
**PROPERTY MANAGEMENT PLAN,
ENERGY USE MANAGEMENT PLAN,
AIR QUALITY MANAGEMENT PLAN,
AND FISH AND WILDLIFE MANAGEMENT PLAN,
FOR THE CANNABIS CULTIVATION OPERATION
AT 23492 JERUSALEM GRADE, MIDDLETOWN,**

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Table of Contents

1.0	Introduction	2
2.0	Project Location and Description	3
3.0	Property Management Plan	5
3.1.	Requirements / Goals	5
3.2.	Uses of the Property	5
3.3.	Property Maintenance	6
3.4.	References and Resources	7
4.0	Energy Use Management Plan	8
4.1.	Requirements / Goals	8
4.2.	Energy Inventory	8
4.3.	Energy Conservation Measures	9
4.4.	References and Resources	10
5.0	Air Quality Management Plan	11
5.1.	Requirements / Goals	11
5.2.	Air Quality Setting and Potential Pollutants	11
5.3.	Potential Odor Issues	13
5.4.	References and Resources	13
6.0	Fish and Wildlife Management Plan	14
6.1.	Requirements / Goals	14
6.2.	Description of Fish and Wildlife Resources on the Parcel	14
6.3.	Description of Ecosystems on the Parcel	15
6.4.	Description of the Watershed	15
6.5.	How Impacts Will Be Minimized	16
6.6.	References and Resources	17
7.0	Exhibits	A
8.0	CASQA Industrial and Commercial Handbook BMP Fact Sheets	B
9.0	Biological Resources Assessment	C

1.0 INTRODUCTION

These Plans have been prepared to fulfill the requirements of Lake County Marijuana Cultivation Ordinance (Ordinance No. 2997). Each Plan is intended to be a "living" document, updated as necessary, such that when operational activities or processes are modified or replaced, the applicable Plans are similarly revised to reflect these changes. These Plans should be amended whenever there is a significant change in cultivation operations, whenever the goals of the Plans are not met, whenever a pollution event occurs, or whenever a violation notice is issued. The Ordinance requires that any deviations from, or changes in, the Plans must be conveyed to the Department in writing within thirty (30) days of the change.

2.0 PROJECT LOCATION AND DESCRIPTION

This permitted cannabis cultivation operation is located on a 183-acre parcel (APN 013-013-11) with address 23492 Jerusalem Grade, Middletown, California. The original operational area was approximately 0.2 acres; this garden is being abandoned and the area restored. The new gardens (Project Area) will be established in phases and allow for multiple cultivation licenses with individual gardens. The original Cannabis cultivation operation consisted of a graded garden within a fenced enclosure. The enclosure was approximately 7,500 square feet (0.17 acres). This garden was abandoned, and the area is being revegetated. Three additional potential garden sites were located at the north end of the parcel. These sites were graded and terraced, but no Cannabis operations were ever established. These three garden sites will be abandoned.

The new garden complex and supporting facilities, an area of approximately 5 acres (the Project Area), will be established in phases and allow for multiple cultivation licenses with individual gardens each capable of growing at least 10,000 square feet of Cannabis canopy. Phase One would be for the 2019 growing season and would consist of four garden compounds (each 11,100 square feet). Phases Two would be for the 2020 grow season and have eight 11,340 square foot compounds; two 11,250 square foot compounds; and one 5,400 square foot compound. A new processing center of approximately 5,000 square feet is also planned, as well as a stormproof chemical shed (10 feet by 10 feet).

The proposed cultivation operations will consist of outdoor gardens. with plants growing in plastic pots, fabric bags ("Smart Pots") and/or raised beds. A new shed for product processing, approximately 5,000 to 4,000 square feet, will be constructed adjacent to the well. No soil is currently stored on-site. However, future soil deliveries will be staged adjacent to the outdoor garden complex. There would also be a 1,000 gallon cone-bottom tank in each garden compound that will be for compost teas.

A well currently serves the single-family residence and the existing garden. This is a permitted well that produces approximately 100 gallons per minute. The proposed garden complex will be irrigated by water from the existing well, which will be pumped into several tanks, each capable of holding 5,000 gallons. The use of water bladders will be discontinued. A previously graded pad for water bladders will be abandoned and revegetated.

The water will be delivered by gravity via underground PVC piping to each garden. Black poly tubing and emitters (drip irrigation) will be used to distribute the water to each planting station. Mixing tanks will be used to add liquid fertilizers and other amendments (compost teas) to the irrigation water. Supplemental irrigation may be applied by hand using garden hoses.

Existing structures consist of a single-family residence and adjacent groundwater well. A small cabin is found near the top of the property. Employees will have access to the toilet in the single-family residence. In addition, portable toilet(s) will be located adjacent to the gardens. Several abandoned structures are found on this parcel. Trash and debris left by a previous owner lay scattered in piles across the southwestern portion of the parcel. The current property owner is in the process of removing the non-functional structures and trash.

The Project Area is accessed by a private gravel road on Jerusalem Grade (see exhibits). Prior to the establishment of this cultivation operation, land use was open space. The surrounding land uses are private estates, cannabis cultivation, and open space. The 2015 Jerusalem Fire burned approximately 80% of the Project Area. Vegetation is recovering from the fire and from the many roads and breaks that were cut during the fire-fighting efforts.

The Project Area has rugged topography, consisting of several ridges and sloping hills of Bishop Mountain (see exhibits). Drainage leaves the Project Area along various vegetated swales and which

then combine into two Class III watercourses (see exhibits). These are potentially-jurisdictional water features. Riparian vegetation occurs in patches along these watercourses. These ephemeral drainage channels start in the eastern portion of the parcel and flow southwest, eventually flowing into Gunther Creek. The channels range in width from 3 to 6 feet and the depth ranges from approximately 6 inches up to 2 feet. The channels have an ordinary high-water mark, bank erosion and scouring, and litter and debris present; the channel was intermittently wet, but not flowing.

The parcel contained an off-channel pond that was excavated and sealed with a liner. This pond will be abandoned and restored to the original condition of the landscape. A spring is located in the southwest portion of the parcel. A thin band of herbaceous wetland vegetation surrounds this spring. The use of this spring as a water source will be abandoned. The nearest portion of the current cultivation area is approximately 130 feet from a Class III watercourse. Future cultivation related operations will take place at least 200 feet from a Class III watercourse.

Numerous roads and fire-breaks are found within this parcel. A gravel driveway leads from Jerusalem Grade to the southwest corner of the parcel. A dirt road accesses the current garden site. Once this garden is abandoned, the access road will be maintained as a fire-break. The proposed garden and processing shed will be accessed by the construction of a new gravel road which will connect to the existing gravel driveway. A dirt/gravel road which extends from the driveway and runs north along the parcel will be maintained as an easement to the adjoining parcel and as fire access. Additional roads and firebreaks within the parcel will be abandoned and allowed to naturally revegetate.

3.0 PROPERTY MANAGEMENT PLAN

The following document is incorporated by reference:

- Site Management Plan for the Cultivation Operation at 23492 Jerusalem Grade, Middletown, California. 2018. Prepared for Central Valley Regional Water Quality Control Board. Prepared by Natural Investigations Co., Inc.

3.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

(q) *A Property Management Plan*

1. *All cannabis permittees shall minimize energy usage.*
2. *All permittees shall prepare a Property Management Plan. Said plan shall:*
 - a. *Identify and locate all existing uses on the property.*
 - b. *Identify and locate all proposed uses on the property.*
 - c. *Describe how all uses will be managed in the future.*
3. *All permittees shall implement the procedures as outlined in their Property Management Plan as approved by the Planning Commission. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*
4. *Grounds.*

The permittee shall establish and implement written procedures to ensure that the grounds of the premises controlled by the permittee are kept in a condition that prevents the contamination of components and cannabis products. The methods for adequate maintenance of the grounds shall include at minimum:

- a. *The proper storage of equipment, removal of litter and waste, and cutting of weeds or grass so that the premises shall not constitute an attractant, breeding place, or harborage for pests.*
- b. *The proper maintenance of roads, yards, and parking lots so that these areas shall not constitute a source of contamination in areas where cannabis products are handled or transported.*
- c. *The provision of adequate draining areas in order to prevent contamination by seepage, foot-borne filth, or the breeding of pests due to unsanitary conditions.*
- d. *The provision and maintenance of waste treatment systems so as to prevent contamination in areas where cannabis products may be exposed to such a system's waste or waste by-products.*
- e. *If the premise is bordered by grounds outside the licensee's control that are not maintained in the manner described in subsections (a) through (d) of this section, inspection, extermination, and other reasonable care shall be exercised within the premise in order to eliminate any pests, dirt, and/or filth that pose a source of cannabis product contamination.*

3.2. Uses of the Property

Prior to the establishment of this cultivation operation, land use was a single residence surrounded by open space. The 2015 Jerusalem Fire burned approximately 80% of the Project Area. Vegetation is recovering from the fire and from the many roads and breaks that were cut during the fire-fighting efforts. The surrounding land uses are private estates with animal husbandry; gardens and vineyards; open space; and grazing land. The cultivation areas are accessed by a private graveled road off of Jerusalem Grade (see exhibits). The operational areas of the cultivation sites will encompass approximately five acres of land, although the

actual cannabis canopy size in each garden will be determined the type of license issued by Lake County.

The existing cultivation area was established by clearing the natural vegetation. No grading occurred for this garden. The proposed gardens may require some clearing of existing vegetation and grading for the construction of outdoor garden compounds and processing building (see exhibits). Ground disturbance will also result from construction of trenches needed for installation of water supply lines and fencing.

The perimeter of the garden will be enclosed in a security fence of welded wire. Inside the compound, adjacent to the gardens, there will be a work area that contains a portable toilet, covered dumpster, and a green waste processing / composting area. Outside the fence, adjacent to the garden, a building will be constructed for cannabis processing. Additional features outside of the fenced garden that are associated with the operation include a house, a small shed for storing fertilizers and chemicals and a small parking lot. Gravel will be placed inside the work area and on the parking lot to suppress dust.

3.3. Property Maintenance

Good housekeeping measures will be implemented. The grounds will be inspected at least once per day and any litter picked up. Trash containers will be emptied when full. Roads will be maintained so that significant erosion does not occur. This may include wetting dusty roads, armoring with gravel or asphalt, patching holes, and maintaining drainage features such as water bars, culverts and side ditches. Weeds will be controlled by mulching or by cutting with a lawnmower or line trimmer.

Property maintenance will follow Best Management Practices. The following CASQA Industrial and Commercial Handbook BMP Fact Sheets are applicable:

- BG-40 Landscape Maintenance
- SC-41 Building & Grounds Maintenance
- SC-40: Contaminated or Erodible Areas
- SC-43 Parking Area Maintenance
- SC-44 Drainage System Maintenance

Wastes will be managed according to the plan created for this operation:

- Growing Medium Management Plan, Fertilizer Management Plan, Integrated Pest Management Plan, Solid Waste Management Plan, Hazardous Waste Management Plan, and Cannabis Vegetative Waste Management Plan, for the Cannabis Cultivation Operation at 23492 Jerusalem Grade, Middletown, CA. 2018. Prepared by Natural Investigations Co., Inc.

3.4. References and Resources

California Stormwater Quality Association. 2014. Stormwater Best Management Practice Handbook Portal: Industrial and Commercial. California Stormwater Quality Association, Menlo Park, California. 474 pp.

Central Valley Region's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

4.0 ENERGY USE MANAGEMENT PLAN

4.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

- (n) *An Energy Use Management Plan*
1. *All cannabis permittees shall minimize energy usage.*
 2. *All permittees shall prepare an Energy Management Plan. Said plan shall:*
 - a. *Provide energy calculation as required by the California Building Code*
 - b. *Identify energy conservation measures to be taken and maintained.*
 - c. *If alternative energy sources are to be used, describe those sources and the amount of electricity that will be provided.*
 - d. *For indoor cannabis cultivation licensees, ensure that electrical power used for commercial cannabis activity shall be provided by any combination of the following: (1) On-grid power with 42 percent renewable source. (2) Onsite zero net energy renewable source providing 42 percent of power. (3) Purchase of carbon offsets for any portion of power above 58 percent not from renewable sources. (4) Demonstration that the equipment to be used would be 42 percent more energy efficient than standard equipment, using 2014 as the baseline year for such standard equipment.*
 3. *All permittees shall implement the procedures as outlined in their Energy Use Management Plan as approved by the Water Resource Department. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

The Ordinance also requires the following:

Electrical Generators

The indoor or mixed-light cultivation of cannabis shall not rely on a personal, gasoline, diesel, propane, or similar fuels, powered generator as a primary source of power and only for temporary use in the event of a power outage or emergency.

Lights

All lights used for cannabis related permits including indoor or mixed light cultivation of cannabis shall be fully contained within structures or otherwise shielded to fully contain any light or glare involved in the cultivation process. Artificial light shall be completely shielded between sunset and sunrise. Security lighting shall be motion activated and all outdoor lighting shall be shielded and downcast or otherwise positioned in a manner that will not shine light or allow light glare to exceed the boundaries of the legal parcel upon which they are placed.

4.2. Energy Inventory

The CDFW CalCannabis Program states the following:

"Outdoor cultivation utilizes natural daylight for photosynthesis, although cultivators may have use artificial lighting to maintain immature plants as a source for propagation. Outdoor cultivation operations typically start the plants indoors or in greenhouses before moving them outside during the summer months. Under the Proposed Program, it is anticipated that this cultivation type would have the least lighting needs, compared to indoor, mixed-light, and nursery operations."

"Note that lighting may be used for propagation under any of the Proposed Program's license types, although for outdoor licenses, this is permissible only to maintain immature plants as a source for propagation."

"Outdoor cultivation is conducted without the use of artificial lighting for plant growth, with the exception that artificial lighting is permissible to maintain immature plants as a source or plant propagation (CDFA 2017)."

The parcel does not have an existing residential service hookup to an electricity provider. The residence has a 3,500 watt solar power array. A 35 horsepower generator is used as backup, if needed. The residence also has an above-ground propane storage tank for fuel for cooking and heating the residence. The previous cultivation operation was an outdoor garden and did not use any electricity for artificial lighting or heating, with the exception of low voltage items such as security cameras and water pumps for mixing liquid fertilizers into the irrigation system. Proposed operation of a future cannabis processing facility and outdoor garden pounds may require an increase in the electrical usage and this Energy Use Plan will need to be updated with new energy use estimates when these facilities are operational. Note that for construction of new structures, the Ordinance states, *"Provide energy calculation as required by the California Building Code."*

4.3. Energy Conservation Measures

A combination of the following energy conservation measures may be employed at this operation:

- use of solar power array and battery storage where electricity is needed
- use of LED lights or another high-efficiency lighting
- use of ambient light whenever possible
- use of highly-insulative materials to reduce energy needed for structure heating and cooling
- use of programmable thermostat for HVAC/climate control
- use of electric vehicles or bicycles instead of combustion-powered vehicles, whenever possible
- use of hand tools instead of power tools.

The following resources can be used to prepare a Cannabis Energy Conservation Plan:

- CalGreen Energy-Saving Measures. *CalGreen standards can be used to implement energy-saving measures.* <http://www.bsc.ca.gov/Home/CALGreen.aspx>
- Pacific Gas & Electric (PG&E). PG&E offers a Green-E Energy certified program to purchase either 50 or 100 percent of your energy from renewable energy sources through the "Solar Choice" program. A secondary program offered by PG&E is the "Regional Renewable Choice" program. Information on both options can be found at https://www.pge.com/en_US/residential/solar-and-vehicles/options/solar/solar-choice/solar-choice.page?WT.mc_id=Vanity_solarchoice
- Renewable Energy for Agriculture Program (REAP). REAP is anticipated to provide \$6 million from the Greenhouse Gas Reduction Fund (GGRF) to assist agriculture operators with the installation of onsite renewable energy technologies, with an emphasis on providing assistance in disadvantaged and low income communities. <http://www.energy.ca.gov/renewables/18-MISC-03/>
- Utility Rebates for Energy Efficiency Improvements. Southern California Edison (SCE) and Pacific Gas & Electric (PG&E) offer rebates and incentives to offset the cost of energy efficiency improvements (www.sce.com/business and www.pge.com/business)

- CSCDA Commercial Property Assessed Clean Energy (PACE) Program. Through the California Statewide Communities Development Authority, property owners can finance the cost of energy improvements via their property tax bill. This resource can be used to finance energy efficiency, renewable energy and water conservation measures. <http://www.cscda.org/getdoc/205a5831-d67d-40e8-b726-086edfae2358/Open-PACE-Property-Assessed-Clean-Energy-Program>
- Utility On-Bill Financing. SCE and PG&E offer interest-free loans for replacing existing equipment with more energy-efficient models. SCE: <https://www.sce.com/wps/portal/home/business/tools/on-bill-financing>. PG&E: https://www.pge.com/en_US/business/save-energy-money/financing/energy-efficiency-financing/energy-efficiency-financing.page

4.4. References and Resources

California Department of Food and Agriculture. 2017. CalCannabis Cultivation Licensing Program Draft Program Environmental Impact Report. State Clearinghouse #2016082077. Prepared by Horizon Water and Environment, LLC, Oakland, California. 484 pp.

Kolwey, N. 2017. A Budding Opportunity: Energy Efficiency Best Practices for Cannabis Grow Operations. Southwest Energy Efficiency Project (www.swenergy.org). 27 pp.

Krigger, J. and C. Dorsi. 2008. "The Homeowner's Handbook to Energy Efficiency: A Guide to Big and Small Improvements" Saturn Resource Management, Inc. Helena, Montana.

5.0 AIR QUALITY MANAGEMENT PLAN

5.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

- (s) *An Air Quality Management Plan*
1. *All cannabis permittees shall not degrade the County's air quality.*
 2. *All permittees shall prepare an Air Quality Management Plan to be approved by Lake County Air Quality Management District (LCAQMD). Said plan shall:*
 - a. *Identify any equipment or activity that which may cause, potentially cause, reduce, control or eliminate the issuance of air contaminants.*
 - b. *Describe how the permittee will minimize solid waste generation, including working with vendors to minimize packaging.*
 - c. *Describe how solid waste will be disposed.*
 3. *All permittees shall implement the procedures as outlined in their Solid Waste Management Plan as approved by Lake County Integrated Waste Management. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*
 4. *All cannabis permittees shall obtain an authority to construct permit pursuant to LCAQMD Rules and Regulations, if applicable prior, to the construction of the facility.*
 5. *All cannabis permittees shall obtain a permit to operate pursuant to LCAQMD Rules and Regulations, if applicable, to operate any article, machine, equipment or other contrivance which causes or may cause the issuance of an air contaminant.*

The Ordinance also requires the following:

- 3. Odor** *Cannabis related permits shall not propagate objectionable odors which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or that endanger the comfort, repose, health, or safety of any of those persons or the public.*
- a. *The applicant shall prepare an odor abatement plan that includes (but is not limited to): Designating an individual who is responsible for responding to odor complaints, 24-hours a day, seven days a week.*
 - b. *Providing property owners and residents of property within a 1,000 foot radius of the cannabis facility, with the contact information of the individual responsible for responding to odor complaints.*
 - c. *Policy and procedure describing the actions to be taken when an odor complaint is received, including the training provided to the responsible party on how to respond to an odor complaint.*
 - d. *The description of potential methods for reducing odors, including minimizing potential add-on air pollution control equipment.*
 - e. *Contingency measures to curtail emissions in the event of a continuous public nuisance.*

5.2. Air Quality Setting and Potential Pollutants

The project is in the Lake County Air Basin. The Lake County Air Quality Management District regulates air quality in Lake County. The U.S. Environmental Protection Agency (EPA) sets acceptable levels for seven air pollutants, and then determines — with the help of states and local air districts — where those standards are or are not met. Lake County currently meets the EPA's health standards for five of those pollutants: carbon monoxide; nitrogen dioxide; sulfur dioxide; lead; and coarse particulates. For the other two — ground-level ozone and fine particulate pollution — Lake County is considered to be a part of a regional non-attainment

area. There are no sensitive receptors such as hospitals, convalescent homes, schools or similar facilities nearby. Public facilities such as schools are over 4 miles away.

Short-term construction emissions could include fugitive dust and other particulate matter, as well as exhaust emissions generated by earthmoving activities and operation of grading or tilling equipment during site preparation. Construction emissions are caused by onsite or offsite activities. Onsite emissions principally consist of exhaust emissions (NOX, CO, ROG, PM10, and PM2.5) from heavy-duty construction equipment, motor vehicle operation, and fugitive dust (mainly PM10) from disturbed soil. Offsite emissions are caused by motor vehicle exhaust from delivery vehicles as well as worker traffic, but they also include road dust (PM10). However, no major construction-related activities are needed for implementation of the proposed cultivation operation. Only a few persons working for a few days will be needed for site preparation, and such low numbers of man-hours would not generate significant vehicle emissions.

Fugitive dust is addressed in the project's Storm Water Management Plan and the Site Management Plan (Natural Investigations Co., 2018), which identifies Best Management Practices for soil stockpiling and the control of fugitive dust. Fugitive dust will be controlled by wetting the soil with a mobile water tank and hose, or by delaying ground disturbing activities until site conditions are not windy, or by eliminating soil stockpiles.

Operational emission sources consist of mobile emissions and area source emissions. Mobile source emissions estimates are derived from motor vehicle traffic from staff commuting. Area source emissions estimates are derived from the consumption of propane, electricity, and consumer products, as well as emissions resulting from landscape maintenance. However, this cultivation operation does not require the use of propane, electricity, or other consumer products. Cultivation operations may generate fugitive dust emissions through ground-disturbing activities such as ground tilling, uncovered soil or compost piles, and vehicle or truck trips on unpaved roads. Fugitive dust is addressed in the project's Site Management Plan (Natural Investigations Co., 2018), which identifies Best Management Practices for soil stockpiling and the control of fugitive dust. Fugitive dust will be controlled by wetting the soil with a mobile water tank and hose, or by delaying ground disturbing activities until site conditions are not windy, or by eliminating soil stockpiles.

Operation of the proposed cultivation operation would generate small amounts of carbon dioxide from operation of small engines, such as tillers, and from vehicular traffic associated with staff commuting. The generation of carbon dioxide would be partially offset by the cultivation of plants, which remove carbon dioxide in the air for photosynthesis. The outdoor cultivation operation would not consume excessive amounts of energy because it utilizes the sun for light.

CDFA (2017) concluded that cannabis cultivation activities under the CalCannabis Licensing Program would not generate a substantial number of vehicle trips and would not require intensive use of heavy equipment, and as such, would not degrade air quality or produce significant amounts of greenhouse gasses. CDFA (2017) summarizes the impacts from small cannabis cultivation operations as follows:

"Despite the potential air quality emission-generating sources described above that are associated with cannabis cultivation activities, it is not anticipated that the Proposed

Program would conflict with or obstruct implementation of air quality plans for the numerous reasons outlined below. First, the cannabis cultivation activities under the Proposed Program would not be anticipated to generate a substantial number of vehicle trips (see Section 4.12, Transportation and Traffic) that would affect air quality. In addition, outdoor and mixed-light cultivation activities would generally occur on such small acreages that these activities would often not require intensive use of heavy equipment." (page 4.3-30)

The CDFA CalCannabis Program concluded that small outdoor Cannabis cultivation operations would not contribute significantly to greenhouse gas emissions because of the limited use of combustion-powered equipment and vehicles and because County ordinances limit the use of generators to emergency-use only (CDFA 2018).

5.3. Potential Odor Issues

Cannabis cultivation can generate objectionable odors, but this is primarily from indoor cultivation operations. In outdoor cultivation, odors can disperse. No significant odor impacts that would affect a substantial number of people are anticipated from this cultivation operation, due to the limited population in the area, the small size of the cultivation operation, and the generous setbacks from roads and property lines.

If odors become objectionable to neighbors, windscreens will be erected, or another mitigation measure will be employed.

5.4. References and Resources

California Department of Food and Agriculture. 2017. CalCannabis Cultivation Licensing Program Draft Program Environmental Impact Report. State Clearinghouse #2016082077. Prepared by Horizon Water and Environment, LLC, Oakland, California. 484 pp.

6.0 FISH AND WILDLIFE MANAGEMENT PLAN

The following report is incorporated by reference and provided in the Appendix:

- Northwest Biosurvey. 2017. Biological Resource Assessment with Botanical Survey and Delineation of Waters of the U.S. for Chris Jennings, APN 010-013-11, Lake County, California. 50 pp.

6.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

(j) *A Fish and Wildlife Management Plan*

1. *All commercial cannabis cultivation, cannabis nursery, cannabis manufactures, cannabis distributor, and cannabis microbusinesses shall minimize adverse impacts on fish and wildlife.*
2. *All permittees shall prepare a Fish and Wildlife Management Plan to be approved. Said plan shall:*
 - a. *A description of the fish and wildlife that are located on or utilize on a seasonal basis the parcel where the permitted activity is located.*
 - b. *A description of the ecosystems found on the parcel.*
 - c. *A description of the watershed in which the permitted activity is located.*
 - d. *Describe how the permittee will minimize adverse impacts on the fish and wildlife.*
 - e. *A map showing the location of any conservation easements or wildlife corridors proposed.*
3. *All permittees shall implement the procedures as outlined in their Fish and Wildlife Management Plan as approved by the Planning Commission. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

The Ordinance also requires the following:

Tree Removal

The removal of any commercial tree species as defined by the California Code of Regulations section 895.1, Commercial Species for the Coast Forest District and Northern Forest District, and the removal of any true oak species (Quercus sp.) or Tan Oak (Notholithocarpus sp.) for the purpose of developing a cannabis cultivation site is prohibited. This prohibition shall not include the pruning of any such tree species for the health of the tree or the removal of such trees if necessary for safety or disease concerns.

6.2. Description of Fish and Wildlife Resources on the Parcel

The following animals are known to occur in the region and may be located on or utilize on a seasonal basis the Parcel: honeybee (*Apis mellifera*); yellowjacket (Vespidae); butterfly (Lepidoptera); ant (Formicidae); dragonfly (Anisoptera); various aquatic insects; grasshopper (Orthoptera); fly (Diptera); northwestern fence lizard (*Sceloporus occidentalis occidentalis*); California alligator lizard (*Elgaria multicarinata multicarinata*); swallow (Hirundinidae); mourning dove (*Zenaida macroura*); California quail (*Callipepla californica*); Anna's hummingbird (*Calypte anna*); California scrub jay (*Aphelocoma californica*); sparrow (Passeridae); common raven (*Corvus corax*); dark-eyed junco (*Junco hyemalis*); Botta's pocket gopher (*Thomomys bottae*); black-tailed jackrabbit (*Lepus californicus*); California ground squirrel (*Otospermophilus beecheyi*); deer mouse (*Peromyscus maniculatus*); coyote (*Canis latrans*); and Columbian black-tailed deer (*Odocoileus hemionus columbianus*).

The California Natural Diversity Database (CNDDB) was queried, and no special-status species are reported on the Parcel. The CNDDB reported 7 special status species are known to occur in the vicinity. The foothill yellow-legged frog, bald eagle, golden eagle, prairie falcon, Townsend's big-eared bat, pallid bat, and western pond turtle are known to occur within 10 miles of the parcel. No special status animal species were detected during the site visit on August 14, 2017 or during the previous assessment (Northwest Biosurvey 2017). No suitable habitat for these special status species known is present on the Parcel.

6.3. Description of Ecosystems on the Parcel

The Parcel is located within the Inner North Coast Range geographic subregion, which is contained within the Northwestern California geographic subdivision of the larger California Floristic Province (Baldwin et al. 2012). This region has a Mediterranean-type climate, characterized by distinct seasons of hot, dry summers and wet, moderately-cold winters. The Parcel and vicinity are in Sunset Climate Zone 7, California's Gray Pine Belt, with hot summers and mild but pronounced winters without severe winter cold or high humidity (Brenzel, 2012). The Parcel contains 2 general terrestrial habitat types (see Exhibits): ruderal/urbanized; and chaparral.

Ruderal/Urbanized: These areas consist of disturbed or converted natural habitat that is now either in ruderal state, graded, or urbanized with gravel roads, or structure and utility placement. Vegetation within this habitat type consists primarily of nonnative annual grasses, weedy or invasive species. This habitat is classified as Holland vegetation type – "42200 Non-native Grassland," and "Urban" wildlife habitat types by CDFW's Wildlife Habitat Relationship System (WHR).

Chaparral: Habitats comprised of sclerophyllous shrubs are the dominant habitats on the Parcel. The majority of the chaparral is dominated by chamise and manzanita species. Much of the chaparral habitat was burned in the 2015 Jerusalem Fire. The regenerating chaparral consists of chamise (*Adenostema fasciculatum*), manzanita (*Arctostaphylos* spp.), coyote brush (*Baccharis pilularis*), poison oak (*Toxicodendron diversilobum*); toyon (*Heteromeles arbutifolia*), leather oak (*Quercus durata*), yerba santa (*Eriodictyon californicum*) along with various grasses (Poaceae), blue oak (*Quercus douglasii*) and gray pine (*Pinus sabiniana*). This vegetation type can be classified as the Holland Type "37200 – Chamise Chaparral" or as "37.101.27 Chamise-White Leaf Manzanita Alliance (Sawyer et al. 2009)".

The only special-status terrestrial habitat detected on the Parcel were areas of ultramafic (serpentine) soils, which occur in various parts of the Parcel having leather oak in the chaparral community.

6.4. Description of the Watershed

The Parcel is located in the Soda Creek Watershed (Hydrologic Unit Code 180201620307), which is a sub-watershed of Putah Creek. The local watershed has rugged topography, and consist of a mountain ridge (Bishop Mountain) that is heavily incised with steep canyons and shoulders that transition to alluvial fans and narrow valleys, such as Jerusalem Valley. Elevations range from 2120 at the top of Bishop Mountain to 800 feet in the valleys. Differing intensities of wildfires, development, and livestock grazing have created a mosaic of vegetation community types. Where sun exposure is strong (south and west-facing slopes), vegetation

consists of chaparral. On north-facing slopes, mixed oak woodlands and gray pine are dominant. Valley floors consist of non-native annual grassland. Riparian habitat is sparse in watercourses.

The topography of the Parcel consists of several west-facing ridges and sloping alluvial hills of Bishop Mountain (see exhibits). Drainage leaves the Parcel along various vegetated swales which then flow into two Class III watercourses (see exhibits). Riparian vegetation occurs in patches along these watercourses. These ephemeral drainage channels start in the eastern portion of the parcel and flow southwest, eventually flowing into Gunther Creek. The channels range in width from 3 to 6 feet and the depth ranges from approximately 6 inches up to 2 feet. The channels have an ordinary high-water mark, bank erosion and scouring, and litter and debris present; the channel was intermittently wet, but not flowing. There are no vernal pools or other isolated wetlands on the Parcel. The Parcel contained an off-stream pond that was excavated and sealed with a liner; this has been abandoned and the area restored. A spring found in the southwest portion of the parcel was used as a water source; this use has been discontinued. A thin band of emergent wetland vegetation surrounds this spring. The nearest portion of the proposed cultivation operation is approximately 200 feet from a Class III watercourse.

6.5. How Impacts Will Be Minimized

No special-status fish or wildlife species are known to occur on the Parcel. Furthermore, the cannabis cultivation operation is over 200 feet away from ephemeral streams and 3,000 feet away from perennial streams. No impacts to special-status species are likely to occur from project implementation because the requisite habitat for special status species does not occur on this parcel. Nevertheless, if land clearing of natural habitats is performed in the future, a pre-construction special-status species survey is recommended.

Implementation of the project will not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites. Implementation of the project does not conflict with any county or municipal policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. No commercial tree species need to be removed for this project.

The project does not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved governmental habitat conservation plan. The Parcel is not within the coverage area of any conservation plan. No mitigation is required; no conservation easements or wildlife corridors are required for impact mitigation.

Potential adverse impacts to water resources could occur during construction by modification or destruction of stream banks or riparian vegetation, the filling of wetlands, or by increased erosion and sedimentation in receiving water bodies due to soil disturbance. The existing cultivation operation is at least 100 feet away from the nearest waterbody. The proposed cultivation operation is at least 200 feet away from the nearest waterbody. There is no indication that project implementation will impact any water resources.

