2"
wood stake
Silt fence
fabric
6"
DETAIL A

Fiber Rolls SE-5



Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

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- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

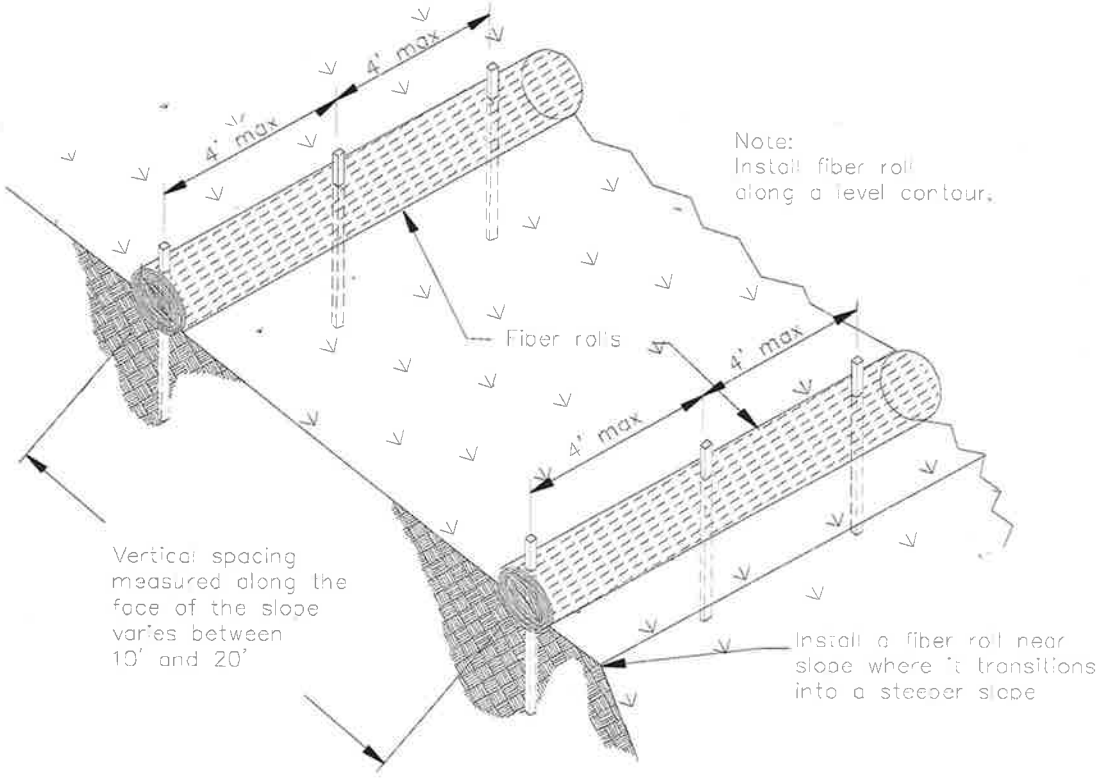
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

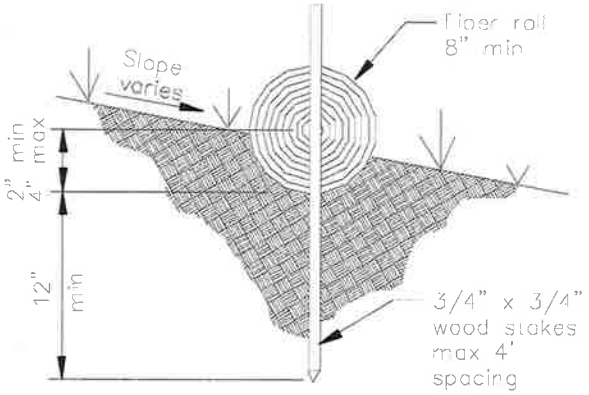
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

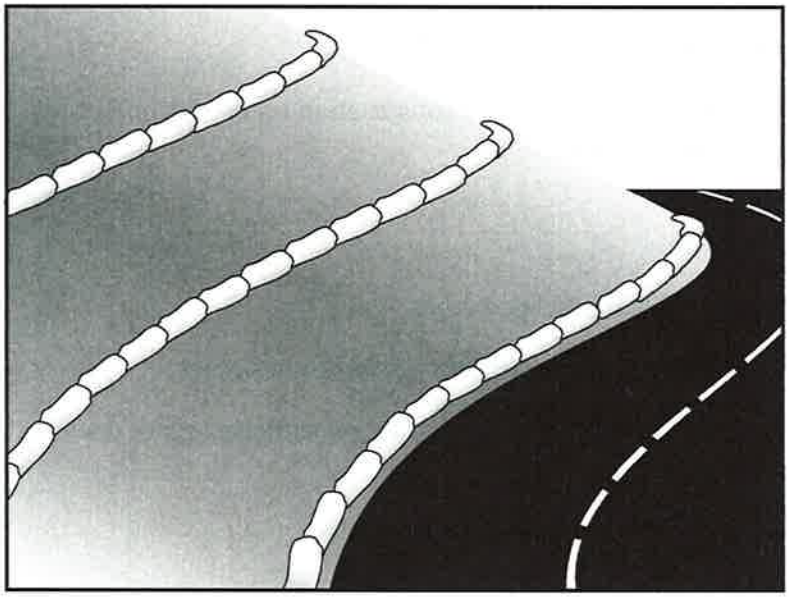


TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm SE-6



Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

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- At the top of slopes to divert runoff away from disturbed slopes.
- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Durability of gravel bags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months.
- Easily damaged by construction equipment.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate gravel bag berms on level contours.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 (H:V) or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.

- ***Bag Size:*** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Material costs for gravel bags are average and are dependent upon material availability. $2.50-3.00 per filled gravel bag is standard based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

- Reshape or replace gravel bags as needed.

- Repair washouts or other damage as needed.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

References

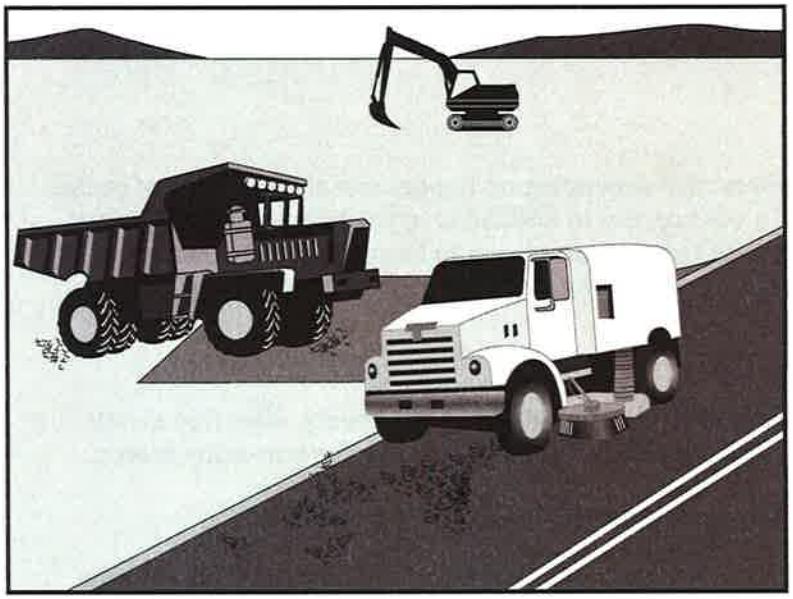
Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

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- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

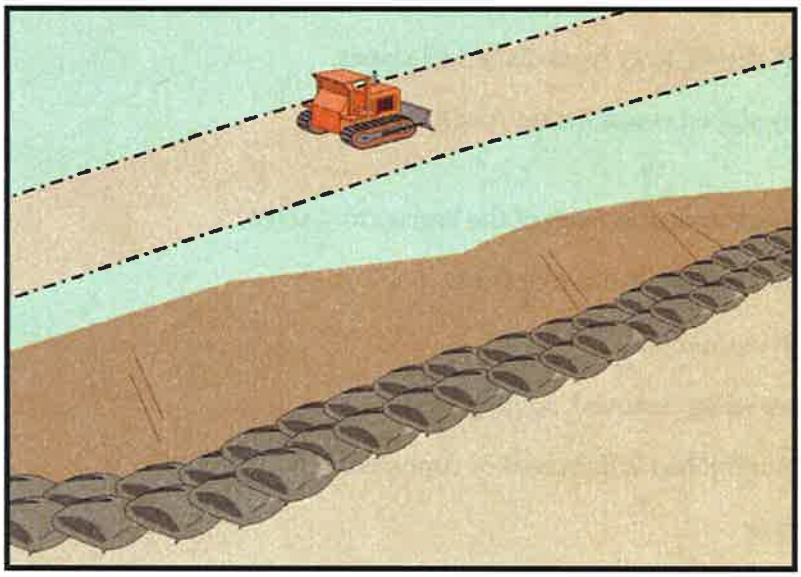
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Categories		
EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-14 Biofilter Bags

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- At the top of slopes to divert runoff away from disturbed slopes.
- As check dams across mildly sloped construction roads.

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Sand is easily transported by runoff if bag is damaged or ruptured.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months. When used to detain concentrated flows, maintenance requirements increase.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms or SE-14, Biofilter Bags. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

    Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- Stack sandbags at least three bags high.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 (H:V) or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- See typical sandbag barrier installation details at the end of this fact sheet.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not an acceptable substitute, as sand can more easily mobilize out of burlap.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 3 (Caltrans Standard Specification, Section 25) permeable material free from clay and deleterious material, such as recycled concrete or asphalt..

Costs

Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag. These costs are based upon vendor research.

Inspection and Maintenance

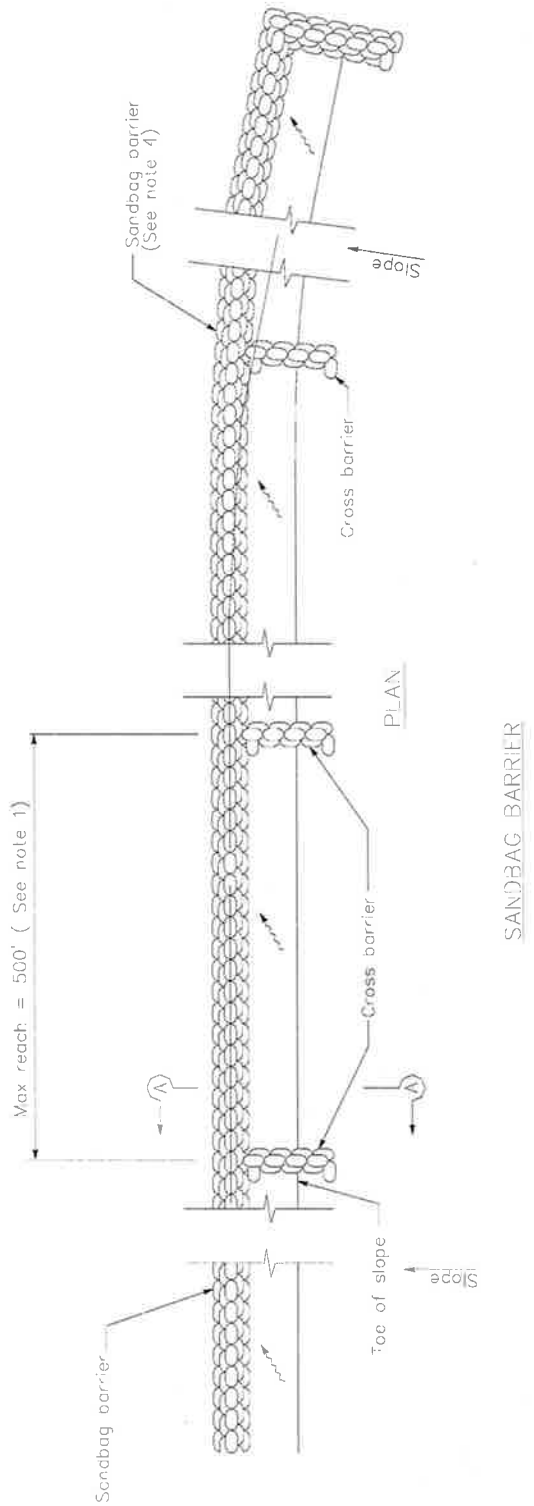
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

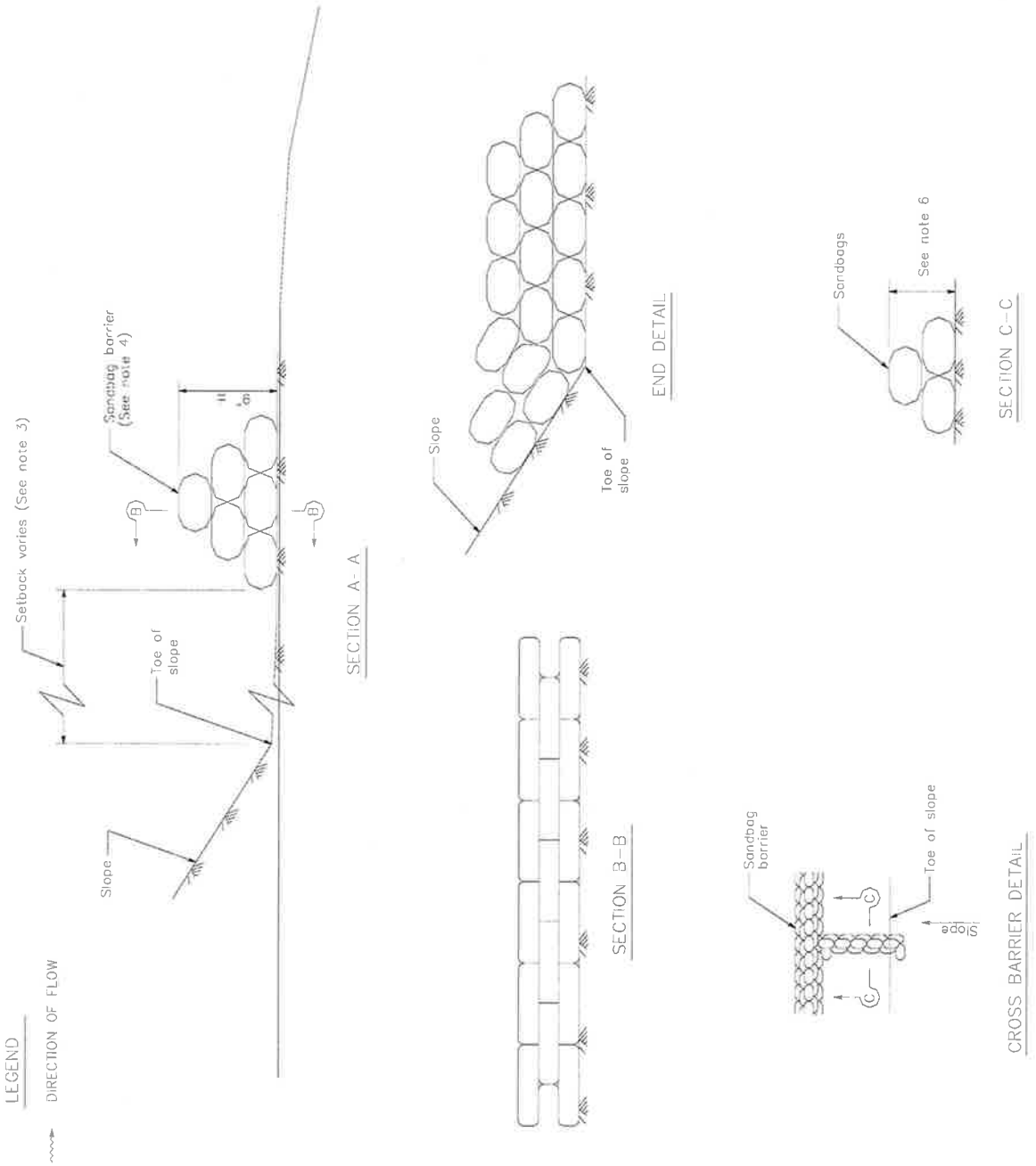
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



