Cannabis Waste and Discharge Compliance Report

Prepared for: Camille Kemak, Emerald Triangle Medicinal, LLC.

APN: 081-051-013-000 and 081-051-014-000

Order No. R1-2015-0023 WDID: 1B171731CHUM

WQ-2017-0023-DWQ WDID: App. No. 417899

Humboldt County, CA

Prepared by: Dan Mar, CPD

Compliant Farms Certified

September 10, 2019

COVER LETTER

Existing Water Resource Protection Plan

Implemented under ORDER No. R1-2015-0023, the Region 1 State Water Resources Control Board's Cannabis Cultivation Policy required that all Tier 1 and 2 Dischargers submit and implement a Water Resources Protection Plan (WRPP) that describes how best management practices (BMPs) would be implemented at the site for each of the outlined Standard Conditions contained in the order.

The Emerald Triangle Medicinals, LLC project has been enrolled in R1-2015-0023 and working under a preexisting WRPP and is presently compliant with all Standard Conditions as set forth in the order. The following report will serve to fulfill the new requirements under ORDER WQ 2017-0023-DWQ, the State Water Resources Control Board's Cannabis Cultivation Policy which requires that all Tier 1 Dischargers submit and implement a Site Management Plan (SMP) that describes how best practical treatment or control (BPTC) measures are implemented at the site.

Table of Contents

Site Management Plan Details

- The following plan includes descriptions for each Standard Condition and each applicable subsection.
- Each applicable subsection includes recommendations for Best Management Practices (BMPs) and Best Practical Treatment or Control (BPTC) measures.
- Each applicable subsection includes Monitoring and Maintenance, Design, Winterization and Permanent Strategies to achieve compliance with the Standard Conditions.
- Each applicable subsection includes an action priority and expected completion date to achieve compliance.
- Attachments are included to support the BMP and BPTC measures.

Existing Project

- The project is located in Humboldt County, in the Myers Flat area, on the south side of State Highway 101, on the property known to be 261 Myers Ave, Myers Flat, CA 95554.
- Local Jurisdiction: Zoning Clearance Certificate for Interim Permit pursuant to the Humboldt County Commercial Medical Marijuana Land Use Ordinance (CMMLUO), Section 314-55.4.1 et seq., specifically Section 314-55.4.8.11, a Zoning Clearance Certificate for an interim Permit may be issued for an Existing Cannabis Cultivation and ancillary activities of existing outdoor cultivation; Apps: 12679
- State Licensing: California Department of Food and Agriculture, Division of CalCannabis Cannabis Cultivation License: TML18-0015461
- California Department of Fish and Wildlife: Streambed Alteration Agreement Notification No. EPIMS:05294.
- Water Source: Myers Flat Municipal Water System

Web Soil Survey

According to the Natural Resources Conservation Service's Web Soil Service, the site's soil type is identified as:

Feature	187
Slope	0-2%
Depth to restrictive feature	>80-inches
Natural drainage class	Moderately Well Drained

Feature	187
Capacity to transmit water	Mod. High to High
Depth to water table	20-39-inches
Frequency of flooding	Rare
Frequency of ponding	Frequent
Available water storage in profile	High, 10.4-inches

See attached Soil Map, Map Unit Legend and Map Unit Descriptions.

Attachements

- Property Diagram
- Parcel Map
- Water Resource Protection Elements Site Map and Descriptions
- Best Practical Treatments and Controls Site Map and Acronyms
- Site Management Plan: Best Practical Treatments and Controls
- Monitoring Timeline and Data Log
- Cultivation Product Descriptions
- Cannabis Waste Management Plan
- Solid and Hazardous Waste Management Plan
- Soil Map, Map Unit Legend and Map Unit Descriptions
- SWRCB_WQ20170023DWC_Sec.2: Requirements and Best Practical Treatment and Control (BPTC) related to water diversions and waste discharge for cannabis cultivation.
- ORDER No. R1-2015-0023 Best Management Practices (BMP) for Site Maintenance and Operations
- Winterization Protocols for the Statewide Cannabis Order
- Various BMP and BPTC Documents

EXECUTIVE SUMMARY

The subject parcel is compliant with all Standard Conditions as set forth in ORDER No. R1-2015-0023. The subject parcel is residentially zoned. There are no access roads, stream crossings or surface water courses. Power is supplied by PG&E. Water is supplied by the municipal water district. Sewer is supplied by an onsite septic system.

ORDER No. R1-2015-0023 Site Characteristics

1. Site Maintenance, Erosion Control and Drainage Features
   i. Road Maintenance and Other Corridors

      A driveway accesses the residence and cultivation site from the paved county road.
   ii. Discharge Points

      There are no discharge points associated with the site or driveway.
   iii. Hydrologic Disconnection

      The site is not hydrologically connected to surface water.
   iv. Stockpiled Materials

      Materials are secured for the wet-season.
2. Stream Crossing Maintenance
   i. There are no stream crossings.
3. Riparian and Wetland Protection and Management
   i. Site meets minimum setbacks from surface water and is hydrologically disconnected.
4. Spoils Management

   Vegetative material is composted onsite, contained and set at a sufficient distance from surface water. Soil is reused within existing cultivation areas.
5. Water Storage and Use
   i. Municipal Water

      Water is supplied by the Myers Flat Municipal Water District.
6. Irrigation Runoff

   There is no runoff associated with irrigation. Irrigation system is maintained regularly to avoid leaks. Irrigation is done manually to avoid over watering and thus the discharge of nutrients. Soils are amended during the off-season to enhance the organic content and

thus the water holding capacity. Soils are mulched and margins of cultivations sites are vegetated.

7. Fertilizers and Soil Amendments

   Fertilizers and soil amendments are stored when not in use and applied per manufactures recommendations.

8. Pesticides and Herbicides

   No restricted commercial pesticides or herbicides are used. Operation employs the use of compost teas and companion planting as part of an integrated pest management plan.

9. Petroleum Products and Other Chemicals

   Petroleum products are present only for the purpose of property management. They are stored in a secure location with secondary containment.

10. Cultivation Related Wastes

    Vegetative material is composted onsite, contained and set at a sufficient distance from surface water. Soil is reused within existing cultivation areas.

11. Refuse and Human Waste

    Refuse is taken off-site on a regular basis to a licensed municipal waste facility. A septic system is onsite and maintained as needed.

ORDER WQ 2017-0023-DWQ Site Characteristics

The following summary addresses standard conditions not addressed in the preceding summary under Order No. R1-2015-0023.

1.1.3.1. Legacy Discharge Issues

There are no legacy discharge issues associated with this site.

5. Winterization Measures

See attached Standard Conditions Compliance Requirements Table for a complete list of winterization recommendations for each Standard Condition.

Appendix

EMERALD TRIANGLE MEDICINAL, INC

APN:081-051-014-000

SHEET INDEX
1: PROPERTY DIAGRAM
2: PREMISES DIAGRAM
3: LIGHTING DIAGRAM

PROJECT DESCRIPTION
STATE LICENSE DIAGRAMS FOR EXISTING CANNABIS CULTIVATION WITH PACKAGING AND PROCESSING ONSITE
HUMBOLDT COUNTY PERMIT APPLICATION NUMBER: 12679

PROJECT ADMINISTRATION CONTACT
AGENT: RAIN AND ZEPP, PLC
CONTACT: TRACY RAIN
EMAIL: TRACY.RAIN@RAINZEPPLAW.COM
PHONE: 707-442-3034
517 THIRD STREET, SUITE 30
EUREKA, CA, 95501

PROJECT LOCATION
THE PROJECT IS LOCATED IN HUMBOLDT COUNTY IN MYERS FLAT, CA. THE PARCEL IS DESCRIBE IN ASSESSOR'S MAP BOOK 81 PAGE 05 COUNTY OF HUMBOLDT CA SEC 30 TOWNSHIP 2 SOUTH RANGE THREE EAST

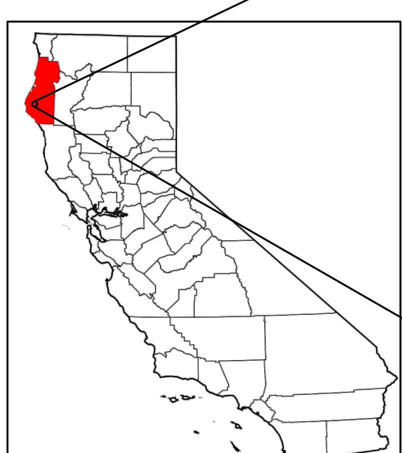
PARCEL COORDINATES
40.2639, −123.8763

SHEET INDEX 1: PROPERTY DIAGRAM 2:

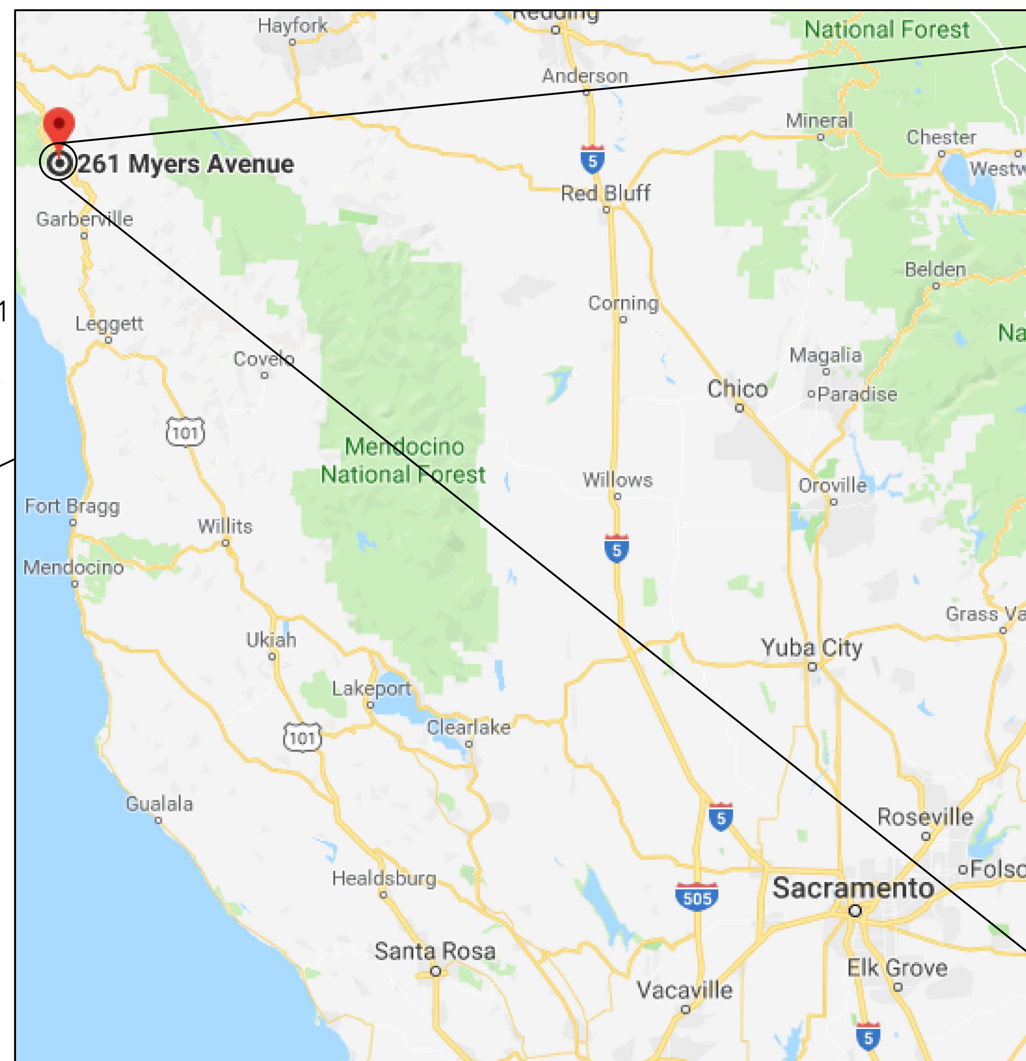
PROJECT DESCRIPTION STATE LICENSE DIAGRAMS FOR EXISTING CANNABIS CULTIVATION WITH PACKAGING WITH PACKAGING WITH PACKAGING AND PROCESSING

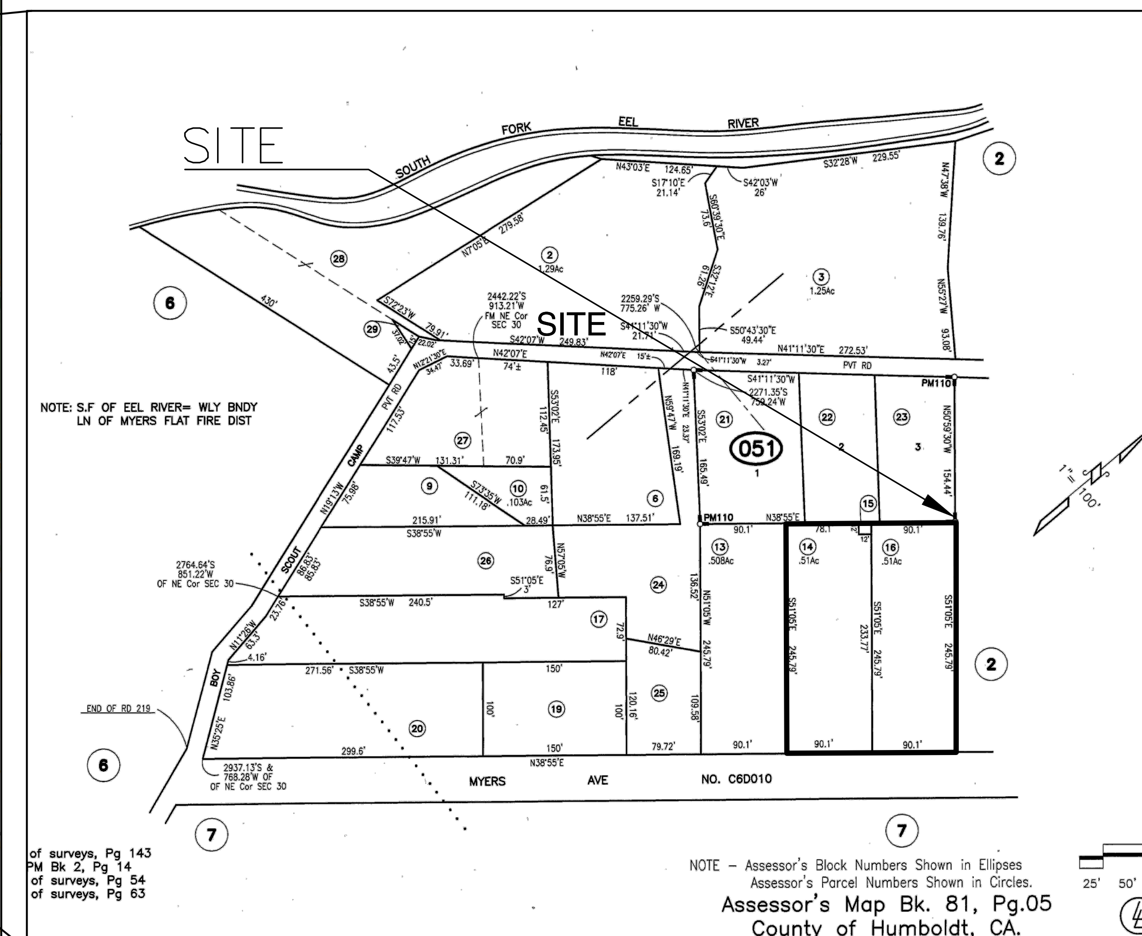
PROJECT ADMINISTRATION CONTACT AGENT: RAIN AND ZEPP, PLC CONTACT TRACY RAIN EMAIL:TRACYRAIN@RAINZEPPLAW.COM PHONE: 707-442-3034 517

PROJECT LOCATION THE PROJECT IS LOCATED IN HUMBOLDT COUNTY IN MYERS FLAT, CA. THE PARCEL IS DESCRIBE IN ASSESSOR'S MAP BOOK 81 PAGE 05 COUNTY OF HUMBOLDT CA SEC 30 TOWNSHIP 2 SOUTH RANGE THREE EAST PARCEL COORDINATES 40.2639, -123.8763



HUMBOLDT COUNTY





NO. | DATE | DESCRIPTION | REVISIONS

A.M. Baird Engineering & Surveying, Inc.
1257 Main Street, PO Box 396, Fortuna, CA 95540, (707) 725-5182