If the total area of ground disturbance required for installation of the cultivation operation is greater than 1 acre, the landowner or cultivator will need to enroll for coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 2009-0009-DWQ) and implement a storm water pollution prevention plan.

Potential adverse impacts to water resources could occur during operation of cultivation activities resources by discharge of sediment or other pollutants (fertilizers, pesticides, human waste, etc.) into receiving waterbodies. However, the Cultivator has enrolled in State Water Resources Control Board's Order WQ 2017-0023-DWQ General Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities (General Order). Compliance with this General Order will ensure that cultivation operations will not significantly impact water resources by using a combination of Best Management Practices, buffer zones, sediment and erosion controls, inspections and reporting, and regulatory oversight. Note also that this site will be Tier II, and that a sediment and erosion control plan is being implemented as part of the larger Site Management Plan. Implementation of these plans and compliance with the General Order will ensure that water quality impacts are less than significant. Therefore, no mitigation is required. It is recommended that a formal delineation of jurisdictional waters be performed before construction work, or ground disturbance, is performed near any wetland, spring, or channel.

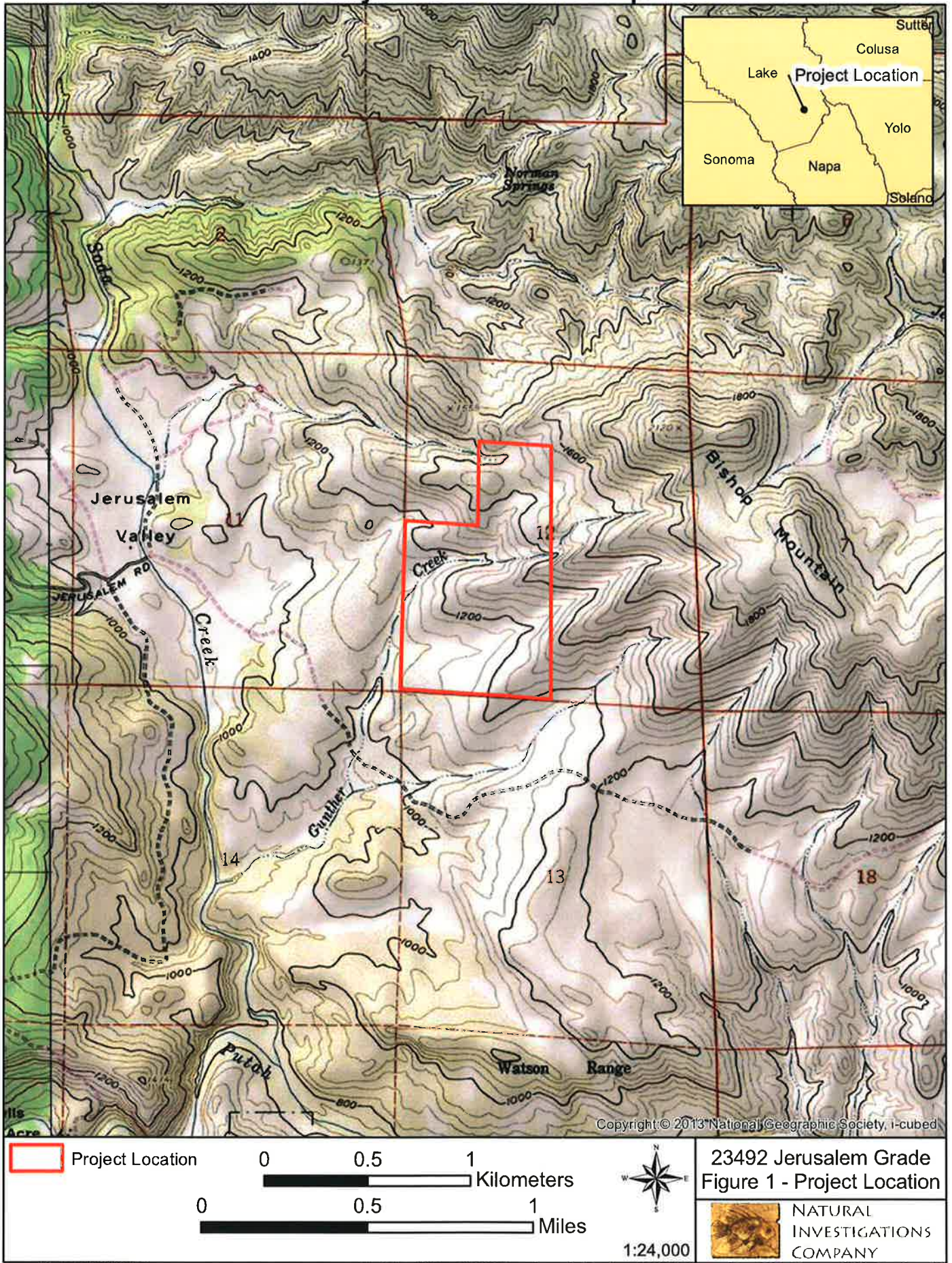
The Parcel contains suitable nesting habitat for various bird species because of the presence of trees, poles, and dense brush. However, no nests or nesting activity was observed in the project area during the field survey. Riparian corridors are focal areas for birds. Riparian habitat is present within the Parcel. However, implementation of the project will have no impact on the riparian habitat. Trees must be inspected for the presence of active bird nests before tree felling or ground clearing. If active nests are present in the project area during construction of the project, CDFW should be consulted to develop measures to avoid "take" of active nests prior to the initiation of any construction activities. Avoidance measures may include establishment of a buffer zone using construction fencing or the postponement of vegetation removal until after the nesting season, or until after a qualified biologist has determined the young have fledged and are independent of the nest site.

6.6. References and Resources

Rodeik, J. and E. Bolen. 2001. *Wildlife and Habitats in Managed Landscapes*. Island Press, Washington, D.C.

7.0 EXHIBITS

Project Location Map





- | | | |
|-----------------|----------------------------|---------------------|
| Parcel Boundary | Existing Garden | Processing building |
| Water Tank | Proposed Garden | |
| Gravel Road | Terraces, Abandoned Garden | |
| Dirt Road | Dirt pad, Abandoned Garden | |
| Storage shed | Watercourse Class 3 | |



0 300 600 Feet

23492 Jerusalem Grade
Facility Overview



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Legend

- Chaparral - Mature
- Chaparral - Recovering from Fire
- Urbanized



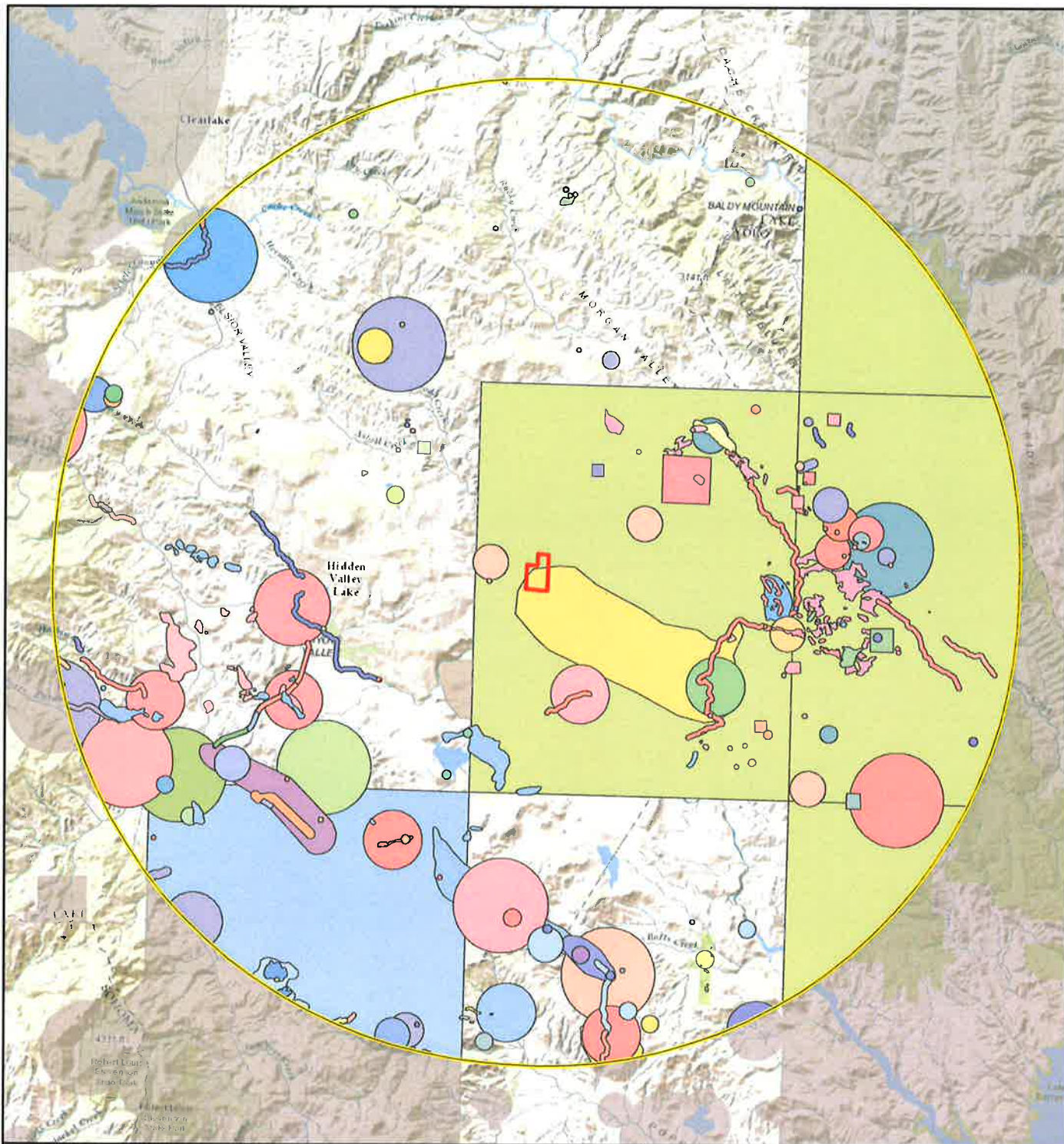
2000 ft

Vegetation Community Types

23492 Jerusalem Grade



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Project Location 10 Mile Buffer

1:190,000 1 inch = 3 miles

0 3 6 Miles



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. Natural Investigations Company can not guarantee the accuracy and content of electronic files. The master file is stored by Natural Investigations Company and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission. Data Sources: California Department of Fish and Wildlife. 2017. RareFind 5.x, California Natural Diversity Data Base. Biogeographic Data Branch, Sacramento, California. (updated monthly by subscription service)

Special-Status Species Occurrences Map

23492 Jerusalem Grade

Jericho Valley 1958 Quadrangle Revised 1993:
Township 11N, Range 6W, Section 12



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**GROWING MEDIUM MANAGEMENT PLAN,
FERTILIZER MANAGEMENT PLAN,
INTEGRATED PEST MANAGEMENT PLAN,
SOLID WASTE MANAGEMENT PLAN,
HAZARDOUS WASTE MANAGEMENT PLAN,
AND CANNABIS VEGETATIVE WASTE MANAGEMENT PLAN,
FOR THE CANNABIS CULTIVATION OPERATION
AT 23492 JERUSALEM GRADE, MIDDLETOWN, CA**

**Prepared: December 1, 2017
Revised: December 5, 2018**

Applicant:

Chris Jennings

Prepared by:

**Natural Investigations Company, Inc.
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Table of Contents

1.0	Introduction	3
2.0	Project Location and Description	4
3.0	Growing Medium Management Plan.....	6
3.1.	Requirements / Goals.....	6
3.2.	Inventory and Handling of Growing Media.....	6
3.3.	Waste Reduction and Disposal	7
3.4.	References and Resources	7
4.0	Fertilizer Management Plan	8
4.1.	Requirements / Goals.....	8
4.2.	Inventory and Handling of Fertilizers	8
4.3.	References and Resources	9
5.0	Integrated Pest Management Plan.....	10
5.1.	Requirements / Goals.....	10
5.2.	Inventory of Pesticides	10
5.3.	Protocols for Use	11
5.4.	References and Resources	11
6.0	Solid Waste Management Plan.....	13
6.1.	Requirements / Goals.....	13
6.2.	Waste Inventory.....	13
6.3.	Material Handling and Waste Management.....	14
6.4.	Waste Reduction	16
6.5.	References and Resources	16
7.0	Hazardous Waste Management Plan	17
7.1.	Requirements and Goals.....	17
7.2.	Chemical Handling	17
7.3.	Pollution Prevention and Spill Response.....	18
7.4.	References and Resources	19
8.0	Cannabis Vegetative Material Waste Management Plan	20
8.1.	Goals	20
8.2.	Sources of Green Waste	20
8.3.	Handling and Disposal of Green Waste.....	21
8.4.	References and Resources	23

9.0 Exhibits A

10.0 Appendix: Fact Sheets (Bound Separately)..... B

11.0 Appendix: List of Approved Pesticides..... C

12.0 Appendix E: Material Safety Data Sheets D

1.0 INTRODUCTION

These Plans have been prepared to fulfill the requirements of Lake County Marijuana Cultivation Ordinance (Ordinance No. 2997). Each Plan is intended to be a "living" document, updated as necessary, such that when operational activities or processes are modified or replaced, the applicable Plans are similarly revised to reflect these changes. These Plans should be amended whenever there is a significant change in cultivation operations, whenever the goals of the Plans are not met, whenever a pollution event occurs, or whenever a violation notice is issued. The Ordinance requires that any deviations from, or changes in, the Plans must be conveyed to the Department in writing within thirty (30) days of the change.

2.0 PROJECT LOCATION AND DESCRIPTION

This cannabis cultivation operation is located on a 183-acre parcel (APN 013-013-11) with address 23492 Jerusalem Grade, Middletown, California. The original operational area was approximately 0.2 acres; this garden is being abandoned and the area restored. The new gardens (Project Area) will be established in phases and allow for multiple cultivation licenses with individual gardens. The original Cannabis cultivation operation consisted of a graded garden within a fenced enclosure. The enclosure was approximately 7,500 square feet (0.17 acres). This garden was abandoned, and the area is being revegetated. Three additional potential garden sites were located at the north end of the parcel. These sites were graded and terraced, but no Cannabis operations were ever established. These three garden sites will be abandoned.

The new garden complex and supporting facilities, an area of approximately 5 acres (the Project Area), will be established in phases and allow for multiple cultivation licenses with individual gardens each capable of growing at least 10,000 square feet of Cannabis canopy. Phase One would be for the 2019 growing season and would consist of four garden compounds (each 11,100 square feet). Phases Two would be for the 2020 grow season and have eight 11,340 square foot compounds; two 11,250 square foot compounds; and one 5,400 square foot compound. A new processing center of approximately 5,000 square feet is also planned, as well as a stormproof chemical shed (10 feet by 10 feet).

The proposed cultivation operations will consist of outdoor gardens. with plants growing in plastic pots, fabric bags ("Smart Pots") and/or raised beds. A new shed for product processing, approximately 5,000 to 4,000 square feet, will be constructed adjacent to the well. No soil is currently stored on-site. However, future soil deliveries will be staged adjacent to the outdoor garden complex. There would also be a 1,000 gallon cone-bottom tank in each garden compound that will be for compost teas.

A well currently serves the single-family residence and the existing garden. This is a permitted well that produces approximately 100 gallons per minute. The proposed garden complex will be irrigated by water from the existing well, which will be pumped into several tanks, each capable of holding 5,000 gallons. The use of water bladders will be discontinued. A previously graded pad for water bladders will be abandoned and revegetated.

The water will be delivered by gravity via underground PVC piping to each garden. Black poly tubing and emitters (drip irrigation) will be used to distribute the water to each planting station. Mixing tanks will be used to add liquid fertilizers and other amendments (compost teas) to the irrigation water. Supplemental irrigation may be applied by hand using garden hoses.

Existing structures consist of a single-family residence and adjacent groundwater well. A small cabin is found near the top of the property. Employees will have access to the toilet in the single-family residence. In addition, portable toilet(s) will be located adjacent to the gardens. Several abandoned structures are found on this parcel. Trash and debris left by a previous owner lay scattered in piles across the southwestern portion of the parcel. The current property owner is in the process of removing the non-functional structures and trash.

The Project Area is accessed by a private gravel road on Jerusalem Grade (see exhibits). Prior to the establishment of this cultivation operation, land use was open space. The surrounding land uses are private estates, cannabis cultivation, and open space. The 2015 Jerusalem Fire burned approximately 80% of the Project Area. Vegetation is recovering from the fire and from the many roads and breaks that were cut during the fire-fighting efforts.

The Project Area has rugged topography, consisting of several ridges and sloping hills of Bishop Mountain (see exhibits). Drainage leaves the Project Area along various vegetated swales and which

then combine into two Class III watercourses (see exhibits). These are potentially-jurisdictional water features. Riparian vegetation occurs in patches along these watercourses. These ephemeral drainage channels start in the eastern portion of the parcel and flow southwest, eventually flowing into Gunther Creek. The channels range in width from 3 to 6 feet and the depth ranges from approximately 6 inches up to 2 feet. The channels have an ordinary high-water mark, bank erosion and scouring, and litter and debris present; the channel was intermittently wet, but not flowing.

The parcel contained an off-channel pond that was excavated and sealed with a liner. This pond will be abandoned and restored to the original condition of the landscape. A spring is located in the southwest portion of the parcel. A thin band of herbaceous wetland vegetation surrounds this spring. The use of this spring as a water source will be abandoned. The nearest portion of the current cultivation area is approximately 130 feet from a Class III watercourse. Future cultivation related operations will take place at least 200 feet from a Class III watercourse.

Numerous roads and fire-breaks are found within this parcel. A gravel driveway leads from Jerusalem Grade to the southwest corner of the parcel. A dirt road accesses the current garden site. Once this garden is abandoned, the access road will be maintained as a fire-break. The proposed garden and processing shed will be accessed by the construction of a new gravel road which will connect to the existing gravel driveway. A dirt/gravel road which extends from the driveway and runs north along the parcel will be maintained as an easement to the adjoining parcel and as fire access. Additional roads and firebreaks within the parcel will be abandoned and allowed to naturally revegetate.

3.0 GROWING MEDIUM MANAGEMENT PLAN

3.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

- (i) *A Growing Medium Management Plan*
 - 1. *All commercial cannabis cultivation, cannabis nursery, and cannabis microbusinesses shall properly manage growing medium and dispose of growing medium properly.*
 - 2. *All permittees shall prepare a Growing Medium Management Plan. Said plan shall:*
 - a. *Provide an estimate of the type and amount of new growing medium that will be used and amount of growing medium will be disposed of on an annual basis.*
 - b. *Describe how the permittee will minimize growing medium waste generation.*
 - c. *Describe how growing medium waste will be disposed.*
 - 3. *All permittees shall implement the procedures as outlined in their Growing Medium Management Plan as approved by the Planning Commission. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

3.2. Inventory and Handling of Growing Media

The CDFA CalCannabis Program describes soils handling as follows:

"Soils used in cannabis cultivation may be treated, reused, stockpiled, and/or discarded. For reuse, soils are piled and covered with tarps for an extended period (months to a year) to allow heat from sunlight to destroy any potential soil pathogens or pests. Another practice for soil reuse is to run a compost tea through the soils between harvests to restore soil nutrients. Although it is not a direct component of the Proposed Program, another aspect of soil reuse can include laboratory testing of soil samples to identify nutrient deficiencies or other issues. Identifying such deficiencies allows the soil to be properly treated or amended with fertilizers or other soil amendments, thereby correcting these deficiencies, prior to being reused with a new cannabis crop." (CDFA 2017)

"Outdoor cultivation typically involves planting rooted cannabis cuttings or seeds in the early spring and harvesting the plants in the fall (mid-September through November), after the plants flower. Soils used in the pots or grow bags are typically amended to ensure that nutrients are available to the plants throughout the growing season. Compost teas, which are created by steeping compost material in water, may also be used to fulfill nutrient needs (Ingham 2014). Water and nutrient supplement needs for outdoor cultivation may vary depending on the type of growing container selected. For example, raised beds typically require more watering and additional liquid nutrient application compared to other growing container options." (CDFA 2017)

The growing medium for this cultivation operation will be approximately 1,000 yards of amended topsoil, which is imported. Each planting station will consist of a large fabric/plastic pot filled with the amended topsoil. Granular fertilizers are mixed into the amended topsoil. The liquid fertilizer and compost tea are added to the irrigation water.

The names, types, and volumes of specific products will be added to this plan as they are introduced and utilized in this cultivation operation.

3.3. Waste Reduction and Disposal

Growing media waste will be reduced or eliminated by composting and blending old soils with new soils and amendments. No growing media is expected to be disposed. Instead, media is reduced in volume yearly because it is absorbed by the plants and metabolized by soil organisms (bacteria, fungi, invertebrates). The primary waste generated will be vegetative material waste (green waste), which is managed under a separate Plan. Green waste, primarily cannabis root balls and stems, will be chipped and mulched and blended back into the planting soil (see Vegetative Waste Plan). Soil staging areas and compost piles will be located inside the fenced garden. BMPs will be employed to ensure that these piles do not contaminate stormwater or cause nuisance dust or odor issues.

3.4. References and Resources

Central Valley Regional Water Quality Control Board's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

Troeh, F., and J. A. Hobbs. 2003. Soil and Water Conservation for Productivity and Environmental Protection, 4th ed. Prentice Hall, Upper Saddle River, N.J.

4.0 FERTILIZER MANAGEMENT PLAN

4.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

- (p) *A Fertilizer Management Plan*
1. *Cultivation, nursery and microbusiness permittees shall comply with the following fertilizer application and storage protocols:*
 - a. *Comply with all fertilizer label directions;*
 - b. *Store fertilizers in a secure building or shed;*
 - c. *Contain any fertilizer spills and immediately clean up any spills;*
 - d. *Apply the minimum amount of product necessary;*
 - e. *Prevent offsite drift;*
 - f. *Do not spray directly to surface water or allow fertilizer product to drift to surface water. Spray only when wind is blowing away from surface water bodies;*
 - g. *Do not apply fertilizer when they may reach surface water or groundwater; and*
 - h. *The use of fertilizer shall not be located within 100 feet of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool. For purposes of determining the edge of Clear Lake, the setback shall be measured from the full lake level of 7.79 feet on the Rumsey Gauge.*
 2. *Permittees shall prepare a Fertilizer Management Plan to be approved by the Lake County Agricultural Commissioner. Said plan shall include:*
 - a. *Product name and fertilizer grade (s) of all fertilizers to be applied to cannabis during any stage of plant growth.*
 - b. *Proposed application rates.*
 - c. *A map of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool on the parcel of land or within 100 feet of the parcel and a 100 foot setback from any identified spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool.*
 3. *All permittees shall implement the procedures as outlined in their Fertilizer Pest Management Plan as approved by the Agricultural Commissioner. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

4.2. Inventory and Handling of Fertilizers

Annual fertilizer inputs consist primarily of 1,800 pounds of granular fertilizer and 2,100 gallons of liquid fertilizer in addition to 195 gallons of liquid compost tea starter. Granular fertilizers are mixed into the amended topsoil. The liquid fertilizer and the compost tea are added to the irrigation water.

During a typical growing season, the following amounts of chemicals/materials are used:

- Granular fertilizers/soil amendments
 - Bat guano nitrogen – 500 pounds
 - Sea bird guano phosphorus – 500 pounds
 - Mr. B's grow – 200 pounds
 - Mr. B's bloom – 200 pounds
 - Glacier dust – 100 pounds
 - Oyster shell – 100 pounds
 - Kelp powder – 100 pounds
 - Trace minerals – 100 pounds

- Liquid fertilizers/soil amendments
 - Biologic Solutions liquid grow – 1,050 gallons
 - Biologic solutions liquid bloom – 1,050 gallons
- Compost Tea
 - Worm castings – 60 gallons
 - Humus – 60 gallons
 - Seaweed extract – 5 gallons
 - Humate – 20 gallons
 - Fish hydrolysate – 40 gallons
 - Activate – 2.5 gallons
 - Bacillus subtilis – 2.5 gallons
 - Mycorrhizae – 5 gallons
 - Azospirillum – 2.5 gallons

Fertilizers will be stored in a storm-proof shed or Conex container so that stormwater is not contaminated. Fertilizers will be properly labeled and open containers sealed when stored. Personal protective equipment will be used by staff when handling fertilizers and other chemicals, such as safety glasses, gloves, dust mask, boots, and pants and long-sleeved shirt. MSDS sheets will be stored in the office and staff members will be able to reference them at any time.

4.3. References and Resources

Central Valley Regional Water Quality Control Board's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

Gershuny, G. 1992. The Rodale Book of Composting: Easy Methods for Every Garden. Rodale Press. Emmaus, PA.

Havlin, J., et al. 2016. Soil Fertility and Fertilizers, 8th ed. Pearson. Upper Saddle River, N.J.

Hess, A. 2016. Homegrown Humus: Cover Crops in a No-Till Garden, Volume 1. Wetknee Books, St. Paul, VA.

Loewnfels, J. 2013. Teaming with Nutrients: The Organic Gardeners Guide to Optimizing Plant Nutrition. Timber Press. Portland, Oregon.

5.0 INTEGRATED PEST MANAGEMENT PLAN

5.1. Requirements / Goals

According to the Ordinance, the Plan must have the following elements:

(o) *Integrated Pest Management Plan*

1. *Cultivation, nursery and microbusiness permittees shall comply with the following pesticide application and storage protocols:*
 - a. *Comply with all pesticide label directions;*
 - b. *Store chemicals in a secure building or shed to prevent access by wildlife;*
 - c. *Contain any chemical leaks and immediately clean up any spills;*
 - d. *Apply the minimum amount of product necessary to control the target pest;*
 - e. *Prevent offsite drift;*
 - f. *Do not apply pesticides when pollinators are present;*
 - g. *Do not allow drift to flowering plants attractive to pollinators;*
 - h. *Do not spray directly to surface water or allow pesticide product to drift to surface water. Spray only when wind is blowing away from surface water bodies;*
 - i. *Do not apply pesticides when they may reach surface water or groundwater; and*
 - j. *Only use properly labeled pesticides.*
 - k. *The use of pesticides shall not be located within 100 feet of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool. For purposes of determining the edge of Clear Lake, the setback shall be measured from the full lake level of 7.79 feet on the Rumsey Gauge.*
2. *Permittees shall prepare an Integrated Pest Management Plan to be approved by the Lake County Agricultural Commissioner. Said plan shall include:*
 - a. *Product name and active ingredient(s) of all pesticides to be applied to cannabis during any stage of plant growth; and*
 - b. *Integrate pest management protocols including chemical, biological, and cultural methods the applicant anticipates using to control or prevent the introduction of pests on the cultivation site*
 - c. *A map of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool on the parcel of land or within 100 feet of the parcel and a 100 foot setback from any identified spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool.*
3. *All permittees shall implement the procedures as outlined in their Integrated Pest Management Plan as approved by the Agricultural Commissioner. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

5.2. Inventory of Pesticides

The CDFA CalCannabis Program describes pesticide use as follows:

"Although California Department of Pesticide Regulation (CDPR) is responsible for managing California's statewide pesticide regulatory program, the local enforcement of pesticide use regulations is delegated to County Agricultural Commissioners (CACs). With oversight by CDPR, CACs plan and develop county programs and regulate pesticide use to ensure that applicators comply with label directions and pesticide laws and regulations (CDPR 2011). CACs oversee pesticide use reporting, promote best management practices, and monitor field applications, and they may assist in cleanup of accidental pesticide spills.

CACs inspect operations and records of growers, nonagricultural (including industrial and institutional) applicators, pest control dealers, agricultural pest control advisers (PCAs), farm labor contractors, and government agencies for compliance with worker protection standards and other pesticide safety requirements. CACs, assisted by CDPR, investigate incidents in which pesticides harm agricultural workers, people nearby, and the environment, including environmental damage (such as fish or wildlife kills) and water quality contamination. When an enforcement action is needed, CACs have the option to revoke or suspend the right of a company to do business in their county or to issue civil or criminal penalties (CDPR 2011)....License and certificate types issued by CDPR under the pesticide regulatory program include, but are not limited to, the following (CDPR 2017).....

Because there are no restricted-use pesticides registered for use on cannabis, application of pesticides for cannabis cultivation would not require any type of license or certificate. Cultivators, however, may obtain a QAC or QAL, or private applicator certificate, or hire individuals with these credentials, in order to avail themselves of information such as proper mixing, loading, and application techniques and selection and use of personal protective equipment. Cannabis cultivators would not necessarily be required to obtain the services of a PCA but, nonetheless, may choose to do so in order to get professional advice on pest control.” (CDFA 2017)

At this cultivation operation, pests will be controlled by employing only approved, organic-certified pesticides. Weeds will be controlled using a line trimmer or mulch; herbicides will not be used. Live traps will be used for rodents.

Organic pesticides may consist of the following:

- Marrone Innovations: Grandevo – 20 pounds
- Marrone Innovations: Venerate – 10 gallons
- Marrone Innovations: Regalia – 5 gallons
- Dr. Zymes – 25 gallons
- Nuke'em – 25 gallons
- Botanigard – 6 quarts

5.3. Protocols for Use

Pesticides will be used according to the instructions on the label or MSDS. County regulations also apply to listed pesticides. Pesticides will be stored in a storm-proof shed or Conex container so that stormwater is not contaminated. Chemicals will be properly labeled and open containers sealed when stored. When handling chemicals, staff will use personal protective equipment such as safety glasses, gloves, dust mask, boots, pants and long-sleeved shirt.

5.4. References and Resources

Central Valley Regional Water Quality Control Board's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

Flint, M.L., and P. Gouveia. 2010. *IPM in Practice: Principles and Methods of Integrated Pest Management*, 2nd ed. University of California Agriculture and Natural Sciences, Richmond, CA.

Rosenthal, E., and K. Imbriani. 2012. *Marijuana Pest and Disease Control: How to Protect Your Plants and Win Back Your Garden*. Quick American Publishing, Oakland, CA.

6.0 SOLID WASTE MANAGEMENT PLAN

6.1. Requirements / Goals

According to the Ordinance, the Solid Waste Management Plan must have the following elements:

(f) *A Solid Waste Management Plan*

1. *All cannabis permittees shall minimize the generation of solid waste and dispose of solid waste properly.*
2. *All permittees shall prepare a Solid Waste Management Plan to be approved by Lake County Integrated Waste Management. Said plan shall:*
 - a. *Provide an estimate of the type and amount of solid waste that will be generated on an annual basis.*
 - b. *Describe how the permittee will minimize solid waste generation, including working with vendors to minimize packaging.*
 - c. *Describe how solid waste will be disposed.*
3. *All permittees shall implement the procedures as outlined in their Solid Waste Management Plan as approved by Lake County Integrated Waste Management. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*
4. *All permittees shall manage all waste that is hazardous waste, as defined in Section 40141 of Public Resources Code, in compliance with all applicable hazardous-waste statutes and regulations.*

The goals of this solid waste management plan are:

- Minimize the generation of solid waste and dispose of solid waste properly.
- Provide an estimate of the type and amount of solid waste that will be generated on an annual basis.
- Describe how mediums, plant waste, and material waste will be handled.
- Describe how the permittee will minimize solid waste generation, including working with vendors to minimize packaging.
- Describe how solid waste will be disposed

6.2. Waste Inventory

The CDFA CalCannabis Program describes solid waste handling as follows:

"In addition to generating green waste, cannabis cultivation operations generate solid waste from various materials and containers used during cultivation (e.g., soils, fertilizers, and pots), household trash from workers, old irrigation piping, and other equipment. Cultivators must comply with the California Integrated Waste Management Act of 1989, which requires that all California cities and counties reduce, recycle, and compost at least 50 percent of wastes by 2000." (CDFA 2017)

The following are potential sources of solid waste that may be generated during cultivation operations:

- growing medium waste: soil, soil amendments, mulch, humus, vermiculite, perlite, etc., and their containers
- landscape maintenance: trimmings, treated lumber, fencing, leaf bags
- irrigation system waste: black poly tubing, PVC pipes and fittings, hoses, mixing tanks, etc.
- Cannabis processing waste: stems and root balls, scissors, knives, saws, etc.
- packaging material from vendors: pallets, plastic bags, cloth bags, plastic jugs and buckets, etc.
- trash from staff: food packaging, water bottles, toilet paper, cigarette butts, etc.
- feces (addressed in the Wastewater Management Plan).