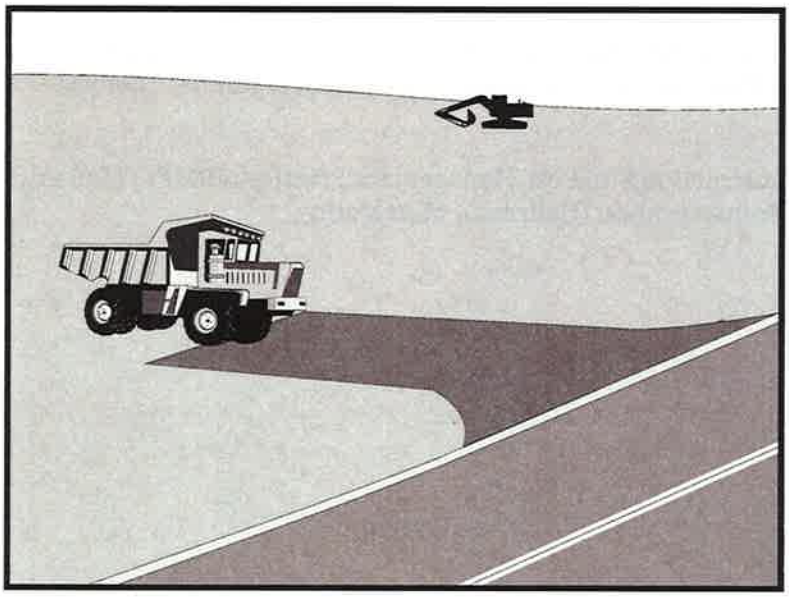
SANDBAG BARRIER

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.


LEGEND
DIRECTION OF FLOW
Setback varies (See note 3)
Sandbag barrier (See note 4)
Toe of slope
Slope
SECTION A- A
Slope
Toe of slope
END DETAIL
SECTION B-B
Sandbags
See note 6
SECTION C-C
Sandbag barrier
Toe of slope
CROSS BARRIER DETAIL

Stabilized Construction Entrance/Exit TC-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water

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runoff.

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft minimum, and 30 ft minimum width.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.

Stabilized Construction Entrance/Exit TC-1

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

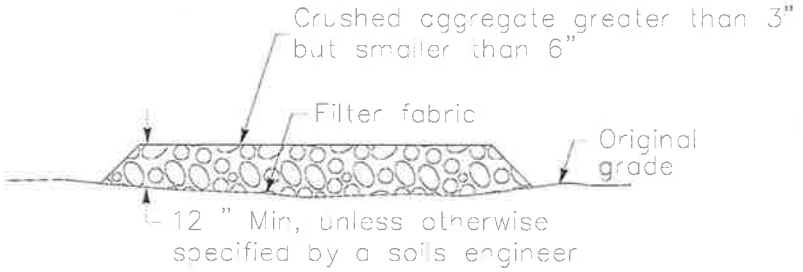
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Stabilized Construction Entrance/Exit TC-1



SECTION B–B
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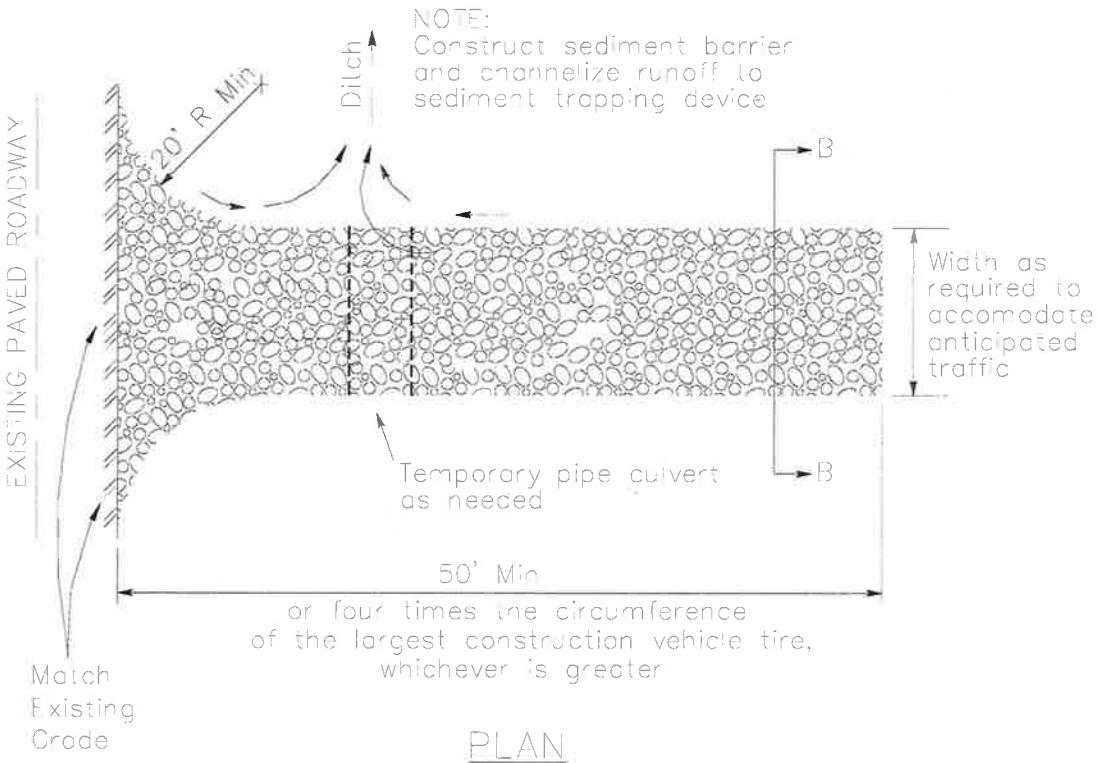

PLAN
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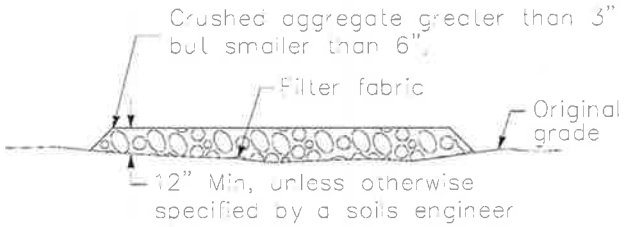
Stabilized Construction Entrance/Exit TC-1



SECTION B–B
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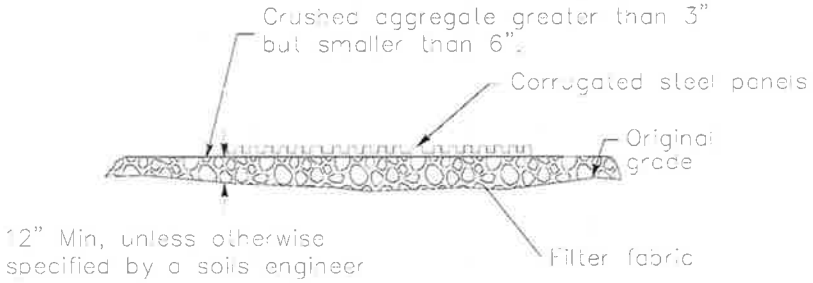

SECTION A–A
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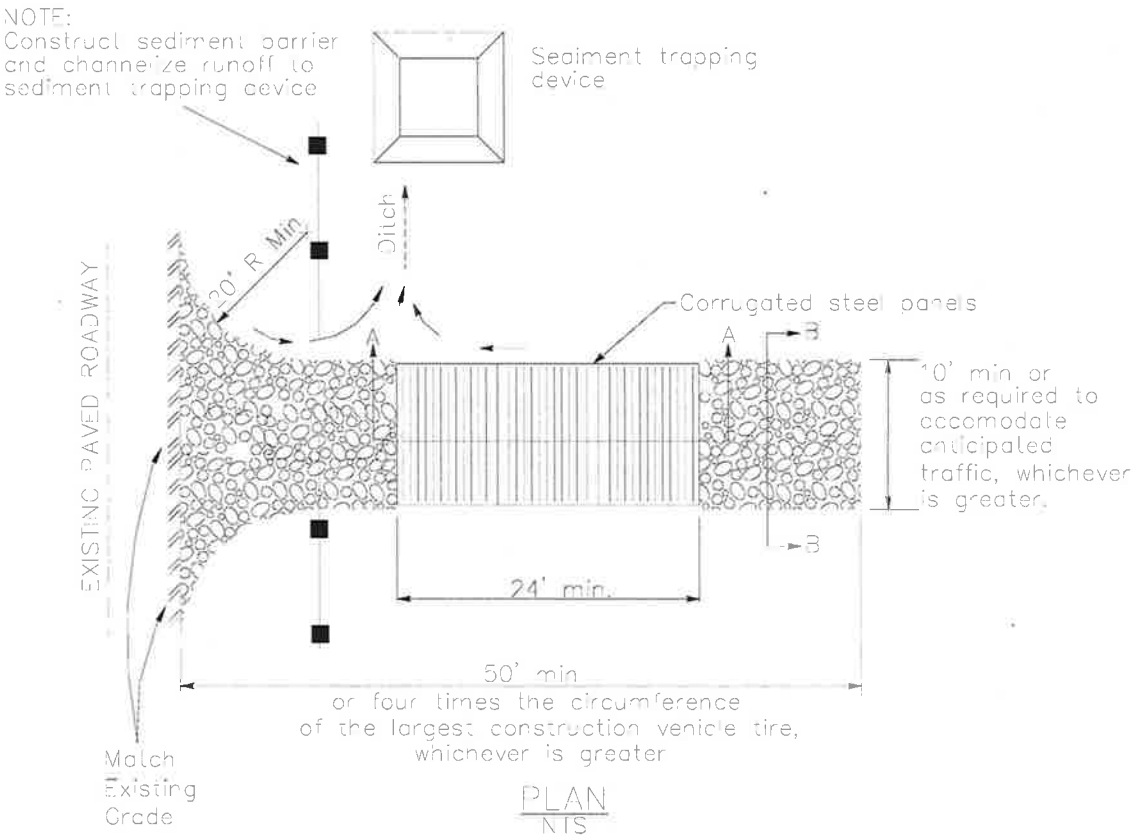
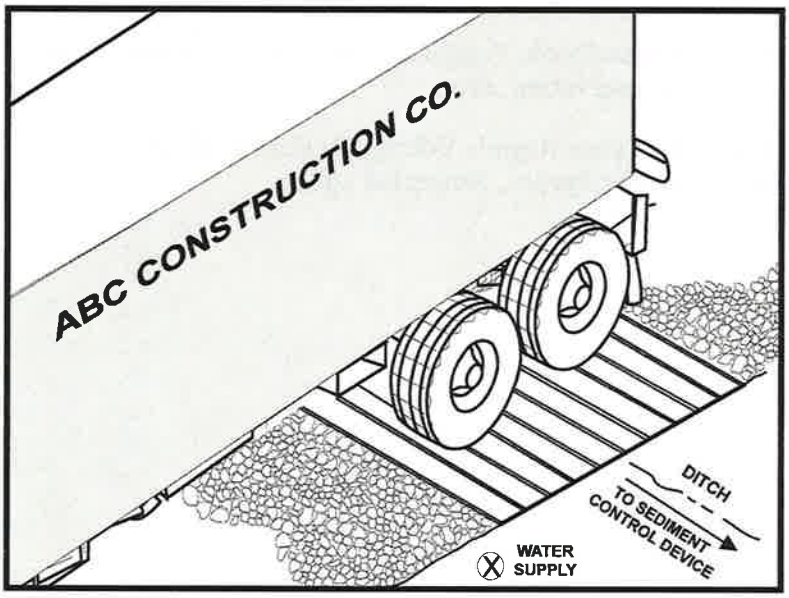


PLAN
NTS

Entrance/Outlet Tire Wash TC-3



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

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- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

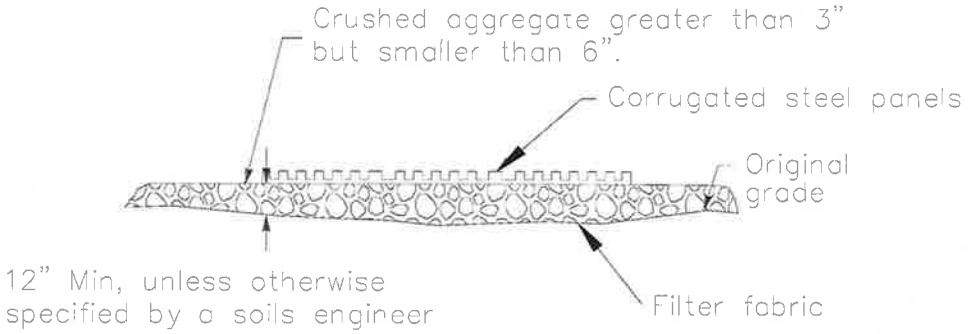
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A-A
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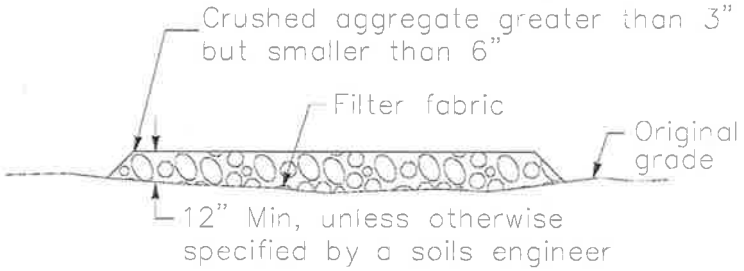