SCALE: NONE
DRAWN BY: CCC
CHKD: A.M.B.
DATE: 11/19/2018

EMERALD TRIANGLE MEDICINAL, INC
APN: 081-051-014
261 MYERS AVENUE, MYERS FLAT, 95554, CA
STATE CANNABIS DIAGRAMS
COVER SHEET

JOB # 17-4202-3
SHEET # 1 OF 1

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NOTE NO WATER
NO WATER CROSSINGS ON PARCEL

SCALE 1"=30'

0 15 30 60

N

NO.	DATE	DESCRIPTION
		REVISIONS

A.M. Baird
Engineering & Surveying Inc.
1257 Main Street, PO Box 396,
Fortuna, CA 95540, (707) 725-5182

SCALE: 1"= 30'
DRAWN BY: CCC
CHKD: A.M.B.
DATE: 11/20/2018

EMERALD TRIANGLE MEDICINAL INC
APN: 033-014-013
261 MCKEE AVENUE
MYERS FLAT, 95554, CA

CANNABIS CULTIVATION

PROPERTY DIAGRAM

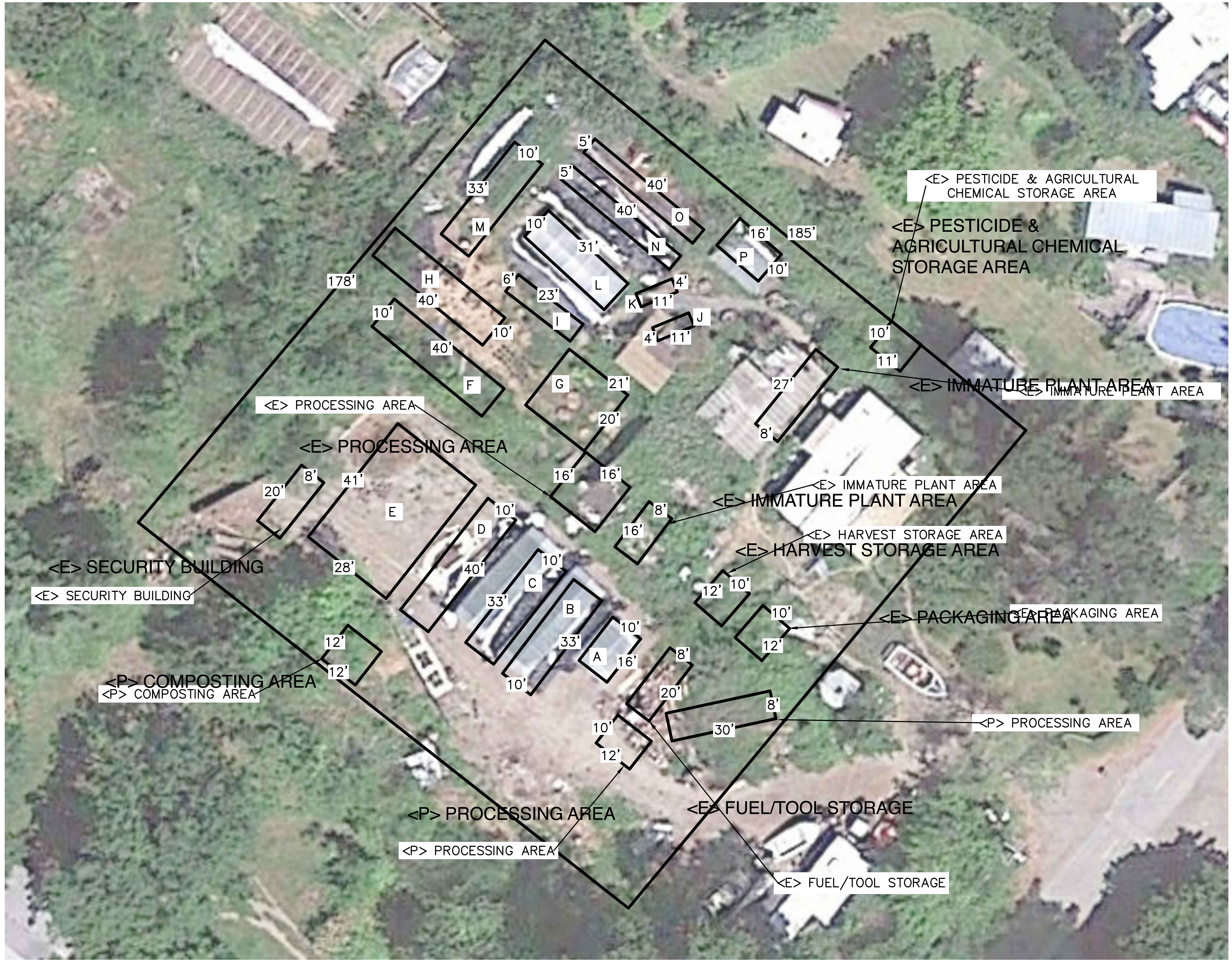
JOB # 17-4202-3

SHEET # 1 OF 3

\\netstorage\public\Chase Cimina\PROJECTS 09272017-CURRENTLY\Projects 07032018\17-4202-03 DOWNING, RON\DWG Files\NEWEST STATE MAPS.dwg, 11/29/2018 2:52:31 PM,
ANSI expand B (11.00 x 17.00 Inches)

NOTE AGGRATE SQUARE FOOTAGE OF CANOPY AREAS = 5,000 SQFT

AGGRAGATE CANOPY AREA	
Canopy Area	SQFT
A	155
B	332.5
C	332.5
D	400
E	1141.5
F	400
G	420
H	400
I	138
J	44
K	44
L	305
M	332.5
N	200
O	200
P	155
TOTAL	5000



SCALE 1"=30'

0 15 30 60

N

NO.	DATE	DESCRIPTION

A.M. Baird Engineering & Surveying Inc.
1257 Main Street, PO Box 396, Fortuna, CA 95540, (707) 725-5182

SCALE: 1"= 30'
DRAWN BY: CCC
CHKD: A.M.B.
DATE: 11/20/2018

EMERALD TRIANGLE MEDICINAL INC
APN: 031-014-013
MYERS FLAT, 95554, CA

CANNABIS CULTIVATION
PREMISES DIAGRAM

JOB # 17-4202-3

SHEET # 2 OF 3

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ANSI expand B (11.00 x 17.00 Inches)

CANOPY AREAS A AND P
2 LIGHTS X 1100 WATTS/LIGHT = 2200 WATTS
CANOPY AREA (GREENHOUSE) = 155 SQFT
2200 WATTS/155 SQFT = 14.2 WATTS/SQFT

CANOPY AREAS F AND H
6 LIGHTS X 1100 WATTS/LIGHT = 6600 WATTS
CANOPY AREA (GREENHOUSE) = 400 SQFT
6600 WATTS/400 SQFT = 16.5 WATTS/SQFT

CANOPY AREAS N AND O
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 200 SQFT
0 WATTS/200 SQFT = 0 WATTS/SQFT

CANOPY AREAS B, C, AND M
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 332.5 SQFT
0 WATTS/332.5 SQFT = 0 WATTS/SQFT

CANOPY AREA G
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 420 SQFT
0 WATTS/420 SQFT = 0 WATTS/SQFT

AGGRAGATE WATTS/SQFT
2X(2200 WATTS/155 SQFT)
3X(0 WATTS/332.5 SQFT)
0 WATTS/400 SQFT
0 WATTS/1141.5 SQFT
2X(6600 WATTS/400 SQFT)
0 WATTS/420 SQFT
0 WATTS/138 SQFT
2X(0 WATTS/44 SQFT)
0 WATTS/305 SQFT
0 WATTS/200 SQFT
17600 WATTS/5000 SQFT

AVERAGE WATTS/SQFT
3.52/SQFT

CANOPY AREA D
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 400 SQFT
0 WATTS/400 SQFT = 0 WATTS/SQFT

CANOPY AREA I
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 138 SQFT
0 WATTS/138 SQFT = 0 WATTS/SQFT

CANOPY AREA E
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 1141.5 SQFT
0 WATTS/1141.5 SQFT = 0 WATTS/SQFT

CANOPY AREAS J AND K
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 44 SQFT
0 WATTS/44 SQFT = 0 WATTS/SQFT

CANOPY AREA L
0 LIGHTS X 0 WATTS/LIGHT = 0 WATTS
CANOPY AREA (GREENHOUSE) = 305 SQFT
0 WATTS/305 SQFT = 0 WATTS/SQFT

REVISIONS

NO.	DATE	DESCRIPTION
1	11/26/18	LIGHTING CHANGES PER CLIENT

A.M. Baird Engineering & Surveying Inc.
1257 Main Street, PO Box 396, Fortuna CA 95540, (707) 725-5182