Volume of solid waste generated at this cultivation facility is estimated at 130 gallons / week (equivalent to two household 65-gallon roll-carts).

6.3. Material Handling and Waste Management

Several abandoned structures are found on this parcel. Trash and debris left by a previous owner lay scattered in piles across the southwestern portion of the parcel. The current property owner is in the process of removing the non-functional structures and trash.

All chemicals will be stored in a storm-proof shed or Conex container so that stormwater is not contaminated. Chemicals will be properly labeled and open containers sealed when stored. Personal protective equipment such as safety glasses, gloves, dust mask, boots, and pants and long-sleeved shirt, will be used by staff when handling chemicals.

The locations of waste bins / containers are shown in the Exhibits. Waste will be hauled to an appropriate licensed facility by a private waste-hauling contractor, such as Waste Management, Inc., or C & S Waste Solutions, or by cultivation operation staff. The Lake County Integrated Waste Management facilities are:

- Eastlake Landfill, 16015 Davis Ave, Clearlake
- Lake County Waste Solutions Transfer Station and Recycling Center, 230 Soda Bay Road, Lakeport
- South Lake Refuse and Recycling Center, 16015 Davis Street, Clearlake
- Quackenbush Mountain Resource Recovery and Compost Facility, 16520 Davis Street, Clearlake

Recyclables will be segregated from the solid waste and deposited in an appropriate recycling facility. Recyclables such as scrap metal, cardboard, glass, metal and plastic containers, and newspaper can be conveniently unloaded at a recycling drop-off center (see previous list of Lake County Integrated Waste Management facilities).

Yard waste, green waste, and other compostable materials will be segregated from the solid waste and shredded and composted onsite for reuse as mulch or as a soil amendment, or deposited at an appropriate transfer facility. Compost and recyclable wood can be dropped off at any compost where it is processed as new compost. The Cannabis Vegetative Waste Plan has additional details for this cultivation operation.

Household toxic materials will be segregated from the solid waste and disposed of at a Lake County Integrated Waste Management facility.

The following material handling and waste management measures will be implemented:

- Prevent or minimize handling of chemical/industrial materials or wastes that can be readily mobilized by contact with stormwater during a storm event;
- Contain all stored non-solid chemical/industrial materials or wastes (e.g., particulates, powders, shredded paper, etc.) that can be transported or dispersed by the wind or contact with stormwater during handling;
- Cover waste disposal containers and material storage containers that contain chemical/industrial materials when not in use;
- Divert run-on and stormwater generated from within the facility away from all stockpiled materials;
- Immediately clean any spills of chemical/industrial materials or wastes that occur during handling in accordance with the spill response procedures); and
- Observe and clean as appropriate, any outdoor material or waste handling equipment or containers that can be contaminated by contact with chemical/industrial materials or wastes.

A sandbag barrier (Construction BMP SE-8) can be placed around storage areas to prevent stormwater run-on from adjacent upstream areas. Sheds or shipping containers will be used to store hand tools, small parts, and most cultivation materials that can be carried by hand. Very large items will be stored in the open in the general storage areas. Such materials should be elevated with pallets or cement blocks to minimize contact with stormwater. Spill clean-up materials, material safety data sheets, a material inventory, and emergency contact numbers will be maintained and stored in the residence or shipping container.

To reduce or eliminate pollution of storm water from stockpiles of soil and cultivation materials, stockpiles will be surrounded with sediment controls (Construction BMP SE-5: Fiber Rolls, SE-8: Sandbag Barrier, and WM-3 Stockpile Management) as needed. Plastic covers will be used, as needed, before rain events or before strong winds begin.

BMPs will be implemented to minimize storm water contact with waste materials and prevent waste discharges (Construction BMP WM-5 Solid Waste Management). Solid waste should be removed and disposed off-site at least weekly at a proper receiving facility. Any chemicals will be stored in the shipping containers or sheds. Chemical wastes will be appropriately and clearly marked in containers and segregated from other non-waste materials.

Storage of soil amendments and chemicals will employ the following CASQA Industrial BMP fact sheets:

- SC-31: Outdoor Liquid Container Storage
- SC-32: Outdoor Equipment Operations
- SC-33: Outdoor Storage of Raw Materials
- SC-34: Waste Handling and Disposal
- SC-40: Contaminated or Erodible Surfaces
- TC-30: Vegetated Swale

- TC-31: Vegetated Buffer Strip.

6.4. Waste Reduction

Solid waste will be reduced using some combination of the following strategies and activities:

- Provide filtered water and dedicated cups instead of bottled water for staff.
- Use biodegradable containers.
- Use durable materials to reduce the use of disposable materials.
- Encourage vendors to use reusable package and shipping containers.
- Minimize the volume of packaging material required by selecting products packaged efficiently or by buying in bulk.
- Grow cannabis plants in the ground instead of in cloth bags, where possible.
- Employ soil fertility practices, such as nitrogen fixation, to reduce the importation of fertilizers and soil amendments.
- Use electricity-powered vehicles and equipment and install a solar array and battery storage.

6.5. References and Resources

Central Valley Regional Water Quality Control Board's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

7.0 HAZARDOUS WASTE MANAGEMENT PLAN

7.1. Requirements and Goals

According to the Ordinance, the Hazardous Materials Plan must have the following elements:

(e) *Hazardous Materials*

2. *All permittees shall prepare a Hazardous Waste Management Plan to be approved by Lake County Health Service Department. Said plan shall:*
 - a. *Identify all RCRA and Non-RCRA hazardous waste and Universal wastes the volume of each.*
 - b. *Identify all containers and container management.*
 - c. *Describe storage locations and chemical segregation procedures.*
 - d. *Describe hazardous waste manifest and recordkeeping protocol.*
 - e. *Outline inspection procedures.*
 - f. *Identify emergency spill response procedures.*
 - g. *Describe staff responsibilities.*
 - h. *Describe the training program.*
 - i. *A map of any private drinking water well, spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool on the parcel of land or within 100 feet of the parcel and a 100 foot setback from any identified private drinking water well, spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool. The map shall also include any public water supply well on the parcel or within 200 feet of the parcel and a 200 foot setback from any public water supply well.*
 - j. *Pursuant to the California Health and Safety Code, the use of hazardous materials shall be prohibited except for limited quantities of hazardous materials that are below State threshold levels of 55 gallons of liquid, 500 pounds of solid, or 200 cubic feet of compressed gas.*
 - k. *The production of any Hazardous Waste as part of the cultivation process is prohibited.*
3. *All permittees shall implement the procedures as outlined in their Hazardous Waste Management Plan as approved by Lake County Integrated Waste Management. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change.*

7.2. Chemical Handling

The Lake County Division of Environmental Health is the Certified Unified Program Agency (CUPA) for all of Lake County, and implements hazardous waste and hazardous materials regulations.

The CUPA typically requires a Hazardous Materials Business Plan for the following volumes of hazardous materials: greater than 55 gallons of liquid; 200 standard cubic feet of compressed gas; or 500 pounds of a solid. All permittees shall manage all waste that is hazardous waste, as defined in Section 40141 of Public Resources Code, in compliance with all applicable hazardous-waste statutes and regulations. This cultivation operation does not currently store or use any hazardous materials. Nevertheless, this Hazardous Waste Management Plan will be implemented.

Pesticides will be stored in a storm-proof shed or Conex container so that stormwater is not contaminated. Chemicals will be properly labeled and open containers sealed when stored.

Staff, when handling chemicals, will use personal protective equipment such as safety glasses, gloves, dust mask, boots, and pants and long-sleeved shirt. Therefore, no hazardous wastes will be generated.

Gasoline in 1 or 5-gallon containers is used to fuel small engines such as an electrical generator, quad ATV, tillers and line trimmers. No significant quantities of petroleum products are currently used, and all large equipment fueling and maintenance operations will occur at service stations outside of the Project Area. Should vehicle and equipment fueling or maintenance be performed in the Project Area, the following CASQA Industrial BMP fact sheets will be followed:

- SC-20: Vehicle and Equipment Fueling
- SC-21: Vehicle and Equipment Cleaning
- SC-22: Vehicle and Equipment Maintenance and Repair

Material Safety Data Sheets (MSDS) will be kept on file for each chemical used at this facility. MSDS sheets will be made available to all staff for viewing. When a new chemical is brought on to this facility, there will be a brief "tailgate" meeting to discuss proper storage, handling, and disposal of the chemical.

The CDFA CalCannabis Program concluded

"With adherence to existing hazardous materials laws, the risk of accidental releases of hazardous materials from cultivation activities that could cause substantial hazards is considered low. In general, cannabis cultivation would not make intensive use of hazardous materials. In addition, the Proposed Program's environmental protection measures (Sections 8301[a][4], 8302[a][5], and 8313 of the proposed regulations, as provided in Appendix A) would minimize potential accidental releases of hazardous materials by requiring licensees to store chemicals in a secure building or shed, and to contain any chemical leaks and immediately clean up any spills. Therefore, the risk of accidental releases of hazardous materials from lawful cannabis cultivation operations would be lower than many other ongoing activities in the state, including existing unpermitted cannabis cultivation activities." (CDFA 2017)

"Cannabis cultivation sites may be located in areas of high risk for wildfire." (CDFA 2017)

7.3. Pollution Prevention and Spill Response

A pollution prevention and spill response subplan was prepared in the following document:

- *Storm Water Management Plan for 23492 Jerusalem Grade Road, Middletown, CA. 2017. Prepared for the Central Valley Regional Water Quality Control Board Prepared by Natural Investigations Co.*

This Storm Water Management Plan prescribes the following practices: good housekeeping; preventative maintenance; other BMPs; spill and leak prevention and response measures, and a monitoring program.

The spill prevention and control plan includes the following components:

- Maintenance of spill kit for petroleum hydrocarbons on site and in fuel supply trucks to include:

- Containment drum;
 - Oleophilic absorbent pads; and
 - Granular spill absorbent suitable for petroleum, brake fluid, and antifreeze;
- Daily inspection of equipment for oil and fuel leaks;
- Fueling only in the designated area; and
- Training of personnel on handling of leaks (training at tailgate safety meetings).

7.4. References and Resources

Central Valley Regional Water Quality Control Board's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

8.0 CANNABIS VEGETATIVE MATERIAL WASTE MANAGEMENT PLAN

8.1. Goals

According to the Ordinance, the Cannabis Vegetative Material Waste Management Plan must have the following elements:

(h) *A Cannabis Vegetative Material Waste Management Plan*

1. *All commercial cannabis cultivation, cannabis nursery, cannabis manufactures, cannabis distributor, and cannabis microbusinesses shall minimize the generation of cannabis vegetative waste and dispose of cannabis vegetative waste properly.*
2. *All permittees shall prepare a Cannabis vegetative Waste Management Plan to be approved by Lake County Integrated Waste Management. Said plan shall:*
 - a. *Provide an estimate of the type and amount of cannabis vegetative waste that will be generated on an annual basis.*
 - b. *Describe how the permittee will minimize cannabis vegetative waste generation.*
 - c. *Describe how solid waste will be disposed.*
3. *All permittees shall implement the procedures as outlined in their Cannabis vegetative Waste Management Plan as approved by Lake County Integrated Waste Management. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change*
4. *Cannabis waste shall not be sold.*

The goals of this green waste management plan are to:

- Describe how growing media, plant waste, and material waste will be handled.
- Provide an estimate of the type and amount of cannabis vegetative waste that will be generated on an annual basis.
- Minimize the generation of green waste, and
- Describe how green waste will be disposed.

8.2. Sources of Green Waste

The CDFA CalCannabis Program describes green waste as follows:

"Green waste is generated throughout the cannabis cultivation process. Some plants fail to reach maturity, pruning generates waste, nuisance weeds must be removed, and other plant material remains unused following harvesting, processing, and preparation for a new crop to be planted. Processing, including trimming, is described in Section 3.8 below.

Some cultivators may use sugar leaves, branch stalks, or stems for various cannabis or hemp products; typically, however, after the flowers are harvested, the remainder of the cannabis plant becomes green waste. Removal of some large plants, particularly in outdoor cultivation operations, may require a chainsaw due to the strength and thickness of the plant's stem. Green waste is generally not piled and stored near active cannabis crops to avoid botrytis or other fungal pest issues that may occur on the waste and spread to the living cannabis plants. Disposal of green waste would follow procedures established by the Proposed Program. On-site composting is an option. If off-site disposal is used, the cultivator would make all cannabis waste unusable and unrecognizable before it leaves the licensed premises by grinding and mixing the green waste with non-consumable solid wastes such that the resulting mixture is at

least 50 percent non-cannabis waste. Under Section 8305, Cannabis Waste Management, of the Proposed Program regulations, acceptable types of non-cannabis waste are any nonhazardous compostable materials, as defined in Title 14 of the California Code of Regulations at Section 17852(a)(11). After the waste is ground and mixed, licensees may dispose of it at a manned and permitted solid waste landfill, compostable materials handling facility, or in-vessel digestion facility as described in the regulations.” (CDFA 2017)

Sources of green waste on this cultivation operation consist of the following:

- growing medium wastes: soil, soil amendments, mulch, humus, vermiculite, perlite, etc.
- landscape maintenance: lawn and weed trimmings, treated lumber, wood fencing, etc.
- Cannabis processing waste: leaves, stems, and root balls that remain after flower harvest, trimming, and grooming; whole dead plants; etc.

Volume of green waste generated by this cultivation operation is estimated at:

- two cubic yards per month (equal to 24 cubic yards per year).

8.3. Handling and Disposal of Green Waste

Non-cannabis green waste will be composted onsite. Cannabis green waste will either be composted onsite or disposed at a licensed landfill offsite after rendering it unconsumable.

Large-stemmed and woody green waste will be shredded in a wood chipper, as necessary. Green waste will be composted by mixing the green waste with soil or amendments, wetted as needed, and inoculating with humus. Compost heaps should be at least one cubic yard in size to generate and sustain necessary metabolic heat for composting (to sustain aerobic digestion). Compost heaps should be segregated into batches as they age, with humus being the resulting product after several weeks of composting. Compost heaps should be turned often to encourage aeration and aerobic digestion and supplemental water added to keep the heaps moist, but not wet (to discourage anaerobic digestion). Cannabis waste should be shredded and mixed with at least an equal amount of compostable materials such as food waste, yard waste, or growing medium (to render the cannabis unconsumable). Cannabis vegetative waste must be kept inside the locked fence or other locked compound at all times.

If cannabis waste is to be disposed offsite, it should first be shredded and blended with an equal part of non-consumable material, such as cardboard. Cannabis waste must be kept inside the locked garden area or other locked compound until ready for transport. It would then be transported as solid waste to the proper disposal facility (see Solid Waste Management Plan).

California Department of Food and Agriculture’s CalCannabis Cultivation Licensing Program dictates specific cannabis waste management practices, that will be adopted, as applicable, by this cultivation operation. The following draft regulations from the CalCannabis Cultivation Licensing Program are quoted as follows, and incorporated by reference:

§ 8305. Cannabis Waste Management

(a) For the purposes of this Chapter, “cannabis waste” is waste that is not hazardous waste as defined in Section 40141 of Public Resources Code, and is solid waste, as defined in Section 40191 of Public Resources Code, that contains cannabis and that has been made unusable and

unrecognizable in the manner prescribed in subsection (e). A licensee may not sell cannabis waste.

(b) A licensee shall manage all waste that is hazardous waste, as defined in Section 40141 of Public Resources Code, in compliance with all applicable hazardous-waste statutes and regulations.

(c) A licensee shall dispose of cannabis waste as identified in the licensee's Cultivation Plan approved by the Department. A licensee shall not dispose of cannabis waste in an unsecured waste receptacle, whether in the control of the licensee or not.

(d) Cannabis that a licensee intends to render into cannabis waste shall be held in the designated holding area for a minimum of 72 hours. A licensee shall affix to each batch one or more documents with batch information and weight. At no time during the 72-hour hold period may the cannabis be handled, moved, or rendered into cannabis waste. The cannabis the licensee intends to render into cannabis waste is subject to inspection by the Department.

(e) A licensee shall make cannabis into cannabis waste by rendering the cannabis unusable and unrecognizable. The licensee shall render the cannabis into cannabis waste before removing the cannabis waste from the licensed premises. A licensee shall render the cannabis into cannabis waste by grinding and incorporating the cannabis with other ground material so that the resulting mixture is at least 50 percent noncannabis material by volume. A licensee shall render cannabis into cannabis waste and track that waste by batch.

(f) Cannabis that a licensee wishes to deposit at a compostable materials handling facility or at an in-vessel digestion facility may be rendered cannabis waste by incorporating any nonhazardous compostable material, as defined in Title 14 of the California Code of Regulations at Section 17852 (a)(11), that a compostable materials handling facility or in-vessel digestion facility may lawfully accept.

(g) Unless a licensee will compost onsite, after a licensee renders the cannabis into cannabis waste, a licensee shall do one of the following with the cannabis waste:

- (1) Dispose of the cannabis waste at a manned and fully permitted solid waste landfill;
- (2) Deposit the cannabis waste at a manned solid waste operation or a manned fully permitted compostable materials handling facility; or
- (3) Deposit the cannabis waste at a manned solid waste operation or a manned fully permitted in-vessel digestion facility.

(h) In addition to all other tracking requirements set forth in Sections 8404 and 8405 of this Chapter, a licensee shall use the track-and-trace system and onsite documents to ensure the cannabis waste materials are identified, weighed, and tracked while on the licensed premises and when disposed of or deposited in accordance with subsection (g).

(i) A licensee shall enter the date and time that the cannabis was rendered cannabis waste and the weight of the resulting cannabis waste into the track-and-trace database.

(j) A licensee shall maintain accurate and comprehensive records regarding cannabis waste material that account for, reconcile, and evidence all activity related to the generation and disposal or disposition of cannabis waste. A licensee shall obtain a record from the solid waste facility evidencing the acceptance of the cannabis waste material at the facility. The record shall contain the name and address of the facility, the date, and the volume or weight of the cannabis waste accepted. These documents are records subject to inspection by the Department and shall be kept in compliance with Section 8400 of this Chapter.

(k) A licensee shall enter the date and time of the disposal or deposit of the cannabis waste at a solid waste facility, compostable materials handling facility, or an in-vessel digestion facility into the track-and-trace system.

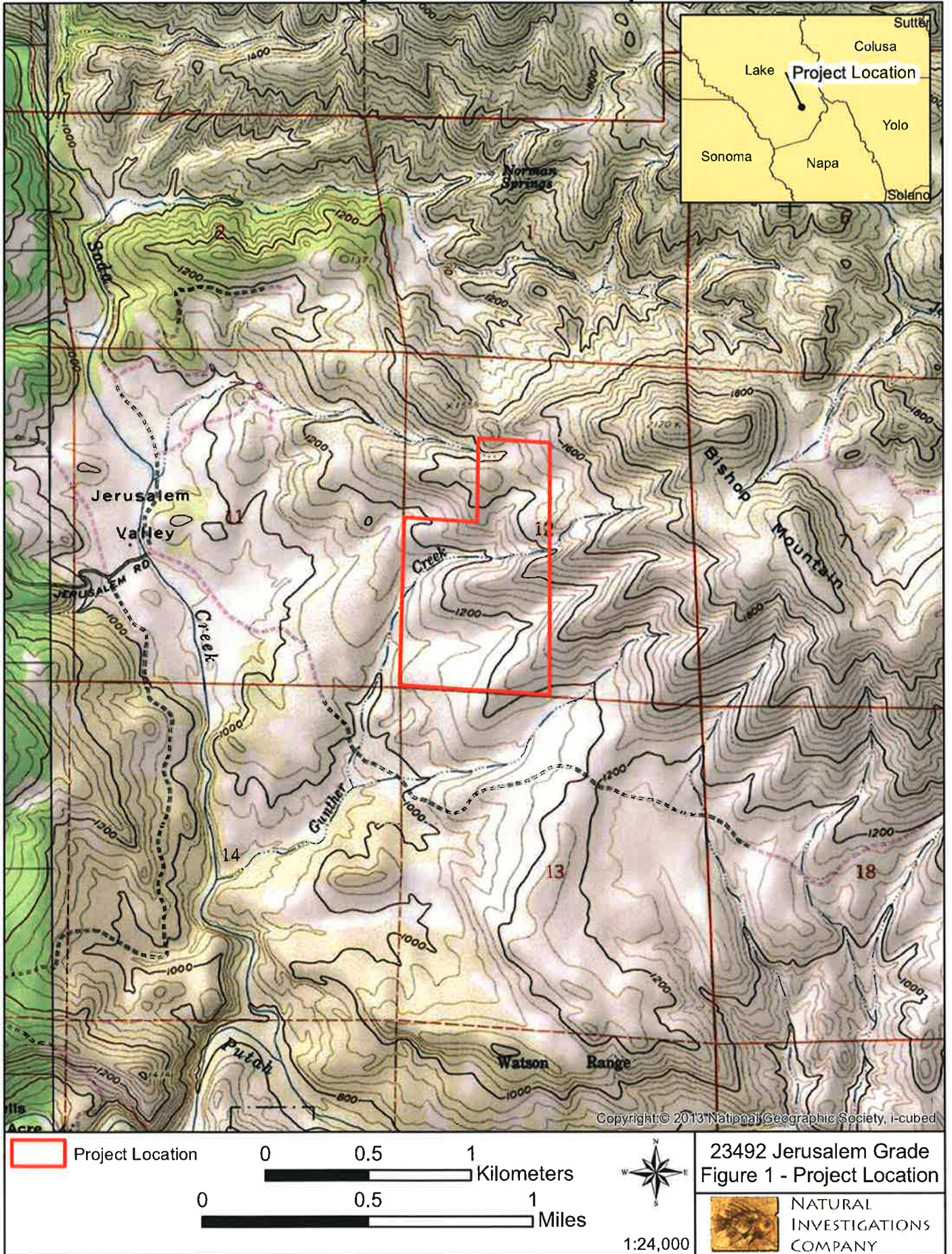
8.4. References and Resources

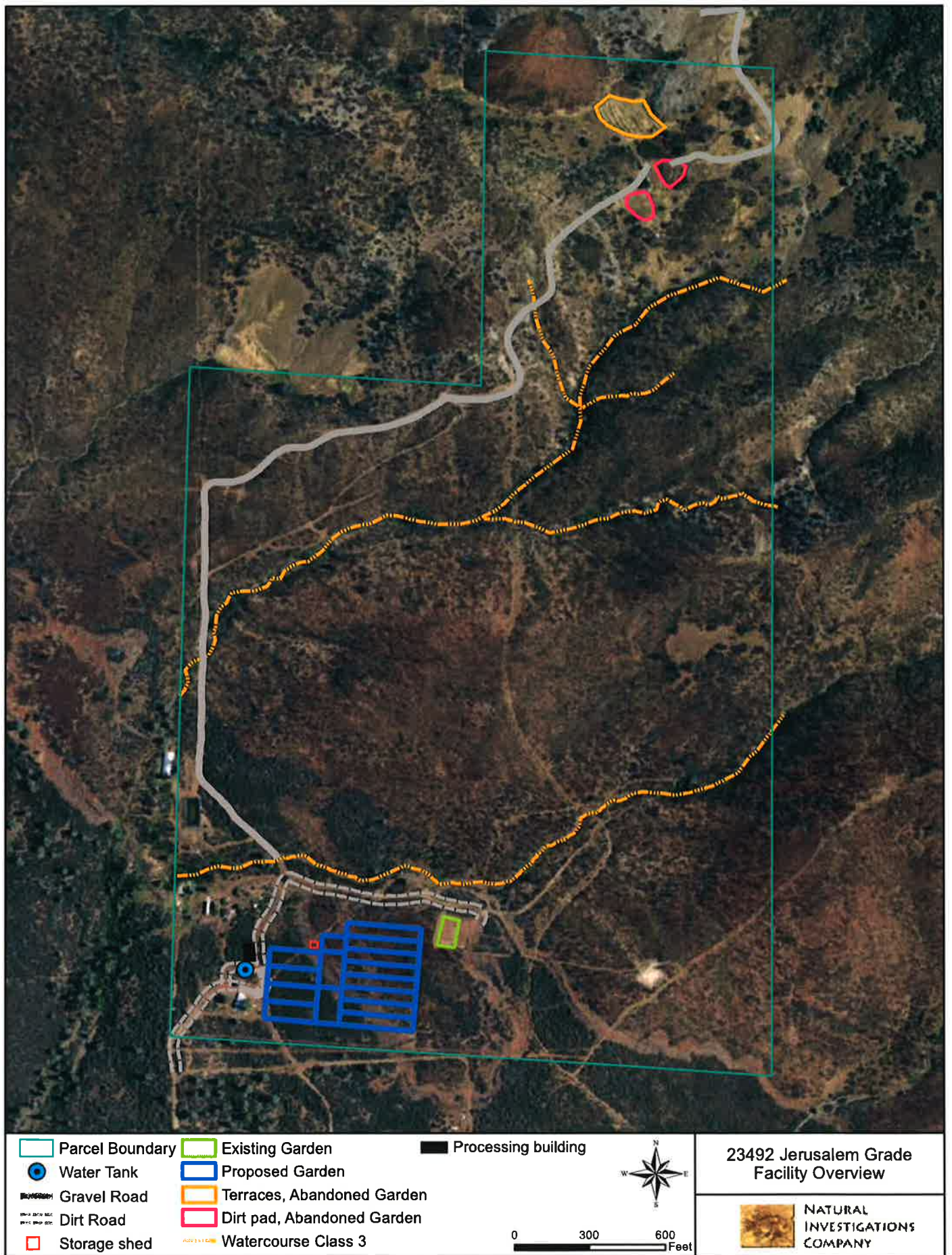
California Department of Food and Agriculture. 2017. CalCannabis Cultivation Licensing Program Draft Program Environmental Impact Report. State Clearinghouse #2016082077. Prepared by Horizon Water and Environment, LLC, Oakland, California. 484 pp.

Gershuny, G. 1992. The Rodale Book of Composting: Easy Methods for Every Garden. Rodale Press. Emmaus, PA.

9.0 EXHIBITS

Project Location Map





10.0 APPENDIX: FACT SHEETS (BOUND SEPARATELY)

- BMP Fact Sheets from the CASQA (2014) Stormwater Best Management Practice Handbook: Industrial & Commercial.
- BMP Fact Sheets from the CASQA (2011) Stormwater Best Management Practice Handbook: Construction.
- Handbook for Forest, Ranch, and Rural Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Upgrading, Maintaining, and Closing Wildland Roads. 2015. Pacific Watershed Associates, Arcata, California. 420 pp.

11.0 APPENDIX: LIST OF APPROVED PESTICIDES



LEGAL PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWERS IN CALIFORNIA

Department of Pesticide
Regulation

PESTS OF MARIJUANA IN CALIFORNIA

Marijuana pests vary according to cultivar (variety), whether the plants are grown indoors or outdoors, and where the plants are grown geographically. The pests included in this review are preliminary and based on the following sources: a presentation given in 2013 by Whitney Cranshaw, an extension entomologist at Colorado State University, and a review article by John M. McPartland, a professor of family medicine at the University of Vermont. We also received input from Kevin Hoffman, Primary State Entomologist, California Department of Food & Agriculture (CDFA).

HOW TO INTERPRET THE TABLES

Table 1 lists active ingredients not illegal to use on marijuana and the pests that these active ingredients target.

These active ingredients are exempt from **residue tolerance requirements**¹ and either exempt from **registration requirements**² or registered for a use that's broad enough to include use on marijuana. Residue tolerance requirements are set by U.S. EPA for each pesticide on each food crop and is the amount of pesticide residue allowed to remain in or on each treated crop with "reasonable certainty of no harm." Some pesticides are exempted from the tolerance requirement when they're found to be safe. Some of these pesticides are bacterial-based insect pathogens (e.g., *Bacillus thuringiensis*) or biofungicides (e.g., *Bacillus subtilis*, *Gliocladium virens*).

Active ingredients exempt from registration requirements are mostly food-grade essential oils such as peppermint oil or rosemary oil.

Tables 2 and 3 list pests of marijuana grown outdoors and indoors, and Table 3 shows pests arranged by the portion of the plant they attack. An explanation of the column labels for Tables 2 and 3 follow.

PESTS. The tables show the most likely pests in California based on Cranshaw's presentation and McPartland's list and gleaned from California-based web sites and blogs. Some pests that drew attention on several blogs (e.g., russet mites) may be worse during drought years. Many have cyclic population

fluctuations and others are mainstays of general greenhouse cultivation (e.g., whiteflies, thrips, and fungus gnats). We'll add weeds to this compendium when we have more information.

DAMAGE. For damage caused by greenhouse pests, we derived information from Cranshaw's presentation; for that of outdoor pests when there wasn't any overlap, McPartland's list was used and information from UC IPM for various crops. Accounts of damage by rodents is anecdotal.

PESTS NOT OFFICIALLY IDENTIFIED IN CALIFORNIA. Kevin Hoffman of CDFA notes that several marijuana pests in other states are not yet known in California. These pests would add to the russet mites, aphids, cutworms, budworms, borers, and flea beetles already in California. As more and more marijuana is planted throughout the state, collecting potential pests will enable entomologists to identify new species.

THE IMPORTANCE OF CORRECT IDENTIFICATION. It's essential to identify the potential pest, or you may launch a futile program for a mite or insect that isn't a pest. And likewise, you need to know the correct species or you may use the wrong management strategy. For accurate identification, take specimens to an entomologist.

HOW TO PRESERVE SPECIMENS FOR IDENTIFICATION. If the mite or insect specimen is hard bodied (e.g., beetles, moths) carefully place it in a small pill vial and cushion with crumpled tissue paper. If your specimen isn't yet dead, put it in a jar and place in a freezer overnight. Do not wrap specimens in tissue and seal them in plastic bags or you'll end up with smashed bug parts.

Place soft-bodied specimens (e.g., mites, leafhoppers, aphids, caterpillars) in a jar filled with rubbing alcohol. Include written information such as where on the plant you found the specimen, the general location of the plant, and date captured. Note original color and texture, since these will change once you immerse the specimen in alcohol. Also helpful are photographs of the specimen in its original habitat.

IPM PRACTICES. Most of these are standard practices for pests on hosts other than marijuana. For more detailed explanations, see information compiled by the

¹ 40 CFR (Code of Federal Regulations)

² under FIFRA section 25(b) and 3 CCR section 6147

University of California Statewide IPM Program (UC IPM) at www.ipm.ucdavis.edu. You can enter a pest name in the search box (e.g., cutworm) and read about IPM practices for the pest on crops other than marijuana. For marijuana grown indoors, go to the UC IPM [home page](#), click on [Agricultural Pests](#) and scroll down the alphabetical list until you reach [ornamental nuiseries](#).

Some practices were excluded because they apply to nearly all of the pests. For example, when targeting aphids, whiteflies, and thrips, growers can attract predaceous and parasitic arthropods by planting strips or borders of cover crops (e.g., California buckwheat) and insectary plants—especially those in the carrot, mustard, and sunflower families (Pickett & Bugg, 1998).

LEGAL PESTICIDES. These are covered above in the Table 1 description and are exempt from **residue tolerance requirements** and either exempt from

registration requirements or registered for a use that is broad enough to include use on marijuana.

Table 4 shows representative marijuana pests by plant part. Not all of these pests are important, but their collective damage may affect the overall health of the plant.

REFERENCES

- Cranshaw, Whitney. 2013. Challenges and opportunities for pest management of medical marijuana in Colorado. Presentation.
- McPartland, J.M. 1996. *Cannabis* pests. J. Internatl. Hemp Assoc. 3(2): 49, 52–55.
- Pickett, C.H. & R.L. Bugg, eds. 1998. Enhancing Biological Control: Habitat management to promote natural enemies of agricultural pests. UC Press, Oakland, Calif.

Table 1. Active ingredients that are exempt from residue tolerance requirements^a and either exempt from registration requirements^b or registered for a use broad enough to include use on marijuana.