SECTION B-B
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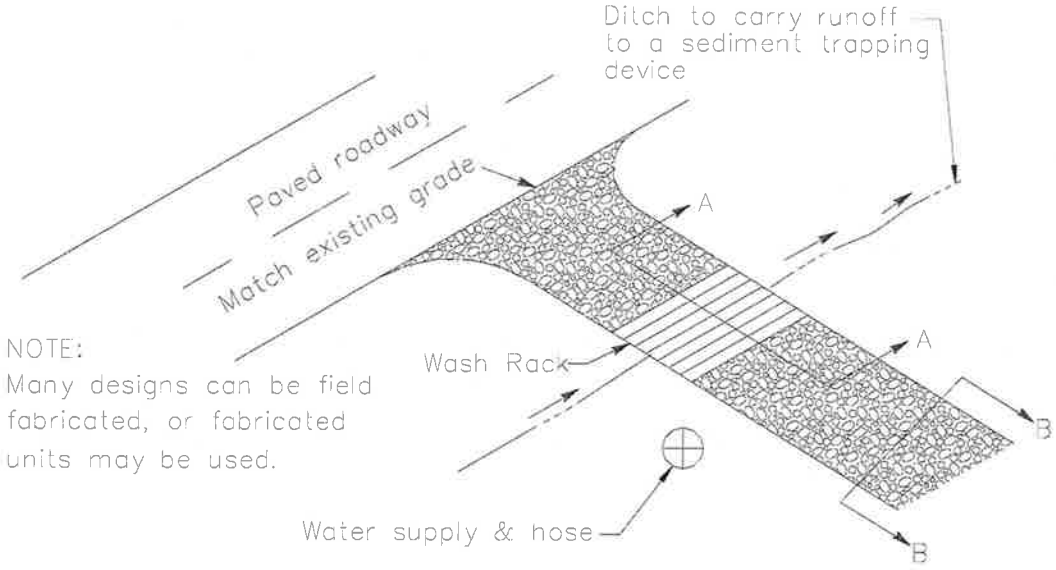
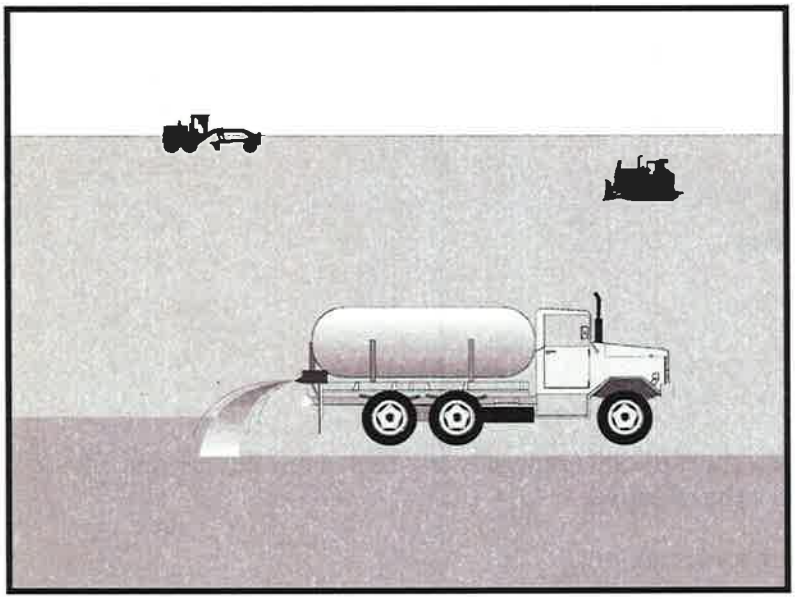


TYPICAL TIRE WASH
NOT TO SCALE

Wind Erosion Control WE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

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- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyls, acrylic), clay additives (e.g. bentonite, montimorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X			X
Disturbed Areas Subject to Traffic			X	X	X	X		X
Material Stockpiles		X	X	X			X	X
Demolition			X			X	X	
Clearing/ Excavation			X	X				X
Truck Traffic on Unpaved Roads			X	X	X	X	X	
Tracking					X	X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board, updated annually.

Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Water Conservation Practices NS-1

Categories		
EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.
- Direct construction water runoff to areas where it can soak

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into the ground or be collected and reused.

- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

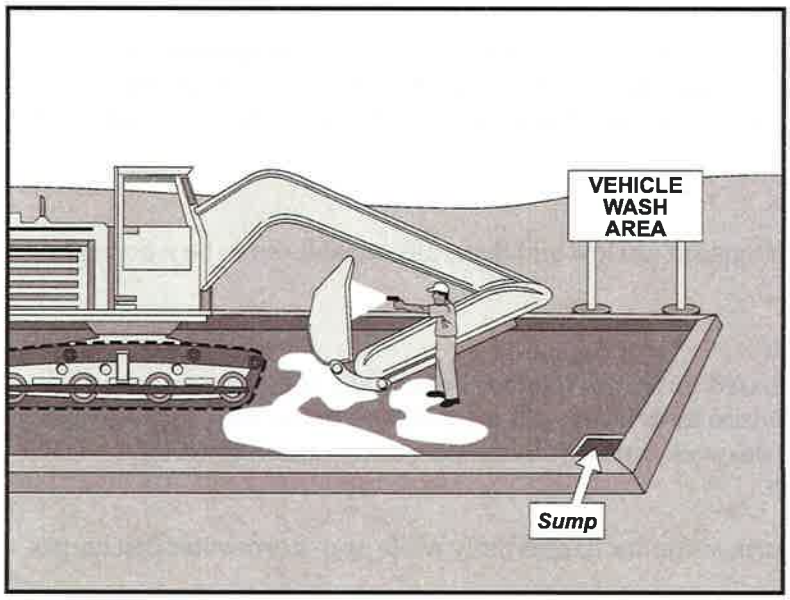
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Vehicle and Equipment Cleaning NS-8



Categories		
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☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

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- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

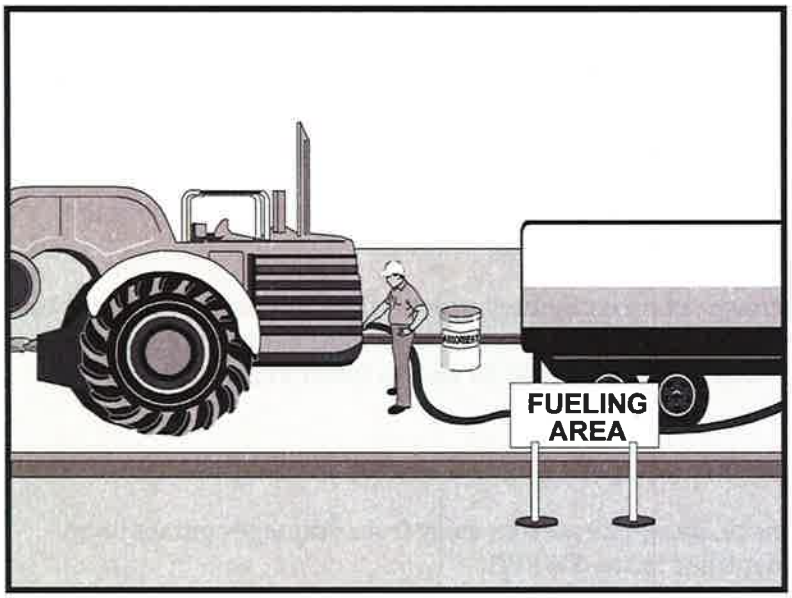
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.
- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should

be disposed of properly after use.

- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

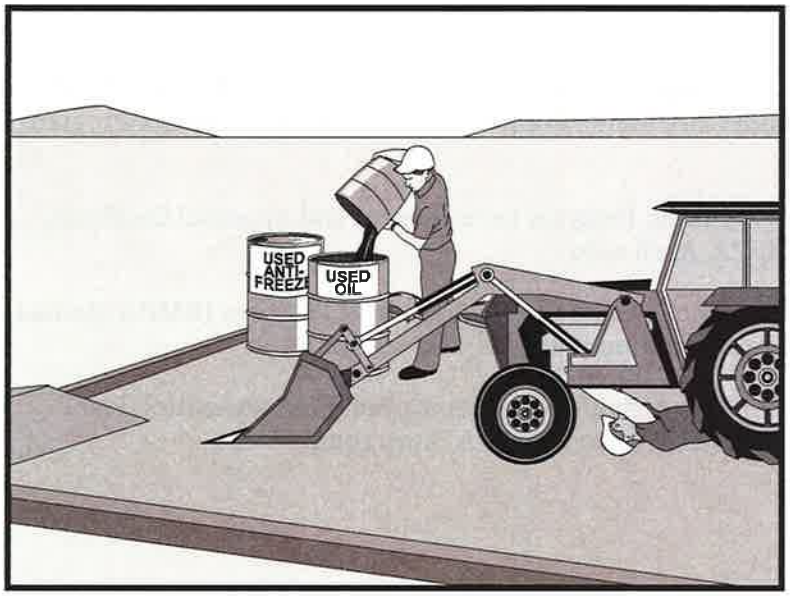
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Categories		
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Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and

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Equipment Fueling.

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.

- Repair leaks of fluids and oil immediately.

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

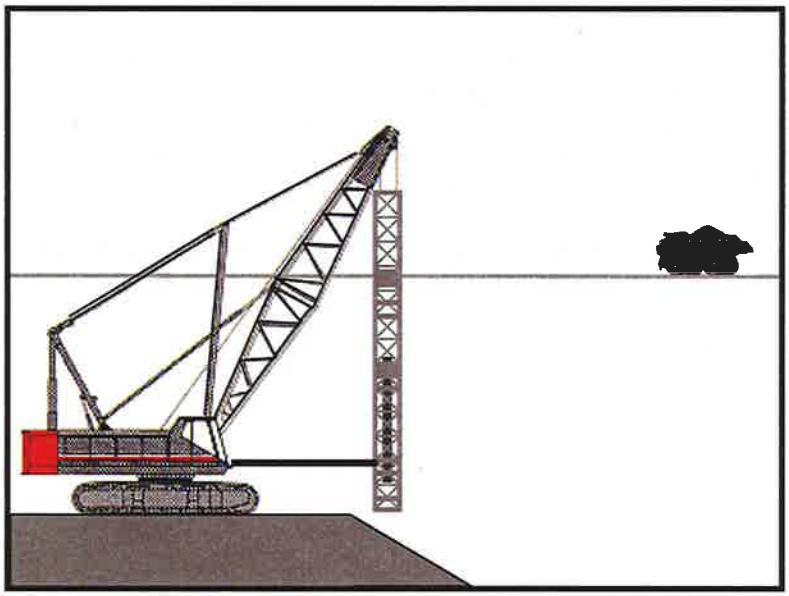
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Pile Driving Operations NS-11



Categories

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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

The construction and retrofit of bridges and retaining walls often include driving piles for foundation support and shoring operations. Driven piles are typically constructed of precast concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.

Suitable Applications

These procedures apply to all construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving (impact and vibratory) takes place, including operations using pile shells as well as construction of cast-in-steel-shell and cast-in-drilled-hole piles.

Limitations

None identified.

Implementation

- Use drip pans or absorbent pads during vehicle and equipment operation, maintenance, cleaning, fueling, and storage. Refer to NS-8, Vehicle and Equipment Cleaning, NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.
- Have spill kits and cleanup materials available at all locations of pile driving. Refer to WM-4, Spill Prevention

and Control.

- Equipment that is stored or in use in streambeds, or on docks, barges, or other structures over water bodies should be kept leak free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water must comply with all applicable permits.
- Implement other BMPs as applicable, such as NS-2, Dewatering Operations, WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.
- When not in use, store pile-driving equipment away from concentrated flows of stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runon and runoff by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain.
- Use less hazardous products, e.g., vegetable oil, when practicable.

Costs

All of the above measures can be low cost.

Inspection and Maintenance

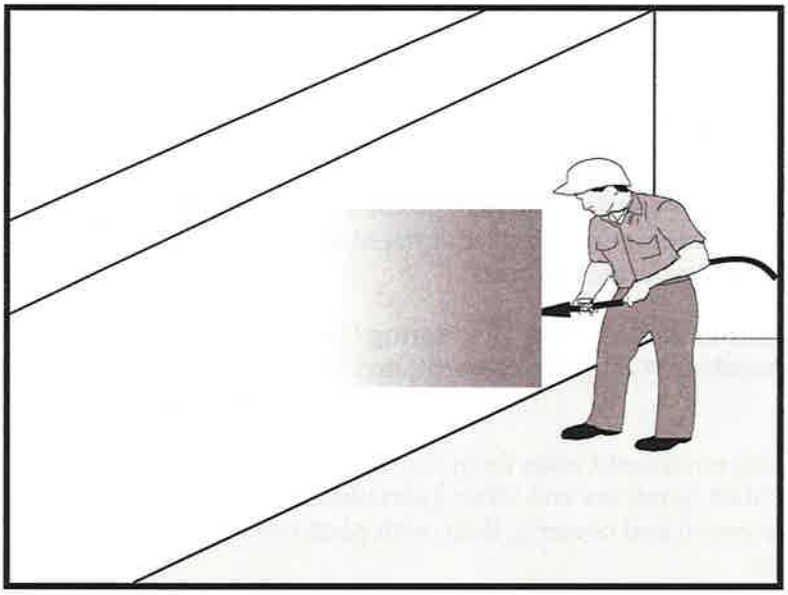
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift changes or at the end of the day and scheduled repairs as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Concrete Curing NS-12



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

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Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.
- Use proper storage and handling techniques for concrete curing compounds. Refer to WM-1, Material Delivery and Storage.
- Protect drain inlets prior to the application of curing compounds.
- Refer to WM-4, Spill Prevention and Control.