SCALE: NTS
DRAWN BY: CCC
CHKD: A.M.B.
DATE: 11/19/2018

EMERALD TRIANGLE MEDICINAL INC
MYERS FLAT, 95554, CA

CANNABIS CULTIVATION

LIGHTING DIAGRAM

JOB # 17-4202-3

SHEET # 3 OF 3

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ArcGIS Web Map

Humboldt County Planning and Building Department

0 40 80 160 Feet

0 0.0075 0.015 0.03 Miles

RF= 1:1,128 1 in = 94 ft

N W E S

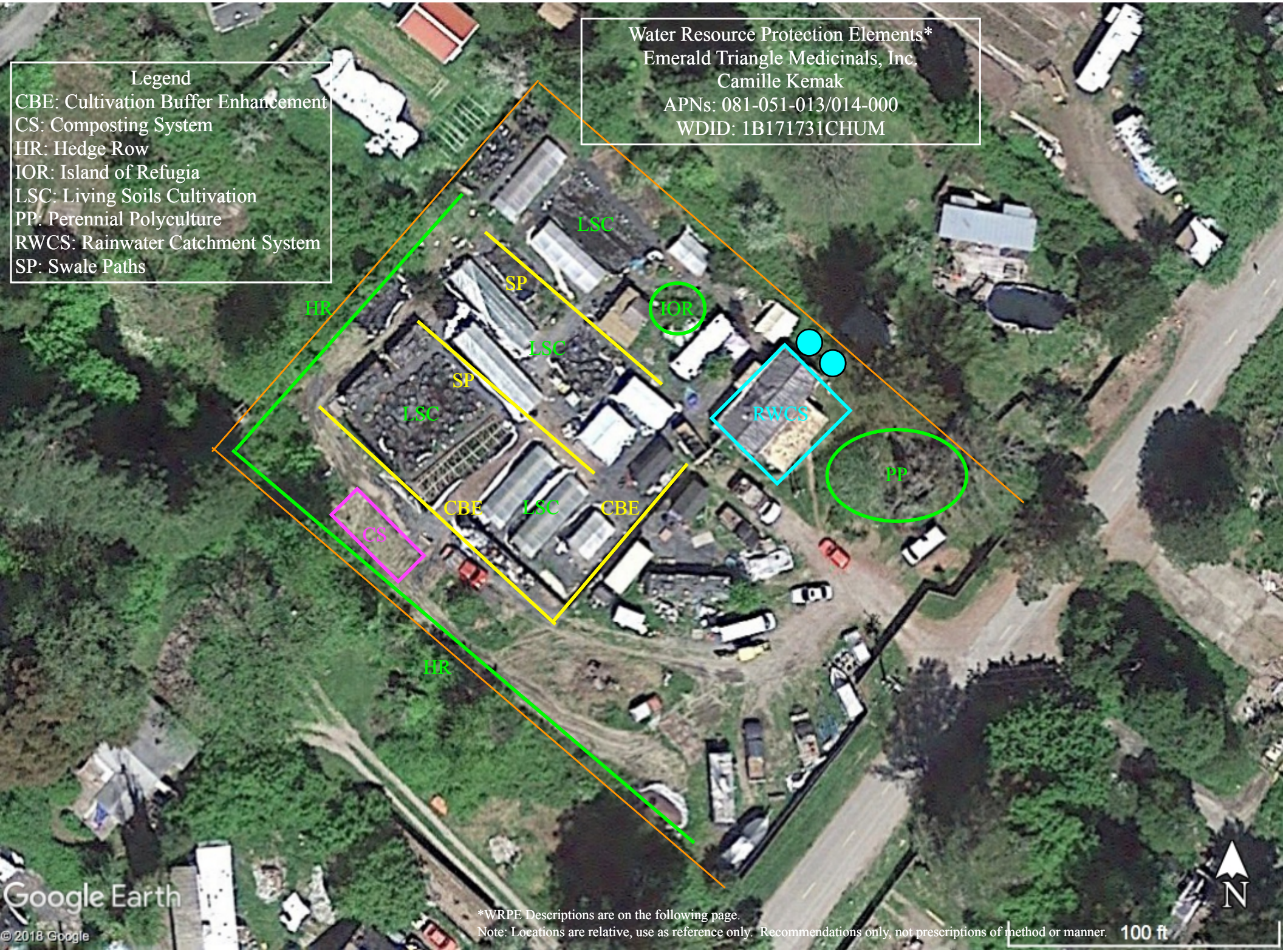
Printed: September 24, 2019 Web AppBuilder 2.0 for ArcGIS

Highways and Roads
- Principal Arterials
- Minor Arterials
- Major Collectors
- Minor Collectors
- Local Roads

- Private or Unclassified
- Major River or Stream

Blue Line Streams
- Perennial 1-3
- Perennial >4

- Intermittent
- Subsurface
- City Boundary
- Counties
- Parcels (no APN labels)


Water Resource Protection Elements*
Emerald Triangle Medicinals, Inc.
Camille Kemak
APNs: 081-051-013/014-000
WDID: 1B171731CHUM
Legend
CBE: Cultivation Buffer Enhancement
CS: Composting System
HR: Hedge Row
IOR: Island of Refugia
LSC: Living Soils Cultivation
PP: Perennial Polyculture
RWCS: Rainwater Catchment System
SP: Swale Paths
HR
LSC
SP
IOR
LSC
SP
LSC
RWCS
PP
CBE
LSC
CBE
CS
HR
Google Earth
© 2018 Google
N
*WRPE Descriptions are on the following page.
Note: Locations are relative, use as reference only. Recommendations only, not prescriptions of method or manner.
100 ft

Recommendations for Identified Water Resources Protection Elements

Overview

The following recommendations are based on site specific conditions related to the management of waste discharge and water resources on cannabis farms in upland watersheds. The intention of these design elements is to protect water quality while enhancing ecologic resources.

Cultivation Buffer Enhancement (CBE)

Cultivation buffers, in conjunction with appropriate setbacks from water resources, serve to off-set and mitigate the surface and subsurface discharge from human-based activities. Buffers also serve to infiltrate water and retain nutrients. The first phase of a cultivation buffer are filter-strips of linear plantings of dense native grasses which serve as sediment traps, habitat for beneficial insects and biomass accumulators. The second phase is a system of perennial plants that serve as part of the site's Integrated Pest Management plan. See attached documents for more information.

Composting System (CS)

Permanent facility to process agricultural spoils (stems, roots, etc.) through a static compost system and soil to be reused during the following cultivation season. Static compost systems require passive, foundational airflow. Site requires containment, remediation and setbacks. All used soil piles must be contained and promote the infiltration of tailwater.

Hedge Row (HR)

Hedge rows serve many purposes: wind break to decrease soil desiccation, increase favorable conditions for insect-based pollinators and pest predators, provide habitat for beneficial bird species and provide visual sector barriers from neighboring properties. All hedge rows should be planted and/or maintained in conjunction with an infiltration system to decrease the irrigation requirements and increase the possible diversity of species that can be planted. See attached documents for more information.

Island of Refugia (IOR)

Development of natural habitats results in the fragmentation of forests. The loss of connectivity may have negative affects on native fauna. In an effort to off-set this disturbance it is recommended that an *island(s) of refugia* be established. *IORs* provide habitat and protection for native fauna as they move across large clearings. *IORs* also provide beneficial aspects to cultivation actives in the form of Integrated Pest Management by hosting beneficial species that target "pests" and microclimate management. They also provide shade for workers during the heat of the day.

Living Soil Cultivation (LSC)

Cultivating with living soils reduces the cost of off-site nutrients and on-site water demands while integrating pest management strategies. Living soil cultivation aligns with the seasons and natural rhythms of the surrounding environment which includes but is not limited to: cover cropping, companion planting, carbon sequestration,

microclimate management, rainwater harvesting and bioregional breeding of commercial crops.

Perennial Polyculture (PP)
Perennial polycultures are areas that are managed for their diversity in both form and function. They serve to provide integrated resources such as pest management, habitat for native fauna and food for humans. Focussing on perennial species and annuals that self-seed, rainwater harvesting systems and forest-model design perennial polycultures are passive systems with great benefits for both natural and constructed environments.