ACTIVE INGREDIENT	PEST OR DISEASE
azadirachtin ^a	aphids, whiteflies, fungus gnats, leafminers, cutworms
<i>Bacillus subtilis</i> QST ^{a1}	root diseases, powdery mildew
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>aizawai</i> or <i>kurstaki</i>	moth larvae (e.g., cutworms, budworms, borer)
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>israelensis</i>	fly larvae (e.g., fungus gnats)
<i>Beauveria bassiana</i> ^{a3}	whiteflies, aphids, thrips
cinnamon oil ^b	whiteflies
<i>Gliocladium virens</i> ^{a1}	root diseases
horticultural oils ^a (petroleum oil)	mites, aphids, whiteflies, thrips; powdery mildew
insecticidal soaps ^a (potassium salts of fatty acids)	aphids, whiteflies, cutworms, budworms
iron phosphate ^a , sodium ferric EDTA ^a	slugs and snails
neem oil ^a	mites; powdery mildew
potassium bicarbonate ^a ; sodium bicarbonate ^a	powdery mildew
predatory nematodes ^a	fungus gnats
rosemary + peppermint essential oils ^b	whiteflies
sulfur ^a	mites, flea beetles
<i>Trichoderma harzianum</i> ^{a1}	root diseases

^a 40 CFR (Code of Federal Regulations)

^b FIFRA §25(b) and 3 CCR §6147 [FIFRA = the Federal Insecticide, Fungicide, and Rodenticide Act; CCR = California Code of Regulations]

¹ Biofungicides

² Bacterial-based insect pathogen

³ Fungal-based insect pathogen

Table 2. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN OUTDOORS

PEST		DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
MITES & INSECTS				
two-spotted spider mites <i>Tetranychus urticae</i> (and other Tetranychidae)		Suck plant sap; stipple leaves	<ul style="list-style-type: none"> Keep dust down by hosing off plants (if dust is a problem) Release predatory mites 	neem oil, horticultural oil
russet mites <i>Aculops</i> spp.		Suck plant sap; kill leaves and flowers	<ul style="list-style-type: none"> Release predatory mites 	neem oil, horticultural oil, sulfur
crickets (field & house)		Eat seedlings	<ul style="list-style-type: none"> Use floating row covers or cones on individual plants 	—
termites		Eat roots	<ul style="list-style-type: none"> Flood nests 	—
leafhoppers		Suck plant sap; weaken plants	<ul style="list-style-type: none"> Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
aphids <i>Myzus persicae</i> , <i>Aphis fabae</i>		Suck plant sap; weaken plants	<ul style="list-style-type: none"> Hang up yellow sticky cards (alates) Hose off plants 	azadirachtin, horticultural oil, insecticidal soaps, <i>Beauveria bassiana</i>
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>		Suck plant sap; weaken plants	<ul style="list-style-type: none"> Hang up yellow sticky cards Use reflective plastic mulch 	azadirachtin, horticultural oil, insecticidal soaps, rosemary + peppermint oils, <i>Beauveria bassiana</i>
leafminers <i>Liriomyza</i> spp.		Bore into roots and leaves	<ul style="list-style-type: none"> Remove older infested leaves Use biocontrol: release <i>Diglyphus</i> parasitoids 	azadirachtin
LEPIDOPTERA	cutworms <i>Agrotis ipsilon</i> , <i>Spodoptera exigua</i> (Noctuidae)	Eat seedlings	<ul style="list-style-type: none"> Use pheromone traps to detect adults. Remove weeds, which serve as a reservoir for cutworms and other noctuids 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> if egg-laying adults found, insecticidal soap; azadirachtin
	budworms <i>Helicoverpa zea</i> (Noctuidae)	Eat flowering buds	<ul style="list-style-type: none"> Shake plants to dislodge larvae Remove infested buds Plant corn as trap crop 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> , insecticidal soap

PEST		DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
COLEOPTERA	flea beetles (Chrysomelidae)	Bore into stems (grubs); feed on seedlings and leaves of larger plants (adults)	<ul style="list-style-type: none"> Use reflective mulches Plant trap crops (e.g., radish or Chinese mustard) 	sulfur
	scarab grubs (possibly other beetles)	Bore into stems	<ul style="list-style-type: none"> Use parasitic nematodes 	—
MAMMALS				
mice (e.g., house mice)		Eat young sprouts and seeds	<ul style="list-style-type: none"> Double wrap a 3'-tall chicken wire fence around plants 	rodenticides*
roof rats, <i>Rattus rattus</i> wood rats, <i>Neotoma</i> spp.		Strip bark from stems to build nests	<ul style="list-style-type: none"> Trap (minus rodenticides) Mount barn owl boxes 	
pocket gophers, <i>Thomomys</i> spp.		Tunnel through planting areas; feed on plants; gnaw on irrigation lines	<ul style="list-style-type: none"> Install underground fencing (hardware cloth or ¾" mesh poultry wire) Mount barn owl boxes 	
Columbian black-tailed deer, <i>Odocoileus hemionus columbianus</i>		Knock over plants; leave dander, droppings, and ticks behind	<ul style="list-style-type: none"> Install deer fencing 	—
black bears, <i>Ursus americana</i>		Knock over plants	<ul style="list-style-type: none"> Install electric fencing 	—

* If using a rodenticide, use products that are not DPR-restricted materials or federally restricted-use pesticides *and* are registered for a broad enough use to include use in or around marijuana cultivation sites. If using a rodenticide always read and follow the label and check to make sure that the target rodent is listed. Second-generation anticoagulant products (contain the active ingredients brodifacoum, bromadiolone, difenacoum, and difethialone) are DPR-restricted materials not labeled for field use and should never be used in or around marijuana cultivation sites.

Table 3. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN INDOORS
(e.g., greenhouses, sheds, and grow rooms)

PEST	DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
DISEASES			
powdery mildew <i>Sphaerotheca macularis</i>	Grow on leaves as white and gray powdery patches	<ul style="list-style-type: none"> Use fans to improve air circulation 	horticultural oil; neem oil; sodium bicarbonate, potassium bicarbonate; <i>Bacillus subtilis</i>
pythium root rots <i>Pythium</i> spp.	Attack root tips and worsens when plants grow in wet soil	<ul style="list-style-type: none"> Avoid hydroponic production or wet soil conditions 	Incorporate biocontrol agents into root-growing media (e.g., <i>Gliricium virens</i> , <i>Trichoderma harzianum</i> , <i>Bacillus subtilis</i>)
MITES & INSECTS			
two-spotted spider mite <i>Tetranychus urticae</i> (and other Tetranychidae)	Suck plant sap; stipple leaves	<ul style="list-style-type: none"> Disinfest cuttings before introducing to growing area Release predatory mites 	neem oil, horticultural oil, sulfur
leafhoppers	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Hang up yellow sticky cards Use biocontrol: <i>Encarsia formosa</i> 	azadirachtin, <i>Beauveria bassiana</i> , cinnamon oil, horticultural oil
thrips <i>Heliothrips haemorrhoidalis</i> , <i>Frankliniella occidentalis</i> , <i>Thrips tabaci</i>	Stipple leaves and vector viruses	<ul style="list-style-type: none"> Hang up yellow or blue sticky cards 	
dark-winged fungus gnats (Diptera: Sciaridae) <i>Bradysia</i> spp.	Damage roots and stunt plant growth	<ul style="list-style-type: none"> Avoid overwatering Use growing media that deters gnat development Hang up yellow sticky cards Use biocontrol: soil-dwelling predatory mites 	<i>Bacillus thuringiensis israelensis</i> (BTI); predatory nematodes; azadirachtin soil drenches

Table 4. PESTS OF MARIJUANA BY PLANT PART

Seedlings	Flower & Leaf (grown outdoors)	Flower & Leaf (grown indoors)	Stalk & Stem	Root
crickets	flea beetles	spider mites	rats	flea beetles
cutworms	leafminers	leafhoppers		white root grubs
flea beetles	budworms	aphids		root maggots
slugs		whiteflies		termites & ants
rodents		thrips		fungus gnats
birds				wireworms

12.0 APPENDIX E: MATERIAL SAFETY DATA SHEETS

Insert here or bind separately



Health	2
Fire	3
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Ethyl alcohol 200 Proof MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethyl alcohol 200 Proof

Catalog Codes: SLE2248, SLE1357

CAS#: 64-17-5

RTECS: KQ6300000

TSCA: TSCA 8(b) inventory: Ethyl alcohol 200 Proof

CI#: Not applicable.

Synonym: Ethanol; Absolute Ethanol; Alcohol; Ethanol 200 proof; Ethyl Alcohol, Anhydrous; Ethanol, undenatured; Dehydrated Alcohol; Alcohol

Chemical Name: Ethyl Alcohol

Chemical Formula: CH₃CH₂OH

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethyl alcohol 200 Proof	64-17-5	100

Toxicological Data on Ingredients: Ethyl alcohol 200 Proof: ORAL (LD50): Acute: 7060 mg/kg [Rat]. 3450 mg/kg [Mouse]. VAPOR (LC50): Acute: 20000 ppm 8 hours [Rat]. 39000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified PROVEN for human. DEVELOPMENTAL TOXICITY: Classified Development toxin [PROVEN]. Classified Reproductive system/toxin/female, Reproductive system/toxin/male [POSSIBLE]. The substance is toxic to blood, the reproductive system, liver, upper respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 363°C (685.4°F)

Flash Points: CLOSED CUP: 12.78°C (55°F). OPEN CUP: 17.78°C (64°F) (Cleveland).

Flammable Limits: LOWER: 3.3% UPPER: 19%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of heat, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Containers should be grounded. CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME Vapor may travel considerable distance to source of ignition and flash back. May form explosive mixtures with air. Contact with Bromine pentafluoride is likely to cause fire or explosion. Ethanol ignites on contact with chromyl chloride. Ethanol ignites on contact with iodine heptafluoride gas. It ignites than explodes upon contact with nitrosyl perchlorate. Addition of platinum black catalyst caused ignition.

Special Remarks on Explosion Hazards:

Ethanol has an explosive reaction with the oxidized coating around potassium metal. Ethanol ignites and then explodes on contact with acetic anhydride + sodium hydrosulfate (ignites and may explode), disulfuric acid + nitric acid, phosphorous(III) oxide platinum, potassium-tert-butoxide+ acids. Ethanol forms explosive products in reaction with the following compound :

ammonia + silver nitrate (forms silver nitride and silver fulminate), iodine + phosphorus (forms ethane iodide), magnesium perchlorate (forms ethyl perchlorate), mercuric nitrate, nitric acid + silver (forms silver fulminate) silver nitrate (forms ethyl nitrate) silver(I) oxide + ammonia or hydrazine (forms silver nitride and silver fulminate), sodium (evolves hydrogen gas). Sodium Hydrazide + alcohol can produce an explosion. Alcohols should not be mixed with mercuric nitrate, as explosive mercuric fulminate may be formed. May form explosive mixture with manganese perchlorate + 2,2-dimethoxypropane. Addition of alcohols to highly concentrate hydrogen peroxide forms powerful explosives. Explodes on contact with calcium hypochlorite

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Use a respirator if the exposure limit is exceeded.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1900 (mg/m³) from OSHA (PEL) [United States] TWA: 1000 (ppm) from OSHA (PEL) [United States] TWA: 1900 (mg/m³) from NIOSH [United States] TWA: 1000 (ppm) from NIOSH [United States] TWA: 1000 (ppm) [United Kingdom (UK)] TWA: 1920 (mg/m³) [United Kingdom (UK)] TWA: 1000 STEL: 1250 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor:

Mild to strong, rather pleasant; like wine or whiskey. Alcohol-like; Ethereal, vinous.

Taste: Pungent. Burning.

Molecular Weight: 46.07 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 78.5°C (173.3°F)

Melting Point: -114.1°C (-173.4°F)

Critical Temperature: 243°C (469.4°F)

Specific Gravity: 0.789 (Water = 1)

Vapor Pressure: 5.7 kPa (@ 20°C)

Vapor Density: 1.59 (Air = 1)

Volatility: Not available.

Odor Threshold: 100 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; $\log(\text{oil/water}) = -0.3$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in cold water, hot water. Soluble in methanol, diethyl ether, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, heat, sources of ignition.

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Ethanol rapidly absorbs moisture from the air. Can react vigorously with oxidizers. The following oxidants have been demonstrated to undergo vigorous/explosive reaction with ethanol: barium perchlorate, bromine pentafluoride, calcium hypochlorite, chloryl perchlorate, chromium trioxide, chromyl chloride, dioxygen difluoride, disulfuryl difluoride, fluorine nitrate, hydrogen peroxide, iodine heptafluoride, nitric acid nitrosyl perchlorate, perchloric acid permanganic acid, peroxodisulfuric acid, potassium dioxide, potassium perchlorate, potassium permanganate, ruthenium(VIII) oxide, silver perchlorate, silver peroxide, uranium hexafluoride, uranyl perchlorate. Ethanol reacts violently/expodes with the following compounds: acetyl bromide (evolves hydrogen bromide) acetyl chloride, aluminum, sesquibromide ethylate, ammonium hydroxide & silver oxide, chlorate, chromic anhydride, cyanuric acid + water, dichloromethane + sulfuric acid + nitrate (or) nitrite, hydrogen peroxide + sulfuric acid, iodine + methanol + mercuric oxide, manganese perchlorate + 2,2-dimethoxy propane, perchlorates, permanganates + sulfuric acid, potassium superoxide, potassium tert-butoxide, silver & nitric acid, silver perchlorate, sodium hydrazide, sulfuric acid + sodium dichromate, tetrachlorosilane + water. Ethanol is also incompatible with platinum, and sodium. No really safe conditions exist under which ethyl alcohol and chlorine oxides can be handled. Reacts vigorously with acetyl chloride

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3450 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 39000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified PROVEN for human. DEVELOPMENTAL TOXICITY: Classified Development toxin [PROVEN]. Classified Reproductive system/toxin/female, Reproductive system/toxin/male [POSSIBLE]. Causes damage to the following organs: blood, the reproductive system, liver, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Dose/Conc: LDL[Human] - Route: Oral; Dose: 1400 mg/kg LDL[Human child] - Route: Oral; Dose: 2000 mg/kg LDL[Rabbit] - Route: Skin; Dose: 20000 mg/kg

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenic) Causes adverse reproductive effects and birth defects (teratogenic) , based on moderate to heavy consumption. May cause cancer based on animal data. Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans:

Acute potential health effects: Skin: causes skin irritation Eyes: causes eye irritation Ingestion: May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea, and alterations in gastric secretions. May affect behavior/central nervous system (central nervous system depression - amnesia, headache, muscular incoordination, excitation, mild euphoria, slurred speech, drowsiness, staggering gait, fatigue, changes in mood/personality, excessive talking, dizziness, ataxia, somnolence, coma/narcosis, hallucinations, distorted perceptions, general anesthetic), peripheral nervous system (spastic paralysis) vision (diplopia). Moderately toxic and narcotic in high concentrations. May also affect metabolism, blood, liver, respiration (dyspnea), and endocrine system. May affect respiratory tract, cardiovascular(cardiac arrhythmias, hypotension), and urinary systems. Inhalation: May cause irritation of the respiratory tract and affect behavior/central nervous system with symptoms similar to ingestion. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may cause dermatitis, an allergic reaction. Ingestion: Prolonged or repeated ingestion will have similar effects as acute ingestion. It may also affect the brain.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 14000 mg/l 96 hours [Rainbow trout]. 11200 mg/l 24 hours [fingerling trout].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethanol UNNA: 1170 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Ethyl alcohol 200 Proof (in alcoholic beverages) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Ethyl alcohol 200 Proof (in alcoholic beverages) Connecticut hazardous material survey.: Ethyl alcohol 200 Proof Illinois toxic substances disclosure to employee act: Ethyl alcohol 200 Proof Rhode Island RTK hazardous substances: Ethyl alcohol 200 Proof Pennsylvania RTK: Ethyl alcohol 200 Proof Florida: Ethyl alcohol 200 Proof Minnesota: Ethyl alcohol 200 Proof Massachusetts RTK: Ethyl alcohol 200 Proof Massachusetts spill list: Ethyl alcohol 200 Proof New Jersey: Ethyl alcohol 200 Proof Tennessee: Ethyl alcohol 200 Proof California - Directors List of Hazardous Substances (8 CCR 339): Ethyl alcohol 200 Proof TSCA 8(b) inventory: Ethyl alcohol 200 Proof

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R11- Highly flammable. S7- Keep container tightly closed. S16- Keep away from sources of ignition - No smoking.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. HSDB, RTECS, and LOLI databases.

Other Special Considerations: Not available.

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Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Sodium Hypochlorite, 5% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Hypochlorite, 5%

Catalog Codes: SLS1654

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water

CI#: Not applicable.

Synonym: Chlorine Bleach, Bleach, Soda Bleach, Chlorox; Sodium Hypochlorite, Solution, 5% Available Chlorine

Chemical Name: Hypochlorous acid, sodium salt, solution

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hypochlorite	7681-52-9	4-7
Sodium hydroxide	1310-73-2	<1
Water	7732-18-5	>92

Toxicological Data on Ingredients: Sodium hypochlorite: ORAL (LD50): Acute: 5800 mg/kg [Mouse]. 8910 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide]. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: combustible materials, metals, organic materials

Explosion Hazards in Presence of Various Substances:

Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Releases chlorine when heated above 35 deg. C. The substance itself is non-combustible and does not burn. However, when heated to decomposition it emits corrosive and/or toxic fumes. May ignite combustibles. Fire risk in contact with organic materials. Contact with metals may evolve flammable hydrogen gas.

Special Remarks on Explosion Hazards:

Anydrous Sodium Hypochlorite is very explosive. Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive. Interaction of ethyleneimine with sodium (or other) hypochlorite gives the explosive N-chloro cmpd. Removal of formic acid from industrial waste streams with sodium hypochlorite soln becomes explosive at 55 deg C. Several explosions involving methanol and sodium hypochlorite were attributed to formation of methyl hypochlorite, especially in presence of acid or other esterification catalyst. Use of sodium hypochlorite soln to destroy acidified benzyl cyanide residues caused a violent explosion, thought to have been due to formation of nitrogen trichloride. (Sodium hypochlorite)

Section 6: Accidental Release Measures**Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Corrosive liquid. Oxidizing material. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Air Sensitive Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Sodium hypochlorite TWA: 1 CEIL: 1 (ppm as Cl₂) STEL: 1 (ppm as Cl₂) from ACGIH (TLV) [United States] Sodium hydroxide STEL: 2 (mg/m³) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m³) from OSHA (PEL) [United States] CEIL: 2 (mg/m³) from NIOSH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Characteristic. Chlorine-like (Slight.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light greenish yellow

pH (1% soln/water): Neutral.

Boiling Point: Decomposition temperature: 40°C (104°F)

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: 1.07 - 1.093 (Water = 1)

Vapor Pressure: 2.3 kPa (@ 20°C)

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials. light, air, heat

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:

Extremely corrosive in presence of aluminum. Corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Decomposed by carbon dioxide from air. Slowly decomposes on contact with air. Unstable in air unless mixed with sodium hydroxide. Incompatible with ammonium acetate, ammonium carbonate, ammonium nitrate, ammonium oxalate, and ammonium phosphate. Decomposition of sodium hypochlorite takes place within a few seconds with these salts. Also incompatible with primary amines, phenyl acetonitrile, ethyleneimine, methanol, acidified benzyl cyanide, formic acid, urea, nitro compounds, methylcellulose, cellulose, aziridine, ether, ammonia. Mixing this product with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, feces, etc.) will release chlorine gas. Chloramine gas may be evolved when ammonia and bleach are mixed. Decomposed by hot water. Sensitive to light. Exposure to light accelerates decomposition.

Special Remarks on Corrosivity:

Sodium Hypochlorite is extremely corrosive to brass, and moderately corrosive to bronze. There is no corrosivity information for copper.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 5800 mg/kg [Mouse]. (Sodium hypochlorite).

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. **MUTAGENIC EFFECTS:** Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide]. Contains material which may cause damage to the following organs: lungs, mucous membranes, skin, eyes.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer, lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic) (Sodium hypochlorite)

Special Remarks on other Toxic Effects on Humans:

Potential Health Effects: Can cause severe irritation and possible burns to skin and eyes. Eye contact may also cause corneal and conjunctival edema, conjunctival hemorrhages. Contact with skin may also cause vesicular eruptions and eczematoid dermatitis which becomes evident upon re-exposure. Prolonged or repeated eye contact may cause conjunctivitis. Ingestion can cause burns to the digestive tract. Symptoms may include: 1. pain and inflammation of the mouth, pharynx, esophagus, and stomach, 2. erosion of the mucous membranes (chiefly of the stomach), nausea, vomiting, choking, coughing, hemorrhage, 3. circulatory collapse with cold and clammy skin (due to methemoglobinemia), cyanosis, and shallow respirations, 4. confusion, delirium, coma, 5. edema of the pharynx, glottis, larynx with stridor and obstruction, 6. perforation of the esophagus, or stomach, with mediastinitis or peritonitis. Inhalation causes slight to severe respiratory tract irritation and delayed pulmonary edema. Prolonged or repeated inhalation may cause allergic respiratory reaction (asthma).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hypochlorite solution UNNA: 1791 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Illinois toxic substances disclosure to employee act: Sodium hydroxide Illinois chemical safety act: Sodium hydroxide New York release reporting list: Sodium hydroxide Rhode Island RTK hazardous substances: Sodium hydroxide Pennsylvania RTK: Sodium hypochlorite; Sodium hydroxide Florida: Sodium hypochlorite Minnesota: Sodium hypochlorite; Sodium hydroxide Massachusetts RTK: Sodium hypochlorite; Sodium hydroxide New Jersey: Sodium hypochlorite; Sodium hydroxide Louisiana spill reporting: Sodium hydroxide TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water CERCLA: Hazardous substances.: Sodium hypochlorite: 100 lbs. (45.36 kg); Sodium hydroxide: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive liquid.

DSCL (EEC):

R8- Contact with combustible material may cause fire. R31- Contact with acids liberates toxic gas. R36/38- Irritating to eyes and skin. S28- After contact with skin, wash immediately with plenty of water. S36/37/39- Wear suitable protective clothing, gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Airgas.


an Air Liquide company

Propane

Section 1. Identification

GHS product identifier	: Propane
Chemical name	: propane
Other means of identification	: Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.
Product use	: Synthetic/Analytical chemistry.
Synonym	: Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.
SDS #	: 001045
Supplier's details	: Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
24-hour telephone	: 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	: FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas
GHS label elements	
Hazard pictograms	: 
Signal word	: Danger
Hazard statements	: Extremely flammable gas. Contains gas under pressure; may explode if heated. May cause frostbite. May form explosive mixtures in Air. May displace oxygen and cause rapid suffocation.
Precautionary statements	
General	: Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.
Prevention	: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Response	: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.
Storage	: Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Section 2. Hazards identification

- Disposal** : Not applicable.
- Hazards not otherwise classified** : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

- Substance/mixture** : Substance
- Chemical name** : propane
- Other means of identification** : Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.

CAS number/other identifiers

- CAS number** : 74-98-6
- Product code** : 001045

Ingredient name	%	CAS number
Propane	100	74-98-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

- Eye contact** : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
- Inhalation** : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Skin contact** : Wash contaminated skin with soap and water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** : No known significant effects or critical hazards.
- Inhalation** : No known significant effects or critical hazards.
- Skin contact** : No known significant effects or critical hazards.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

- Eye contact** : No specific data.
- Inhalation** : No specific data.
- Skin contact** : No specific data.

Section 4. First aid measures

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Section 6. Accidental release measures

- Large spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Propane	<p>NIOSH REL (United States, 10/2013). TWA: 1800 mg/m³ 10 hours. TWA: 1000 ppm 10 hours.</p> <p>OSHA PEL (United States, 2/2013). TWA: 1800 mg/m³ 8 hours. TWA: 1000 ppm 8 hours.</p> <p>OSHA PEL 1989 (United States, 3/1989). TWA: 1800 mg/m³ 8 hours. TWA: 1000 ppm 8 hours.</p>

- Appropriate engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls/personal protection

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.
- Skin protection**
- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

- Physical state** : Gas. [Liquefied compressed gas.]
- Color** : Colorless.
- Molecular weight** : 44.11 g/mole
- Molecular formula** : C₃H₈
- Boiling/condensation point** : -161.48°C (-258.7°F)
- Melting/freezing point** : -187.6°C (-305.7°F)
- Critical temperature** : 96.55°C (205.8°F)
- Odor** : Odorless.BUT MAY HAVE SKUNK ODOR ADDED.
- Odor threshold** : Not available.
- pH** : Not available.
- Flash point** : Closed cup: -104°C (-155.2°F)
Open cup: -104°C (-155.2°F)
- Burning time** : Not applicable.
- Burning rate** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
- Lower and upper explosive (flammable) limits** : Lower: 1.8%
Upper: 8.4%
- Vapor pressure** : 109 (psig)
- Vapor density** : 1.6 (Air = 1)

Section 9. Physical and chemical properties

Specific Volume (ft ³ /lb)	: 8.6206
Gas Density (lb/ft ³)	: 0.116 (25°C / 77 to °F)
Relative density	: Not applicable.
Solubility	: Not available.
Solubility in water	: 0.0244 g/l
Partition coefficient: n-octanol/water	: 1.09
Auto-ignition temperature	: 287°C (548.6°F)
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Not applicable.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.
Incompatible materials	: Oxidizers
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

IDLH : 2100 ppm

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Section 11. Toxicological information

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.
Developmental effects : No known significant effects or critical hazards.
Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Propane	1.09	-	low

Mobility in soil






Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1978	UN1978	UN1978	UN1978	UN1978
UN proper shipping name	PROPANE	PROPANE	PROPANE	PROPANE	PROPANE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	<p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: 150 kg</p> <p>Special provisions 19, T50</p>	<p>Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).</p> <p>Explosive Limit and Limited Quantity Index 0.125</p> <p>ERAP Index 3000</p>	-	-	<p>Passenger and Cargo Aircraft Quantity limitation: 0 Forbidden</p> <p>Cargo Aircraft Only Quantity limitation: 150 kg</p>

Section 14. Transport information

	For domestic transportation only, UN1075 may be substituted for the UN number shown as long as the substitution is consistent on package markings, shipping papers, and emergency response information. See 49 CFR 172.102 Special Provision 19. Containers of NON-ODORIZED liquefied petroleum gas must be marked either NON-ODORIZED or NOT ODOORIZED as of September 30, 2006. [49 CFR 172.301(f), 326(d), 330(c) and 338 (e)]	<u>Passenger Carrying Ship Index</u> 65 <u>Passenger Carrying Road or Rail Index</u> Forbidden <u>Special provisions</u> 29, 42			
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“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption:** Not determined
United States inventory (TSCA 8b): This material is listed or exempted.
Clean Air Act (CAA) 112 regulated flammable substances: propane

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Section 15. Regulatory information

Massachusetts	: This material is listed.
New York	: This material is not listed.
New Jersey	: This material is listed.
Pennsylvania	: This material is listed.

International regulations

International lists

National inventory

Australia	: This material is listed or exempted.
Canada	: This material is listed or exempted.
China	: This material is listed or exempted.
Europe	: This material is listed or exempted.
Japan	: This material is listed or exempted.
Malaysia	: This material is listed or exempted.
New Zealand	: This material is listed or exempted.
Philippines	: This material is listed or exempted.
Republic of Korea	: This material is listed or exempted.
Taiwan	: This material is listed or exempted.

Canada

WHMIS (Canada)

: Class A: Compressed gas.
Class B-1: Flammable gas.

CEPA Toxic substances: This material is not listed.

Canadian ARET: This material is not listed.

Canadian NPRI: This material is listed.

Alberta Designated Substances: This material is not listed.

Ontario Designated Substances: This material is not listed.

Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

Hazardous Material Information System (U.S.A.)

Health	1
Flammability	4
Physical hazards	2

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The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Section 16. Other information

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Flam. Gas 1, H220 Press. Gas Liq. Gas, H280	Expert judgment Expert judgment

History

Date of printing : 6/28/2017

Date of issue/Date of revision : 6/28/2017

Date of previous issue : 10/20/2015

Version : 0.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Indicates information that has changed from previously issued version.

Other special considerations : The information below is given to call attention to the issue of "Naturally occurring radioactive materials". Although Radon-222 levels in the product represented by this MSDS do not present any direct Radon exposure hazard, customers should be aware of the potential for Radon daughter build up within their processing systems, whatever the source of their product streams. Radon-222 is a naturally occurring radioactive gas which can be a contaminant in natural gas. During subsequent processing, Radon tends to be concentrated in Liquefied Petroleum Gas streams and in product streams having a similar boiling point range. Industry experience has shown that this product may contain small amounts of Radon-222 and its radioactive decay products, called Radon "daughters". The actual concentration of Radon-222 and radioactive daughters in the delivered product is dependent on the geographical source of the natural gas and storage time prior to delivery. Process equipment (i.e. lines, filters, pumps and reaction units) may accumulate significant levels of radioactive daughters and show a gamma radiation reading during operation. A potential external radiation hazard exists at or near any pipe valve or vessel containing a Radon enriched stream, or containing internal deposits of radioactive material due to the transmission of gamma radiation through its wall. Field studies reported in the literature have not shown any conditions that subject workers to cumulative exposures in excess of general population limits. Equipment emitting gamma radiation should be presumed to be internally contaminated with alpha emitting decay products which may be a hazard if inhaled or ingested. Protective equipment such as coveralls, gloves, and respirator (NIOSH/MHSA approved for high efficiency particulates and radionuclides, or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion, or inhalation of any residues containing alpha radiation. Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Notice to reader

Section 16. Other information

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

**STORM WATER MANAGEMENT PLAN
FOR THE CANNABIS CULTIVATION OPERATION
AT 23492 JERUSALEM GRADE, MIDDLETOWN**

**Prepared: November 4, 2017
Revised: December 4, 2018**

**Prepared by:
Dr. G.O. Graening, QSD #473, QISP #597
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Table of Contents

1.0	Plan Requirements and Goals	2
1.1.	Plan Amendments	3
1.2.	List of Responsible Parties and Contact Information	3
2.0	Project and Site Description.....	4
2.1.	Project Location and Description	4
3.0	Compliance	7
3.1.	Setbacks and Buffers	7
3.2.	Water Board Permitting	7
4.0	Storm water Management.....	8
4.1.	Site Layout Maps and Water Pollution Control Drawings	8
4.2.	Water Pollution Control Schedule.....	8
4.3.	Pollutant Source Identification and BMP Selection	8
4.4.	BMP Maintenance, Inspection, and Repair	17
4.5.	Spill Prevention Control and Countermeasure Plan	19
4.6.	Post-Construction Storm Water Management	19
4.7.	Training	19
5.0	Project Site Monitoring Program	20
5.1.	Objectives.....	20
5.2.	Types of Inspections and Frequency	20
5.3.	Record Keeping and Reports	20
5.4.	Visual Inspection Plan	21
5.5.	Sampling Plan for Pollutants	22
5.6.	General Sampling Methodology	22
6.0	References	24

Attachments

Attachment A: Site Layout, Project Plans, and Water Pollution Control Drawings (WPCDs)

Attachment B: Fact Sheets of Selected BMPs

Attachment C: Inspection Reports

1.0 PLAN REQUIREMENTS AND GOALS

This Storm Water Management Plan ("Plan") has been prepared to fulfill some requirements of the Lake County Marijuana Cultivation Ordinance (Ordinance No. 2997). The Ordinance states:

"Section 8, Subsection K. Storm Water Management

1. *All permittees shall manage storm water runoff to protect downstream receiving water bodies from water quality degradation.*
2. *Cultivation, Nursery and Microbusiness*
 - a. *All cultivation activities shall comply with the California Regional Water Quality Control Board Central Valley Region Order R5-2015-0113 Waste Discharge Requirements General Order for Discharge of Waste Associated with Medical Cannabis Cultivation Activities or the California Regional Water Quality Control Board North Coast Region Order No. 2015-0023 Waiver of Waste Discharge Requirements and General Water Quality Certification for Discharges of Waste Resulting from Cannabis Cultivation and Associated Activities or Operations with Similar Environmental Effects In the North Coast Region as appropriate.*
 - b. *Outdoor cultivation, including any topsoil, Pest Managements, or fertilizers used for the cultivation cannabis shall not be located within 100 feet of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool. For purposes of determining the edge of Clear Lake, the setback shall be measured from the full lake level of 7.79 feet on the Rumsey Gauge.*
 - c. *The illicit discharges of irrigation or storm water from the premises, as defined in Title 40 of the Code of Federal Regulations, Section 122.26, which could result in degradation of water quality of any water body is prohibited.*
3. *Manufacturing, Testing, Retail, and Distributer*
 - a. *The illicit discharges of storm water from the premises, as defined in Title 40 of the Code of Federal Regulations, Section 122.26, which could result in degradation of water quality of any water body is prohibited.*
4. *All permittees shall prepare a Storm Water Management Plan to be approved by the Lake County Water Resources Department. Similar plans submitted to the State Water Quality Board may be substituted for this Stormwater Management Plan. Said plan shall:*
 - a. *Comply with the requirements of Chapter 29, Storm Water Management Ordinance of the Lake County Ordinance Code.*
 - b. *Describe the proposed grading of the property.*
 - c. *Describe the storm water management system and how it will protect the water quality of receiving water bodies.*
 - d. *Describe the best management practices (BMPs) that will be used during construction and those that will be used post-construction. Post-construction BMPs shall be maintained through the life of the permit.*
5. *All permittees shall implement the procedures as outlined in their Storm Water Management Plan as approved by the Water Resource Department. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change."*

The County's application process asks these questions pertaining to the goals of stormwater management:

Goals

Does the application have a stormwater management plan including the retention on site of the 2 year storm, the prevention of sediment from leaving the property, the identification of all best management practices (BMPs) during and after construction, and the long range management of those BMPs?