Water Curing for Bridge Decks, Retaining Walls, and other Structures

- Direct cure water away from inlets and watercourses to collection areas for evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

References

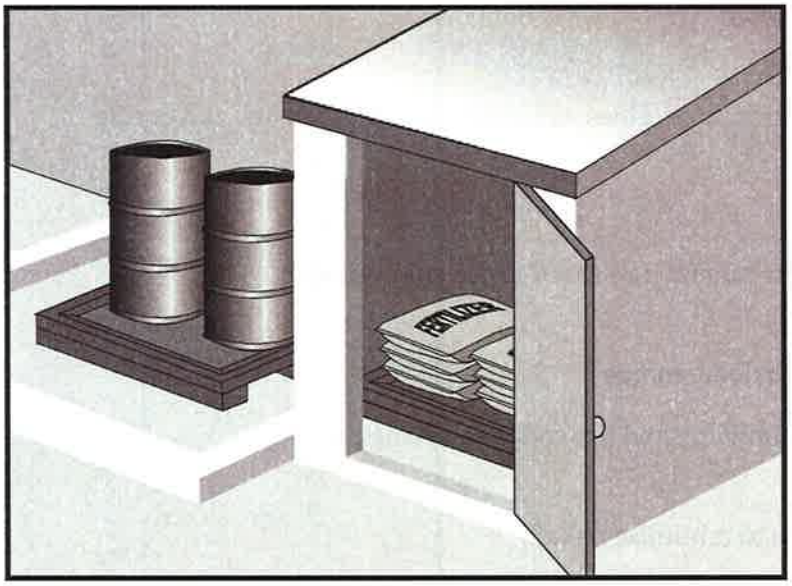
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Material Delivery and Storage WM-1



Categories		
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Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

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- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

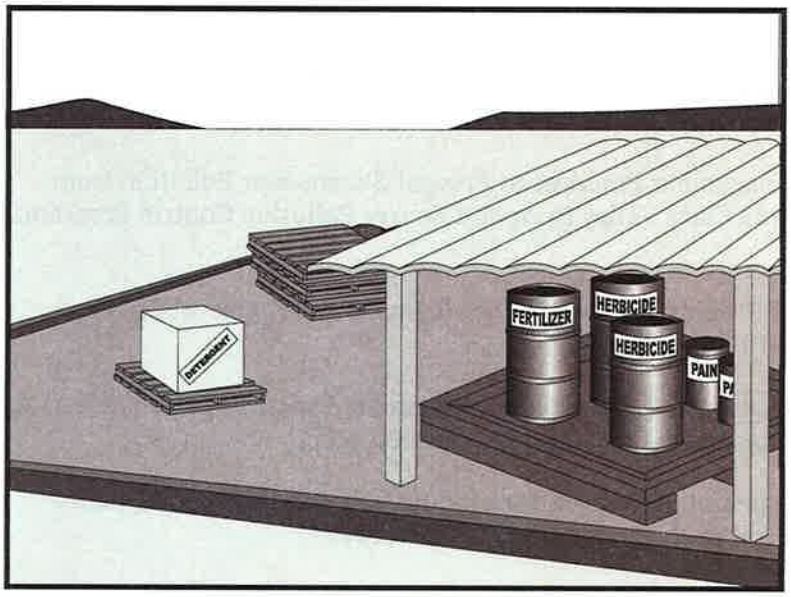
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use

WM-2



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

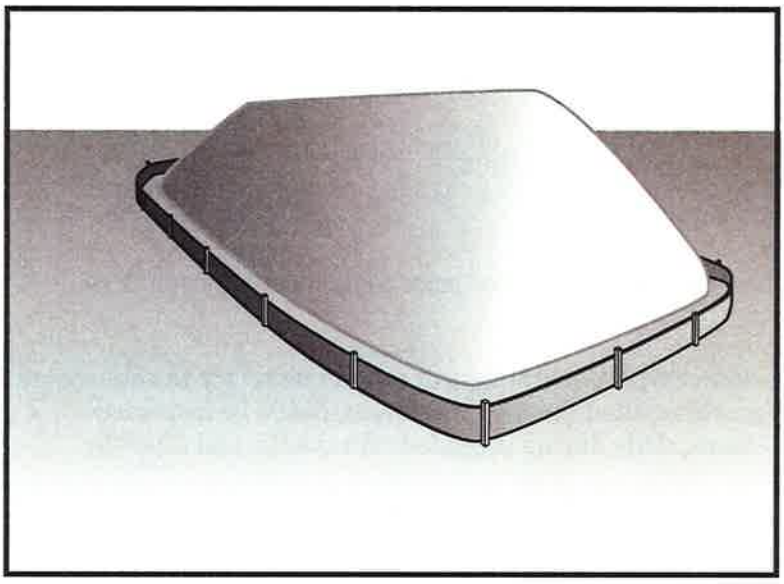
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Potential Alternatives

None

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

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- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater runon using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

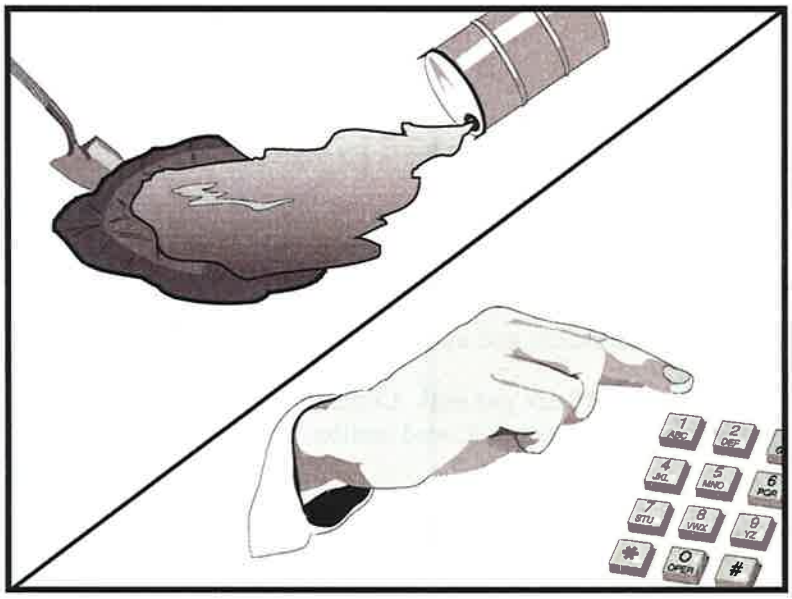
Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Spill Prevention and Control WM-4



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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

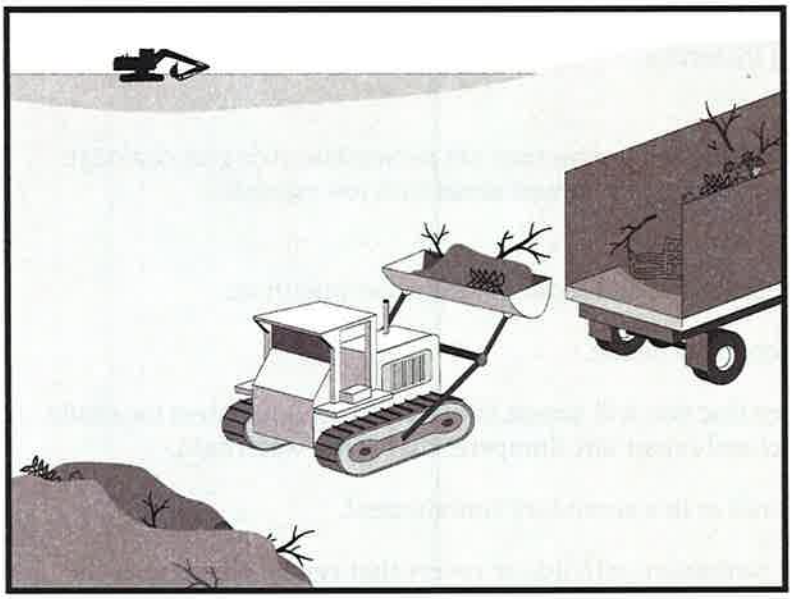
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials
- Highway planting wastes, including vegetative material,

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plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.

- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

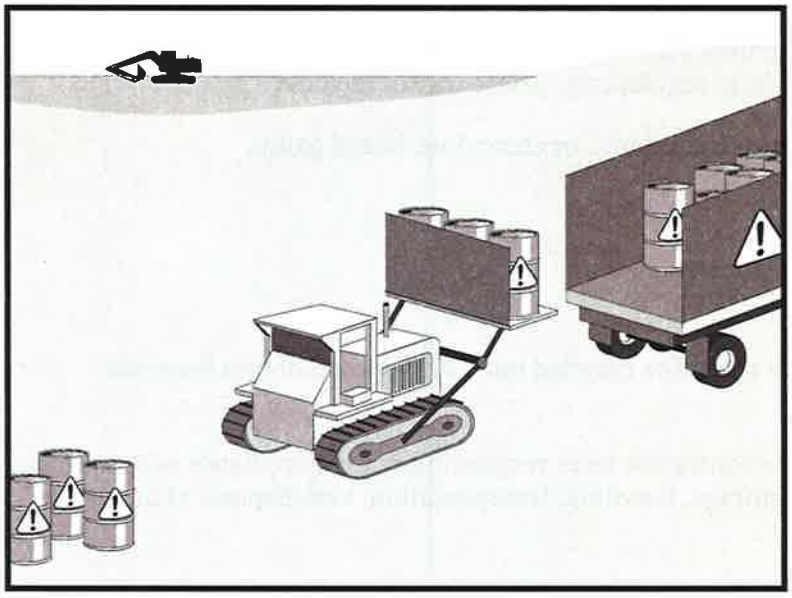
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Asphalt Products
- Concrete Curing Compounds
- Pesticides
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:
  - Ensure that adequate hazardous waste storage volume is available.
  - Ensure that hazardous waste collection containers are conveniently located.
  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.
  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.
  - Segregate potentially hazardous waste from non-hazardous construction site debris.
  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.
- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.

- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

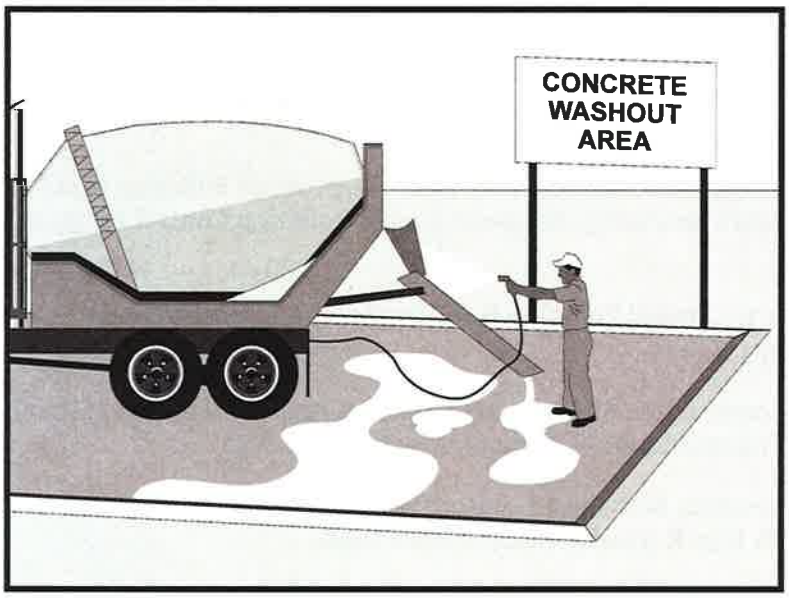
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.

The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result from demolition activities.
- Slurries containing portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.

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- Concrete trucks and other concrete-coated equipment are washed onsite.
- Mortar-mixing stations exist.
- Stucco mixing and spraying .
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washout should be lined so there is no discharge into the underlying soil.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.
- See typical concrete washout installation details at the end of this fact sheet.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.

- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.
- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

Concrete Demolition Wastes

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.
- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

Concrete Slurry Wastes

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).
  - Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a "roll-off"; this concrete washout facility should be properly sealed to prevent leakage, and should be removed from the site and replaced when the container reaches 75% capacity.
- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations..

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures. Roll-off concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

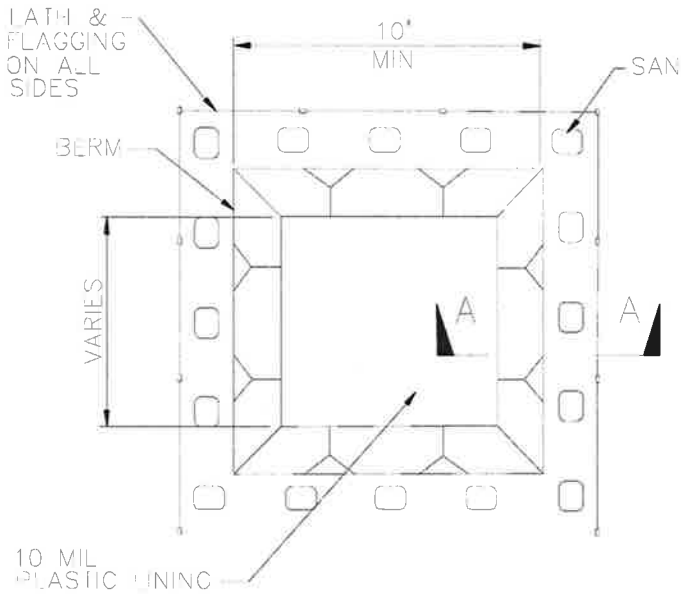
- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



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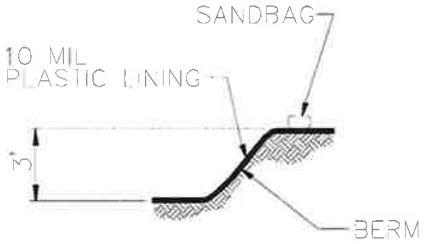

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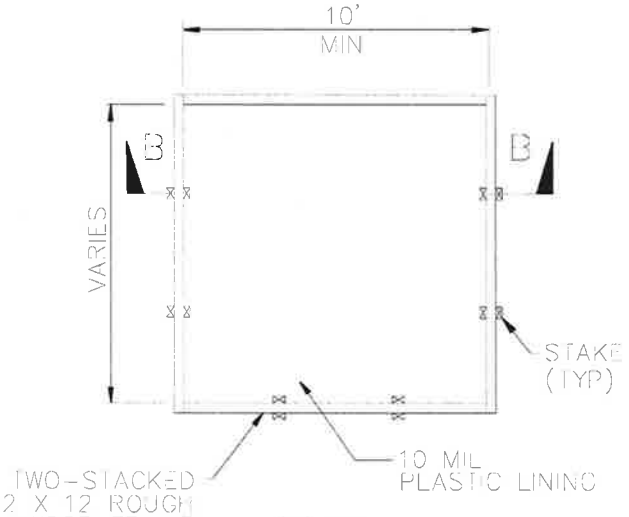

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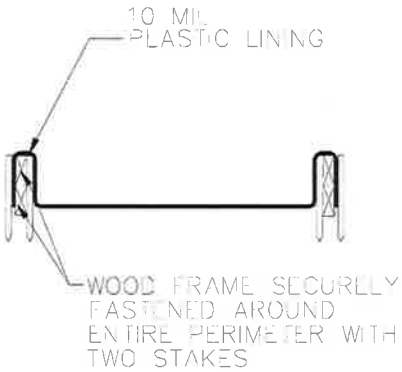

SECTION B - B
NOT TO SCALE

NOTES

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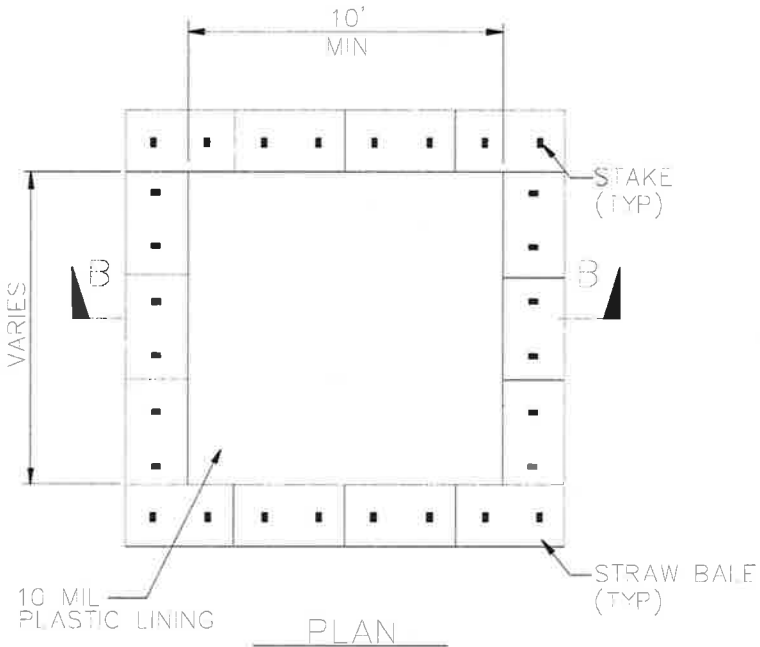
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