Rainwater Catchment System (RWCS)
The residence can supply 600-gallons per 1-inch of precipitation. There is sufficient stable ground adjacent to the structure for storage tanks. Power is also present to pump stored rainwater to water storage (WS) site upslope of cultivation site.

Sale Paths (SP)
Swale paths are designed to facilitate the mitigation of stormwater runoff while protecting the integrity of the pathway. Swales can be implemented to mitigate stormwater (off-contour) from a site or infiltrate (on-contour) stormwater to be used as a resource within the site. Swales are back filled with drain rock.

<u>Other Recommended Water Resource Protection Elements</u>

Ecological Offsets
Soils compaction, forest fragmentation and water resource extraction are the results of roads, developed sites and cultivation activities. The loss of connectivity may have negative affects on native fauna. In the interest of offsetting the impacts to the natural environment it is recommended that forest management, groundwater recharge and habitat restoration plans be implemented by a ratio of 2:1 (two square feet of offsets for every one square foot of disturbance). An example of a simple offset is an *island(s) of refugia*. *IORs* provide habitat and protection for native fauna as they move across large clearings. *IORs* also provide beneficial aspects to cultivation actives in the form of Integrated Pest Management (IPM) by hosting beneficial species that target “pests” and microclimate management. They also provide shade for workers during the heat of the day.

Water Conservation
In an effort to reduce the irrigation requirements for the cultivation site and thus the forbearance storage and demand on surface water diversions the following water conservation strategies are recommended. Increase the organic material in the potting soil to enhance the water holding capacity of the medium. Protect the soil surface from direct insolation through the use of natural and/or living mulches. Irrigate less frequently and at a greater depth to encourage wide and deep root growth. Utilize offseason protocols such as living soil methods that increase the biological and moisture levels to facilitate plant growth with reduced irrigation requirements.

Integrated Pest Management - IPM

In an effort to reduce and ultimately eliminate the need for pesticides - chemical, natural, organic or otherwise - it is recommended that the cultivation site buffers be planted with native and analog plant species that attract and host pest predator species of invertebrates and birds. It is further recommended that habitat be created to attract and host reptile species that also prey on agricultural pests. Through the management of microclimates the need for fungicides can be reduced and ultimately eliminated.

The above are recommendations and not prescriptions of method and manner. Your WRPP provides short term strategies to prevent the discharge of sediment and cultivation related wastes from entering surface waters until permanent systems can be deployed during the appropriate time of year. All features should be engineered and implemented by licensed professionals where applicable.


Best Practical Treatment and Control Measures*
Emerald Triangle Medicinals, Inc.
Camille Kemak
APNs: 081-051-013/014-000
WDID: 1B171731CHUM
Developed Areas
SDSM57-62, 104-116
WCU96-99
IR100-103
FPPP104-111
FS112-114
PH115-116
PPOC117-119
CRW120-123
RDW122-124
Throughout Subject Parcel
EC9, 11
CRM37
W125, 130-133
Access Roads
ARLLD17, 21-22
Water Storage
WSDS68
WCU96-99
Google Earth
© 2018 Google
*BPTC Measures: A list of BPTC acronyms is on the following page.
Note: Locations are relative, use as reference only. Recommendations only, not prescriptions of method or manner.
N
100 ft

Acronyms for Best Practical Treatment and Control Measures

ARLDD: Access Road/Land Development and Drainage

CRM: Cleanup, Restoration and Mitigation

CRW: Cultivation Related Waste

DC: Drainage Culverts

EC: Erosion Control

FPPP: Fertilizers, Pesticides and Petroleum Products

FS: Fertilizers and Soils

IR: Irrigation Runoff

PH: Pesticides and Herbicides

PPOC: Petroleum Products and Other Chemicals

RDW: Refuse and Domestic Waste

RWPM: Riparian and Wetland Protection and Management

SDSM: Soil Disposal and Spoils Management

W: Winterization

WC: Water Course Crossings

WCU: Water Conservation and Use

WSDS: Water Supply, Diversion and Storage

State Water Resources Control Board - Order WQ 2017-0023-DWQ Site Management Plan - 2019		
Emerald Triangle Medicinal, LLC. / WDID: 1B171731CHUM / APN:081-051-013/014-000		
1. Sediment Discharge BPTC Measures		
1.1 Site Characteristics		
1.1.1. Site Map	**Recommendations**	**Monitoring**
Provide a map showing access roads, vehicle parking areas, streams, stream crossings, cultivation site(s), disturbed areas, buildings, and other relevant site features.		
See attached Property Diagram.		
1.1.2. Access Road		
Description	**Recommendations**	**Monitoring**
Describe the access road conditions including estimating vehicle traffic, road surface (e.g., paved, rocked, or bare ground), and maintenance activities. Describe how storm water is drained from the access road (e.g., crowned, out slope, armored ditch, culverts, rolling dips, etc.).		
The subject parcel is accessed via a paved, county road. These roads service many parcels within the community with an estimated 25 vehicles daily. Road maintenance is the responsibility of the County of Humboldt.		As Needed.
1.1.2. Requirements		
Subsection	**Description**	**Deployment**
17. Access Road / Land Development and Drainage	Cannabis cultivators shall ensure that all access roads are hydrologically disconnected to receiving waters to the extent possible by installing disconnecting drainage features, increasing the frequency of (inside) ditch drain relief as needed, constructing out-sloped roads, constructing energy dissipating structures, avoiding concentrating flows in unstable areas, and performing inspection and maintenance as needed to optimize the access road performance.	On-Going.

22. Access Road / Land Development and Drainage	Cannabis cultivators shall ensure that access road surfacing, especially within a segment leading to a waterbody, is sufficient to minimize sediment delivery to the wetland or waterbody and maximize access road integrity. Road surfacing may include pavement, chip-seal, lignin, rock, or other material appropriate for timing and nature of use. All access roads that will be used for winter or wet weather hauling/traffic shall be surfaced. Steeper access road grades require higher quality rock (e.g., crushed angular versus river-run) to remain in place. The use of asphalt grindings is prohibited.	On-Going.
1.1.3 Stream Crossings		
Description	**Recommendations**	**Monitoring**
Describe any vehicle stream crossing including the type of crossing (e.g., bridge, culvert, low water, etc.).		
There are no stream crossings.	Meets BPTC requirements.	NA
1.1.3.1. Legacy Discharge Issues		
Description	**Recommendations**	**Monitoring**
For Region 1 Dischargers, identify, discuss, and locate on the site map any legacy waste discharge issues that exist on the property.		
There are no legacy discharge issues.	Meets BPTC requirements.	NA
1.2 Sediment Erosion Prevention and Sediment Capture		
1.2.1. Erosion Prevention BPTC Measures		
Description	**Recommendations**	**Monitoring**
1.2.1.1. Describe the BPTC measures that have been, or will be implemented to prevent or limit erosion. Provide an implementation schedule for BPTC measures that have not yet been implemented. Identify the erosion prevention BPTC measures on a site map.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Per Document
Roads: County maintained road. Short dirt driveway accesses the residence and cultivation site.		On-Going and Seasonally.
Developed Areas: Margins are well vegetated and surfaces are maintained.		On-Going and Seasonally.

Cultivation Sites: Margins are well vegetated and sites meet the minimum setbacks from surface water. Winterization protocols will be deployed by the onset of the wet-season (November 15) of each year.		On-Going and Seasonally.
1.2.1.1.1. The description shall address physical BPTC measures and biological BPTC measures.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Per Document
1.2.2. Sediment Control BPTC Measures		
Description	**Recommendations**	**Monitoring**
1.2.2.1. Describe the BPTC measures that have been, or will be implemented to capture sediment that has been eroded. Provide an implementation schedule for BPTC measures that have not yet been implemented. Identify the sediment control BPTC measures on a site map.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Per Document
1.2.2.1.1. The description shall address physical BPTC measures and biological measures.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Per Document
1.2.3. Maintenance Activities - Erosion Prevention and Sediment Control		
Description	**Recommendations**	**Monitoring**
1.2.3.1. Describe how the erosion prevention and sediment control BPTC measures will be monitored and maintained to protect water quality.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Per Document
1.2.3.2. Describe how any captured sediment will be either stabilized in place, excavated and stabilized on-site, or removed from site.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		On-Going and Seasonally.