Will the applicant monitor and document the performance of the stormwater management plan?

This Plan also takes guidance from the State Water Resources Control Board (SWRCB)'s Construction General Permit:

National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities Order No. 2009-0009-DWQ, NPDES No. CAS000002.

1.1. Plan Amendments

This Plan should be developed and amended or revised by a qualified professional such as Qualified SWPPP Developer (QSD) or Qualified Industrial Stormwater Professional. The professional should include information in the Plan that supports the conclusions, selections, use, and maintenance of Best Management Practices (BMPs).

This Plan should be amended:

- Whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4);
- If any condition of relevant permits is violated or the general objective of reducing or eliminating pollutants in storm water discharges has not been achieved;
- When deemed necessary by the QSD or Stormwater Manager.

The following items will be included in each amendment: who requested the amendment; the location of proposed change; the reason for change; the original BMP proposed, if any; and the new BMP proposed. Furthermore, the Ordinance states, *"Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change."*

1.2. List of Responsible Parties and Contact Information

The Stormwater Manager currently assigned to this project is:

- to be determined
- the Stormwater Management Consultant is Dr. G.O. Graening, QSD #00473, QISP #597.

The stormwater manager shall have primary responsibility and significant authority for the implementation, maintenance, inspection, and amendments to the Stormwater Management Plan. Duties of the stormwater manager include but are not limited to:

- Ensuring full compliance with the Plan and the Chapter 29, Storm Water Management Ordinance of the Lake County Ordinance Code;
 - Implementing all elements of the Plan, including but not limited to implementation of prompt and effective erosion and sediment control measures, and implementing all non-storm water management, and materials and waste management activities (such as monitoring discharges (dewatering, diversion devices); general site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.);
- Inspections (pre-storm, during storm, and post-storm) or designating qualified personnel to do so;
- Routine inspections as specified in the cultivation operation's specifications or described in the Plan;
- Preparing any annual compliance certification;
- Ensuring elimination of all unauthorized discharges;
- The storm water manager shall be assigned authority to mobilize crews to make immediate repairs to the control measures;
- Coordinate with the landowner or cultivator to assure all the necessary corrections/repairs are made immediately, and that the project complies with the Plan and relevant permits; and
- Submit Notices of Discharge and reports of Illicit Connections or Illegal Discharges.

2.0 PROJECT AND SITE DESCRIPTION

2.1. Project Location and Description

This permitted cannabis cultivation operation is located on a 183-acre parcel (APN 013-013-11) with address 23492 Jerusalem Grade, Middletown, California. The original operational area was approximately 0.2 acres; this garden is being abandoned and the area restored. The new gardens (Project Area) will be established in phases and allow for multiple cultivation licenses with individual gardens. The original Cannabis cultivation operation consisted of a graded garden within a fenced enclosure. The enclosure was approximately 7,500 square feet (0.17 acres). This garden was abandoned, and the area is being revegetated. Three additional potential garden sites were located at the north end of the parcel. These sites were graded and terraced, but no Cannabis operations were ever established. These three garden sites will be abandoned.

The new garden complex and supporting facilities, an area of approximately 5 acres (the Project Area), will be established in phases and allow for multiple cultivation licenses with individual gardens each capable of growing at least 10,000 square feet of Cannabis canopy. Phase One would be for the 2019 growing season and would consist of four garden compounds (each 11,100 square feet). Phases Two would be for the 2020 grow season and have eight 11,340 square foot compounds; two 11,250 square foot compounds; and one 5,400 square foot compound. A new processing center of approximately 5,000 square feet is also planned, as well as a stormproof chemical shed (10 feet by 10 feet).

The proposed cultivation operations will consist of outdoor gardens. with plants growing in plastic pots, fabric bags, and/or raised beds. A new shed for product processing,

approximately 5,000 to 4,000 square feet, will be constructed adjacent to the well. No soil is currently stored on-site. However, future soil deliveries will be staged adjacent to the outdoor garden complex. There would also be a 1,000 gallon cone-bottom tank in each garden compound that will be for compost teas.

A well currently serves the single-family residence and the existing garden. This is a permitted well that produces approximately 100 gallons per minute. The proposed garden complex will be irrigated by water from the existing well, which will be pumped into several tanks, each capable of holding 5,000 gallons. The use of water bladders will be discontinued. A previously graded pad for water bladders will be abandoned and revegetated.

The water will be delivered by gravity via underground PVC piping to each garden. Black poly tubing and emitters (drip irrigation) will be used to distribute the water to each planting station. Mixing tanks will be used to add liquid fertilizers and other amendments (compost teas) to the irrigation water. Supplemental irrigation may be applied by hand using garden hoses.

Existing structures consist of a single-family residence and adjacent groundwater well. A small cabin is found near the top of the property. Employees will have access to the toilet in the single-family residence. In addition, portable toilet(s) will be located adjacent to the gardens. Several abandoned structures are found on this parcel. Trash and debris left by a previous owner lay scattered in piles across the southwestern portion of the parcel. The current property owner is in the process of removing the non-functional structures and trash.

The Project Area is accessed by a private gravel road on Jerusalem Grade (see exhibits). Prior to the establishment of this cultivation operation, land use was open space. The surrounding land uses are private estates, cannabis cultivation, and open space. The 2015 Jerusalem Fire burned approximately 80% of the Project Area. Vegetation is recovering from the fire and from the many roads and breaks that were cut during the fire-fighting efforts.

The Project Area has rugged topography, consisting of several ridges and sloping hills of Bishop Mountain (see exhibits). Drainage leaves the Project Area along various vegetated swales and which then combine into two Class III watercourses (see exhibits). These are potentially-jurisdictional water features. Riparian vegetation occurs in patches along these watercourses. These ephemeral drainage channels start in the eastern portion of the parcel and flow southwest, eventually flowing into Gunther Creek. The channels range in width from 3 to 6 feet and the depth ranges from approximately 6 inches up to 2 feet. The channels have an ordinary high-water mark, bank erosion and scouring, and litter and debris present; the channel was intermittently wet, but not flowing.

The parcel contained an off-channel pond that was excavated and sealed with a liner. This pond will be abandoned and restored to the original condition of the landscape. A spring is located in the southwest portion of the parcel. A thin band of herbaceous wetland vegetation surrounds this spring. The use of this spring as a water source will be abandoned. The nearest portion of the current cultivation area is approximately 130 feet from a Class III watercourse. Future cultivation related operations will take place at least 200 feet from a Class III watercourse.

Numerous roads and fire-breaks are found within this parcel. A gravel driveway leads from Jerusalem Grade to the southwest corner of the parcel. A dirt road accesses the current garden site. Once this garden is abandoned, the access road will be maintained as a fire-break. The proposed garden and processing shed will be accessed by the construction of a new gravel road which will connect to the existing gravel driveway. A dirt/gravel road which extends from the driveway and runs north along the parcel will be maintained as an easement to the adjoining parcel and as fire access. Additional roads and firebreaks within the parcel will be abandoned and allowed to naturally revegetate

3.0 COMPLIANCE

3.1. Setbacks and Buffers

The Ordinance requires that all cultivation operations be located at least 100 feet away from all waterbodies (i.e. spring, top of bank of any creek or seasonal stream, edge of lake, wetland or vernal pool).

Existing Garden: The nearest waterbody is a Class III watercourse located at least 130 feet to the north. The existing garden will be abandoned after this growing season (2017).

Proposed garden: The nearest waterbody is a Class III watercourse located at least 200 feet to the north. The proposed garden will be developed for the 2018 growing season.

3.2. Water Board Permitting

This cultivation operation is enrolled in Tier II of the State Water Resources Control Board's *Order WQ 2017-0023-DWQ General Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities* (General Order).

The following Site Management Plan was prepared for this cultivation operation, and this SMP includes an Erosion Control Subplan:

Site Management Plan for the Cultivation Operation at 23492 Jerusalem Grade, Middletown, California. 2018. Prepared by: Natural Investigations Co., Inc.

4.0 STORM WATER MANAGEMENT

4.1. Site Layout Maps and Water Pollution Control Drawings

The project site layout maps and the Water Pollution Control Drawings are presented in Attachment A.

4.2. Water Pollution Control Schedule

The following table summarizes the general schedule of implementation of site BMPs.

Water Pollution Control Schedule

Phase, Activity, or Milestone	Date
File any needed permit registration documents	immediately
Implementation of rainy season BMPs	October 1 st of every year
Implementation of dry season BMPs	May 1 st of every year
Repair / replacement of erosion control devices	see BMP section of this Plan
Site inspections	see Inspection section of this Plan
Submit Annual Report	annually, as required
Expansion / modification of cultivation operational area	modify this Plan within 30 days

4.3. Pollutant Source Identification and BMP Selection

4.3.1. Inventory of Materials and Activities that May Pollute Storm Water

Construction or cultivation activities that have the potential to contribute sediment to storm water discharges include:

- Tilling, grading and excavation operations;
- Soil import/export operations;
- Structure installation process; and
- Paving operations.

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

Table 4-1. Summary of Potential Project Pollutant Other Than Sediment

Activity/Material Type	Potential Pollutant
Vehicle lubricants and fuels, including oil, grease, diesel and gasoline, and coolants	Petroleum hydrocarbons, volatile organic compounds (VOCs)
Asphaltic emulsions associated with asphalt-concrete paving operations	Petroleum hydrocarbons, VOCs
Portland cement, masonry, and concrete products, muriatic acid, etc.	Materials with a low or high pH, materials with high alkalinity, metals
Road base and subbase material	Materials with high alkalinity or high pH, metals
Gardening materials and wastes	Pesticides, nutrient pollution (nitrates, phosphates, biological oxygen demand, etc.), metals
Treated lumber (materials and waste)	Arsenic, copper, other metals, creosote
Material packaging and site personnel	General litter (municipal solid waste, universal waste)
Portable toilets	Septic waste (fecal coliform, biological oxygen demand)

4.3.2. Selection of Best Management Practices

Resources consulted for BMP selection included:

- Central Valley Region's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.
- California Stormwater Quality Association. 2011. California Stormwater Best Management Practice Handbook – Construction. California Stormwater Quality Association, Menlo Park, California 886 pp.
- California Stormwater Quality Association. 2014. Stormwater Best Management Practice Handbook Portal: Industrial and Commercial. California Stormwater Quality Association, Menlo Park, California. 474 pp.
- The California Department of Transportation's Construction Site BMPs Handbook, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm>
- The California Department of Transportation's Construction Site BMP Fact Sheets, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/factsheets.htm>
- USEPA NPDES Storm Water Program's National Menu of BMPs website at <http://www.epa.gov/npdes/stormwater/menuofbmps>

The following sections list all BMPs that have been selected for implementation in this project. Implementation and location of BMPs are shown on the Water Pollution Control Drawings (WPCDs) in Attachment A. Narrative descriptions of BMPs to be used during the project are listed by category in each of the following sections. Attachment B includes a list of the fact sheets of all the BMPs selected for this project.

4.3.3. Existing (pre-construction) Control Measures

The following are existing (pre-construction) control measures within the project site:

- vegetated buffers
- gravel or asphalt pavement on driveways and roads

4.3.4. Nature of Fill Material and Existing Data Describing the Soil

No known fill is present at the site. Fill is not required for leveling of the project areas. Soil and amendments will be imported for cultivation purposes. Soils on hills are well-drained and highly erodible.

4.3.5. Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in storm water runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles. This project will incorporate erosion control measures required by the contract documents, and other measures selected by the stormwater manager. This project will implement the following practices for effective temporary and final erosion control during construction and cultivation:

- Preserve existing vegetation where required and when feasible;
- Apply temporary erosion control to remaining active and non-active areas and reapply as necessary to maintain effectiveness;
- Implement erosion control prior to the defined rainy season and maintain temporary erosion control measures at regular intervals throughout the defined rainy season to control erosion;

- Stabilize non-active areas as soon as feasible after the cessation of earth-moving activities;
- Control erosion in concentrated flow paths by applying erosion control devices as required;
- Apply seed, as needed, to areas deemed substantially complete by the stormwater manager during the defined rainy season; and
- At completion of construction, apply permanent erosion control to all remaining disturbed soil areas.

Sufficient erosion control materials should be maintained on-site to allow implementation of this Plan. This includes implementation requirements for active areas and non-active areas that require deployment before the onset of rain. Implementation and locations of temporary erosion control BMPs are shown on the WPCDs in Attachment A and/or described in this section. The BMP Consideration Checklist in the following table indicates the BMPs that were considered and those that were selected to control erosion on the project site.

Table 4-2 Consideration Checklist for Erosion Control BMPs

BMP No.	BMP	Considered for Project	Used	Not Used	If not used, state reason
EC-1	Scheduling	X	X		
EC-2	Preservation of Existing Vegetation	X	X		
EC-3	Hydraulic Mulch			X	May use in the future for graded slopes
EC-4	Hydroseeding			X	May use in the future for graded slopes
EC-5	Soil Binders			X	May use in the future for graded slopes
EC-6	Straw Mulch	X			
EC-7	Geotextiles & Mats			X	May use in the future for graded slopes
EC-8	Wood Mulching	X			
EC-9	Earth Dikes & Drainage Swales	X			May be used in future adjacent to proposed garden.
EC-10	Velocity Dissipation Devices			X	Use if needed.
EC-11	Slope Drains			X	No slope drains planned for site

Scheduling

A schedule shall be prepared that shows the sequencing of construction activities with the installation and maintenance of soil stabilization and sediment control BMPs. See BMP EC-1,

Preservation of Existing Vegetation

Preserving existing vegetation to the maximum extent possible and for as long as possible on a construction site reduces or eliminates erosion in those areas. See BMP EC-2, Preservation of Existing Vegetation, for BMP details.

Straw Mulch, Geotextiles & Mats and Wood Mulching

Various types of mulch may be used throughout the disturbed areas adjacent to excavations and on shallow slopes surrounding the site.

4.3.6. Sediment Control

Sediment controls are structural measures that are intended to complement and enhance the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water. This project will incorporate sediment control measures required by the contract documents, and other measures selected by the stormwater manager. Implementation and locations of sediment control BMPs are shown on the WPCDs in Attachment A. The BMP Consideration Checklist in the following table indicates the BMPs that were considered and those that were selected to control sediment on the project site.

Table 4-3 Consideration Checklist for Sediment Control BMPs

BMP No.	BMP	Considered for Project	Used	Not Used	If not used, state reason
SC-1	Silt Fence	X	X		Only if needed
SC-2	Sediment Basin	X		X	Re-evaluate as necessary
SC-3	Sediment Trap	X		X	Re-evaluate as necessary
SC-4	Check Dam			X	no concentrated flows are expected
SC-5	Fiber Rolls	X	X		
SC-6	Gravel Bag Berm	X	X		Only if needed
SC-7	Street Sweeping and Vacuuming	X		X	No paved streets present
SC-8	Sand Bag Barrier	X	X		only if needed
SC-9	Straw Bale Barrier	X	X		only if needed
SC-10	Strom Drain Inlet Protection	X		X	Not applicable

Implementation of Temporary Sediment Controls

Temporary sediment control BMPs will be deployed according to the schedule. During the rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas, at the toe of slopes, and at outfall areas at all times. During the non-rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas and at storm drain downstream from disturbed areas before rain events. During the non-rainy season, in the event of a predicted storm, the following temporary sediment control materials will be maintained on-site: silt fence, and fiber rolls.

Silt Fence

A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.

Fiber Rolls

A fiber roll consists of wood excelsior, rice or wheat straw, or coconut fibers that is rolled or bound into a tight tubular roll and placed on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff.

Gravel Bag Berm

A gravel bag berm consists of a single row of gravel bags that are installed end to end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide some sediment removal.

Sand Bag Barrier

A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags, designed to intercept and slow the flow of sediment-laden sheet flow runoff.

4.3.7. Tracking Control

The following BMPs have been selected to reduce sediment tracking from the project site on to private or public roads if construction / ground disturbance occurs:

- TC-1: Stabilized Construction Entrance/Exit; and
- TC-2: Stabilized Construction Roadway.

Stabilized Construction Roadway

The roadway through the site may also be designated and stabilized to prevent erosion and to control tracking of mud and soil material onto adjacent roads. The roadway should be clearly marked for limited speed to control dust. Refer to the WPCDs for entrance/exit and project roadway locations. Stabilization material commonly consists of 3 to 6-inch crushed stone aggregate.

4.3.8. Wind Erosion Control

The following BMPs have been selected to control dust from the project site:

- WE-1: Wind Erosion Control;
- NS-1: Water Conservation Practices; and

- WM-3: Stockpile Management.

Dust Control

Potable water may be applied to disturbed soil areas of the project site to control dust and maintain optimum moisture levels for compaction. The water can be applied using water trucks. Water applications will be concentrated during the late summer and early fall months, when soils have the lowest moisture content or when winds are severe. BMPs WE-1: Wind Erosion Control and NS-1: Water Conservation Practices will be implemented to provide dust control and prevent discharges from dust control activities and water supply equipment. Water application rates will be minimized as necessary to prevent runoff and ponding and water equipment leaks will be repaired immediately. During windy conditions (forecast or actual wind conditions of approximately 25 miles per hour or greater), dust control will be applied to disturbed areas, including haul roads, to adequately control wind erosion. BMP WM-3: Stockpile Management will be implemented using silt fences and plastic covers to prevent wind dispersal of sediment from stockpiles.

4.3.9. Non-Storm Water Control

An inventory of project activities and potential non-storm water discharges was provided previously. The BMP Consideration Checklist in Table 3-4 indicates the BMPs that were considered and those that were selected to control non-storm water pollution on the project site. Implementation and locations of some non-storm water control BMPs are shown on the Water Pollution Control Drawings in Attachment A. A narrative description of each BMP follows.

Table 4-4 Non-Stormwater Control BMPs Consideration Checklist

BMP No.	BMP	Considered for Project	Used	Not Used	If not used, state reason
NS-1	Water Conservation Practices	X	X		
NS-2	Dewatering Operations	X			Not applicable to site
NS-3	Paving and Grinding Operations	X			Not applicable to site
NS-4	Temporary Stream Crossing	X			Not applicable to site
NS-5	Clear Water Diversion	X			Not applicable to site
NS-6	Illicit Connection/ Discharge	X	X		
NS-7	Potable Water/ Irrigation	X	X		
NS-8	Vehicle and Equipment Cleaning	X	X		
NS-9	Vehicle and Equipment Fueling	X	X		
NS-10	Vehicle and Equipment Maintenance	X	X		
NS-14	Material and Equipment Use Over Water	X		X	Not applicable to site
NS-15	Demolition Adjacent to Water	X		X	Not applicable to site

Water Conservation Practices

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and/or the transport of pollutants off site. See BMP NS-1 for details.

Illicit Connection/Illegal Discharge Detection and Reporting

The site manager and stormwater manager will implement BMP NS-6: Illicit Connection/Illegal Discharge Detection and Reporting throughout the duration of the project.

Potable Water/Irrigation

Potable Water/Irrigation management consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing. See BMP NS-7 for details.

Vehicle and Equipment Operations

Several types of vehicles and equipment may be used on-site throughout the project, including trucks, quads, tractors, and tillers. BMPs NS-8 Vehicle and Equipment Cleaning, NS-9: Vehicle and Equipment Fueling, and NS-10: Vehicle and Equipment Maintenance will be utilized to prevent discharges of fuel and other vehicle fluids. Vehicle cleaning should not be performed on-site. All self-propelled vehicles should be fueled off site. If they are fueled by mobile fuel trucks, fuel trucks will each be equipped with absorbent spill clean-up materials. Drip pans will be used for all mobile fueling. Drip pans or absorbent pads will be used for all vehicle and equipment maintenance activities that involve grease, oil, solvents, or other vehicle fluids. All vehicle maintenance and mobile fueling operations will be conducted at least 50 feet away from operational inlets and drainage facilities and on a level graded area.

4.3.10. Waste Management and Materials Pollution Control

An inventory of project activities, materials, and wastes was provided previously. The BMP Consideration Checklist in Table 3-5 indicates the BMPs that were considered and those that were selected to control project site wastes and materials. Implementation and locations of some materials handling and waste management BMPs are shown on the WPCDs in Attachment A. A narrative description of each BMP follows.

Table 4-5 Waste Management and Material Pollution Control BMP Consideration Checklist

BMP No.	BMP	Considered for Project	Used	Not Used	If not used, state reason
WM-1	Material Delivery and Storage	X	X		
WM-2	Material Use	X	X		
WM-3	Stockpile Management	X	X		
WM-4	Spill Prevention and Control	X	X		
WM-5	Solid Waste Management	X	X		
WM-6	Hazardous Waste Management	X	X		
WM-7	Contaminated Soil Management	X		X	not applicable
WM-8	Concrete Waste Management	X		X	not applicable
WM-9	Sanitary/Septic Waste Management	X	X		
WM-10	Liquid Waste Management	X	X	X	

Material Delivery, Storage, and Use

In general, BMPs WM-1 and WM-2 will be implemented to help prevent discharges of materials during delivery, storage, and use. A sandbag barrier (BMP SE-8) may be provided around the storage area to prevent run-on from adjacent areas. Watertight shipping containers may be used to store hand tools, small parts, and most materials that can be carried by hand, such as paint cans, solvents and grease. Very large items may be stored in the open in the general storage area. Such materials will be elevated with wood blocks to minimize contact with run-on. Spill clean-up materials, material safety data sheets, a material inventory, and emergency contact numbers will be maintained and stored in the southern shipping container.

Stockpile Management

BMP WM-3: Stockpile Management, will be implemented to reduce or eliminate pollution of storm water from stockpiles of soil and other materials. Stockpiles will be surrounded with sediment controls (SE-5: Fiber Rolls or SE-8: Sandbag Barrier) as needed. Plastic covers (EC-7: Geotextiles & Mats) may also be used.

Spill Prevention and Control

BMP WM-4: Spill Prevention and Control, will be implemented to contain and clean-up spills and prevent material discharges to the storm drain system. Spill prevention is also discussed above under Material Delivery, Storage, and Use and below under Waste Management.

Waste Management

BMP WM-5: Solid Waste Management and BMP WM-6: Hazardous Waste Management will be implemented to minimize storm water contact with waste materials and prevent waste discharges. Solid wastes will be loaded directly into trucks or roll-off dumpsters for off-site disposal. When on-site storage is necessary, solid wastes will be stored in watertight dumpsters in the general storage area of the contractor's yard. A licensed subcontractor will provide solid waste disposal services. Hazardous wastes will be stored in the shipping containers or covered containment area discussed above for materials storage. Hazardous wastes will be appropriately and clearly marked in containers and segregated from other non-waste materials.

Sanitary and Septic Wastes

The site manager will implement BMP WM-9: Sanitary and Septic Waste Management and portable toilets will be located and maintained at the project site for the duration of the project. Regular maintenance will be provided by a licensed contractor and wastes will be disposed off-site. The toilets will be located away from concentrated flow paths and traffic flow.

4.4. BMP Maintenance, Inspection, and Repair

All inspection, maintenance repair, and sampling activities should be performed by qualified personnel. The site manager or storm water manager may delegate any or all of these activities to an employee appropriately trained to do the task(s).

4.4.11. Implementation of Erosion Control BMPs

BMPs will be deployed in a sequence to follow the progress of grading and construction, or tilling / cultivation. As the locations of soil disturbance change, erosion and sedimentation

controls will be adjusted accordingly to control storm water runoff at the downgrade perimeter and drain inlets. BMPs will be mobilized as follows:

- Year-round:
 - The site manager or stormwater manager will monitor weather using National Weather Service reports to track conditions and alert crews to the onset of rainfall events.
 - Disturbed soil areas will be stabilized with temporary erosion control or with permanent erosion control as soon as possible after grading or construction is complete.
- During the rainy season:
 - Disturbed areas will be stabilized with temporary or permanent erosion control before rain events.
 - Disturbed areas that are substantially complete will be stabilized with permanent erosion control (soil stabilization) and vegetation (if within seeding window for seed establishment).
 - Prior to forecast storm events, temporary erosion control BMPs will be deployed and inspected.
- During the non-rainy season:
 - The project schedule will sequence earth-moving activities with the installation of both erosion control and sediment control measures. The schedule will be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to grading.

Sufficient quantities of temporary sediment control materials will be maintained on-site throughout the duration of the project, to allow implementation of temporary sediment controls in the event of predicted rain, and for rapid response to failures or emergencies. This includes implementation requirements for active areas and non-active areas before the onset of rain.

The site manager and stormwater manager shall use the guidelines in Table 3-6 for maintenance, inspection, and repair of BMPs.

Table 4-6 Program for Maintenance, Inspection and Repair of BMPs

BMPs	INSPECTION FREQUENCY (all controls)	MAINTENANCE/REPAIR PROGRAM
Soil Stabilization, Grade Surfaces	Weekly and after each storm	Regrade and reapply seed, straw or tack as necessary.
Stabilized Construction Roadway	Weekly and after each storm	Replace gravel material as necessary and remove sediment deposited on roadway within 24 hours.
Temporary Sediment Retention Facilities	Weekly and after each storm	Inspect retention facilities for sediment buildup. Sediment shall be excavated as necessary.
Temporary Stockpile Area, Silt Fence	Weekly and after each storm	Replace plastic covers or torn sections of silt fence and clear as necessary.
Dust Control	Daily, or as needed	Maintain sufficient watering devices on site.

4.5. Spill Prevention Control and Countermeasure Plan

The spill prevention and control plan for the project may include the following components:

- Maintenance of spill kit for petroleum hydrocarbons on site and in fuel supply trucks to include:
 - Containment drum;
 - Oleophilic absorbent pads; and
 - Granular spill absorbent suitable for petroleum, brake fluid, and antifreeze;
- Daily inspection of construction equipment for oil and fuel leaks;
- Fueling in the designated area; and
- Training of personnel on handling of leaks (training at tailgate safety meetings).

4.6. Post-Construction Storm Water Management

4.6.1. Post-Construction Control Practices

The following are the post-construction BMPs that are to be used at this project site after all construction is complete:

- boundary fence which functions as a silt fence
- maintenance of drainage ditches which intercept or collect sheetflow
- vegetative buffers
- water conservation and drip irrigation
- and armored roads.

4.7. Training

A copy of the Plan will be made available to the site personnel or contractor representatives engaged in the maintenance or installation of BMPs. Site inspectors observing pollution caused by ineffective construction or cultivation practices will inform site personnel of appropriate and proper erosion and sedimentation control practices, along with special follow-up inspection for further training. The Stormwater Manager or general contractor shall organize orientation sessions with all installation, inspection, and maintenance personnel upon initiation of a specific project activity or change in key personnel. These sessions will be setup to ensure that all contractor and sub-contractor operations are implemented in accordance with this Plan. Training sessions will be included as part of regular safety meetings to familiarize works with the requirements of the Plan.

5.0 PROJECT SITE MONITORING PROGRAM

5.1. Objectives

The Project Site Monitoring Program shall be developed and implemented to address the following objectives:

- To demonstrate that the site is in compliance with all permits and ordinances;
- To determine whether non-visible pollutants are present at the project site and are causing or contributing to exceedances of water quality objectives;
- To determine whether immediate corrective actions, additional BMP implementation, or Plan revisions are necessary to reduce pollutants in storm water discharges and authorized non-storm water discharges; and
- To determine whether BMPs indicated in the Plan are effective in preventing or reducing pollutants in storm water discharges and authorized non-storm water discharges.

5.2. Types of Inspections and Frequency

Based on the project site's location, construction / cultivation periods, and rainfall erosivity factor, this project should perform inspections at the following times: beginning of the rain season; before and after any storm that produces over 1 inch of rain; and during any storm that produces a significant stormwater discharge. Each inspection event will be logged in the Inspection Log in Attachment C or in a separate binder.

5.2.1. Exceptions

The inspectors shall be prepared to collect samples and conduct visual inspections. Inspectors are not required to physically collect samples or conduct visual inspections under the following conditions:

- During dangerous weather conditions such as flooding and electrical storms; and
- Outside of scheduled site business hours.

5.2.2. Inspection and Sampling Personnel

All inspection and sampling activities should be performed by the stormwater manager until site personnel are properly trained to take over these tasks. The name(s) and contact number(s) of the assigned inspection and sampling personnel are:

- to be determined

5.3. Record Keeping and Reports

The site manager or storm water manager should retain records of all storm water monitoring information and copies of all reports for a period of at least three years. Each inspection event can be logged in the Inspection Log in Attachment C. These records include:

- The date, place, time of facility inspections, sampling, visual inspections, and/or measurements, including precipitation;
- The individual(s) who performed the facility inspections, sampling, visual inspections, and or measurements;
- The date and approximate time of analyses;
- The individual(s) who performed the analyses;
- Rain gauge readings from site inspections;

- Non-storm water discharge inspections and visual inspections and storm water discharge visual observation records;
- Visual observation and sample collection exception records; and
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual inspections, or inspections.

5.4. Visual Inspection Plan

The inspector should conduct visual observations (inspections) during business hours only. The inspector should record the time, date and rain gauge reading of all qualifying rain events. Within 2 business days (48 hours) prior to major rain events, the inspector should visually observe (inspect):

- All storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources (if needed, the site manager should implement appropriate corrective actions);
- All BMPs to identify whether they have been properly implemented in accordance with the Plan (if needed, the site manager shall implement appropriate corrective actions); and
- Any storm water storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.

The inspector should conduct during-rain event visual observations (inspections) at regular intervals during extended storm events. The inspector shall visually observe (inspect) storm water discharges at all discharge locations.

Within two business days (48 hours) after major rain events, the inspector should conduct post rain event visual observations (inspections) to (1) identify whether BMPs were adequately designed, implemented, and effective, and (2) identify additional BMPs and revise the Plan accordingly.

For the visual inspections described above, the inspector shall observe the presence or absence of floating and suspended materials, a sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants. The inspector should maintain on-site records of all visual observations (inspections), personnel performing the observations, observation dates, weather conditions, locations observed, and corrective actions taken in response to the observations.

5.4.3. Non-Storm Water Discharge Monitoring Requirements

The following visual monitoring requirements apply to the project:

- The inspector shall visually observe (inspect) each drainage area for the presence of (or indications of prior) unauthorized and authorized non-storm water discharges and their sources.
- The inspector shall conduct one visual inspection quarterly in each of the following periods: January-March, April-June, July-September, and October-December.
- The inspector shall ensure that visual inspections document the presence or evidence of any non-stormwater discharge (authorized or unauthorized), pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.), and source. The inspector shall maintain on-site records indicating the personnel performing the visual inspections, the dates and approximate time each drainage area and non-storm water discharge was observed, and the response taken to eliminate unauthorized non-storm

water discharges and to reduce or prevent pollutants from contacting non-storm water discharges.