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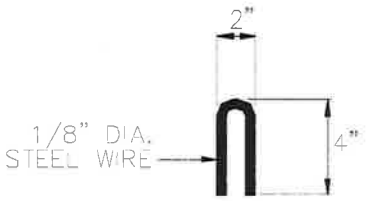
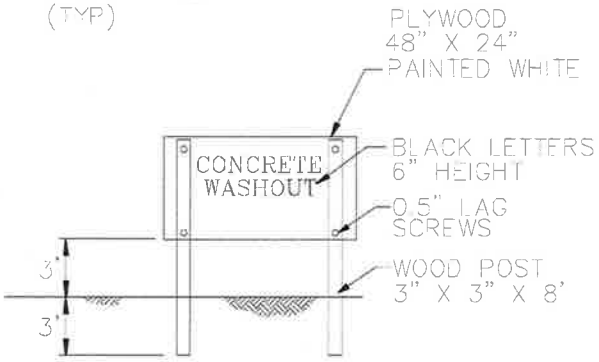
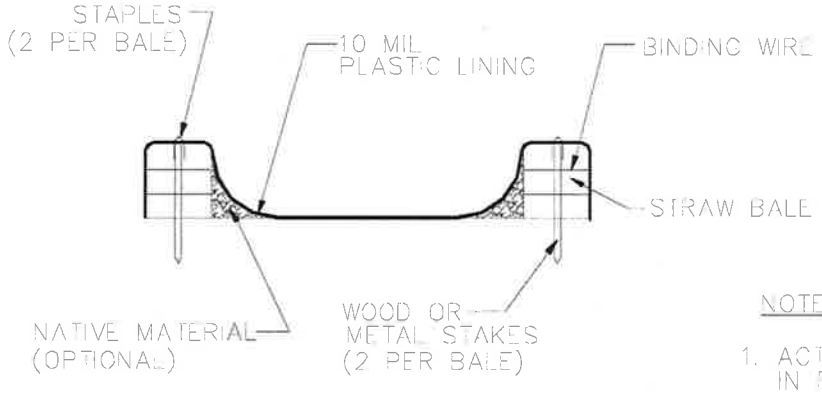
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

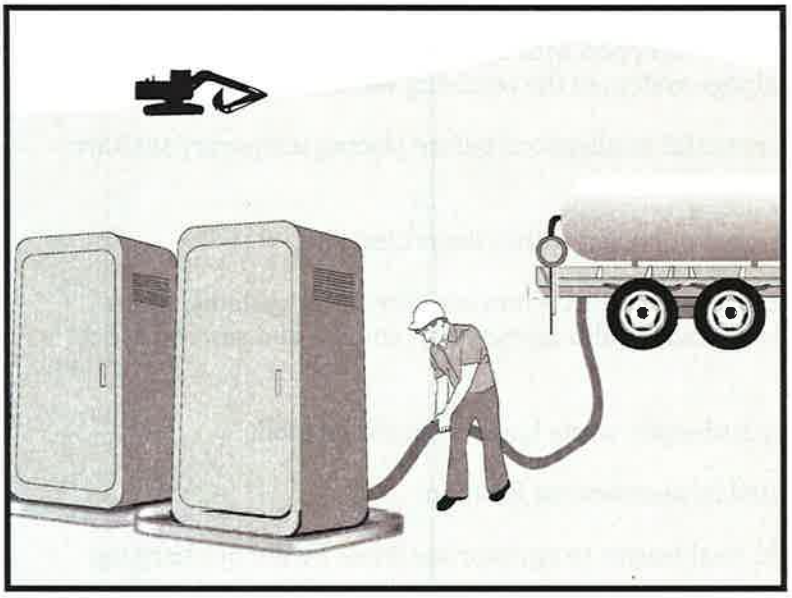


SECTION B-B
NOT TO SCALE

NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Sanitary/Septic Waste Management WM-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

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CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Appendix H
Construction Site Inspection Report Forms
(Blank and Completed Forms)

Risk Level 1 ***Visual Inspection Field Log Sheet***						
Date and Time of Inspection:				Report Date:		
Inspection Type:	□ Weekly	□ Before predicted rain	□ During rain event	□ Following qualifying rain event	□ Contained storm water release	□ Quarterly non-storm water
Site Information						
Construction Site Name:						
Construction stage and completed activities:					Approximate area of exposed site:	
Weather and Observations						
Date Rain Predicted to Occur:				Predicted % chance of rain:		
Estimate storm beginning: _____ (date and time)		Estimate storm duration:_____ (hours)		Estimate time since last storm: _____ (days or hours)	Rain gauge reading: _____ (inches)	
Observations: If yes identify location						
Odors	Yes □	No □				
Floating material	Yes □	No □				
Suspended Material	Yes □	No □				
Sheen	Yes □	No □				
Discolorations	Yes □	No □				
Turbidity	Yes □	No □				
Site Inspections						
Outfalls or BMPs Evaluated			**Deficiencies Noted**			
(add additional sheets or attached detailed BMP Inspection Checklists)						
Photos Taken:	Yes □	No □	Photo Reference IDs:			
Corrective Actions Identified (note if SWPPP/REAP change is needed)						
Inspector Information						
Inspector Name:				Inspector Title:		
Signature:					Date:	

BMP	Yes	No	N/A	Corrective Action
Preservation of Existing Vegetation				
Is temporary fencing provided to preserve vegetation in areas where no construction activity is planned?				
Location:				
Erosion Control				
Does the applied temporary erosion control provide 100% coverage for the affected areas?				
Are any non-vegetated areas that may require temporary erosion control?				
Is the area where erosion controls are used required free from visible erosion?				
Location:				
Location:				
Location:				
Location:				
Temporary Linear Sediment Barriers (Silt Fence, Fiber Rolls, Sandbag Barriers, etc.)				
Are temporary linear sediment barriers properly installed, functional and maintained?				
Are temporary linear sediment barriers free of accumulated litter?				
Is the built-up sediment less than 1/3 the height of the barrier?				
Are cross barriers installed where necessary and properly spaced?				
Location:				
Location:				
Location:				
Location:				
Stockpiles				
Are all locations of temporary stockpiles, including soil, hazardous waste, and construction materials in approved areas?				
Are stockpiles protected from run-on, run-off from adjacent areas and from winds?				
Are stockpiles located at least 15 m from concentrated flows, downstream drainage courses and storm drain inlets?				
Are required covers and/or perimeter controls in place?				
Location:				
Location:				
Location:				
Location:				
Concentrated Flows				
Are concentrated flow paths free of visible erosion?				

BMP	Yes	No	N/A	Corrective Action
Location:				
Location:				
Location:				
Location:				
Tracking Control				
Is the entrance stabilized to prevent tracking				
Is the stabilized entrance inspected daily to ensure that it is working properly				
Are points of ingress/egress to public/private roads inspected and swept and vacuumed as needed?				
Are all paved areas free of visible sediment tracking or other particulate matter?				
Location:				
Location:				
Location:				
Location:				
Wind Erosion Control				
Is dust control implemented?				
Location:				
Location:				
Dewatering Operations				
Are all one-time dewatering operations covered by the General Permit inspected before and as they occur and BMPs implemented as necessary during discharge?				
Is ground water dewatering handled in conformance with the dewatering permit issued by the RWQCB?				
Is required treatment provided for dewatering effluent?				
Location:				
Location:				
Location:				
Vehicle & Equipment Fueling and Maintenance				
Are vehicle and equipment fueling, and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermeable surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, and maintenance areas located at least 100 feet away from downstream drainage facilities and watercourses and protected from run-on and run-off?				

BMP	Yes	No	N/A	Corrective Action
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Location:				
Location:				
Location:				
Location:				
Waste Management & Materials Pollution Control				
Are material storage areas and washout areas protected from run-on and run-off, and located at least 100 feet from concentrated flows and downstream drainage facilities?				
Are all material handling and storage areas clean; organized; free of spills, leaks, or any other deleterious material; and stocked with appropriate clean-up supplies?				
Are liquid materials, hazardous materials, and hazardous wastes stored in temporary containment facilities?				
Are bagged and boxed materials stored on pallets?				
Are hazardous materials and wastes stored in appropriate, labeled containers?				
Are proper storage, clean-up, and spill-reporting procedures for hazardous materials and wastes posted in open, conspicuous and accessible locations adjacent to storage areas?				
Are temporary containment facilities free of spills and rainwater?				
Are temporary containment facilities and bagged/boxed materials covered?				
Are spills from mobile equipment fueling and maintenance properly contained and cleaned up?				
Is the site free of litter?				
Are covered trash receptacles provided in the yard, field trailer areas, and at locations where workers congregate for lunch and break periods?				
Is litter from work areas collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				
Are waste management receptacles filled at or beyond capacity?				
Location:				
Location:				
Location:				
Location:				
Illicit Connection/ Discharge				
Is there any evidence of illicit discharges or illegal dumping on the project site?				
If yes, has the Owner/Operator been notified?				

BMP	Yes	No	N/A	Corrective Action
Location:				
Location:				
Location:				
Location:				
Discharge Points				
Are discharge points and discharge flows free from visible pollutants?				
Are discharge points free of any significant sediment transport?				
Location:				
Location:				
Location:				
Location:				
SWPPP Update				
Does the SWPPP and Project Schedule adequately reflect the current site conditions and contractor operations?				
Are all BMPs shown on the water pollution control drawings installed in the proper location(s) and according to the details in the SWPPP?				
Location:				
Location:				
Location:				
Location:				
General				
Are there any other potential concerns at the site?				
Location:				
Location:				
Location:				
Location:				
Storm Water Monitoring				
Does storm water discharge directly to a water body listed in the General Permit as impaired for sediment/sedimentation or turbidity?				
If yes, were samples for sediment/sedimentation or turbidity collected pursuant to the sampling and analysis plan in the SWPPP?				
Did the sampling results indicate that the discharges are causing or contributing to further impairment?				
If yes, were the erosion/sediment control BMPs improved or maintained to reduce the discharge of sediment to the water body?				
Were there any BMPs not properly implemented or breaches, malfunctions, leakages or spills observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water?				

BMP	Yes	No	N/A	Corrective Action
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				
If sampling indicated pollution of the storm water, were the leaks, breaches, spills, etc., cleaned up and the contaminated soil properly disposed of?				
Were the BMPs maintained or replaced?				
Were soil amendments (e.g., gypsum, lime) used on the project?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan in the SWPPP?				
If sampling indicated pollution of the storm water by the use of the soil amendments, is there a contingency plan for retention onsite of the polluted storm water?				
Did storm water contact stored materials or waste and run off the construction site? (Materials not in watertight containers, etc.)				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan in the SWPPP?				

Risk Level 1 ***Effluent Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	□ Storm water	□ Non-storm water	□ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Additional Sampling Notes:
Time End:

Appendix I
Site-Specific Rain Event Action Plan
(Not Used)

Appendix J

Training Reporting Form

Appendix K

Weather Reports and Rain Gauge Log

Weather Reports and Rain Gauge Log

Date	Time	Rain Gauge Reading	Name and Company

APPENDIX A-9

PRELIMINARY GEOTECHNICAL EVALUATION

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

PRELIMINARY GEOTECHNICAL EVALUATION
MANDALAY GENERATING STATION REPOWERING PROJECT
393 NORTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

PREPARED FOR:
NRG Energy, Inc.
1201 Fannin Street
Houston, Texas 77002

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
475 Goddard, Suite 200
Irvine, California 92618

November 27, 2013
Project No. 209044001

November 27, 2013
Project No. 209044001

Mr. Chris Curry
NRG Energy, Inc.
1201 Fannin Street
Houston, Texas 77002

Subject: Preliminary Geotechnical Evaluation
Mandalay Generating Station Repowering Project
393 North Harbor Boulevard
Oxnard, California

Dear Mr. Curry:

In accordance with your request and authorization, Ninyo & Moore has performed a preliminary geotechnical evaluation for the repowering of the Mandalay Generating Station at 393 North Harbor Boulevard in Oxnard, California. We understand that the results of this evaluation will be utilized in the assessment of preliminary foundation alternatives for the proposed repowering project. Our evaluation was conducted in general accordance with the scope of services presented in our proposal dated November 14, 2013. This report presents our preliminary findings and conclusions regarding the site geologic conditions and potential geologic and seismic hazards, and provides preliminary recommendations regarding mitigation of these hazards and geotechnical design alternatives.

We appreciate the opportunity to provide geotechnical consulting services for this project.

Sincerely,
NINYO & MOORE

Michael E. Rogers, PG, CEG
Senior Project Geologist

PROFESSIONAL GEOLOGIST
MICHAEL E. ROGERS
No. 2364
CERTIFIED
ENGINEERING
GEOLOGIST
Exp. 6/30/15
STATE OF CALIFORNIA

Soumitra Guha, PhD, GE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
SOUMITRA GUHA
NO. GE 2632
EXP. 6/30/15
GEOTECHNICAL
STATE OF CALIFORNIA

MER/SG/lr

Distribution: (1) Addressee (via e-mail)

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Appendices

1. INTRODUCTION

In accordance with your request and authorization and the California Energy Commission (CEC) guidelines, we have performed a preliminary geotechnical evaluation for the repowering of the Mandalay Generating Station (MGS) located at 393 North Harbor Boulevard in Oxnard, California (Figure 1). The existing MGS power unit was commissioned in 1959. We understand that NRG Energy, Inc. (NRG) is seeking preliminary geotechnical design alternatives for the site related to proposed upgrades to the existing facilities as part of the proposed repowering project.

Our geotechnical evaluation was based on review of readily available geologic, groundwater and seismic data, a site reconnaissance, limited subsurface exploration and engineering analyses. Recommendations to mitigate potential geologic hazards are presented, as appropriate. Preliminary geotechnical design considerations are also presented for planning purposes.

2. SCOPE OF SERVICES

Our geotechnical services for the project included the following:

- Review of readily available geologic maps, published geotechnical literature, geologic and seismic data, groundwater data, aerial photographs, and in-house information.
- Review of preliminary project plans provided to us by NRG.
- Geotechnical site reconnaissance to document the existing surficial conditions at the project site. During our site reconnaissance we marked proposed cone penetration test (CPT) sounding locations for utility clearance by Underground Service Alert.
- Attendance at a safety meeting with the facility safety officer prior to field exploration.
- Subsurface exploration consisting of the performance of three CPTs advanced to depths of up to approximately 50 feet. The CPT soundings were observed by a representative from our firm.
- Data compilation and preliminary geotechnical analysis of background and field data.
- Preparation of this report presenting the results of our data review, subsurface exploration and preliminary engineering analysis, as well as our conclusions and recommendations relative to the geotechnical aspects of the project's conceptual design and construction.