1.2.1. - 1.2.3. Requirements		
Subsection	**Description**	**Deployment**
9. Erosion Control	The cannabis cultivator shall not plant or seed noxious weeds. Prohibited plant species include those identified in the California Invasive Pest Plant Council's database, available at: www.cal-ipc.org/paf/. Locally native, non-invasive, and non-persistent grass species may be used for temporary erosion control benefits to stabilize disturbed land and prevent exposure of disturbed land to rainfall. Nothing in this term may be construed as a ban on cannabis cultivation that complies with the terms of this Policy.	Seasonally.
11. Erosion Control	Cannabis cultivators shall only use geotextiles, fiber rolls, and other erosion control measures made of loose-weave mesh (e.g., jute, coconut (coir) fiber, or from other products without welded weaves). To minimize the risk of ensnaring and strangling wildlife, cannabis cultivators shall not use synthetic (e.g., plastic or nylon) monofilament netting materials for erosion control for any cannabis cultivation activities. This prohibition includes photo- or bio-degradable plastic netting.	On-Going.
1.2.4. Erosion Control BPTC Measures		
Description	**Recommendations**	**Monitoring**
Describe the interim soil stabilization, if applicable and long-term BPTC measures implemented to prevent sediment transport at each identified disturbed area(s) and improperly constructed features.		
See attached documents: Water Resource Protection Elements Site Map and Project Descriptions, Best Practical Treatments and Controls Site Map, Monitoring Timeline and Data Log, and Winterization Protocols for Statewide Cannabis Order.		Seasonal and As Needed.
2. Fertilizer, Pesticide, Herbicide and Rodenticide BPTC Measures		
2.1. Summary Table	**Recommendations**	**Monitoring**
Provide a summary table that identifies the products used at the site, when they are delivered to the site, how they are stored, and used at the site. If products are not consumed during the growing season, describe how they are removed from the site or stored to prevent discharge over the winter season.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document

2.2. Site Map	Recommendations	Monitoring
Provide a site map that locates storage locations.		
See attached Property Diagram.		
2.3. Storage, Application and Disposal		
Description	**Recommendations**	**Monitoring**
Describe how bulk fertilizers and chemical concentrates are stored, mixed, applied and how empty containers are disposed.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document
2.4. Spill Prevention and Cleanup		
Description	**Recommendations**	**Monitoring**
Describe procedures for spill prevention and cleanup.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document
2.3. - 2.4. Requirements		
Subsection	**Description**	**Deployment**
57. Soil Disposal and Spoils Management	Cannabis cultivators shall store soil, construction, and waste materials outside the riparian setback except as needed for immediate construction needs. Such materials shall not be stored in locations of known slope instability or where the storage of construction or waste material could reduce slope stability.	On-Going.
58. Soil Disposal and Spoils Management	Cannabis cultivators shall separate large organic material (e.g., roots, woody debris, etc.) from soil materials. Cannabis cultivators shall either place the large organic material in long-term, upland storage sites, or properly dispose of these materials offsite.	On-Going.
59. Soil Disposal and Spoils Management	Cannabis cultivators shall store erodible soil, soil amendments, and spoil piles to prevent sediment discharges in storm water. Storage practices may include use of tarps, upslope land contouring to divert surface flow around the material, or use of sediment control devices (e.g., silt fences, straw wattles, etc.).	On-Going.

60. Soil Disposal and Spoils Management	Cannabis cultivators shall contour and stabilize stored spoils to mimic natural slope contours and drainage patterns (as appropriate) to reduce the potential for fill saturation and slope failure.	On-Going.
61. Soil Disposal and Spoils Management	For soil disposal sites cannabis cultivators shall: • revegetate soil disposal sites with a mix of native plant species, • cover the seeded and planted areas with mulched straw at a rate of two tons per acre, and • apply non-synthetic netting or similar erosion control fabric (e.g., jute) on slopes greater than 2:1 if the site is erodible.	On-Going.
62. Soil Disposal and Spoils Management	Cannabis cultivators shall haul away and properly dispose of excess soil and other debris as needed to prevent discharge to waters of the state.	On-Going.
104. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall not mix, prepare, over apply, or dispose of agricultural chemicals/products (e.g., fertilizers, pesticides[22], and other chemicals as defined in the applicable water quality control plan) in any location where they could enter the riparian setback or waters of the state. The use of agricultural chemicals inconsistently with product labeling, storage instructions, or DPR requirements for pesticide applications[23] is prohibited. Disposal of unused product and containers shall be consistent with labels.	On-Going.
105. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall keep and use absorbent materials designated for spill containment and spill cleanup equipment on-site for use in an accidental spill of fertilizers, petroleum products, hazardous materials, and other substances which may degrade waters of the state. The cannabis cultivator shall immediately notify the California Office of Emergency Services at 1-800-852-7550 and immediately initiate cleanup activities for all spills that could enter a waterbody or degrade groundwater.	On-Going.
106. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall establish and use a separate storage area for pesticides, and fertilizers, and another storage area for petroleum or other liquid chemicals (including diesel, gasoline, oils, etc.). All such storage areas shall comply with the riparian setback Requirements, be in a secured location in compliance with label instructions, outside of areas of known slope instability, and be protected from accidental ignition, weather, and wildlife. All storage areas shall have appropriate secondary containment structures, as necessary, to protect water quality and prevent spillage, mixing, discharge, or seepage. Storage tanks and containers must be of suitable material and construction to be compatible with the substances stored and conditions of storage, such as pressure and temperature.	On-Going.

107. Fertilizers, Pesticides and Petroleum Products	Throughout the wet season, Cannabis Cultivators shall ensure that any temporary storage areas have a permanent cover and side-wind protection or be covered during non-working days and prior to and during rain events.	Prior to and during wet-season.
108. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall only use hazardous materials[24] in a manner consistent with the product's label.	On-Going.
109. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall only keep hazardous materials in their original containers with labels intact, and shall store hazardous materials to prevent exposure to sunlight, excessive heat, and precipitation. Cannabis cultivators shall provide secondary containment for hazardous materials to prevent possible exposure to the environment. Disposal of unused hazardous materials and containers shall be consistent with the label.	On-Going.
110. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall only mix, prepare, apply, or load hazardous materials outside of the riparian setbacks.	On-Going.
111. Fertilizers, Pesticides and Petroleum Products	Cannabis cultivators shall not apply agricultural chemicals within 48 hours of a predicted rainfall event of 0.25 inches or greater with a probability greater than 50-percent.	Prior to any rain event.
112. Fertilizers and Soils	To minimize infiltration and water quality degradation, Cannabis cultivators shall irrigate and apply fertilizer to consistent with the crop need (i.e., agronomic rate).	On-Going.
113. Fertilizers and Soils	When used, cannabis cultivators shall apply nitrogen to cannabis cultivation areas consistent with crop need (i.e., agronomic rate). Cannabis cultivators shall not apply nitrogen at a rate that may result in a discharge to surface water or groundwater that causes or contributes to exceedance of water quality objectives, and no greater than 319 pounds/acre/year unless plant tissue analysis performed by a qualified individual demonstrates the need for additional nitrogen application. The analysis shall be performed by an agricultural laboratory certified by the State Water Board's Environmental Laboratory Accreditation Program.	On-Going.
114. Fertilizers and Soils	Cannabis cultivators shall ensure that potting soil or soil amendments, when not in use, are placed and stored with covers, when needed, to protect from rainfall and erosion, to prevent discharge to waters of the state, and to minimize leaching of waste constituents into groundwater.	On-Going.
115. Pesticides and Herbicides	Cannabis cultivators shall not apply restricted materials, including restricted pesticides, or allow restricted materials to be stored at the cannabis cultivation site.	On-Going.

116. Pesticides and Herbicides	Cannabis cultivators shall implement integrated pest management strategies where possible to reduce the need and use of pesticides and the potential for discharges to waters of the state.[25]	On-Going.
3. Petroleum Product BPTC Measures		
3.1. Summary Table	**Recommendations**	**Monitoring**
Provide a summary table that identifies the products used at the site, when they are delivered to the site, how they are stored, and used at the site. If products are not consumed during the growing season, describe how they are removed from the site or stored to prevent discharge over the winter season.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document
3.2. Site Map	**Recommendations**	**Monitoring**
Provide a site map that locates storage locations.		
See attached Property Diagram.		
3.3. Storage, Application and Disposal		
Description	**Recommendations**	**Monitoring**
Describe how fuels, lubricants and other petroleum products are stored, mixed, applied and empty containers are disposed.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document
3.4. Spill Prevention and Cleanup		
Description	**Recommendations**	**Monitoring**
Describe procedures for spill prevention and cleanup.		