5.5. Sampling Plan for Pollutants

The inspector should analyze one or more effluent samples for any parameters indicating the presence of pollutants during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water. Samples of discharge will be collected at the designated sampling locations shown on the WPCDs for observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event. Sampling locations are shown in the WPCDs in Attachment A.

The inspector should analyze samples for all applicable pollutant parameters. The inspector shall collect a sample of storm water that has not come in contact with the disturbed soil or the materials stored or used on-site (uncontaminated sample) for comparison with the discharge sample. The inspector shall compare the uncontaminated sample to the samples of discharge using field analysis or through laboratory analysis. The inspector shall keep all field /or analytical data. Samples will be analyzed for the applicable constituents using the USEPA analytical methods.

5.6. General Sampling Methodology

5.6.1. Sample Collection and Delivery

The storm water manager shall designate and train personnel to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring Program's 2008 Quality Assurance Program Plan. The storm water manager shall ensure that testing laboratories will receive samples within 48 hours of the physical sampling (unless otherwise required by the laboratory), and shall use only the sample containers provided by the laboratory to collect and store samples.

The storm water manager shall ensure that all sampling and sample preservation are in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association). All monitoring instruments and equipment (including a discharger's own field instruments for measuring pH and turbidity) should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements. The storm water manager shall ensure that all laboratory analyses are conducted according to test procedures under 40 Code of Federal Regulations Part 136, unless other test procedures have been specified in this General Permit or by the Regional Water Board. With the exception of field analysis conducted by the inspectors for turbidity and pH, all analyses should be sent to and conducted at a laboratory certified for such analyses by the State Department of Health Services.

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants should be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight. Sampling personnel should be available to collect samples in

accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, surgical gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, Sampling Activity Log forms, and Chain of Custody (COC) forms. The storm water manager will obtain and maintain the field-testing instruments for analyzing samples in the field by trained sampling personnel.

Grab samples will be collected and preserved in accordance with the applicable test method. Only personnel trained in proper water quality sampling will collect samples. Samples will be collected by placing a separate lab-provided sample container directly into a stream of water down gradient and within close proximity to the potential non-visible pollutant discharge location. This separate lab-provided sample container will be used to collect water, which will be transferred to sample bottles for laboratory analysis. The up gradient and uncontaminated background samples shall be collected first prior to collecting the down gradient to minimize cross-contamination. The sampling personnel will collect the water upgradient of where they are standing. Once the separate lab-provided sample container is filled, the water sample will be poured directly into sample bottles provided by the laboratory for the analyte(s) being monitored. To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Wear a clean pair of surgical gloves prior to the collection and handling of each sample at each location;
- Not contaminate the inside of the sample bottle by not allowing it to come into contact with any material other than the water sample;
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection;
- Not leave the cooler lid open for an extended period of time once samples are placed inside;
- Not sample near a running vehicle where exhaust fumes may impact the sample;
- Not touch the exposed end of a sampling tube, if applicable;
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles;
- Not eat, smoke, or drink during sample collection;
- Not sneeze or cough in the direction of an open sample bottle;
- Minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample to take place;
- Decontaminate sampling equipment prior to sample collection using a laboratory-grade soapy water wash, distilled water rinse, and final rinse with distilled water; and
- Dispose of decontamination water/soaps appropriately; i.e., not discharge to the storm drain system or receiving water.

Immediately following collection, samples for field analysis will be tested in accordance with the field instrument manufacturer's instructions and results recorded on the Sampling Activity Log. Immediately following collection, sample bottles for laboratory analytical testing will be capped, labeled, documented on a COC form provided by the analytical laboratory, sealed in a re-sealable storage bag, placed in an ice-chilled cooler, at as near to 4 degrees Celsius as practicable, and delivered within 24 hours to a California state-certified laboratory such as TestAmerica.

6.0 REFERENCES

California Department of Transportation's Construction Site BMPs Handbook, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm>.

California Department of Transportation's Construction Site BMP Fact Sheets, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/factsheets.htm>.

California Stormwater Quality Association. 2011. California Stormwater Best Management Practice Handbook – Construction. California Stormwater Quality Association, Menlo Park, California 886 pp.

California Stormwater Quality Association. 2014. Stormwater Best Management Practice Handbook Portal: Industrial and Commercial. California Stormwater Quality Association, Menlo Park, California. 474 pp.

Central Valley Region's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

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Renard, K.C., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE), Agricultural Handbook 703, USDA-ARS, U.S. Government Printing Office, Washington, D.C.

Newman, J. (editor). 2008. Greenhouse and Nursery Management Practices to Protect Water Quality. Publication Number: 3508. University of California Agriculture and Natural Resources Publications, Oakland, CA. 160 pp.

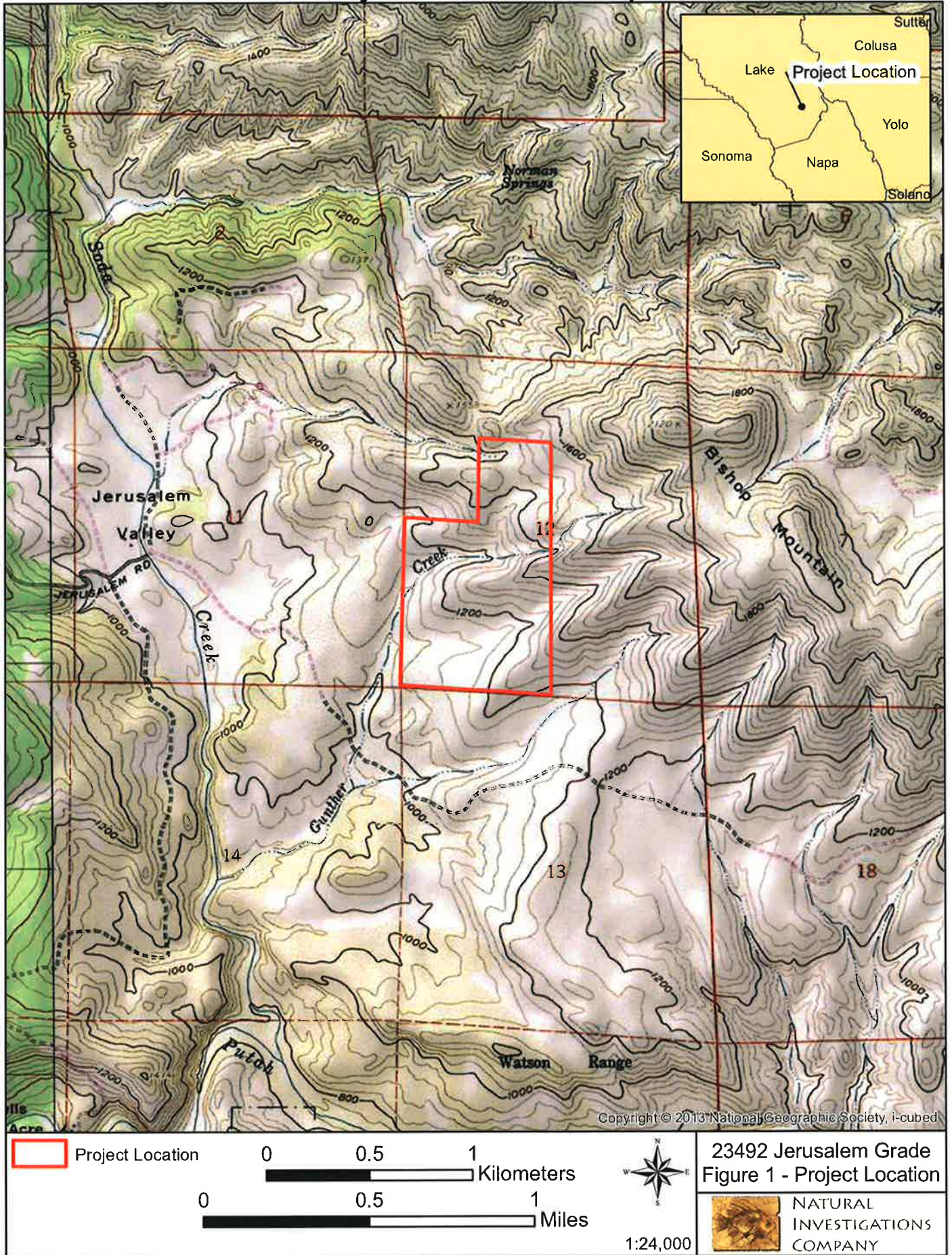
Troeh, F. and J.A. Hobbs. 2003. Soil and Water Conservation for Productivity and Environmental Protection, 4th ed. Prentice Hall, Upper Saddle River, N.J.

United States Department of Agriculture. Hanford Series. 1999. National Cooperative Soil Survey. Available from: <http://www2.ftw.nrcs.usda.gov/osd/dat/H/HANFORD.html> [cited 18 Apr 2009]

USEPA NPDES Storm Water Program's National Menu of BMPs website at <http://www.epa.gov/npdes/stormwater/menuofbmps>.

Attachment A: Site Layout, Project Plans, and Water Pollution Control Drawings (WPCDs)

Project Location Map





- | | | |
|-----------------|----------------------------|---------------------|
| Parcel Boundary | Existing Garden | Processing building |
| Water Tank | Proposed Garden | |
| Gravel Road | Terraces, Abandoned Garden | |
| Dirt Road | Dirt pad, Abandoned Garden | |
| Storage shed | Watercourse Class 3 | |

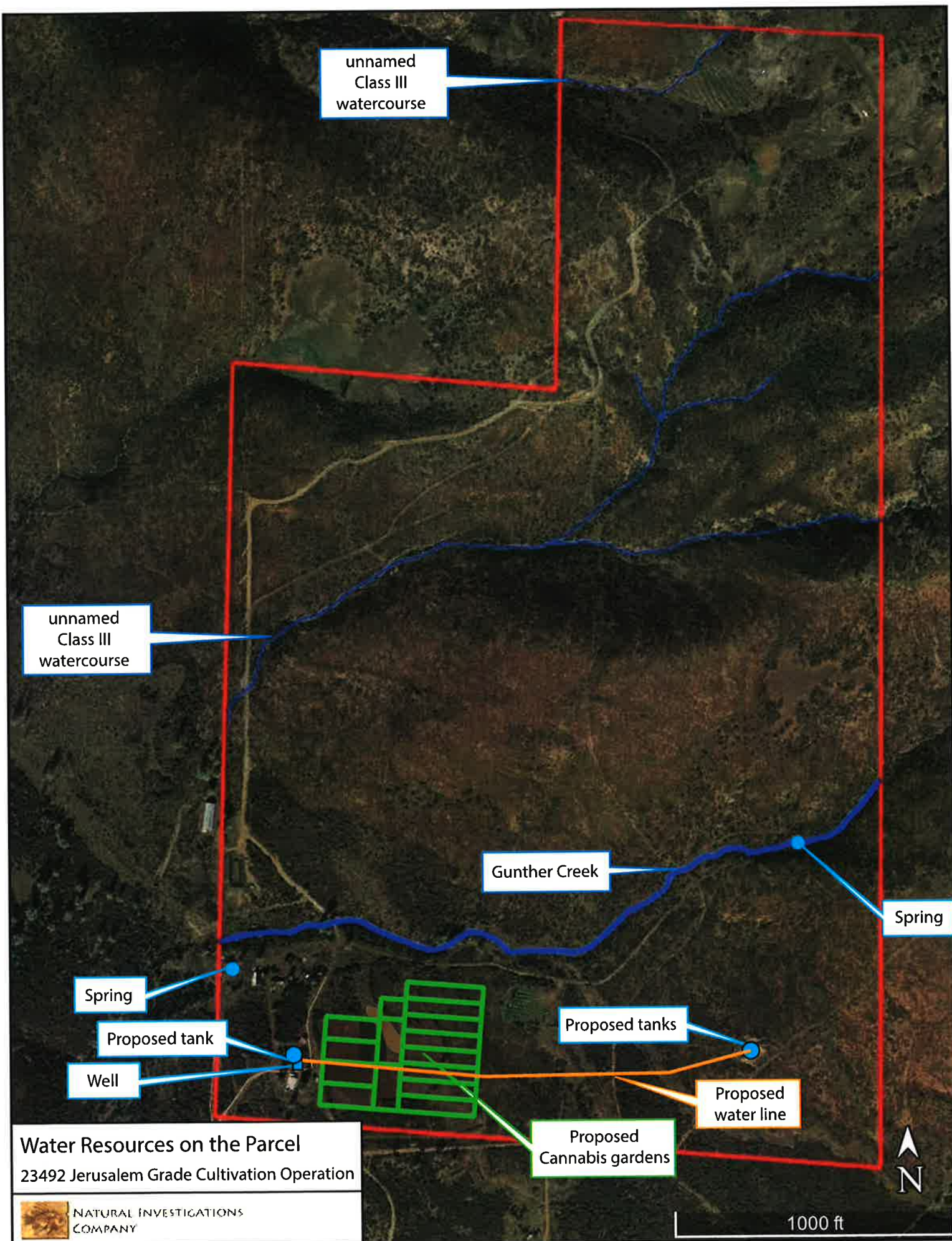


0 300 600 Feet

23492 Jerusalem Grade
Facility Overview

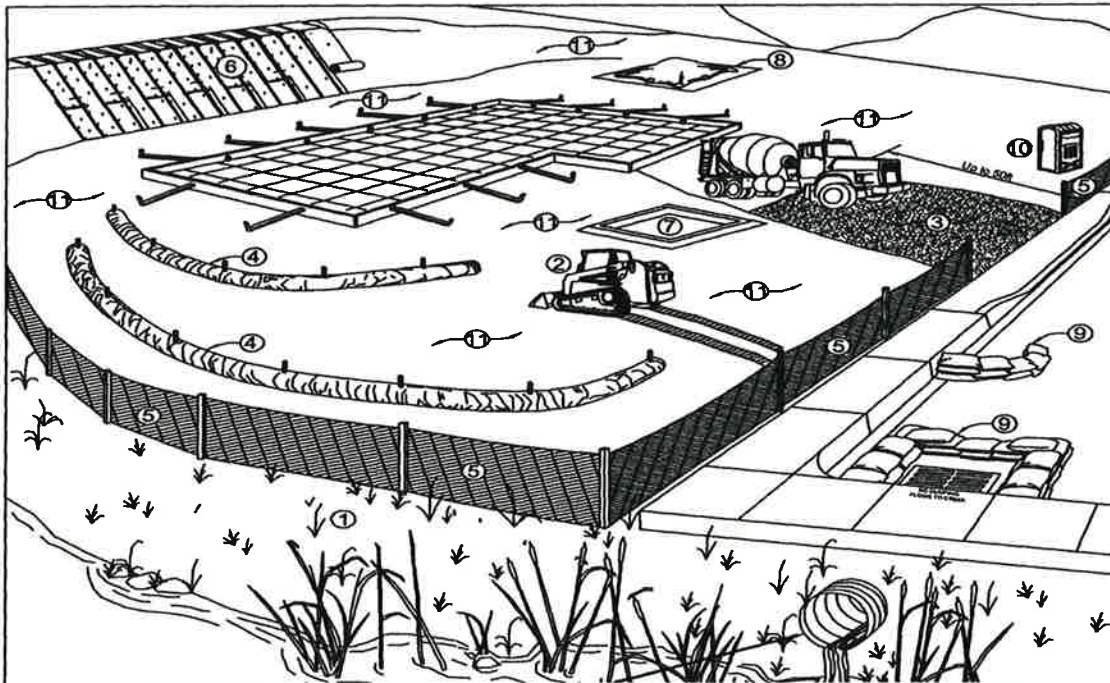


NATURAL
INVESTIGATIONS
COMPANY



Attachment B: Fact Sheets of Selected BMPs

MINIMUM EROSION CONTROL MEASURES FOR SINGLE FAMILY HOME CONSTRUCTION



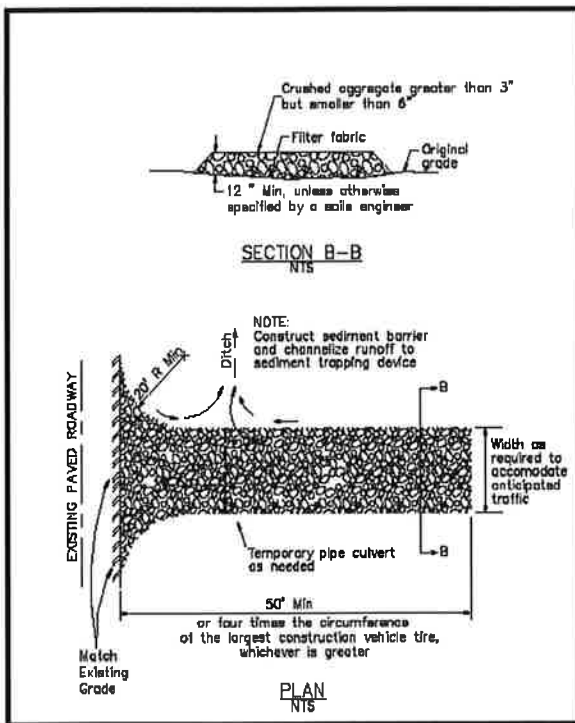
Storm Drains Lead Directly into Clear Lake or its tributaries.

MINIMUM BEST MANAGEMENT PRACTICES (BMPs)

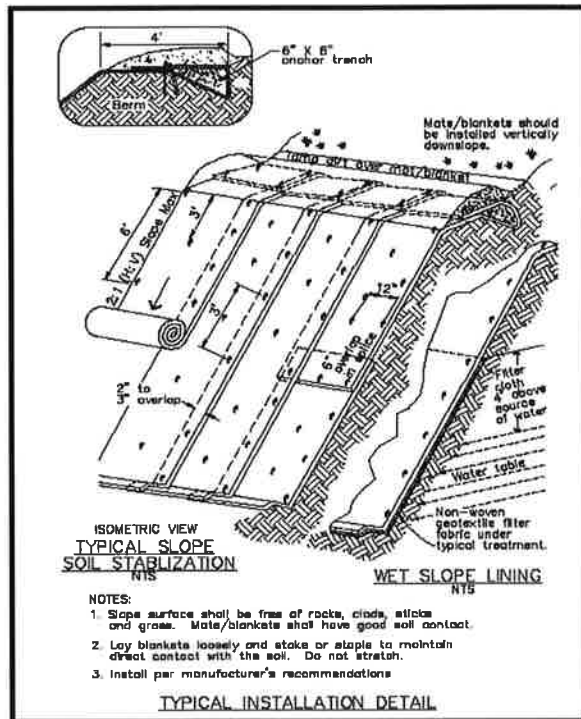
- 1 Check with Lake County Planning Department for creek setback requirements.
- 2 During grading phase, track-walk up and down slopes, not parallel.
- 3 Stabilize site entrance and temporary driveways with 3" crushed rock up to 50' in length to prevent tracking soil from site.
- 4 Install straw wattles along contours when slope \geq 2:1 gradient; key wattles into ground 3" deep, 25' to 50' apart.
- 5 Install silt fence as secondary measure along contours to keep sediment on-site and to minimize vehicle and foot traffic beyond limits of site disturbance.
- 6 Install erosion blankets on any disturbed area \geq 2:1 slope.
- 7 Construct concrete washout site adjacent to stabilized entrance. Clean as needed and remove at end of project. Dispose of hardened concrete properly.
- 8 Cover all stockpiles and landscape materials; keep behind silt fence, and away from water bodies.
- 9 Use pea-gravel bags around drain-inlets, both on-site and off-site as a last line of defense.
- 10 Place porta-potty near stabilized site entrance and away from storm drain inlets and water bodies.
- 11 Cover all exposed soil with straw or straw with tackifier.

Note: Sediment and erosion control shall be continually maintained throughout the year (not only during the rainy season) and to remain effective during construction phase. Continue inspection and maintenance of BMPs before and after rain events; adjust as needed for changing conditions.

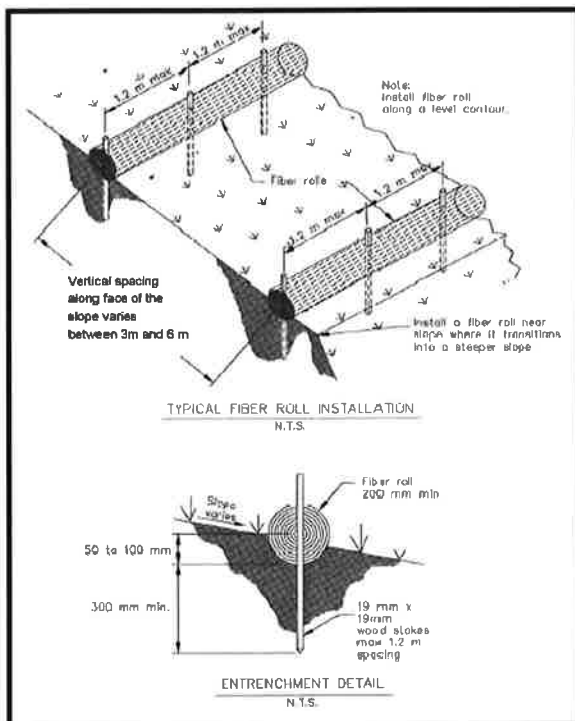




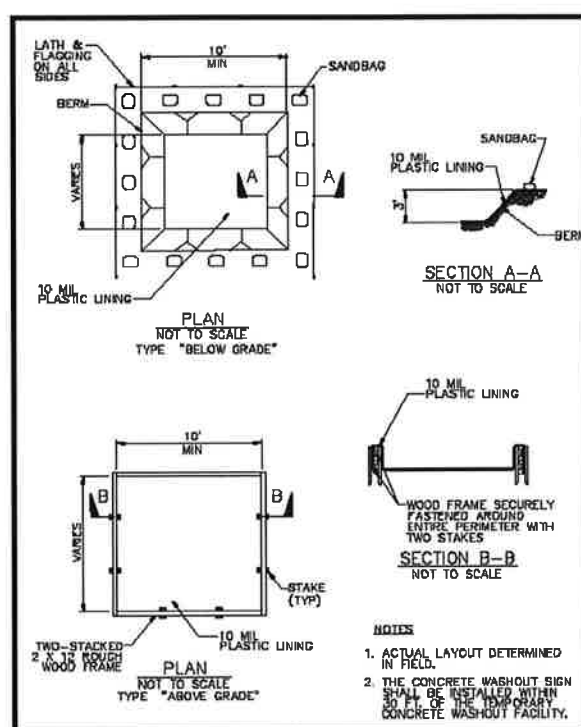
Stabilized Construction Entrance



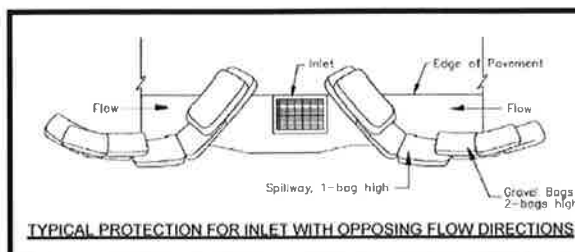
Erosion Blanket



Fiber Rolls (Wattles)



Concrete Washout



Drop Inlet Protection

For additional information contact:

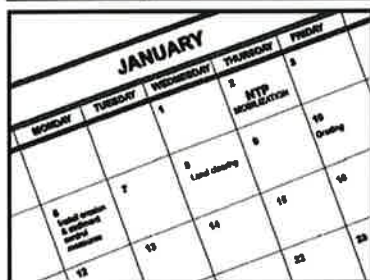
**County of Lake
Community Development 263-2382
Public Works Department 263-2341**

**City of Lakeport 263-5613
City of Clearlake 994-8201**

Or visit: www.cabmphandbooks.com

Scheduling

EC-1



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 of construction. Clearly show how the rainy season relates to soil

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None



January 2003

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1 of 3

EC-1

Scheduling

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.

2 of 3

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January 2003

Scheduling

EC-1

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.

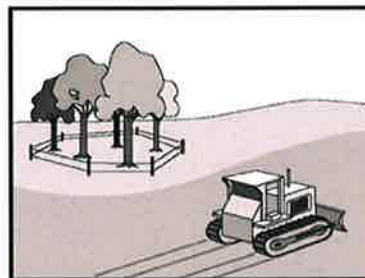
Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

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3 of 3

Preservation Of Existing Vegetation EC-2



Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi-year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TR	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	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None



January 2003

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1 of 4

EC-2 Preservation Of Existing Vegetation

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
 - Orange colored plastic mesh fencing works well.
 - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Preservation Of Existing Vegetation EC-2

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of \$10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed.

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a tree root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
 - Fertilize stressed or damaged broadleaf trees to aid recovery.
 - Fertilize trees in the late fall or early spring.

EC-2 Preservation Of Existing Vegetation

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.
- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

County of Sacramento Tree Preservation Ordinance, September 1981.

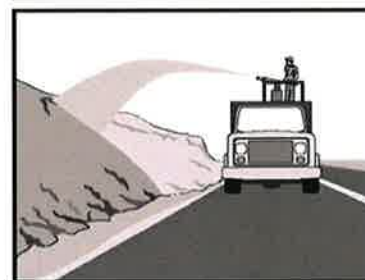
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch

EC-3



Description and Purpose

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

Suitable Applications

Hydraulic mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

Wood fiber hydraulic mulches are generally short lived and need 2-4 hours to dry before rainfall occurs to be effective. May require a second application in order to remain effective for an entire rainy season.

Implementation

- Prior to application, roughen embankment and fill areas by rilling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- To be effective, hydraulic matrices require 2-4 hours to dry before rainfall occurs.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
OE	Sediment Control	<input type="checkbox"/>
TR	Tracking Control	<input type="checkbox"/>
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	<input type="checkbox"/>
WM	Waste Management and Material Pollution Control	<input type="checkbox"/>

Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input type="checkbox"/>
Trash	<input type="checkbox"/>
Metals	<input type="checkbox"/>
Bacteria	<input type="checkbox"/>
Oil and Grease	<input type="checkbox"/>
Organics	<input type="checkbox"/>

Potential Alternatives

- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching



- Paper based hydraulic mulches alone shall not be used for erosion control.

Hydraulic Mulches

Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 lb/acre. Wood fiber mulch is manufactured from wood or wood waste from lumber mills or from urban sources.

Hydraulic Matrices

Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area: 2,000 to 4,000 lb/acre wood fiber mulch, and 5 to 10% (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)

Bonded Fiber Matrix

Bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 lb/acre to 4,000 lb/acre based on the manufacturer's recommendation. A biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Costs

Average cost for installation of wood fiber mulch is \$900/acre. Average cost for installation of BFM is \$5,500/acre.

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.
- Areas where erosion is evident shall 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.
- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.

References

Controlling Erosion of Construction Sites, Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service - SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

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.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

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

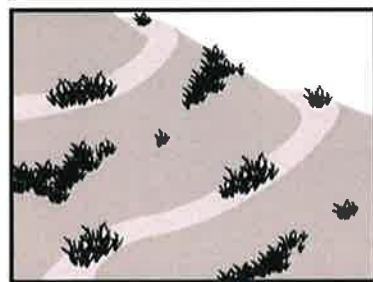
Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding

EC-4



Description and Purpose

Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily protect exposed soils from erosion by water and wind.

Suitable Applications

Hydroseeding is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short term inactivity.

Objectives

- | | | |
|----|--|-------------------------------------|
| EC | Erosion Control | <input checked="" type="checkbox"/> |
| SE | Sediment Control | <input type="checkbox"/> |
| TR | Tracking Control | <input type="checkbox"/> |
| WE | Wind Erosion Control | <input checked="" type="checkbox"/> |
| NS | Non-Stormwater Management Control | <input type="checkbox"/> |
| WM | Waste Management and Materials Pollution Control | <input type="checkbox"/> |

Legend

- ☒ Primary Objective
☐ Secondary Objective

Targeted Constituents

- | | |
|----------------|-------------------------------------|
| Sediment | <input checked="" type="checkbox"/> |
| Nutrients | <input type="checkbox"/> |
| Trash | <input type="checkbox"/> |
| Metals | <input type="checkbox"/> |
| Bacteria | <input type="checkbox"/> |
| Oil and Grease | <input type="checkbox"/> |
| Organics | <input type="checkbox"/> |

Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching



EC-4

Hydroseeding

Implementation

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- | | |
|----------------------|----------------------------------|
| - Soil conditions | - Maintenance requirements |
| - Site topography | - Sensitive adjacent areas |
| - Season and climate | - Water availability |
| - Vegetation types | - Plans for permanent vegetation |

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps shall be followed for implementation:

- Avoid use of hydroseeding in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow up applications shall be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average cost for installation and maintenance may vary from as low as \$300 per acre for flat slopes and stable soils, to \$1600 per acre for moderate to steep slopes and/or erosive soils.

Hydroseeding

EC-4

Hydroseeding		Installed Cost per Acre
High Density	Grass/Seeds	\$100 - \$1600
	Turf Species	\$150
	Bunch Grasses	\$300 - \$1200
Fast Growing	Annual	\$250 - \$650
	Perennial	\$300 - \$800
Non-Competing	Native	\$300 - \$600
	Non-Native	\$400 - \$500
Sterile Cereal Grains		\$500

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

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.
- Areas where erosion is evident shall be repaired and BMP's 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.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and brooks repaired before the system is put back into operation.
- Irrigation systems shall be inspected for complete coverage and adjusted as needed to maintain complete coverage.

References

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

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

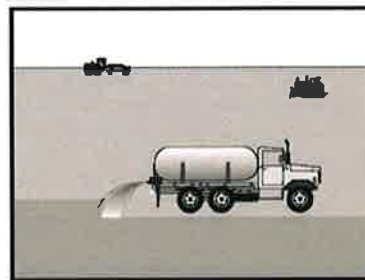
January 2003

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3 of 3

Soil Binders

EC-5



Description and Purpose

Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water induced erosion of exposed soils on construction sites. Soil binders also prevent wind erosion.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring short term temporary protection. Because soil binders can often be incorporated into the work, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are also suitable for use on stockpiles.

Limitations

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

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input type="checkbox"/>
TR	Tracking Control	<input type="checkbox"/>
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non Stormwater Management Control	<input type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input type="checkbox"/>

Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input type="checkbox"/>
Trash	<input type="checkbox"/>
Metals	<input type="checkbox"/>
Bacteria	<input type="checkbox"/>
Oil and Grease	<input type="checkbox"/>
Organics	<input type="checkbox"/>

Potential Alternatives

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



January 2003

California Stormwater BMP Handbook
Construction
www.caltransbnpbooks.com

1 of 7

EC-5

Soil Binders

- Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil binders may not perform well with low relative humidity. Under many 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 soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup.
- A sampling and analysis plan must be incorporated into the SWPPP as soil binders could be a source of non-visible pollutants.

Implementation

General Considerations

- Regional 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.
- Some soil binders may not be compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this BMP. 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** - Finest 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 can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could

2 of 7

California Stormwater BMP Handbook
Construction
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January 2003

Soil Binders

EC-5

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) 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	60	60	70

Psyllium: Psyllium is composed of the finely ground mucoid 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) 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 should air cure within a maximum of 36 to 48 hours. 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.

January 2003

California Stormwater BMP Handbook
Construction
www.caltransbnpbooks.com

3 of 7

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 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 2:1	5.0 - 10.0
2:1 to 1:1	10.0 - 20.0

Poly-Acrylamide and Copolymer of Acrylamide: Linear copolymer polyacrylamide is packaged as a dry flowable solid. When used as a stand alone stabilizer, it is diluted at a rate of 11lb/1,000 gal of water and applied at the rate of 5.0 lb/acre.

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 costs:

Soil Binder	Cost per Acre
Plant-Material Based (Short Lived) Binders	\$4.00
Plant-Material Based (Long Lived) Binders	\$1,200
Polymeric Emulsion Blend Binders	\$400 ⁽¹⁾
Cementitious-Based Binders	\$800

(1) \$1,200 for Acrylic polymers and copolymers

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

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.
- Areas where erosion is evident shall 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.