3. SITE DESCRIPTION

The existing MGS is located on the western edge of the gently sloping Oxnard coastal plain within a large agricultural region. The facility is bordered by the Pacific Ocean to the west, North Harbor Boulevard to the east, vacant land to the south and vacant land and the McGrath Lake wetlands to the north (Figure 2). The existing MGS facility and the proposed repowering area in the northwest part of the facility are situated on relatively level ground at an elevation of approximately 10 feet above mean sea level (MSL). The facility is bordered by sand dunes and an artificial berm that are elevated up to approximately 25 feet above MSL. We understand that the berm was constructed to protect the facility from flooding. Vegetation in the proposed repowering area consists of native coastal brush and groundcover. Surface water was not observed in the repowering area during our site visits.

The existing facilities at the site include the steam power generating plants, above-ground storage tanks, settling basins, pipelines, electrical switching and transmission facilities, office and maintenance/storage buildings, and other appurtenant features. Other improvements include asphalt- and concrete-paved driveways, parking lots, and storage areas, and minor landscaped areas.

4. PROJECT DESCRIPTION

Based on our review of the conceptual project plans, the proposed repowering improvements will be located in the northwest part of the facility, generally in the vicinity of our CPT sounding locations shown on Figure 2. Based on our experience, we anticipate that the new repowering improvements would generally consist of combustion gas turbine generators, heat recovery steam generators, steam turbine generators, auxiliary mechanical and electrical equipment, storage tanks, above-ground and buried piping and conduits, and related appurtenant structures and improvements. We anticipate that the project may also include construction of a control room building and/or electrical switchgear, and new pavements and hardscape improvements. In general, we anticipate that the proposed project improvements will be built at or near the existing site grades and earthwork associated with the construction would include preparation of structure

and equipment pads, pavement and hardscape areas, and trench excavations for pipelines and utility lines less than 10 feet deep.

Based on our previous experience, some of the anticipated repowering equipment is sensitive to settlement, particularly the combustion turbine generators, steam turbine generators and heat recovery steam generators. Foundation plans for the proposed improvements were not available for our review at the time of the preparation of this report.

5. SUBSURFACE EVALUATION

Our subsurface exploration at the site was performed on November 21, 2013, and consisted of the performance of three CPT soundings (CPT-1 through CPT-3). The locations of the CPT soundings are shown on Figure 2. Prior to the CPT soundings, Underground Service Alert was contacted to check for utility conflicts. In addition, the upper approximately 5 feet of the CPT holes were hand-augered for utility clearance. The CPTs were advanced to a depth of up to approximately 50 feet. Logs of the CPT soundings are presented in Appendix A.

6. GEOLOGY

6.1. Regional Geology

The project site is located on a coastal alluvial plain approximately 1½ miles south of the Santa Clara River mouth. The Edison Canal is located on the south side of the facility. Coastal wetlands are located north of the site. The site is bordered by sand dunes. The alluvial plain in the vicinity of the MGS facility is mapped as underlain by Holocene age alluvial flood plain deposits comprised predominantly of clay with interbedded sand and gravel layers (California Geological Survey [CGS], 2003). Young eolian (wind-blown) deposits generally comprised of sand and silt overlies the alluvium within the borders of the MGS site (CGS, 2003).

The project site is situated within the northwestern portion of the Transverse Ranges geomorphic province of southern California (Norris and Webb, 1990). The Transverse

Ranges geomorphic province is characterized by generally east to west-trending mountain ranges and fault systems, and is generally underlain by thick sequences of marine sedimentary rock.

6.2. Site Geology

Our subsurface evaluation to a depth of approximately 50 feet indicates that the site is predominantly underlain by sand and silty sand sediments, with some interbedded sandy silt and clay. Detailed profiles of the soils encountered beneath the site are presented on the CPT logs in Appendix A.

6.3. Groundwater

Groundwater was recorded in our exploratory CPTs at the time of exploration at a depth of approximately 9 feet. The CGS Seismic Hazard Zone report for this area indicates that the historic high groundwater in the vicinity of the site is approximately 5 feet below the ground surface (CGS, 2002a). Fluctuations in the depth to groundwater will occur due to tidal variations, seasonal precipitation, variations in ground elevations, groundwater pumping, projected sea level rise and other factors.

7. FAULTING AND SEISMICITY

7.1. Regional Seismicity

The site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structures. Figure 3 shows the approximate site location relative to the principal faults in the region. The site is located within a State of California Seismic Hazard Zone as an area considered susceptible to liquefaction (CGS, 2002b), as shown on Figure 4.

The Oak Ridge fault is located approximately 2.4 miles north of the site. Other known principal active faults within approximately 10 miles of the project site include the

Montalvo-Oak Ridge Trend, Ventura-Pitas Point, Simi-Santa Rosa, and Red Mountain (Table 1). Table 1 lists selected principal known active faults that may affect the project site and the maximum moment magnitude (M_{max}) as published by the CGS (Cao, et al., 2003). The approximate distances from the faults to the site listed in the table were calculated by the computer program FRISKSP (Blake, 2001).

Table 1 – Principal Active Faults

Fault	Approximate Fault-to-Site Distance [1] miles (kilometers)	Maximum Moment Magnitude [2] (M_{max})
Oak Ridge	2.4 (3.9)	7.1
Montalvo-Oak Ridge Trend	3.2 (5.2)	6.6
Ventura-Pitas Point	5.7 (9.2)	6.9
Simi-Santa Rosa	7.9 (12.7)	7.0
Red Mountain	10.2 (16.4)	7.0
Mission Ridge-Arroyo Parida-Santa Ana	15.4 (24.8)	7.2
Anacapa-Dume	15.6 (25.1)	7.5
Channel Island Thrust (Eastern)	16.0 (25.8)	7.5
San Cayetano	17.8 (28.7)	7.0
Malibu Coast	21.2 (34.1)	6.7
Santa Cruz Island	21.3 (34.3)	7.0
Santa Ynez (East)	21.5 (34.7)	7.1
North Channel Slope	26.9 (43.3)	7.4
Santa Ynez (West)	29.2 (47.0)	7.1
Santa Susana	29.5 (47.5)	6.7
Big Pine	32.4 (52.2)	6.9
Holser	32.5 (52.4)	6.5
Northridge (E. Oak Ridge)	34.1 (54.9)	7.0
Santa Rosa Island	39.6 (63.7)	7.1

Notes:
[1] Blake, 2001
[2] Cao, et al., 2003

8. POTENTIAL GEOLOGIC AND SEISMIC HAZARDS

Our preliminary evaluation included assessment of the potential geologic and seismic hazards that may impact the proposed project. The principal seismic hazards evaluated at the site are surface ground rupture, ground shaking, seismically induced liquefaction, and various manifestations of liquefaction-related hazards (e.g., dynamic settlement and lateral spreading). A brief description of these hazards and other geologic hazards are discussed in the following

sections. Where appropriate, recommendations to mitigate potential geologic hazards, as noted, are provided in subsequent sections.

8.1. Surface Fault Rupture

Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. Based on our review of referenced geologic and fault hazard data, the site is not transected by known active or potentially active faults. The Oak Ridge fault is located approximately 2.4 miles north of the site (Figure 3). The site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone, Hart and Bryant, 1997). Therefore, the potential for surface rupture at the site is relatively low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

8.2. Seismic Ground Shaking

Earthquake events from one of the regional active or potentially active faults near the project area could result in strong ground shaking which could affect the site. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. The type of construction also affects how particular structures and improvements perform during ground shaking.

The 2013 California Building Code (CBC) recommends that the design of structures be based on the horizontal peak ground acceleration (PGA) having a 1 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for the risk-targeted PGA_{MCE} is approximately 4,975 years. The probabilistic PGA_{MCE} for the site was calculated as 0.88g using the United States Geological Survey (USGS, 2013) ground motion calculator (web-based). The mapped and design PGA were estimated to be 0.81g and 0.59g, respectively, using the USGS (2013) calculator and the American Society of Civil Engineers (ASCE) 7-10 Standard.

8.3. Liquefaction, Dynamic Settlement and Lateral Spreading

Liquefaction is the phenomenon in which loosely deposited granular soils located below the water table undergo rapid loss of shear strength due to excess pore pressure generation when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to rapid rise in pore water pressure causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The project site is mapped in a State of California Seismic Hazard Zone as potentially liquefiable as shown on Figure 4 (CGS, 2002b). The results of the CPT soundings were utilized to evaluate the potential for liquefaction at the project site. The liquefaction analysis was based on the National Center for Earthquake Engineering Research (NCEER) procedure (Youd, et al., 2001) developed from the methods originally recommended by Seed and Idriss (1982) using the computer program LiquefyPro (CivilTech, 2008). The design groundwater level was considered to be at a depth of 5 feet below the existing grade. A design PGA of 0.59g was used in our analysis for an earthquake magnitude of 7.0. Our analysis of soil profiles at the three CPT locations indicated that scattered saturated sandy alluvial layers located between depths of approximately 5 and 50 feet are potentially liquefiable during the design earthquake event.

To evaluate the potential impact from liquefaction, we also performed analysis to estimate the magnitude of dynamic settlement due to liquefaction. In order to estimate the amount of post-earthquake settlement, the method proposed by Tokimatsu and Seed (1987) is generally used in which the seismically induced cyclic stress ratios and corrected blow counts (N-values) are correlated to the volumetric strain of the soil. The amount of soil settlement during a strong seismic event depends on the thickness of the liquefiable layers and the density and/or consistency of the soils. Our analysis indicates that liquefaction induced

dynamic settlement at the project site may range from approximately ½-inch to 2 inches, with an average dynamic settlement on the order of 1 inch. A majority of the dynamic settlement is expected to occur within the near-surface alluvial soils up to a depth of about 15 feet below the surface.

Lateral spreading of the ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope, channel) but has also been observed to a lesser extent on ground surfaces with gentle slopes. An empirical model developed by Youd, et al. (2002) is typically used to predict the amount of horizontal ground displacement within a site. For sites located in proximity to a free-face, the amount of lateral ground displacement is strongly correlated with the distance of the site from the free-face. Other factors such as earthquake magnitude, distance from the earthquake epicenter, thickness of the liquefiable layers, and the fines content and particle sizes of the liquefiable layers also affect the amount of lateral ground displacement.

The project site includes free-face slopes along the Edison Canal on the south side of the existing MGS facility and also gentle sloping ground condition toward the ocean along the west side of the facility. The canal is located approximately 700 feet south of the proposed repowering area. Based on the relative density of the potentially liquefiable soil layers and the distance from the canal, the repowering site is not considered susceptible to significant seismically induced lateral spread toward the canal or the ocean.

8.4. Mass Wasting

Mass wasting is an erosional process by which soil or earth material is loosened or dissolved and removed from its original location. Erosion can occur by varying processes and may occur at the project site where bare soil is exposed to wind or moving water (both rainfall and surface runoff). The processes of erosion are generally a function of material type, terrain steepness, rainfall or irrigation levels, surface drainage conditions, and general land uses.

Our site reconnaissance and subsurface exploration indicates that the near-surface soils at the project site are predominantly comprised of sand and silty sand. Sandy soils typically have low cohesion and have a relatively higher potential for erosion from surface runoff. Surface soils with higher amounts of clay or silt tend to be less erodible as the clay and silt acts as a binder to hold the soil particles together.

Construction of the proposed project would result in ground surface disruption during excavation, grading, and trenching that would create the potential for erosion to occur. However, a Storm Water Pollution Prevention Program (SWPPP) incorporating the Best Management Practices (BMPs) for erosion control is expected to be prepared prior to the start of construction. In addition, the topographic gradients at the project site are relatively gentle, which would tend to reduce the potential for off-site runoff and erosion. During long-term operation of the new facilities, surface drainage design provisions and site maintenance would manage soil erosion at the site. Therefore, the potential impacts due to mass wasting and erosion are considered to be relatively low.

8.5. Slope Stability

Landslides, slope failures, and mudflows of earth materials generally occur where slopes are steep and/or the earth materials too weak to support themselves. Earthquake-induced landslides may also occur due to seismic ground shaking. The repowering improvement area is relatively flat and there are no slopes within the project limits, nor are slopes proposed as part of the project development. Therefore, there is no potential for impacts related to landslides or mudflows within the limits of the repowering improvement area.

8.6. Subsidence

Subsidence is characterized as a sinking of the ground surface relative to surrounding areas, and can generally occur where deep soil deposits are present. Subsidence in areas of deep soil deposits is typically associated with regional groundwater withdrawal or other fluid withdrawal from the ground such as oil and natural gas. Subsidence can result in the

development of ground cracks and damage to foundations, buildings and other improvements.

Historic groundwater withdrawal on the Oxnard Plain since the late 1800s resulted in approximately 3 feet of land subsidence in the site region. The land subsidence occurred primarily during the drought of the late 1920s and during the agricultural expansion of the 1950s and 1960s. Artificial recharge of groundwater in the Oxnard Plain beginning in the 1930s abated the ground subsidence by 1993 (USGS, 2003). Therefore, the potential for subsidence to affect the project site is relatively low.

8.7. Compressible/Collapsible Soils

Compressible soils are generally comprised of soils that undergo consolidation when exposed to new loading, such as added fill soil or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Buildings, structures and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present.

Based on our subsurface exploration, the project site is generally underlain by sandy eolian and alluvial sediments. The presence of existing fill soils or natural soils that may be compressible were not evaluated as part of our preliminary study, and should be further evaluated through exploratory borings and laboratory testing during the detailed design phase of the project. Due to the high groundwater levels encountered at the site and the reported historically high groundwater, it is our opinion that the site soils are not susceptible to significant hydro-collapse.

8.8. Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall,

irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors.

Volumetric change of expansive soil may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials. Constructing project improvements on soils known to be potentially expansive could have a significant impact to the project. Our surface reconnaissance and limited subsurface exploration indicate that the near-surface soils at the project site are predominantly comprised of sandy soils. These soils typically have a low potential for expansion. Therefore, the potential for expansive soils to affect the project site is relatively low.

8.9. Groundwater

During our subsurface exploration, groundwater was recorded in our CPTs at a depth of approximately 9 feet below the ground surface. Based on our background review, historic high groundwater levels near the site have been mapped at approximately 5 feet below the ground surface. Groundwater levels will vary and may be influenced by tidal fluctuations, precipitation, irrigation, groundwater pumping, projected sea level rise and other factors. Based on our subsurface exploration and the reported historic groundwater levels, groundwater may be encountered during excavation activities at the site. Groundwater, if encountered, could have potential impacts on excavations and construction activities for the project. Therefore, the potential impacts of groundwater should be evaluated prior to construction, particularly in areas of deeper excavations.