See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.	Per Document

3.1. - 3.4. Requirements		
Subsection	**Description**	**Deployment**
117. Petroleum Products and Other Chemicals	Cannabis cultivators shall only refuel vehicles or equipment outside of riparian setbacks. Cannabis cultivators shall inspect all equipment using oil, hydraulic fluid, or petroleum products for leaks prior to use and shall monitor equipment for leakage. Stationary equipment (e.g., motors, pumps, generators, etc.) and vehicles not in use shall be located outside of riparian setbacks. Spill and containment equipment (e.g., oil spill booms, sorbent pads, etc.) shall be stored onsite at all locations where equipment is used or staged.	On-Going.
118. Petroleum Products and Other Chemicals	Cannabis cultivators shall store petroleum, petroleum products, and similar fluids in a manner that provides chemical compatibility, provides secondary containment, and protection from accidental ignition, the sun, wind, and rain.	On-Going.
119. Petroleum Products and Other Chemicals	Use of an underground storage tank(s) for the storage of petroleum products is allowed if compliant with all applicable federal, state, and local laws; regulations; and permitting requirements.	On-Going.

4. Trash/Refuse and Domestic Wastewater BPTC Measures		
4.1. Types, Containment and Disposal		
Description	**Recommendations**	**Monitoring**
Describe procedures for spill prevention and cleanup.		
See attached documents: Cultivation Activities Product Descriptions, Cannabis Waste Management Plan, Pest Management Plan, and Solid and Hazardous Waste Management Plan.		Per Document
4.1.1. Site Map	**Recommendations**	**Monitoring**
Provide a site map that locates the trash/refuse storage locations.		
See attached Property Diagram.		

4.1. Requirements		
Subsection	**Description**	**Deployment**
120. Cannabis-Related Waste	Cannabis cultivators shall contain and regularly remove all debris and trash associated with cannabis cultivation activities from the cannabis cultivation site. Cannabis cultivators shall only dispose of debris and trash at an authorized landfill or other disposal site in compliance with state and local laws, ordinances, and regulations. Cannabis cultivators shall not allow litter, plastic, or similar debris to enter the riparian setback or waters of the state. Cannabis plant material may be disposed of onsite in compliance with any applicable CDFA license conditions.	On-Going.
121. Cannabis-Related Waste	Cannabis cultivators shall only dispose or reuse spent growth medium (e.g., soil and other organic media) in a manner that prevents discharge of soil and residual nutrients and chemicals to the riparian setback or waters of the state. Spent growth medium shall be covered with plastic sheeting or stored in water tight dumpsters prior to proper disposal or reuse. Spent growth medium should be disposed of at an authorized landfill or other disposal site in compliance with state and local laws, ordinances, and regulations. Proper reuse of spent growth medium may include incorporation into garden beds or spreading on a stable surface and revegetating the surface with native plants. Cannabis cultivators shall use erosion control techniques, as needed, for any reused or stored spent growth medium to prevent polluted runoff.	On-Going.
122. Refuse and Domestic Waste	Cannabis cultivators shall ensure that debris, soil, silt, bark, slash, sawdust, rubbish, creosote-treated wood, raw cement and concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to any life stage of fish and wildlife or their habitat (includes food sources) does not contaminate soil or enter the riparian setback or waters of the state.	On-Going.
123. Refuse and Domestic Waste	Cannabis cultivators shall not dispose of domestic wastewater unless it meets applicable local agency and/or Regional Water Board requirements. Cannabis cultivators shall ensure that human or animal waste is disposed of properly. Cannabis cultivators shall ensure onsite wastewater treatment systems (e.g., septic system) are permitted by the local agency or applicable Regional Water Board.	On-Going.

4.2. Employees, Visitors or Residents		
Description	**Recommendations**	**Monitoring**
Describe the number of employees, visitors or residents at the site.		
Two employees, no visitors and two residents.		
4.2.1. Domestic Wastewater		
Description	**Recommendations**	**Monitoring**
Describe the types of domestic wastewater generated at the site.		
Waste water (grey water) from hand washing and showering is generated at the site. Waste water (black water) from human waste is generated at the site.		
4.2.2. Domestic Wastewater Disposal		
Description	**Recommendations**	**Monitoring**
Describe how the domestic wastewater is disposed.		
All waste water is disposed of in an onsite septic system.		
4.2.2.1. Permitted Onsite Wastewater Treatment System		
Description	**Recommendations**	**Monitoring**
Describe the permitted onsite wastewater treatment system if applicable.		
See county code for specifics.	Maintain as directed by a waste water specialist.	As Needed.
4.2.2.2. Chemical Toilets and Holding Tank		
Description	**Recommendations**	**Monitoring**
If so, provide the name of the servicing company and the frequency of service.		
NA		
4.2.2.3. Outhouse or Privy		
Description	**Recommendations**	**Monitoring**
Use of this alternative requires approval from the Regional Water Board Executive Officer; include approval from the Executive Officer and any conditions imposed for use of this alternative.		

NA		
4.2.2.3.1. Site Map	**Recommendations**	**Monitoring**
Provide a site map that locates any domestic wastewater treatment, storage or disposal.		
See attached Property Diagram.		
5. Winterization BPTC Measures		
5.1. Activities		
Description	**Recommendations**	**Monitoring**
Describe activities that will be performed to winterize the site and prevent discharges of waste. The description should address all the issues listed above.		
See attached documents: Monitoring Timeline and Data Log and Winterization Protocols for Statewide Cannabis Order.		Per Document
5.2. Maintenance		
Description	**Recommendations**	**Monitoring**
Describe maintenance of all drainage or sediment capture features (e.g., drainage culverts, drainage trenches, settling ponds, etc.) to remove debris, soil blockages, and ensure adequate capacity exists.		
See attached documents: Monitoring Timeline and Data Log and Winterization Protocols for Statewide Cannabis Order.		Per Document
5.1. - 5.2. Requirements		
Subsection	**Description**	**Deployment**
125. Winterization	Cannabis cultivators shall implement all applicable Erosion Control and Soil Disposal and Spoils Management Requirements in addition to the Winterization Requirements below by the onset of the winter period.	On-Going and Seasonally.
130. Winterization	Cannabis cultivators shall stabilize all disturbed areas and construction entrances and exits to control erosion and sediment discharges from land disturbance.	Prior to and during wet-season.
131. Winterization	Cannabis cultivators shall cover and berm all loose stockpiled construction materials (e.g., soil, spoils, aggregate, etc.) that are not actively (scheduled for use within 48 hours) being used as needed to prevent erosion by storm water. The cannabis cultivator shall have adequate cover and berm materials available onsite if the weather forecast indicates a probability of precipitation.	Prior to and during wet-season.

132. Winterization	Cannabis cultivators shall cover and berm all loose stockpiled construction materials (e.g., soil, spoils, aggregate, etc.) that are not actively (scheduled for use within 48 hours) being used as needed to prevent erosion by storm water. The cannabis cultivator shall have adequate cover and berm materials available onsite if the weather forecast indicates a probability of precipitation.	Prior to and during wet-season.
133. Winterization	As part of the winterization plan approval process, the Regional Water Board may require cannabis cultivators to implement additional site-specific erosion and sediment control requirements if the implementation of the Requirements in this section do not adequately protect water quality.	TBD
5.3. Revegetation		
Description	**Recommendations**	**Monitoring**
Describe any revegetation activities that will occur either at the beginning or end of the precipitation season.		
See attached documents: Monitoring Timeline and Data Log and Winterization Protocols for Statewide Cannabis Order.		Per Document
5.3. Requirements		
Subsection	**Description**	**Deployment**
37. Cleanup, Restoration and Mitigation	Cannabis cultivators shall prevent the spread or introduction of exotic plant species to the maximum extent possible by cleaning equipment before delivery to the cannabis cultivation Site and before removal, restoring land disturbance with appropriate native species, and post-cannabis cultivation activities monitoring and control of exotic species. Nothing in this term may be construed as a ban on cannabis cultivation that complies with the terms of this Policy.	On-Going and Seasonally.
5.4. Compliance Schedule		
Description	**Recommendations**	**Monitoring**
If any BPTC measure cannot be completed before the onset of winter period, contact the Regional Water Board to establish a compliance schedule.		
NA		
5.5. Legacy Waste Discharge Issues		
Description	**Recommendations**	**Monitoring**
For Region 1 Dischargers, describe any activities that will be performed to address legacy discharge issues.		
There are no legacy discharge issues.		NA

These are recommendations only and not prescriptions for method or manner. All work should be designed and implemented by licensed professionals. We accept no liability for owner-build work based on this management plan.