References

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.

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Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

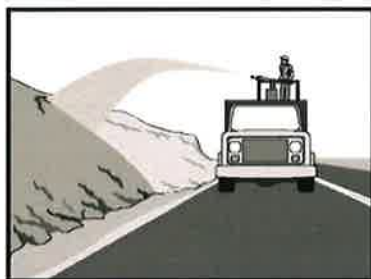
Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
Relative Cost	Low	Low	Low	Low
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 lb/acre

(1) See Implementation for specific rates.

Straw Mulch

EC-6



Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch is typically used for erosion control on disturbed areas until soils can be prepared for permanent vegetation. Straw mulch is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Limitations

- Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- There is a potential for introduction of weed seed and unwanted plant material.
- When straw blowers are used to apply straw mulch, the treatment areas must be within 150 ft of a road or surface capable of supporting trucks.
- Straw mulch applied by hand is more time intensive and potentially costly.

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
BE	Sediment Control	
TR	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	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching



January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

1 of 3

EC-6

Straw Mulch

- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding, or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.

Implementation

- Straw shall be derived from wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw shall be used.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.
- In San Diego, use of straw near wood framed home construction has been frowned on by the Fire Marshall.

Application Procedures

- Apply straw at a minimum rate of 4,000 lb/acre, either by machine or by hand distribution.
- Roughen embankments and fill rills before placing the straw mulch by rolling with a crimping or punching type roller or by track walking.
- Evenly distribute straw mulch on the soil surface.
- Anchor straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating). Alternatively, use a tackifier to adhere straw fibers.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
 - On small areas, a spade or shovel can be used to punch in straw mulch.
 - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coultter, known commercially as a "crimper".
 - On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes as described in EC-7, Geotextiles and Mats.
 - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place. A tackifier is

2 of 3

California Stormwater BMP Handbook
Construction
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January 2003

Straw Mulch

EC-6

typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is \$2,500 per acre. Application by hand is more time intensive and potentially costly.

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.
- 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.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service - SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

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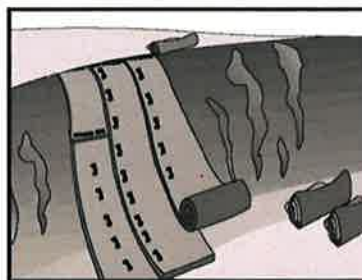
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3 of 3

Geotextiles and Mats

EC-7



Description and Purpose

Mattings of natural materials are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, matting may be used to stabilize soils until vegetation is established.

Suitable Applications

Mattings are commonly applied on short, steep slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks where moving water at velocities between 3 ft/s and 6 ft/s are likely to wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. Matting may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). Erosion control matting should be considered when the soils are fine grained and potentially erosive. These measures should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop
- Channels with flows exceeding 3 ft/s

Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
BE	Sediment Control	
TR	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	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-8 Wood Mulching



January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

1 of 11

- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs)

Limitations

- Properly installed matting provides excellent erosion control but do so at relatively high cost. This high cost typically limits the use of matting to areas of concentrated channel flow and steep slopes.
- Matting is more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes)
- Installation is critical and requires experienced contractors. The contractor should install the matting material in such a manner that continuous contact between the material and the soil occurs.
- Geotextiles and Mats may delay seed germination, due to reduction in soil temperature.
- Blankets and mats are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until alternative measures, such as seeding and mulching, may be installed.
- Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.
- Not suitable for areas that have heavy foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.

Implementation

Material Selection

Organic matting materials have been found to be effective where re-vegetation will be provided by re-seeding. The choice of matting should be based on the size of area, site slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

The following natural and synthetic matting are commonly used:

Geotextiles

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permeability of the fabric should be approximately 0.07 sec⁻² in conformance with the requirements in ASTM Designation: D 14191. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D 13455. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil.
- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.
 - Jute is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
 - Excelsior (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd², ±10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples

should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long, and a minimum of 0.5 lb/yd². Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd². Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd². Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

- Plastic netting** is a lightweight bixially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than 1/4 in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geotextile. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Bonded synthetic fibers** consist of a three dimensional geotextile nylon (or other synthetic) matting. Typically it has more than 90 percent open area, which facilitates root growth. It's a tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geotextile. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geotextile or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket

installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. When using jute matting on a seeded area, apply approximately half the seed before laying the mat and the remainder after laying the mat. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots are made of glass fiber strips, excelsior matting strips or tight folded jute matting blanket or strips for use on steep, highly erodible watercourses. The check slots are placed in narrow trenches 6 to 12 in. deep across the channel and left flush with the soil surface. They are to cover the full cross section of designed flow.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the friable seedbed made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

Anchoring

- U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 6 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with 0.15 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft.

- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd². Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 1/2 staples/yd².

Installation in Channels

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channel.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 3 in. above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 3 in. overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 to 30 ft intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.

- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement)

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

Temporary Soil Stabilization Removal

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Relatively high compared to other BMPs. Biodegradable materials: \$0.50 - \$0.57/yd². Permanent materials: \$3.00 - \$4.50/yd². Staples: \$0.04 - \$0.05/staple. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre
Biodegradable	Jute Mesh	\$6,500
	Curled Wood Fiber	\$10,500
	Straw	\$8,900
	Wood Fiber	\$8,900
	Coconut Fiber	\$13,000
	Coconut Fiber Mesh	\$21,200
	Straw Coconut Fiber	\$10,900
	Plastic Netting	\$2,000
	Plastic Mesh	\$3,900
Non Biodegradable	Synthetic Fiber with Netting	\$34,500
	Banded Synthetic Fibers	\$50,000
	Combination with Biodegradable	\$32,000

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

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, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.
- Check that disturbed areas are seeded.

References

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

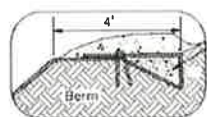
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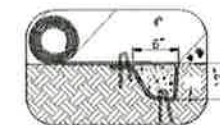
6' X 6' anchor trench



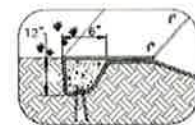
NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations.

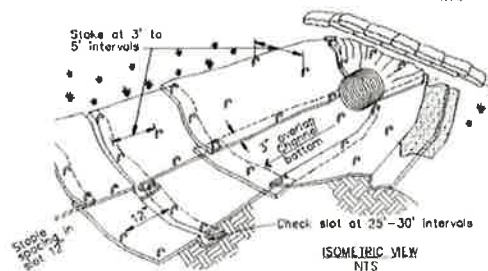
TYPICAL INSTALLATION DETAIL



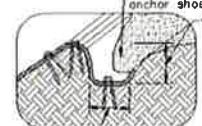
INITIAL CHANNEL ANCHOR TRENCH NTS



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH NTS



INTERMITTENT CHECK SLOT NTS



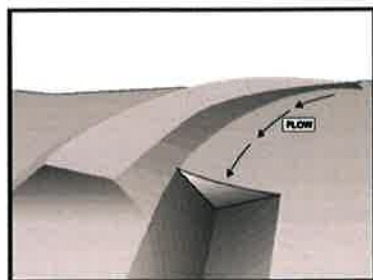
LONGITUDINAL ANCHOR TRENCH NTS

NOTES:

1. Check slots to be constructed per manufacturer's specifications.
2. Staking or sloping layout per manufacturer's specifications.
3. Install per manufacturer's recommendations.

TYPICAL INSTALLATION DETAIL

Earth Dikes and Drainage Swales EC-9



Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:

- To convey surface runoff down sloping land
- To intercept and divert runoff to avoid sheet flow over sloped surfaces
- To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
- To intercept runoff from paved surfaces
- Below steep grades where runoff begins to concentrate
- Along roadways and facility improvements subject to flood drainage

Objectives

- EC Erosion Control ☒
- SE Sediment Control
- TR Tracking Control
- WE Wind Erosion Control
- NS Non-Stormwater Management Control
- WM Waste Management and Material Pollution Control

Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

- Sediment ☒
- Nutrients
- Trash
- Metals
- Bacteria
- Oil and Grease
- Organics

Potential Alternatives

None



EC-9 Earth Dikes and Drainage Swales

- At the top of slopes to divert runoff from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off-site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and

Earth Dikes and Drainage Swales EC-9

compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

January 2003

California Stormwater BMP Handbook
Construction
www.cabmp-handbooks.com

3 of 7

EC-9 Earth Dikes and Drainage Swales

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft.
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.

4 of 7

California Stormwater BMP Handbook
Construction
www.cabmp-handbooks.com

January 2003

Earth Dikes and Drainage Swales EC-9

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from \$15 to \$55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: \$2.50 - \$6.50/linear ft; Large dikes: \$2.50/yd³.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

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.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Burszynsky, P.E., McGraw Hill Book Company, 1986.

January 2003

California Stormwater BMP Handbook
Construction
www.cabmp-handbooks.com

5 of 7

EC-9 Earth Dikes and Drainage Swales

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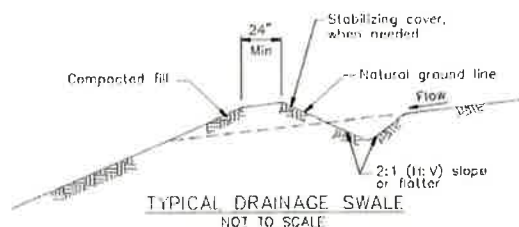
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6 of 7

California Stormwater BMP Handbook
Construction
www.cabmp-handbooks.com

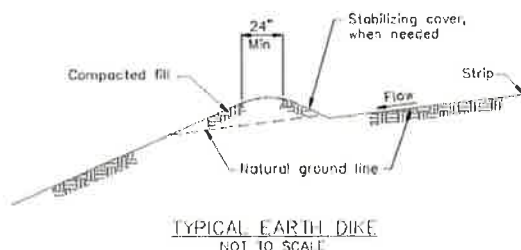
January 2003

Earth Dikes and Drainage Swales EC-9



NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



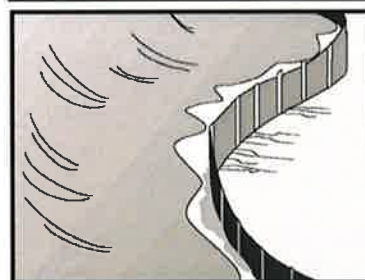
January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

1 of 1

Silt Fence SE-1

SE-1



Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	<input type="checkbox"/>
WE	Wind Erosion Control	<input type="checkbox"/>
NS	Non-Stormwater Management Control	<input type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input type="checkbox"/>
Trash	<input type="checkbox"/>
Metals	<input type="checkbox"/>
Bacteria	<input type="checkbox"/>
Oil and Grease	<input type="checkbox"/>
Organics	<input type="checkbox"/>

Potential Alternatives

SE-5 Fiber Roll
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

A silt fence is made of a filter fabric 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 should also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion. 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 stock piles.
- Below other small cleared areas.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.



January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

1 of 8

SE-1

Silt Fence

- Do not use in locations where ponded water may cause flooding.
- Do not place fence on a slope, or across any contour line. If not installed at the same elevation throughout, silt fences will create erosion.
- Filter fences will create a temporary sedimentation pond on the upstream side of the fence and may cause temporary flooding. Fences not constructed on a level contour will be overtopped by concentrated flow resulting in failure of the filter fence.
- Improperly installed fences are subject to failure from undercutting, overlapping, 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 allow water depth to exceed 1.5 ft at any point.

Implementation

General

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, 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.

Silt fences are preferable to straw bale barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw bale barriers, there are many instances where silt fences have been improperly installed. The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Don't use in streams, channels, or anywhere flow is concentrated. Don't use silt fences to divert flow.
- Don't use below slopes subject to creep, slumping, or landslides.
- Select filter fabric that retains 85% of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.
- 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.

2 of 8

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

January 2003

Silt Fence

SE-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 ft² 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.

Design and Layout

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specification) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet that it has openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. Standard Sieve No. 200, select the EOS to retain 85% of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100. If 85% or more of a soil, by weight, passes through the openings in a No. 200 sieve, filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large and they would clog the fabric quickly if the EOS were small enough to capture the soil.

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). Filter fabric 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.

January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.org

3 of 8

Materials

- Silt fence fabric should be woven polypropylene 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 permeability 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.
- There are new products that may use prefabricated plastic holders for the silt fence and use 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.

Installation Guidelines

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 the proposed silt fence.
- 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 filter fabric 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 filter fabric and closer post spacing are used, the mesh support fence may be eliminated. Filter fabric should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, filter cloth 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 compacted native material.
- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, 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 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.

Costs

- Average annual cost for installation and maintenance (assumes 6 month useful life): \$7 per linear foot (\$850 per drainage acre). Range of cost is \$3.50 - \$9.10 per linear foot.

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.
- Repair undercut silt fences.
- Repair or replace split, torn, shrimping, 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 of, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence must be inspected and maintained.
- Holes, depressions, or other ground disturbance caused by the removal of the silt fences should be backfilled and repaired.

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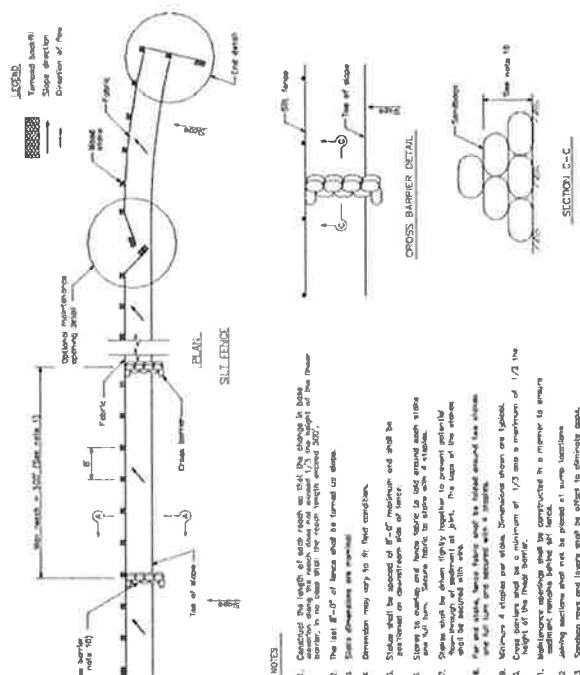
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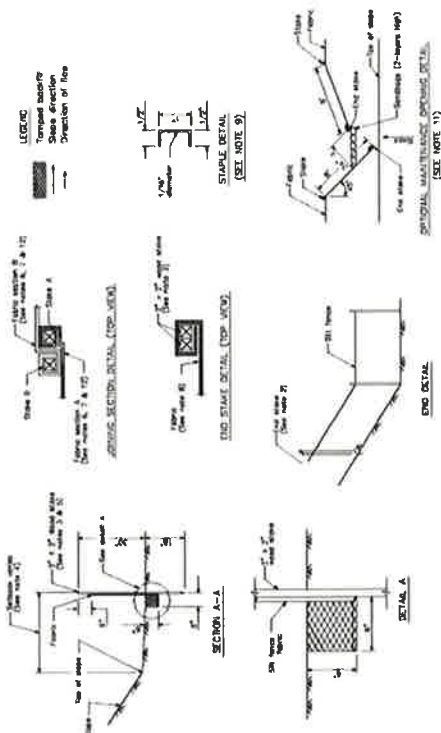
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SE-1

Silt Fence



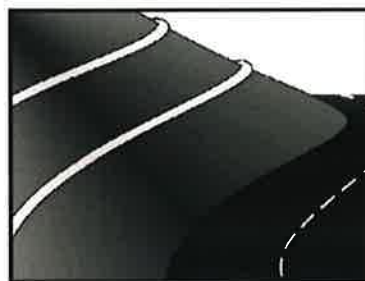
8 of 8

California Stormwater BMP Handbook
Construction
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January 2003

Fiber Rolls

SE-5



Objectives

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	<input type="checkbox"/>
WE	Wind Erosion Control	<input type="checkbox"/>
NS	Non-Stormwater Management Control	<input type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input type="checkbox"/>
Timber	<input type="checkbox"/>
Metals	<input type="checkbox"/>
Bacteria	<input type="checkbox"/>
Oil and Grease	<input type="checkbox"/>
Organics	<input type="checkbox"/>

Potential Alternatives

SE-1 Silt Fence
SE-4 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

A fiber roll consists of straw, flax, or other similar materials bound into a tight tubular roll. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

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
- Down-slope of exposed soil areas
- Around temporary stockpiles

Limitations

- Fiber rolls are not effective unless trenched



January 2003

California Stormwater BMP Handbook
Construction
www.calbmphandbook.com

1 of 4

SE-5

Fiber Rolls

- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 in. diameter or installations achieving the same protection (i.e. stacked smaller diameter fiber rolls, etc.)
- 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.

Implementation

Fiber Roll Materials

- Fiber rolls should be either prefabricated rolls or rolled tubes of erosion control blanket.

Assembly of Field Rolled Fiber Roll

- Roll length of erosion control blanket into a tube of minimum 8 in. diameter.
- Bind roll at each end and every 4 ft along length of roll with jute-type twine.

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).
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into a 2 to 4 in. deep trench with a width equal to the diameter of the fiber roll
 - 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.

Removal

- Fiber rolls are typically left in place.

2 of 4

California Stormwater BMP Handbook
Construction
www.calbmphandbook.com

January 2003

Fiber Rolls

SE-5

- If fiber rolls are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

Costs

Material costs for fiber rolls range from \$20 - \$30 per 25 ft roll

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.
- 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 must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the fiber roll and the adjacent ground surface. Sediment removed during maintenance may be incorporated into earthwork on the site of disposal at an appropriate location.
- If fiber rolls are used for erosion control, such as in a mini 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.

References

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

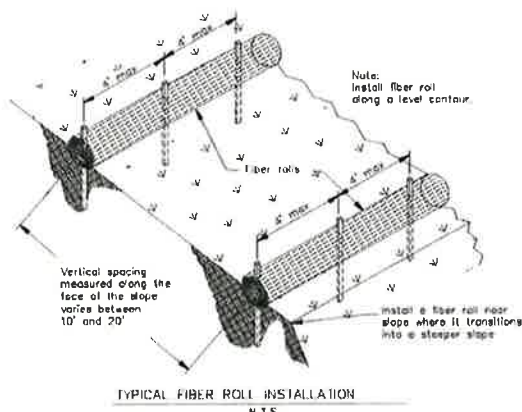
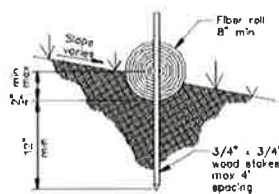
January 2003

California Stormwater BMP Handbook
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3 of 4

SE-5

Fiber Rolls

TYPICAL FIBER ROLL INSTALLATION
N.T.S.ENTRENCHMENT DETAIL
N.T.S.

Street Sweeping and Vacuuming

SE-7



Objectives

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
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.



SE-7 Street Sweeping and Vacuuming

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- 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 yd³ hopper) to \$88/hour (9 yd³ 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.

Storm Drain Inlet Protection

SE-10



Objectives

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-9 Straw Bale Barrier

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction.

Suitable Applications

Every storm drain inlet receiving sediment-laden runoff should be protected.

Limitations

- Drainage area should not exceed 1 acre.
- Straw bales, while potentially effective, have not produced in practice satisfactory results, primarily due to improper installation.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Inlet protection usually requires other methods of temporary protection to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are



SE-10 Storm Drain Inlet Protection

expected, use other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Large amounts of sediment may enter the storm drain system when storm drains are installed before the uplope drainage area is stabilized, or where construction is adjacent to an existing storm drain. In cases of extreme sediment loading, the storm drain itself may clog and lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Inlet protection methods not presented in this handbook should be approved by the local stormwater management agency.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- Limit upstream drainage area to 1 acre maximum. For larger drainage areas, use SE-2, Sediment Basin, or SE-3, Sediment Trap, upstream of the inlet protection device.
- The key to successful and safe use of storm drain inlet protection devices is to know where runoff will pond or be diverted.
 - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
 - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable, and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the

Storm Drain Inlet Protection SE-10

inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Four types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
 - Filter Fabric Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
 - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
 - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
 - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- **DI Protection Type 1 - Filter Fabric Fence** - The filter fabric fence (Type 1) protection is shown in the attached figure. Similar to constructing a silt fence, see BMP SE-1, Silt Fence. Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
 1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
 2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes must be at least 48 in.
 3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 2.4 in.
 4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.
 5. Backfill the trench with gravel or compacted earth all the way around.
- **DI Protection Type 2 - Excavated Drop Inlet Sediment Trap** - The excavated drop inlet sediment trap (Type 2) is shown in the attached figures. Install filter fabric fence in

SE-10 Storm Drain Inlet Protection

accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd³/acre of drainage area.

- **DI Protection Type 3 - Gravel bag** - The gravel bag barrier (Type 3) is shown in the figures. Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability.
 1. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
 2. Construct on gently sloping street.
 3. Leave room upstream of barrier for water to pond and sediment to settle.
 4. Place several layers of sand bags - overlapping the bags and packing them tightly together.
 5. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.
- **DI Protection Type 4 - Block and Gravel Filter** - The block and gravel filter (Type 4) is shown in the figures. Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction.
 1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place filter fabric over the wire mesh.
 2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
 3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
 4. Fill washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

Costs

- Average annual cost for installation and maintenance (one year useful life) is \$200 per inlet.

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.

Storm Drain Inlet Protection SE-10

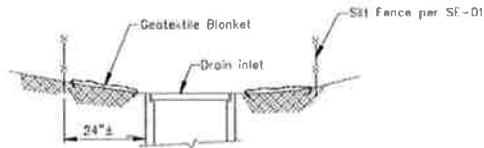
- **Filter Fabric Fences**. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.
- **Gravel Filters**. If the gravel becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and rips, and replace bags as needed. Check gravel bags for proper arrangement and displacement.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove storm drain inlet protection once the drainage area is stabilized.
 - Clean and regrade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

References

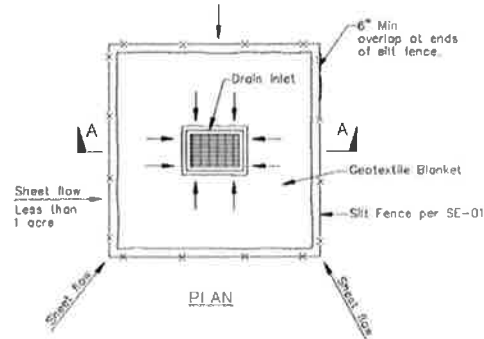
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Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

SE-10 Storm Drain Inlet Protection



SECTION A-A

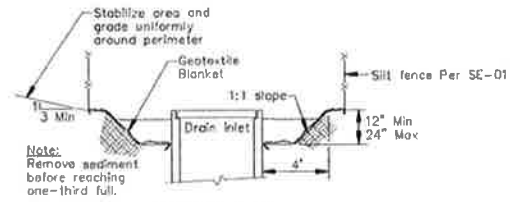


DI PROTECTION TYPE 1
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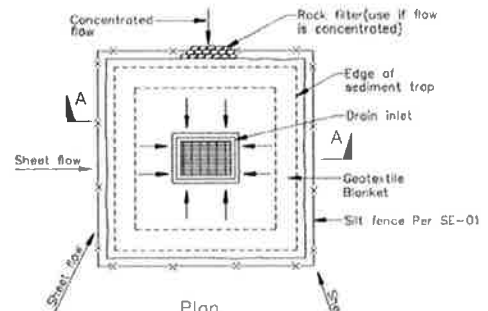
NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.

Storm Drain Inlet Protection SE-10



Section A-A

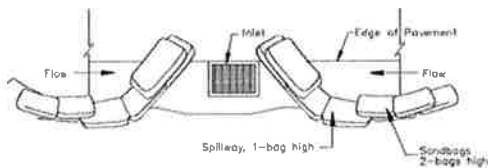


DI PROTECTION TYPE 2
NOT TO SCALE

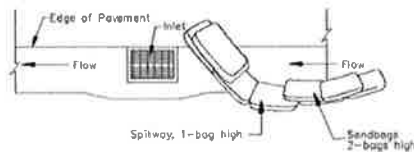
Notes

1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.

SE-10 Storm Drain Inlet Protection



TYPICAL PROTECTION FOR INLET ON SUMP



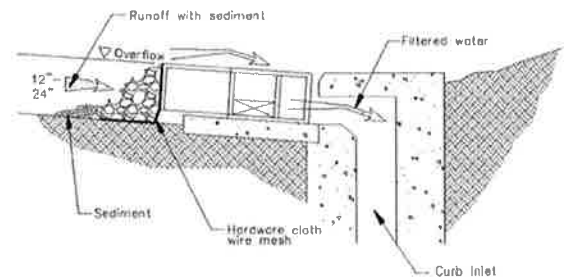
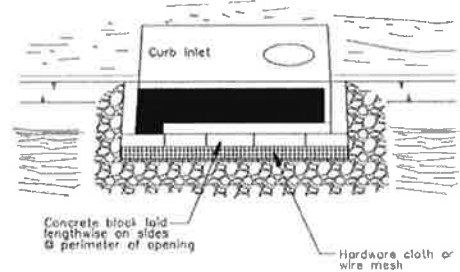
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed.
5. Not applicable in areas with high silts and clays without filter fabric.

DI PROTECTION TYPE 3
NOT TO SCALE

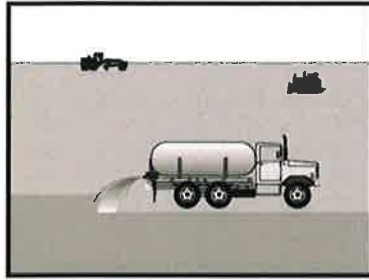
Storm Drain Inlet Protection SE-10



DI PROTECTION TYPE 4
NOT TO SCALE

Wind Erosion Control

WE-1



Objectives

- 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

Wind erosion or dust control consists of applying water or other dust palliatives 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.

Suitable Applications

Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- 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 and should be applied daily (or more often) to be effective.
- Over watering may cause erosion.



January 2003

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1 of 3

WE-1

Wind Erosion Control

- 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.
- Effectiveness depends on soil, temperature, humidity, and wind velocity.
- Chemically treated sub grades may make the soil water repellent, 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.
- Asphalt, as a mulch tack or chemical mulch, requires a 24-hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

Implementation

General

California's Mediterranean climate, with short wet seasons and long hot dry seasons, allows the soils to thoroughly dry out. During these dry seasons, 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.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast, and Sacramento, among others, have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line.

Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). Approximately 90 percent of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and public health departments are in place in some regions within California.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction and Grading Permits: Require provisions for dust control plans.
- Opacity Emission Limits: Enforce compliance with California air pollution control laws.
- Increase Overall Enforcement Activities: Priority given to cases involving citizen complaints.
- Maintain Field Application Records: Require records of dust control measures from contractor.
- Stormwater Pollution Prevention Plan (SWPPP): Integrate dust control measures into SWPPP.

2 of 3

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January 2003

Wind Erosion Control

WE-1

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table shows dust control practices that can be applied to site conditions that 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 would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph, and controlling the number and activity of vehicles on a site at any given time.

SITE CONDITION	DUST CONTROL PRACTICES						
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Site Fencing	Temporary Gravel Construction Entrances/Equipment Wash Areas
Disturbed Areas not Subject to Traffic	X	X	X	X	X		
Disturbed Areas Subject to Traffic			X	X	X		X
Major Stock Pile Stabilization			X	X		X	
Demolition			X				X
Grading/Excavation		X	X	X		X	X
Truck Traffic on Unpaved Roads			X	X	X		X
MudOut Carry Out					X		X

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (EC-1, Scheduling).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and 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.
- Direct most construction traffic to stabilized roadways within the project site.
- 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.

January 2003

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3 of 3

WE-1

Wind Erosion Control

- 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 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."
- Materials applied as temporary soil stabilizers and soil binders also generally provide wind erosion control benefits.
- 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 wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize inactive construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

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.

Costs

Installation costs for water and chemical dust suppression are low, but annual costs may be quite high since 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. 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.
- Check areas protected to ensure coverage.
- Most dust control measures require frequent, often daily, or multiple times per day attention.

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, 1992.

4 of 5

California Stormwater BMP Handbook
Construction
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January 2003

Wind Erosion Control

WE-1

Caltrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

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.

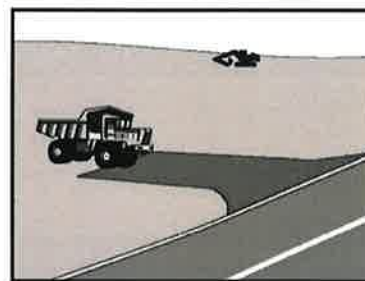
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January 2003

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5 of 5

Stabilized Construction Entrance/Exit TC-1



Objectives

EC	Erosion Control	<input type="checkbox"/>
SE	Sediment Control	<input type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	<input type="checkbox"/>
NS	Non-Stormwater Management Control	<input type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input type="checkbox"/>
Trash	<input type="checkbox"/>
Metals	<input type="checkbox"/>
Bacteria	<input type="checkbox"/>
Oil and Grease	<input type="checkbox"/>
Organics	<input type="checkbox"/>

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 runoff.



January 2003

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1 of 6

Stabilized Construction Entrance/Exit TC-1

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.
- 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.

2 of 6

California Stormwater BMP Handbook
Construction
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January 2003

Stabilized Construction Entrance/Exit TC-1

- 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.

January 2003

California Stormwater BMP Handbook
Construction
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3 of 6

Stabilized Construction Entrance/Exit TC-1

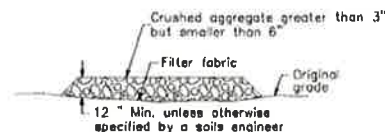
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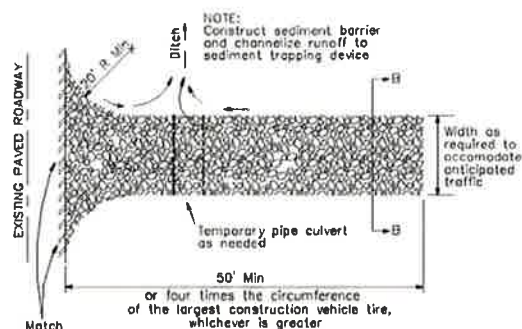
Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991

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

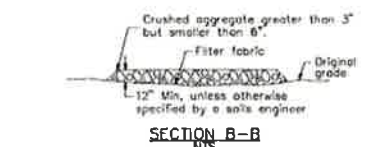


SECTION B-B
NTS

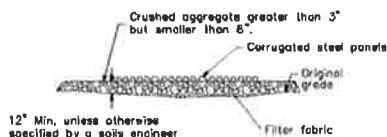


PLAN
NTS

Stabilized Construction Entrance/Exit TC-1

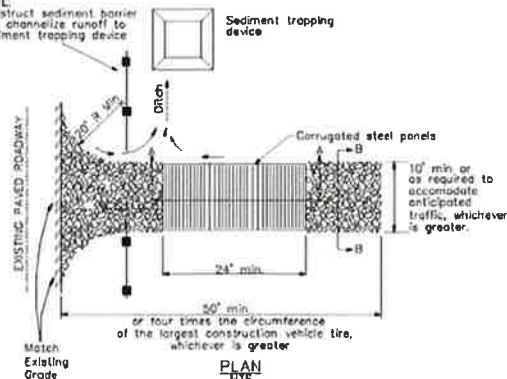


SECTION B-B
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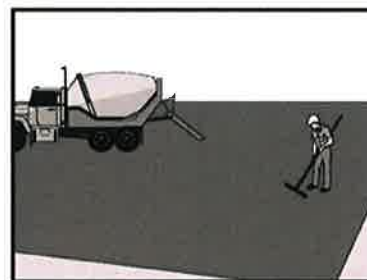
SECTION A-A
NOT TO SCALE

NOTE:
Construct sediment barrier
and channelize runoff to
sediment trapping device



PLAN
NTS

Paving and Grinding Operations NS-3



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runoff and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather.

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is in the forecast.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runoff (see WM-1, Material Delivery and Storage).