8.10. Tsunami Run-Up

Tsunamis are open-sea waves generated by earthquakes that can impact low-lying coastal areas. Water surge caused by tsunamis is measured by distance of run-up on the shore. As shown on Figure 5, the project site is located adjacent to a State of California Tsunami Inundation Area mapped for susceptibility to tsunami run-up hazard (California Emergency Management Agency, 2009). The potential tsunami inundation area is located along the

beach on the west side of the dunes that border the west side of the site (Figure 5). The dunes are elevated up to approximately 25 feet above MSL and offer some protection to the facility from tsunami run-up. However, due to the site location in an area mapped as susceptible to tsunami run-up hazards, the potential for tsunami run-up hazard at the site and possible mitigation techniques should be evaluated during the detailed design phase of the project.

8.11. Sea Level Rise

The State Coastal Conservancy (Conservancy) adopted a Policy Statement on Climate Change on June 4, 2009 (State of California Coastal Conservancy, 2009). The Climate Change Policy addresses impacts related to global warming, including projected sea level rise, and it describes strategies and criteria that the Conservancy uses to address sea level rise. California's coastal areas are anticipated to experience impacts due to the predicted sea level rise, potentially more severe El Niño climate events, increased storm frequency and intensity, and higher coastal erosion rates (State of California Coastal Conservancy, 2009). For assessment of coastal development projects, the Conservancy has adopted a sea level rise scenario of 16 inches by 2050 and 55 inches by 2100.

9. CONCLUSIONS

Based on the results of our preliminary geotechnical evaluation, the project site is considered suitable for the proposed repowering improvements from a geotechnical perspective. There are no known geotechnical conditions that would preclude the proposed construction provided the recommendations of this report and appropriate construction practices are followed. In general, the following conclusions were made based on our limited evaluation:

- The site is underlain by eolian and alluvial deposits consisting predominantly of sand and silty sand with some interbedded sandy silt and clay.
- Groundwater was recorded at a depth of about 9 feet below the surface at the time of our CPT soundings. Historic high groundwater is approximately 5 feet below the ground surface. Groundwater should be anticipated and planned for by the contractor during excavations for the proposed repowering improvements.

- The site soils should be generally excavatable with earthmoving equipment in good working condition.

- The risk-targeted probabilistic PGA_{MCE} for the site was calculated as 0.88g using the United States Geological Survey (USGS, 2013) ground motion calculator (web-based). The mapped and design PGA were estimated to be 0.81g and 0.59g, respectively, using the USGS (2013) calculator.

- The subsurface soils are susceptible to liquefaction during the design seismic event. Our analysis indicates that some of the granular soil layers to a depth of approximately 50 feet below the existing grade could liquefy during the design seismic event.

- Post-earthquake dynamic ground settlements ranging from approximately ½-inch to 2 inches are estimated to occur in relatively saturated soils located below the groundwater to a depth of approximately 50 feet. We estimate that, on an average, dynamic settlement will be on the order of 1 inch across the site. A majority of the dynamic settlement is expected to occur within the near-surface alluvial soils up to a depth of about 15 feet below the surface.

- Liquefaction-induced lateral spread is not a significant design concern at the proposed repowering site.

- The site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone). Based on our review of published geologic maps and aerial photographs, no known active or potentially active faults underlie the site. The potential for surface fault rupture at the site is considered to be low.

10. PRELIMINARY MITIGATION ALTERNATIVES AND RECOMMENDATIONS

The potential geologic and seismic hazards described above may be mitigated by employing sound engineering practice in the design and construction of the new power generating facilities and associated improvements. This practice includes the implementation of appropriate geotechnical recommendations during the design and construction of the improvements at the site. Typical methods to mitigate potential significant hazards that may be encountered during the construction of the improvements are described in the following sections.

Prior to design, a detailed subsurface geotechnical evaluation should be performed to address the site-specific conditions at the locations of the planned improvements and to provide detailed recommendations for design and construction.

10.1. Hazard Mitigation

Mitigation alternatives for potentially significant impacts at the project site are provided in the following sections.

10.1.1. Seismic Ground Shaking

Mitigation of the potential impacts of seismic ground shaking can be achieved through project design. During the detailed design phase, site-specific seismic design parameters would be developed from detailed geotechnical evaluation for use by the project structural engineer. Structural elements of the project can then be designed to resist or accommodate appropriate site-specific ground motions and to conform to the current seismic design standards.

10.1.2. Liquefaction and Dynamic Settlement

Mitigation alternatives for potential dynamic settlement related to liquefaction include supporting structures on deep pile foundations that extend through the liquefiable zones into competent material. Alternatively, densification of the liquefiable soils using in-situ ground improvement techniques such as vibro-replacement stone columns, rammed aggregate piers or compaction grouting would mitigate the liquefaction hazard and the new structures could then be supported on shallow mat foundation systems. However, based on our limited evaluation, the liquefaction induced dynamic settlement at the repowering site is considered to be at a level that does not necessitate specialized ground improvement or structural mitigation techniques. We anticipate that the proposed structures may be supported on relatively shallow spread footings on foundation soils that are improved through standard remedial grading methods (e.g., removal and recompaction of foundations soils in place).

10.1.3. Compressible Soils

To mitigate potential settlement at the site, the major power generating structures can be supported on mat foundations designed to limit settlement to acceptable levels so that structures are not adversely impacted. To mitigate potential settlement for other

relatively light minor structures, new pavements and hardscape, loose/soft soils encountered at the subgrade and foundation levels of these improvements during construction can be removed and replaced with suitable compacted fill, based on detailed design stage recommendations.

10.1.4. Groundwater

The subject property includes a relatively flat site with a ground surface elevation of approximately 10 feet above mean sea level. Groundwater was observed at a depth of approximately 9 feet below the existing grade during our field exploration. The historically shallow groundwater near the site is reported at approximately 5 feet below the ground surface. Variations in groundwater will occur due to tidal fluctuations, seasonal precipitation, variations in ground elevations, groundwater pumping, projected sea level rise and other factors.

During the design phase of the project, additional evaluation of groundwater and fluctuations in groundwater levels should be performed. The impacts associated with groundwater are anticipated to involve construction excavations and possible below-grade structures. Excavations that extend below groundwater would involve construction dewatering to maintain excavations in a relatively dry condition. Below-grade structures that extend below groundwater, including pipelines, vaults, and retention basins, will need to be designed to resist hydrostatic uplift pressures due to groundwater and would involve waterproofing, as appropriate.

10.1.5. Tsunami Run-Up

Mitigation of tsunami run-up hazards includes structural and civil engineering evaluation, strengthening of seafront structures and providing emergency warning systems. Tsunami warning systems include the seismic Sea-Wave Warning System for the Pacific Ocean operated by a cooperative program of nations around the Pacific Rim and the Alaska Tsunami Warning Center operated by the National Weather Service.

Structural reinforcement at the site can be included for tsunami protection, as deemed appropriate at the detailed design stage by the project structural engineer.

10.1.6. Sea Level Rise

The effects of projected sea level rise are anticipated to increase slowly as higher tides and storm waves begin to impact the beach and dunes west of the repowering area. The existing dunes are up to approximately 25 feet above MSL and should continue to provide protection to the site during the predicted sea level rise of 55 inches by 2100. As sea level rises, however, periodic storm surge and wave activity will impact the dunes. Future maintenance/re-building of the dunes (and berms) that border the site would provide continued protection for the project site, and reduce the impacts of projected sea level rise.

10.2. Preliminary Earthwork Considerations

In general, we anticipate that the proposed project improvements will be built at or near the existing site grades and earthwork associated with the construction would be relatively minor. Earthwork associated with construction of the project is anticipated to include preparation of structure and equipment pads, pavement and hardscape areas, detention basins, and trench excavations for pipelines and utility lines that are generally less than 10 feet deep.

Based on our limited subsurface exploration, we anticipate that the materials encountered in near-surface excavations will be comprised predominantly of sand and silty sand, with some silt and clay, and these materials would be appropriate for re-use as structural fill. We recommend that backfill materials be in conformance with the "Greenbook" (Standard Specifications for Public Works Construction) specifications for structure backfill. Gravel and cobbles were not encountered in our CPTs, and we anticipate that excavations within the fill and alluvial materials at the project site will be feasible with conventional grading equipment.

Prior to excavation and placement of fill, the foundation bearing area for critical structures should be cleared of existing structures, pavements, abandoned utilities (if present), and stripped of rubble, debris, vegetation, any loose, soft, wet, or otherwise unstable soils, as well as soils containing organic material. Obstructions that extend below the finished grade, if any, should be removed and the resulting holes filled with compacted soil. Materials generated from the clearing operations that are unsuitable for reuse and engineered backfill material should be removed from the site and disposed of at a legal dumpsite away from the project area.

Based on available information, we anticipate that granular (sandy) soils will be encountered within the construction areas. Sandy soils generally have relatively little cohesion and have a high potential for caving. In our opinion, temporary slopes above the water table should be stable at an inclination of 1½:1 (horizontal to vertical) for excavations deeper than 4 feet but not more than 10 feet below existing grade. Some surficial sloughing may occur, and temporary slopes should be evaluated in the field by Ninyo & Moore in accordance with Occupational Safety and Health Administration (OSHA) criteria.

10.3. Preliminary Foundation Criteria

Due to the relatively minor potential for dynamic settlement at the site related to liquefaction, the repowering structures may be supported on shallow spread footings in general. For settlement-sensitive structures with relatively low tolerance, mat foundations may be considered. The structural foundations should be underlain by engineered fill, the depth and extent of which will have to be evaluated on a case-by-case basis during the detailed design phase of the project. Recommendations for foundation bearing capacity, settlement and lateral earth pressures should be provided following further geotechnical evaluation of the site.

11. LIMITATIONS

The field evaluation and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration and laboratory testing. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for preliminary planning for the project and for preliminary design purposes. It does not provide sufficient data for detailed design or accurate construction cost estimates. Prior to the design phase of the project, additional geotechnical evaluation of the site should be performed. The purpose of additional geotechnical evaluation would be to develop additional subsurface data and prepare detailed design and construction recommendations for the project.

Our preliminary conclusions and recommendations are based on a review of readily available geotechnical literature, review of preliminary plans provided to us, and an analysis of the observed conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified, and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In

addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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N

SCALE IN FEET

0 2,400 4,800

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	SITE LOCATION	FIGURE
PROJECT NO. 209044001 / DATE 11/13	MANDALAY GENERATING STATION REPOWERING PROJECT 393 NORTH HARBOR BOULEVARD OXNARD, CALIFORNIA	1

REFERENCE: GOOGLE EARH AERIAL PHOTO, 2013.

LEGEND	
CPT-3 TD=50.4	CONE PENETRATION TEST; TD=TOTAL DEPTH IN FEET

N

SCALE IN FEET

0 250 500

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

CPT LOCATIONS

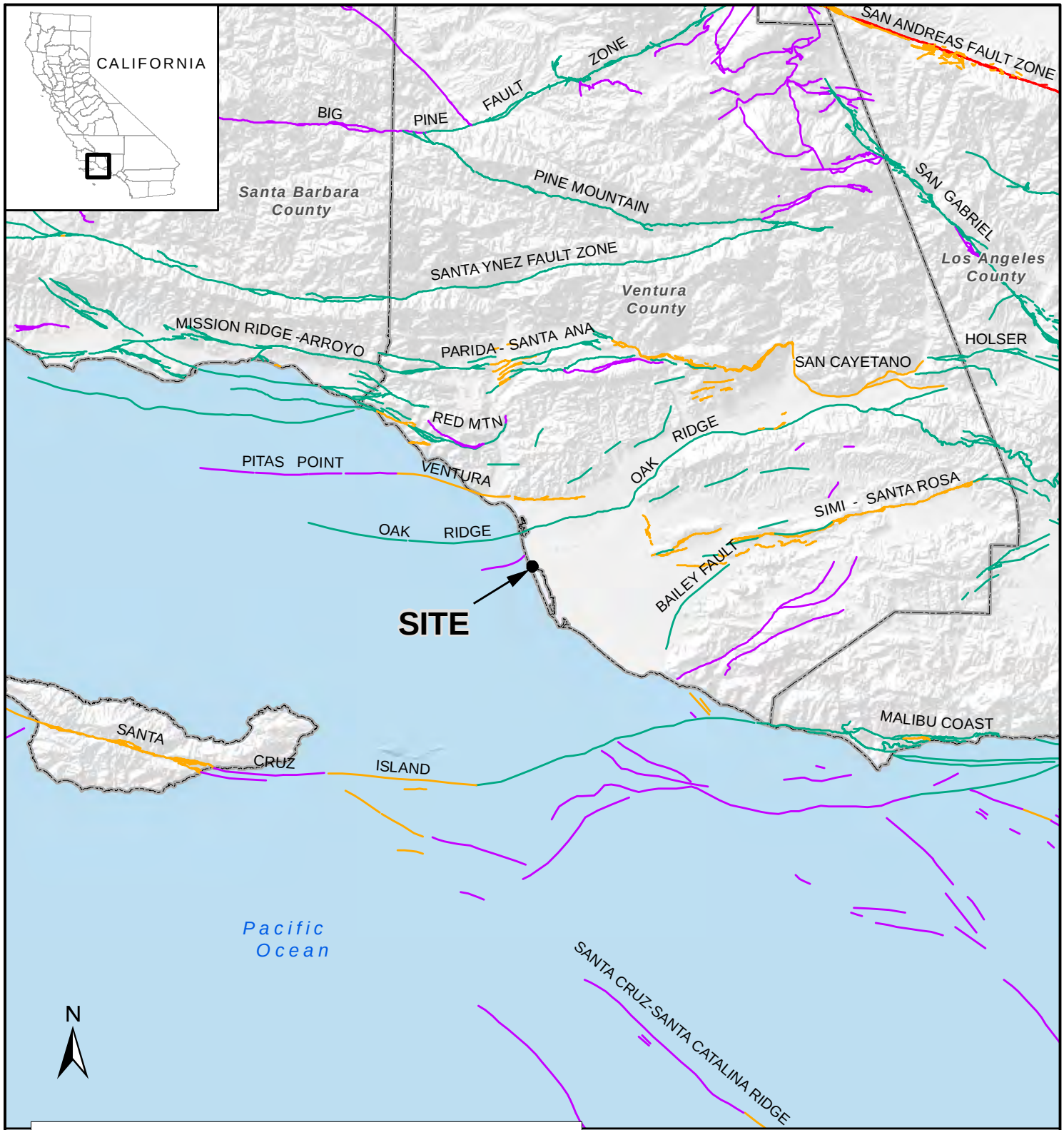
PROJECT NO.	DATE
209044001	11/13

MANDALAY GENERATING STATION REPOWERING PROJECT
393 NORTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

FIGURE

2

209044001_CPTL.dwg 13:01:27 11/27/2013 GK



LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

SOURCE: U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, 2006, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES, ACCESSED 2011, FROM USGS WEB SITE: HTTP//EARTHQUAKES.USGS.GOV/REGIONAL/QFAULTS/.