NS-3 Paving and Grinding Operations

- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- If paving involves an onsite mixing plant, follow the stormwater permitting requirements for industrial activities.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
 - AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; or SE-5, Fiber Rolls.
 - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
 - Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 1 ft of material.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

Paving and Grinding Operations NS-3

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.
- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.
- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.
- Drainage inlet structures and manholes should be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.
- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.
- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.
- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.
- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.
- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

NS-3 Paving and Grinding Operations

Thermoplastic Striping

- Thermoplastic striping and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

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 at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

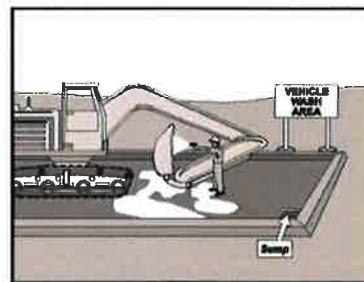
References

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.

Hot Mix Asphalt-Paving Handbook AC 359/5370-1.1, Appendix I, U.S. Army Corps of Engineers, July 1991.

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



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 TR-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:

Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control <input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control

Legend

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

Potential Alternatives

None



NS-8 Vehicle and Equipment Cleaning

- 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 concentrations.
- 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 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.

Vehicle and Equipment Cleaning NS-8

Inspection and Maintenance

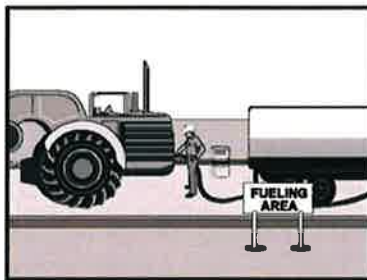
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect 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 Dekker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



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 TR-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.

Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control <input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control

Legend

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment
Nutrients
Trash
Metals
Bacteria
Oil and Grease <input checked="" type="checkbox"/>
Organics

Potential Alternatives

None



NS-9 Vehicle and Equipment Fueling

- 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 absorbent 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 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 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.

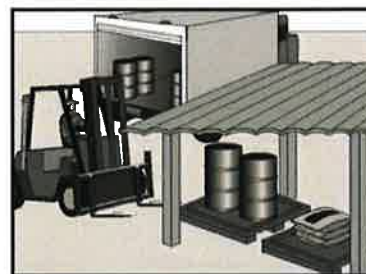
References

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.



Objectives

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	<input checked="" type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

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 a 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
- Asphalt and concrete components



WM-1 Material Delivery and Storage

- 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:

- Temporary storage area should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located near the construction entrances, away from waterways, if possible.
 - Avoid transport near drainage paths or waterways.
 - Surround with earth berms. See RC-9, Earth Dikes and Drainage Swales.
 - Place in an area which 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.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

Material Delivery and Storage WM-1

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Chemicals should be kept in their original labeled containers.
- 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 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.
- Throughout the rainy season, each temporary containment facility should be covered during non-working days, 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.

WM-1 Material Delivery and Storage

- 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 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 storage of hazardous materials.

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.

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

- 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.
- Keep an ample supply of spill cleanup materials near the storage area.
- Keep storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

Material Delivery and Storage WM-1

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.

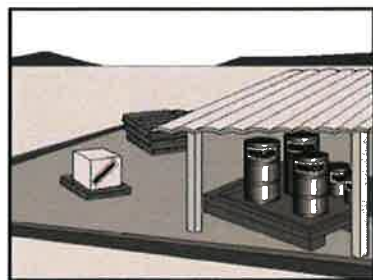
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper, USEPA, April 1992.

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 Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use

WM-2



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
- Plaster
- 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
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Objectives

EC	Erosion Control
SC	Sediment Control
TC	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control <input checked="" type="checkbox"/>

Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

Potential Alternatives

None



WM-2

Material Use

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.
- 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 hydro seeding. 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 just before it rains.
- 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 into a concrete washout pit or temporary sediment trap. 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.

Material Use

WM-2

- Require contractors to complete the "Report of Chemical Spray Forms" when spraying herbicides and pesticides.
- 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.

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 at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Maintenance of this best management practice is minimal.
- Spot check employees and subcontractors throughout the job to ensure appropriate practices are being employed.

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 Practice, EPA 832-R-92-005; USEPA, April 1992.

January 2003

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3 of 3

Stockpile Management

WM-3



Description and Purpose

Stockpile Management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, 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 binder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other materials.

Limitations

None identified.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- Locate stockpiles a minimum of 60 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater runoff using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, sandbag, gravel bags, or straw bale barriers.

Objectives

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



January 2003

California Stormwater BMP Handbook
Construction
www.caltranshandbooks.com

1 of 3

WM-3

Stockpile Management

- 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.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- During the rainy season, soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.

- During the non-rainy season, soil stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- During the rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier at all times.

- During the non-rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of "cold mix"

- During the rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material at all times.

- During the non-rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammoniacal, copper, zinc, and arsenate

- During the rainy season, treated wood should be covered with plastic or comparable material at all times.

- During the non-rainy season, treated wood should be covered with plastic or comparable material at all times and cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected further as follows:

- All stockpiles should be protected with a temporary linear sediment barrier prior to the onset of precipitation.

- Stockpiles of "cold mix" should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

2 of 3

California Stormwater BMP Handbook
Construction
www.caltranshandbooks.com

January 2003

Stockpile Management

WM-3

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.
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

References

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

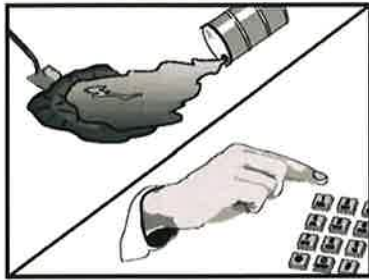
January 2003

California Stormwater BMP Handbook
Construction
www.caltranshandbooks.com

3 of 3

Spill Prevention and Control

WM-4



Objectives

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 <input checked="" type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

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/blenders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals



January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbmp.com

1 of 6

Spill Prevention and Control

WM-4

- Puels
- 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 runoff during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

2 of 6

California Stormwater BMP Handbook
Construction
www.calstormwaterbmp.com

January 2003

Spill Prevention and Control

WM-4

- 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.

January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbmp.com

3 of 6

Spill Prevention and Control

WM-4

- 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:

4 of 6

California Stormwater BMP Handbook
Construction
www.calstormwaterbmp.com

January 2003

Spill Prevention and Control

WM-4

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 runoff 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 runoff 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.

January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.com

5 of 6

Spill Prevention and Control

WM-4

- 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; USKPA, April 1992.

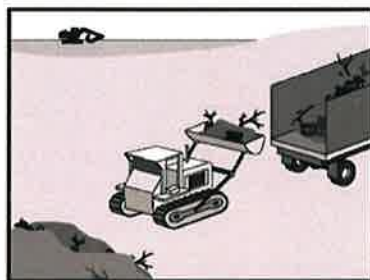
6 of 6

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.com

January 2003

Solid Waste Management

WM-5



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.

Objectives

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 <input checked="" type="checkbox"/>

Legend

- ☒ Primary Objective
- ☒ Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

Potential Alternatives

None



January 2003

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.com

1 of 4

WM-5

Solid Waste Management

- Highway planting wastes, including vegetative material, 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 later.
- 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.

2 of 4

California Stormwater BMP Handbook
Construction
www.calstormwaterbhp.com

January 2003

Solid Waste Management

WM-5

- 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 runoff 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.

January 2003

California Stormwater BMP Handbook
Construction
www.calbmphandbooks.com

3 of 4

WM-5

Solid Waste Management

- 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.

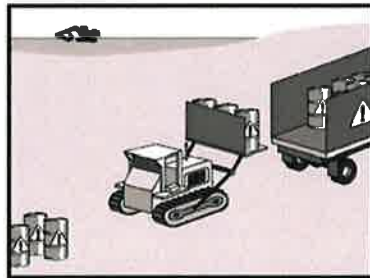
4 of 4

California Stormwater BMP Handbook
Construction
www.calbmphandbooks.com

January 2003

Hazardous Waste Management

WM-6



Objectives

- 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
- Concrete Curing Compounds
- Palliatives
- Septic Wastes
- Stains
- Wood Preservatives
- Asphalt Products
- Pesticides
- Acids
- Paints
- Solvents
- 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



January 2003

California Stormwater BMP Handbook
Construction
www.calbmphandbooks.com

1 of 6

Hazardous Waste Management

WM-6

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 hauled 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.

2 of 6

California Stormwater BMP Handbook
Construction
www.calbmphandbooks.com

January 2003

Hazardous Waste Management WM-6

- 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 containment:
 - 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.

Hazardous Waste Management WM-6

- 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.

Hazardous Waste Management WM-6

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.

Hazardous Waste Management WM-6

- 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



Objectives

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 <input checked="" type="checkbox"/>

Legend:

<input checked="" type="checkbox"/>	Primary Objective
<input type="checkbox"/>	Secondary Objective

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, performing onsite washout in a designated area, and training employee and subcontractors.

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) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, grooving, and hydrom-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.
- Mortar-mixing stations exist.
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.



January 2003

California Stormwater BMP Handbook
Construction
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1 of 7

WM-8

Concrete Waste Management

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- 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.
- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:**
 - Locate washout area 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.
 - Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed properly.
- Avoid creating runoff by draining water to a bermed or level area when washing concrete to remove fine particles and expose the aggregate.
- 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.

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.

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.
- A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

2 of 7

California Stormwater BMP Handbook
Construction
www.catsplandbooks.com

January 2003

Concrete Waste Management

WM-8

- Below grade concrete washout facilities are typical. Above grade facilities are used if excavation is not practical.
- 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 PCC 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. 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.
- Slurry residue should be vacuumed and disposed in a temporary pit (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.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete washout.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of 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 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

WM-8

Concrete Waste Management

minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

- Straw bales, wood stakes, and sandbag materials should conform to the provisions in SE-9, Straw Bale 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.
- 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.

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 disposed of. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and disposed of.
- 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.

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.
- 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 disposed of.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

January 2003

California Stormwater BMP Handbook
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3 of 7

4 of 7

California Stormwater BMP Handbook
Construction
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January 2003

Concrete Waste Management WM-8

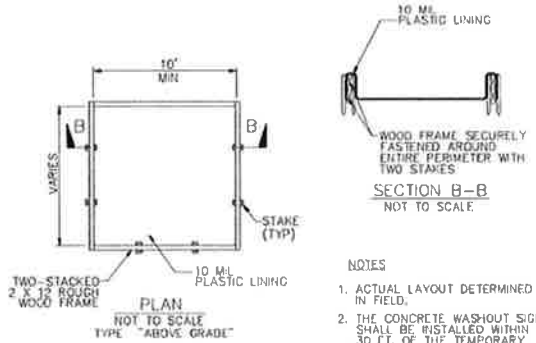
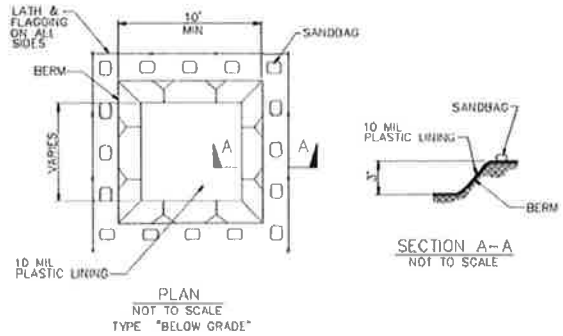
References

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.

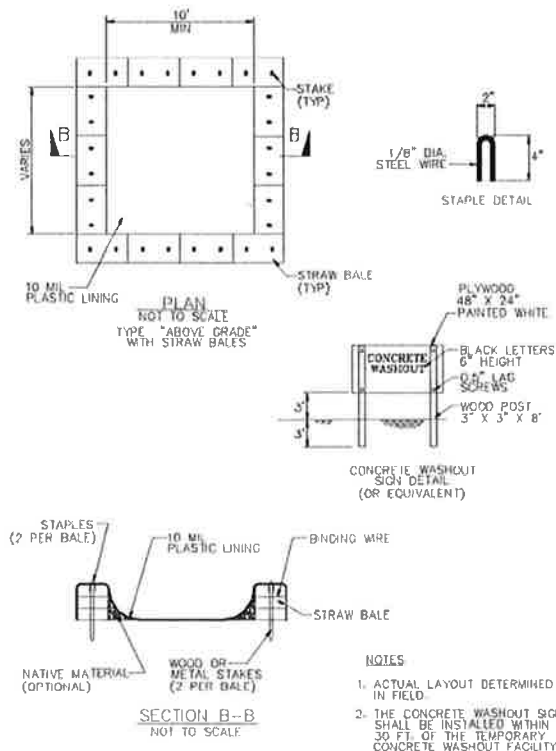
WM-8 Concrete Waste Management



NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Concrete Waste Management WM-8



NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Attachment C: Inspection Reports

Inspection Reports may be bound separately.

**WATER RESOURCES MANAGEMENT PLAN
AND
WATER USE MANAGEMENT PLAN**

FOR THE CANNABIS CULTIVATION OPERATION

AT 23492 JERUSALEM GRADE, MIDDLETOWN, CALIFORNIA

Prepared: November 4, 2017
Revised: December 4, 2018

Applicant:

Chris Jennings

Prepared by:

Natural Investigations Company, Inc.
3104 O Street, #221, Sacramento, CA 95816



NATURAL INVESTIGATIONS CO.
WWW.NATURALINVESTIGATIONS.COM

Table of Contents

1.0	Introduction	2
2.0	Project Location and Description	3
3.0	Water Resources	5
4.0	Water Resource Protection	6
4.1.	Avoidance and Minimization Measures	6
4.2.	Best Management Practices	6
5.0	Water Sources and Uses	8
5.1.	Water Supplies	8
5.2.	Water Use	8
6.0	Water Conservation	10
7.0	Wastewater Management	11
7.1.	Existing Sanitary Disposal System	11
7.2.	Proposed Sanitary Disposal System	11
7.3.	Waste Discharge Other Than Sanitary Waste	11
8.0	References	12
9.0	Exhibits	A

1.0 INTRODUCTION

This Water Resources Management Plan and Water Use Management Plan ("Plan") has been prepared to fulfill the requirements of the Lake County Marijuana Cultivation Ordinance (Ordinance No. 2997). Each Plan is intended to be a "living" document, updated as necessary, such that when operational activities or processes are modified or replaced, the applicable Plans are similarly revised to reflect these changes. These Plans should be amended whenever there is a significant change in cultivation operations, whenever the goals of the Plans are not met, whenever a pollution event occurs, or whenever a violation notice is issued. The Ordinance requires that any deviations from, or changes in, the Plans must be conveyed to the Department in writing within thirty (30) days of the change.

According to the Ordinance, the 2 Plans must have the following elements:

A Water Resources Management Plan

1. *All commercial cannabis cultivation, cannabis nursery, cannabis manufactures, cannabis distributor, and cannabis microbusinesses shall minimize adverse impacts on surface and groundwater resources.*
2. *All permittees shall prepare a Water Resources Management Plan to be approved by the Lake County Water Resources Department. Said plan shall:*
 - a. *A description of the surface and groundwater resources that are located on the parcel where the permitted activity is located.*
 - b. *A description of the watershed in which the permitted activity is located.*
 - c. *Describe how the permittee will minimize adverse impacts on the surface and groundwater resources.*
 - d. *A map of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool on the parcel of land or within 200 feet of the parcel.*
3. *All permittees shall implement the procedures as outlined in their Water Resources Management Plan as approved by the Planning Commission. Any deviations from or changes in the plan must be conveyed to the Department in writing within thirty (30) days of the change*

A Water Use Management Plan

1. *All permitted activities shall have a legal water source on the premises, and have all local, state, and federal permits required to utilize the water source.*
2. *Permittee shall not engage in unlawful or unpermitted surface drawing of water.*
3. *The use of water provided by a public water supply, unlawful water diversions, transported by a water hauler, bottled water, a water-vending machine, or a retail water facility is prohibited.*
4. *Where a well is used, the well must be located on the premise. The production well shall have a meter to measure the amount of water pumped. The production wells shall have continuous water level monitors. A monitoring well of equal depth within the cone of influence of the production well may be substituted for the water level monitoring of the production well. The monitoring wells shall be constructed and monitoring began at least three months prior to the use of the supply well. An applicant shall maintain a record of all data collected and shall provide a report of the data collected to the County annually.*
5. *If water will be supplied by a retail water supplier, as defined in Section 13575 of the Water Code, the application shall identify the retail water supplier.*

2.0 PROJECT LOCATION AND DESCRIPTION

This permitted medicinal cannabis cultivation operation is located on a 183-acre parcel (APN 013-013-11) with address 23492 Jerusalem Grade, Middletown, California. The original operational area was approximately 0.2 acres; this garden is being abandoned and the area restored. The new gardens (Project Area) will be established in phases and allow for multiple cultivation licenses with individual gardens. The original Cannabis cultivation operation consisted of a graded garden within a fenced enclosure. The enclosure was approximately 7,500 square feet (0.17 acres). This garden was abandoned, and the area is being revegetated. Three additional potential garden sites were located at the north end of the parcel. These sites were graded and terraced, but no Cannabis operations were ever established. These three garden sites will be abandoned.

The new garden complex and supporting facilities, an area of approximately 5 acres (the Project Area), will be established in phases and allow for multiple cultivation licenses with individual gardens each capable of growing at least 10,000 square feet of Cannabis canopy. Phase One would be for the 2019 growing season and would consist of four garden compounds (each 11,100 square feet). Phases Two would be for the 2020 grow season and have eight 11,340 square foot compounds; two 11,250 square foot compounds; and one 5,400 square foot compound. A new processing center of approximately 5,000 square feet is also planned, as well as a stormproof chemical shed (10 feet by 10 feet).

The proposed cultivation operations will consist of outdoor gardens. with plants growing in plastic pots, fabric bags ("Smart Pots") and/or raised beds. A new shed for product processing, approximately 5,000 to 4,000 square feet, will be constructed adjacent to the well. No soil is currently stored on-site. However, future soil deliveries will be staged adjacent to the outdoor garden complex. There would also be a 1,000 gallon cone-bottom tank in each garden compound that will be for compost teas.

A well currently serves the single-family residence and the existing garden. This is a permitted well that produces approximately 100 gallons per minute. The proposed garden complex will be irrigated by water from the existing well, which will be pumped into several tanks, each capable of holding 5,000 gallons. The use of water bladders will be discontinued. A previously graded pad for water bladders will be abandoned and revegetated.

The water will be delivered by gravity via underground PVC piping to each garden. Black poly tubing and emitters (drip irrigation) will be used to distribute the water to each planting station. Mixing tanks will be used to add liquid fertilizers and other amendments (compost teas) to the irrigation water. Supplemental irrigation may be applied by hand using garden hoses.

Existing structures consist of a single-family residence and adjacent groundwater well. A small cabin is found near the top of the property. Employees will have access to the toilet in the single-family residence. In addition, portable toilet(s) will be located adjacent to the gardens. Several abandoned structures are found on this parcel. Trash and debris left by a previous owner lay scattered in piles across the southwestern portion of the parcel. The current property owner is in the process of removing the non-functional structures and trash.

The Project Area is accessed by a private gravel road on Jerusalem Grade (see exhibits). Prior to the establishment of this cultivation operation, land use was open space. The surrounding land uses are private estates, cannabis cultivation, and open space. The 2015

Jerusalem Fire burned approximately 80% of the Project Area. Vegetation is recovering from the fire and from the many roads and breaks that were cut during the fire-fighting efforts.

Numerous roads and fire-breaks are found within this parcel. A gravel driveway leads from Jerusalem Grade to the southwest corner of the parcel. A dirt road accesses the current garden site. Once this garden is abandoned, the access road will be maintained as a fire-break. The proposed garden and processing shed will be accessed by the construction of a new gravel road which will connect to the existing gravel driveway. A dirt/gravel road which extends from the driveway and runs north along the parcel will be maintained as an easement to the adjoining parcel and as fire access. Additional roads and firebreaks within the parcel will be abandoned and allowed to naturally revegetate.

Pests will be controlled by employing only approved, organic pesticides. Weeds will be controlled using a line trimmer or mulch; herbicides will not be used. Green waste, primarily cannabis rootballs and stems, will be chipped and mulched and blended back into the planting soil. Five-gallon plastic containers of gasoline and diesel fuel will be used to power small engines such as line trimmers, quads, tillers, or small tractor. All chemicals will be stored in water-proof sheds or Conex containers. Commercial electrical utility service is connected to service the existing home and may be used to power low voltage items such as security cameras and water pumps for mixing liquid fertilizers into the irrigation system. The proposed cannabis processing facility will be supplied with electricity.

3.0 WATER RESOURCES

The Parcel is located in the Soda Creek Watershed (Hydrologic Unit Code 180201620307), which is a sub-watershed of Puta Creek. The local watershed has rugged topography, and consist of a mountain ridge (Bishop Mountain) that is heavily incised with steep canyons and shoulders that transition to alluvial fans and narrow valleys, such as Jerusalem Valley. Elevations range from 2120 at the top of Bishop Mountain to 800 feet in the valleys. Differing intensities of wildfires, development, and livestock grazing have created a mosaic of vegetation community types. Where sun exposure is strong (south and west-facing slopes), vegetation consists of chaparral. On north-facing slopes, mixed oak woodlands and gray pine are dominant. Valley floors consist of non-native annual grassland. Riparian habitat is sparse in watercourses.

The topography of the Parcel consists of several west-facing ridges and sloping alluvial hills of Bishop Mountain (see exhibits). Drainage leaves the Parcel along various vegetated swales which then flow into two Class III watercourses (see exhibits). Riparian vegetation occurs in patches along these watercourses. These ephemeral drainage channels start in the eastern portion of the parcel and flow southwest, eventually flowing into Gunther Creek. The channels range in width from 3 to 6 feet and the depth ranges from approximately 6 inches up to 2 feet. The channels have an ordinary high-water mark, bank erosion and scouring, and litter and debris present; the channel was intermittently wet, but not flowing. There are no vernal pools or other isolated wetlands on the Parcel. The Parcel contained an off-stream pond that was excavated and sealed with a liner; this has been abandoned and the area restored. A spring found in the southwest portion of the parcel was used as a water source; this use has been discontinued. A thin band of emergent wetland vegetation surrounds this spring. The nearest portion of the proposed cultivation operation is approximately 200 feet from a Class III watercourse.

4.0 WATER RESOURCE PROTECTION

This cultivation operation is enrolled in Tier III of the Central Valley Regional Water Quality Control Board (Regional Board) Order R5-2015-0113 (Waste Discharge Requirements for Medicinal Cannabis Cultivation Activities). Compliance with this Order will ensure that cultivation operations will not significantly impact water resources by using a combination of Best Management Practices, buffer zones, sediment and erosion controls, inspections and reporting, and regulatory oversight. Note also that this site will be Tier III, and that a sediment and erosion control plan is being implemented as part of the larger Site Management Plan.

- *Site Management Plan for the Cultivation Operation at 23492 Jerusalem Grade, Middletown, California. August 24, 2017. Prepared for Central Valley Regional Water Quality Control Board. Prepared by: Natural Investigations Co., Inc. 242 pp.*

4.1. Avoidance and Minimization Measures

Zoning Setbacks and Site Selection

This cultivation operation was located in the flattest areas of the Parcel to reduce the potential for erosion. The Ordinance requires that all cultivation operations be located at least 100 feet away from all waterbodies (i.e. spring, top of bank of any creek or seasonal stream, edge of lake, wetland or vernal pool). This cultivation operation was located as far away from water resources as possible.

Existing Garden: The nearest waterbody is a Class III watercourse located at least 100 feet to the north. This garden has been abandoned.

Proposed Garden: The nearest waterbody will be a Class III watercourse located at least 200 feet to the north.

Vegetative Buffers

Generous vegetative buffers (200 feet) exist between this cultivation operation and the nearest water resource. These vegetated areas will be preserved as much as possible. The exception are fire breaks needed for wildfire protection. Areas that are covered in grasses will be regularly mowed or trimmed. Areas that are covered in chaparral will be not be trimmed but left in a natural state, where possible.

4.2. Best Management Practices

The following management plans that will be implemented will also ensure the protection of water resources:

- *Storm Water Management Plan for the Cannabis Cultivation Operation at 23492 Jerusalem Grade, Middletown. December 2018. Prepared by Natural Investigations Co.*
- *Growing Medium Management Plan, Fertilizer Management Plan, Integrated Pest Management Plan, Solid Waste Management Plan, Hazardous Waste Management Plan, and Cannabis Vegetative Waste Management Plan for the Cannabis Cultivation*

Operation at 23492 Jerusalem Grade, Middletown. December 2018. Prepared by Natural Investigations Co.

- *Site Management Plan for the Cultivation Operation at 23492 Jerusalem Grade, Middletown, California. December 2018. Prepared for Central Valley Regional Water Quality Control Board. Prepared by Natural Investigations Co., Inc.*

The following resources were consulted for BMP selection:

- Central Valley Region's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.
- California Stormwater Quality Association. 2011. California Stormwater Best Management Practice Handbook – Construction. California Stormwater Quality Association, Menlo Park, California 886 pp.
- California Stormwater Quality Association. 2014. Stormwater Best Management Practice Handbook Portal: Industrial and Commercial. California Stormwater Quality Association, Menlo Park, California. 474 pp.
- The California Department of Transportation's Construction Site BMPs Handbook, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm>
- The California Department of Transportation's Construction Site BMP Fact Sheets, available electronically at <http://www.dot.ca.gov/hq/construc/stormwater/factsheets.htm>
- Newman, J. (editor). 2008. Greenhouse and Nursery Management Practices to Protect Water Quality. Publication Number: 3508. University of California Agriculture and Natural Resources Publications, Oakland, CA. 160 pp.

5.0 WATER SOURCES AND USES

5.1. Water Supplies

The Lake County Groundwater Management Plan, together with the Lake County Water Inventory and Analysis (CDM 2006) and the Lake County Water Demand Forecast (CDM 2006), serve to manage the water resources in Lake County and provide a framework for the County and other water users to implement effective water resource management programs.

Municipal

There is no municipal water supply service to the Parcel.

Surface Water

The parcel contained an off-channel pond that was excavated and sealed with a liner. This pond will be abandoned and restored to the original condition of the landscape. A spring is located in the southwest portion of the parcel. A thin band of herbaceous wetland vegetation surrounds this spring. The use of this spring as a water source will be abandoned. No surface water will be used or diverted for cannabis cultivation on this Parcel.

The nearest portion of the current cultivation area is approximately 130 feet from a Class III watercourse. Future cultivation related operations will take place at least 200 feet from a Class III watercourse.

Groundwater

A groundwater well currently serves the single-family residence and former Cannabis garden. This is a permitted well that produces approximately 100 gallons per minute. The proposed garden will be irrigated by water from the existing well, which will be pumped uphill and stored in water tanks for a gravity-powered system. Buried PVC piping will deliver the water from the tanks to the gardens. Black poly tubing will be used to deliver the water from PVC piping to each growing station. Mixing tanks may be used to add liquid fertilizers and other amendments to the irrigation water. Supplemental irrigation may be applied by hand using garden hoses.

5.2. Water Use

Water use requirements for outdoor cannabis production are similar to water use requirements for other agricultural crops such as corn (CDFA 2017). CDFA (2017) reports the following regarding the water use for cannabis:

"According to Hammon et al. (2015), water use requirements for outdoor cannabis production (25-35 inches per year) are generally in line with water use for other agricultural crops, such as corn (20-25 inches per year), alfalfa (30-40 inches per year), tomatoes (15-25 inches per year), peaches (30-40 inches per year), and hops (20-30 inches per year). Lindsey (2012) similarly cites a University of California researcher who suggested that cannabis does well under irrigation management and, as a small-acreage crop, will use far less water than crops such as

cotton. Estimates of daily water usage per cannabis plant range from 5 gallons (Live Science 2014) to 6-8 gallons (CDFW 2016)."

CDFA (2017) concludes the following regarding groundwater impacts from small cultivation operations:

"Based on the relatively low quantities of water use (from 0.002 to 1.8 acre-feet per year), the likelihood that an individual cultivator or group of cultivators using groundwater from a defined alluvial aquifer would, by themselves, cause substantial groundwater overdraft is considered unlikely, for several reasons. First, groundwater overdraft is typically caused by the combination of various uses in a basin and is not typically attributable to a particular user or set of users; in other words, it is typically a cumulative issue (which is discussed in more detail in Chapter 6, Cumulative Considerations). In addition, the size limitations for cultivation sites under the Proposed Program would limit the maximum extent of water use. For instance, the highest estimate, provided by Hammon et al. (2015), would result in less than 3 acre-feet of annual usage at the largest allowable cultivation site of 1 acre. Finally, no information is available to suggest that there would be high concentrations of cultivators using groundwater from an alluvial basin in a particular location in a manner that could substantially affect neighboring wells." (pages 4.8-34 to 4.8-35)

The following values were used to estimate annual water usage:

- 100 plants in the garden
- 4 gallons per plant for 3 months (April, May, June)
- 8 gallons per plant for 4 months (July, August, September, October)

Annual water demand is estimated at: (90 days x 4 gal/day/plant x 100 plants) + (160 days x 8 gal/day/plant x 100 plants) = 164,000 gallons per year.

6.0 WATER CONSERVATION

Water conservation practices will be implemented, including a combination of the following strategies and actions:

- selection of plant varieties that are suitable for the climate of the region
- the use of driplines and emitters (instead of spray irrigation)
- mulching to reduce evaporation
- water application rates modified from data from soil moisture meters and weather monitoring
- rooftop water collection (where feasible and permitted)
- shutoff valves on hoses and water pipes
- immediate repair of leaking or malfunctioning equipment
- water metering and budgeting
- daily visual inspections of irrigation systems

CASQA Construction BMP Fact Sheet NS-1: Water Conservation Practices will be implemented to prevent discharges from water supply equipment. Water application rates will be minimized as necessary to prevent runoff and ponding and water equipment leaks will be repaired immediately. Implement Construction BMP Fact Sheet NS-7: Potable Water / Irrigation to manage the potential pollutants generate during discharges from irrigation lines and unplanned discharges from water sources.

7.0 WASTEWATER MANAGEMENT

7.1. Existing Sanitary Disposal System

Employees will have access to the flush toilet within the house, which is served by a permitted septic system.

7.2. Proposed Sanitary Disposal System

As needed, portable toilet(s) will be rented and placed at the entrance to the gardens.

7.3. Waste Discharge Other Than Sanitary Waste

This cultivation operation will not be discharging wastewater. No process water is needed. Irrigation water will be applied at agronomic rates and will not produce runoff that exits the property. This cultivation operation is enrolled in the State Water Resources Control Board's *Order WQ 2017-0023-DWQ General Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities* (General Order). Compliance with this Order will ensure that the cultivation operation will not discharge liquid pollutants by using a combination of Best Management Practices, buffer zones, sediment and erosion controls, inspections and reporting, and regulatory oversight. Details are found in the Site Management Plan:

- *Site Management Plan for the Cultivation Operation at 23492 Jerusalem Grade, Middletown, California. 2018. Prepared for Central Valley Regional Water Quality Control Board. Prepared by: Natural Investigations Co., Inc.*

8.0 REFERENCES

California Stormwater Quality Association. 2011. California Stormwater Best Management Practice Handbook – Construction. California Stormwater Quality Association, Menlo Park, California 886 pp.

California Stormwater Quality Association. 2014. Stormwater Best Management Practice Handbook Portal: Industrial and Commercial. California Stormwater Quality Association, Menlo Park, California. 474 pp.

Central Valley Region's Best Management Practices Manual for Cannabis Cultivation. Appendix A in: Waste Discharge Requirements for Cannabis Cultivation Order R5-2015-0113.

Lake County Groundwater Management Plan. 2006. Lake County Watershed Protection District. Prepared by CDM in Cooperation with California Department of Water Resources, Northern District. 138 pp.

(http://www.co.lake.ca.us/Government/Directory/WaterResources/Programs/Groundwater_Management.htm)

Newman, J. (editor). 2008. Greenhouse and Nursery Management Practices to Protect Water Quality. Publication Number: 3508. University of California Agriculture and Natural Resources Publications, Oakland, CA. 160 pp.

Troeh, F. and J.A. Hobbs. 2003. Soil and Water Conservation for Productivity and Environmental Protection, 4th ed. Prentice Hall, Upper Saddle River, N.J.