SCALE IN MILES

0 10 20

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	FAULT LOCATIONS	FIGURE
PROJECT NO. / DATE	MANDALAY GENERATING STATION REPOWERING PROJECT 393 NORTH HARBOR BOULEVARD OXNARD, CALIFORNIA	3
209044001 / 11/13		

3_209044001_FL_Z.mxd 11/27/2013 12:45:54 PM JDL

REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATIONS, DIVISION OF MAPS AND GEOLOGY, STATE OF CALIFORNIA, 2002, SEISMIC HAZARD ZONES MAP OFFICIAL REVISED MAP OXNARD QUADRANGLE, 7.5-MINUTE SERIES: SCALE 1:24,000.

N

SCALE IN FEET

0 2,000 4,000

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

LIQUEFACTION:
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Ninyo & Moore

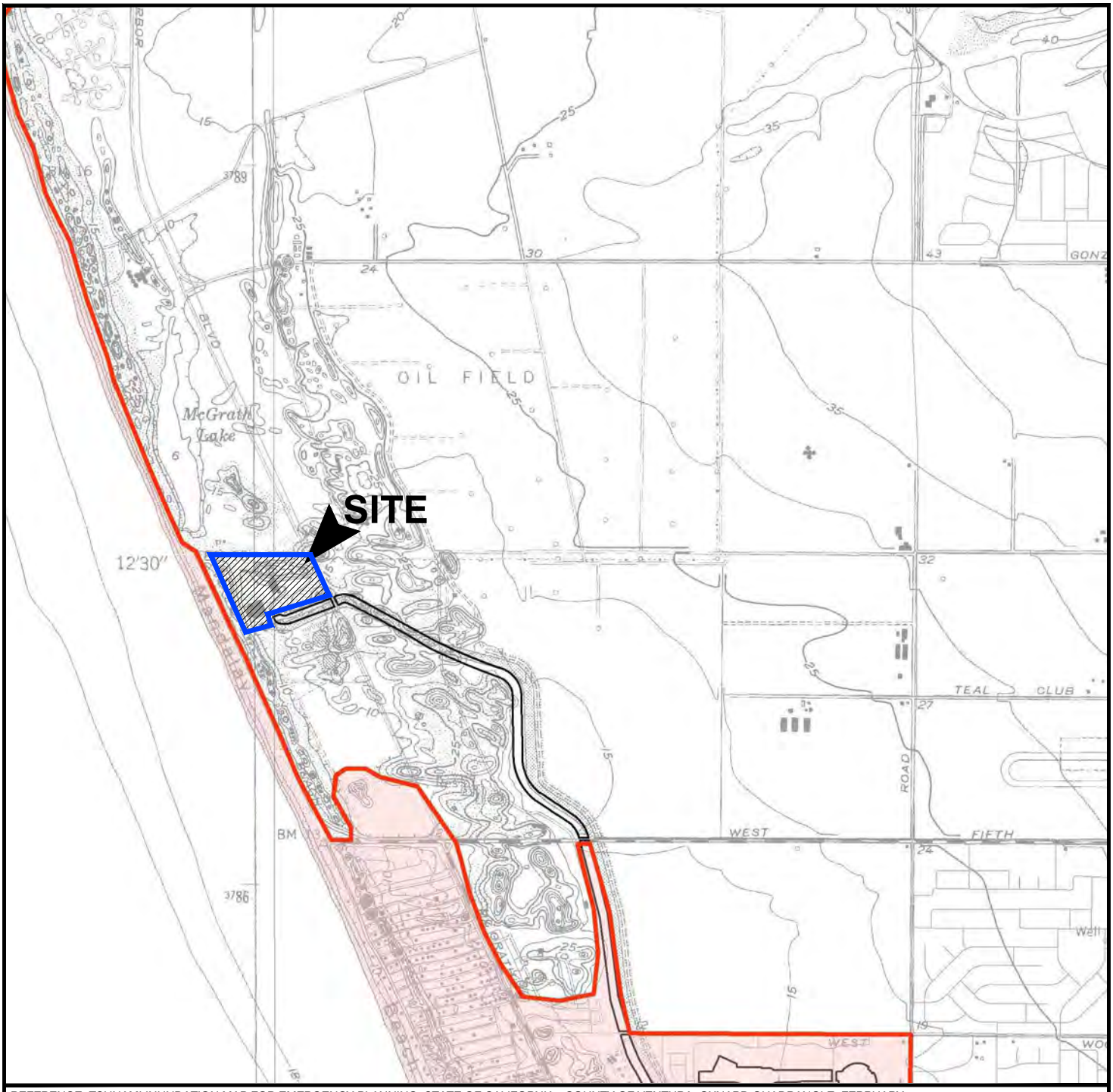
SEISMIC HAZARD ZONES

FIGURE 4

PROJECT NO.	DATE
209044001	11/13

MANDALAY GENERATING STATION REPOWERING PROJECT
393 NORTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

209044001_SHZ.DWG 16:19:22 11/22/2013 GK



REFERENCE: TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING, STATE OF CALIFORNIA - COUNTY OF VENTURA, OXNARD QUADRANGLE, FEBRUARY 15, 2009.

N

SCALE IN FEET

0 2,000 4,000

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

TSUNAMI INUNDATION LINE

TSUNAMI INUNDATION AREA

Ninyo & Moore

TSUNAMI INUNDATION

PROJECT NO.	DATE
209044001	11/13

MANDALAY GENERATING STATION REPOWERING PROJECT
393 NORTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

FIGURE

5

209044001_TI.dwg 13:04:27 11/27/2013 GK

APPENDIX A

CPT SOUNDING LOGS

Field Procedure for Cone Penetration Tests (CPTs)

The CPT soundings performed for this evaluation were conducted by Kehoe Testing and Engineering in general accordance with ASTM International D 3441. The cone penetrometer assembly used for this project consisted of a conical tip and a cylindrical friction sleeve. The conical tip had an apex angle of 60 degrees and a diameter of approximately 1.4 inches resulting in a projected cross-sectional area of approximately 1.5 square inches. The cylindrical friction sleeve was approximately 5.3 inches long and had an outside diameter of approximately 1.4 inches, resulting in a surface area of approximately 23 square inches. The interior of the CPT probe was instrumented with strain gauges that allowed simultaneous measurement of cone tip and friction sleeve resistance during penetration. The cone was hydraulically pushed into the soil using the reaction mass of a specially designed 23-ton truck at a constant rate of approximately 4 feet per minute while the cone tip resistance and sleeve friction resistance were recorded at an approximately 2-inch interval and stored in digital form. The computer generated logs presented in the following pages include cone resistance, friction resistance, friction ratio, equivalent SPT blow counts, and interpreted soil types. The soil type interpretations were based on the method proposed by Robertson and Campanella (1989).

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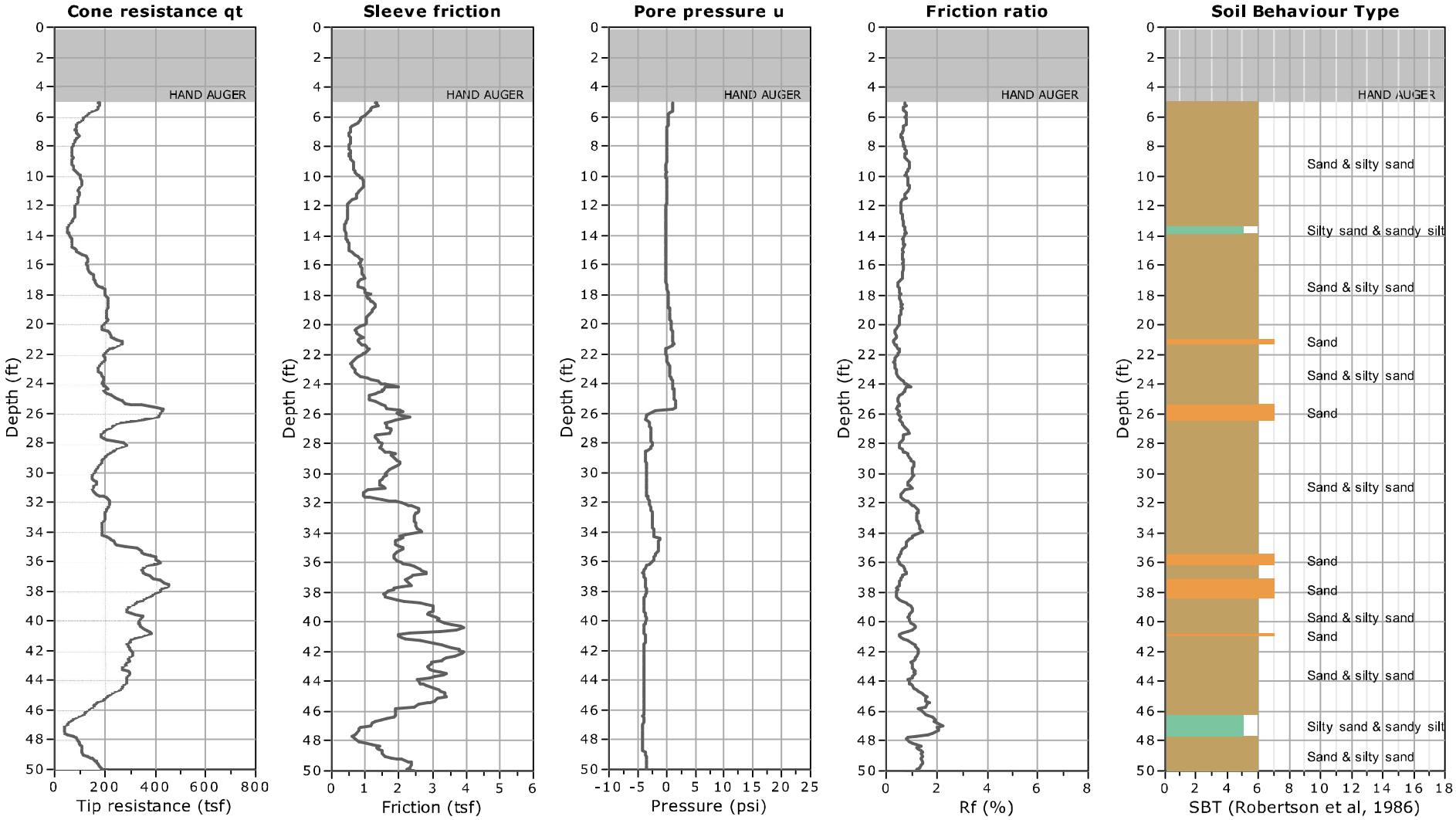
CPT: CPT-1

Project: **Ninyo & Moore/GenOn Mandalay Gernerating Station**
Location: **393 Harbor Blvd. Oxnard, CA**

Total depth: 50.46 ft, Date: 11/21/2013
Cone Type: Vertek



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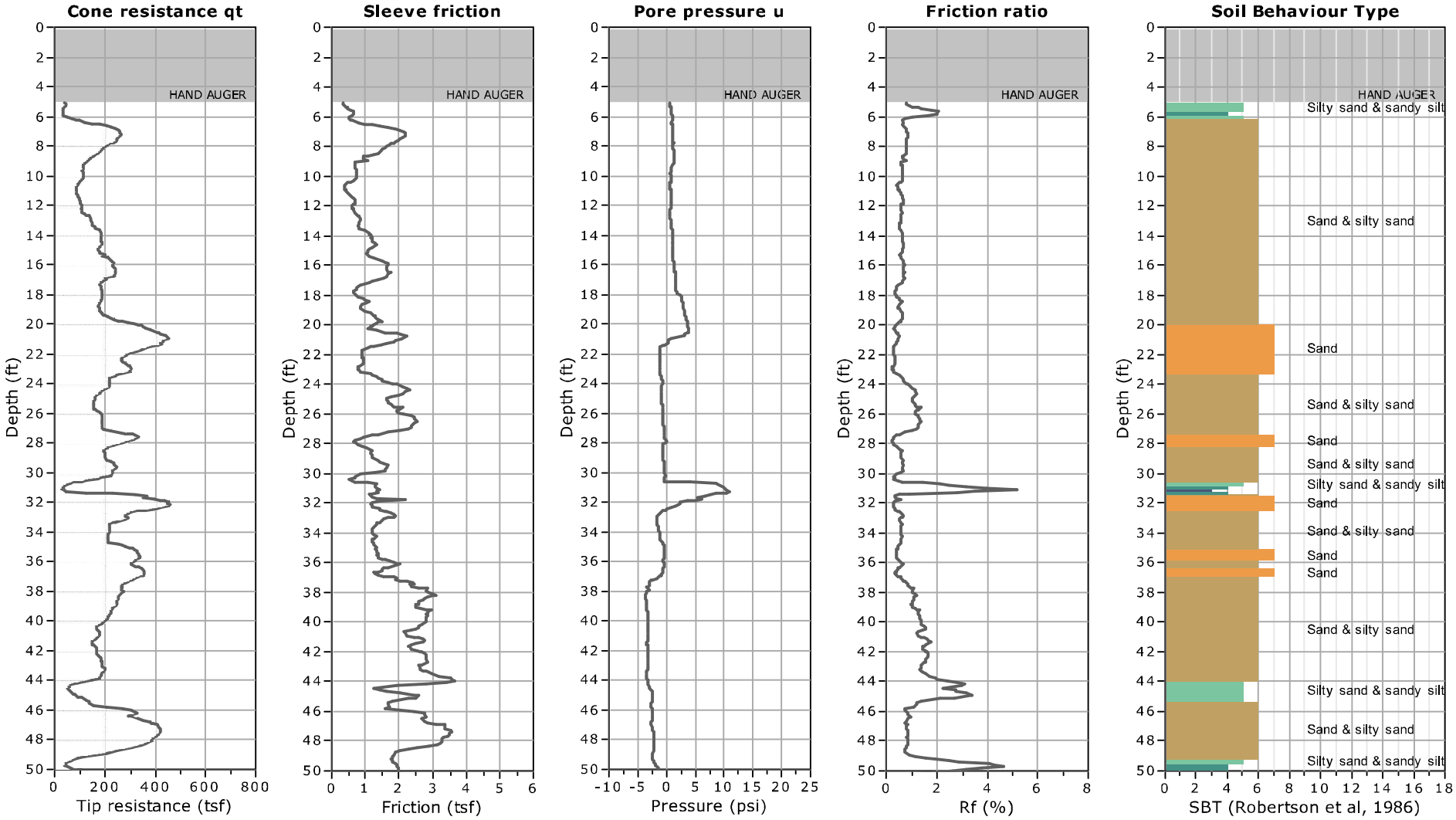
CPT: CPT-2

Project: **Ninyo & Moore/GenOn Mandalay Gernerating Station**
Location: **393 Harbor Blvd. Oxnard, CA**

Total depth: 50.81 ft, Date: 11/21/2013
Cone Type: Vertek



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CPT: CPT-3

Project: **Ninyo & Moore/GenOn Mandalay Gernerating Station**
Location: **393 Harbor Blvd. Oxnard, CA**

Total depth: 50.41 ft, Date: 11/21/2013
Cone Type: Vertek