Rural Property Seasonal Timeline

	Topography	Roads	Water System	Natural Areas	Agriculture/ Livestock
January	Monitor/Maintain	Monitor/Maintain	Monitor/Maintain	Fuel Load Reduction	Prune Orchards
February	Monitor/Maintain	Monitor/Maintain	Monitor/Maintain	Fuel Load Reduction	Amend Ag Zones
March	Monitor/Maintain	Monitor/Maintain	Monitor/Maintain	Fuel Load Reduction	Chop Cover Crop
April	Implementation	Implementation	Monitor/Maintain	Forest Resources	Mulch/Amend
May	Implementation	Implementation	Assess Water System	Invasive Species Management	Monitor
June	Professional Assessment	Professional Assessment	Assess Water System	Professional Assessment	Monitor
July	Implementation	Implementation	Assess Water System	Invasive Species Management	Monitor
August	Implementation	Implementation	Assess Water System	Monitor	Monitor
September	Implementation	Implementation	Assess Water System	Restoration	Winterization
October	Erosion Control	Culverts/Drainage	Update Water System	Restoration	Plant Cover Crop
November	Winterization	Winterization	Winterization	Restoration	Monitor
December	Monitor/Maintain	Monitor/Maintain	Monitor/Maintain	Restoration	Monitor

*See other side for descriptions.

Topography: Slopes related to areas of development that have the capacity for erosion and/or failure.
Monitor/Maintain: Assess winterization and engineered features. Maintain as necessary.
Implementation: Engineered features based on professional assessment.
Professional Assessment: Assessment of slopes, erosion and unstable features by a licensed professional.
Erosion Control: Purchase and stage erosion control materials at sites requiring winterization.
Winterization: Deploy erosion control (brush−weirs, erosion seed mix, wattles, straw mulch) by November 15th of each year. Plant native plants per professional assessment after soil moisture reaches 12-inches in depth.

Roads: Main access, seasonal roads and atv roads.
Monitor/Maintian: Assess winterization and engineered features. Maintain as necessary.
Implementation: Engineered features based on professional assessment.
Professional Assessment: Assessment of surface, margins, stream crossings, cross drains, and discharge points by a licensed professional.
Culverts and Drainage: Clear culverts and cross drains, maintain inboard ditches and discharge points.
Winterization: Deploy winterization protocols by November 15th of each year.

Water System: Diversion, Storage and Use.
Monitor and Maintain: Maintain float valves, manifolds and overflow to ensure proper filling of storage tanks. Purge rainwater catchment first-flush mechanism.
Maintain diversion infrastructure (foot valve) for proper placement in channel and functionality of organism exclusion device.
Assess Water System: Filters, storage volume, conveyance, use (meter) and check for leaks.
Update Water System: Purge sediment, clean/replace filters, expand storage volume, and maintain conveyance/fittings/valves. Install rainwater catchment.
Winterization: Prepare rainwater catchment system. Inspect foot-valve, float valves and overflow system.

Natural Areas: Includes forests, grasslands and riparian areas.
Fuel Load Reduction: Mechanical maintenance of road margins and CalFire zones.
Forest Resources: Fir poles, fire wood, etc.
Invasive Species Management: Mechanical removal of invasive/exotic plants based on species specific management protocols.
Professional Assessment: Assessment of forests, grasslands and riparian areas by a licensed professional.
Monitor: Documentation of elements outlined by professional assessment, restoration plan and restoration projects
Restoration: Engineered and vegetative restoration-based projects implementation.

Agriculture and Livestock
Prune Orchards: Prune based on species specific protocols.
Amend Ag Zones: Amend soil based on use (crops, pastures, etc.).
Chop Cover Crop: Chop and mulch cover crop at least three weeks before planting.
Mulch/Amend: Add spring nutrients based on species specific protocols. Mulch with appropriate strategies to protect soil from desiccation and erosion.
Monitor: Monitor soil, plants and livestock for needs and system upgrades. Monitor rational grazing zones.
Winterization: Prepare soil, livestock and structures for winter season. Continue monitoring.
Plant Cover Crop: Plant in conjunction with autumn rains and before soil temperatures drop below germination levels.

Property Data Log*

Year: _____

	Topography			Roads			Water System			Natural Areas			Agriculture/Livestock		
January															
February															
March															
April															
May															
June															
July															
August															
September															
October															
November															
December															

*Use the above log to record the date (day of the month) that monitoring occurred for each of the five property systems per the *Rural Property Seasonal Timeline* protocols. Use the following pages to record your monitoring observations and maintenance activities.

	Monitoring Observations	Maintenance Activities
Topography		
Roads		
Water System		
Natural Areas		
Ag/Livestock		

Measurement of Diverted Flow and Water Use Data

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Direct Diversion												
Diversion to Storage												
Total Diversion												
Domestic Use												
Irrigation Use[1] Direct												
Irrigation Use[1] Storage												
Total Use												

Irrigation Use[1]: Water use for cannabis cultivation only. Use attached water log to record daily irrigation rates.

Maximum Diversion Rate[2]

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Gallons per Minute												

Maximum Diversion Rate[2]: As measured with bypass valve, bucket and stopwatch or other method to measure gallons per minute.

Specific Water Diversion Agreements			
Maximum Diversion Rate			
Bypass Flow			
Seasonal Diversion Minimization			

Annual Soil Fertilizer and Chemical Use

Amendment	Amount	Chemical Makeup	Use
Age Old Bloom	54-gallons	5-10-5 Fish solubles, feather meal & Colloidal Phosphates. Micronutrients derived from: Seaweed extracts, Borax, and complex sugars of Glucoheptonate of Copper, Manganese, Molybdenum and Zinc.	Bloom is an odorless formula that supplies plants with a fast-acting, natural source of nutrients high in phosphorus. The high phosphate levels encourage early flowering and better fruitset for most fruiting plants and vegetables. Liquid Bloom may be used in both foliar feed and soil drench applications, soak roots in diluted Liquid Bloom before transplanting for a greater root mass.
Alaskan Humisoil	20-pounds	naturally occurring biologically active beat based humus	The mineralization process that converts raw organic matter to the relatively stable substance that is humus feeds the soil population of micro-organisms and other creatures, thus maintaining high and healthy levels of soil life
Alfalfa Meal	50-pounds	2-1-2	Fertilizer
Big Worm	5-cubic feet	Worm castings.	Fertilizer
Biokashi	10-gallons	Fermented Organic Wheat Bran	Top Dress & Compost Tea Brewing
Cal Phos	100-pounds	0-3-0	It is comprised of the bony structures of prehistoric marine creatures mined in Florida from the best deposit in the country. An immediately available and a long-term source of phosphorus.
Cal-Mag	5-gallons	2-0-0 Calcium nitrate, magnesium nitrate, iron	A highly beneficial bio-catalyst for plants. Botanicare Cal-Mag Plus (2-0-0) is a custom plant supplement designed to correct the inherent problem of calcium, magnesium and iron mineral deficiencies found in most soil fertilizers and some hydroponic nutrient formulas. Now with trace minerals.
Dr. Earth Bud and Bloom	250-pounds	3-7-4 Alfalfa meal, bone meal, dehydrated manure, kelp meal, humid acid, potassium sulfate, mycorrhizal inoculant, bacterial inoculant.	perfect organic fertilizer to kick-start your flowering plants. With its high phosphorous content, this organic fertilizer is blended with natural ingredients that help flowering plants produce vibrant blooms that any gardener would be proud to show.
Fish Hydrosolate	32.5-gallons	2-4-0 hydrolyzed fish, phosphoric acid	Soil Conditioner
Glacial Rock Dust	250-pounds	A broad range of trace minerals,	Soil Conditioner
Insect Frass	10-pounds	Herbivores insect guano.	Pest and mold deterrent by increasing plant's natural auto-immune response.

Amendment	Amount	Chemical Makeup	Use
Jersey Green Sand	150-pounds	Silicate	This naturally occurring iron-potassium silicate (also called glauconite) has the consistency of sand but is able to absorb 10 times more moisture, making it an exceptional soil conditioner for pastures, forage fields, lawns, orchards, small fruits, vegetables and greenhouse potting mixes. Greensand contains potassium, iron, magnesium, calcium and phosphorus plus as many as 30 other trace minerals.
Kelp Help	15-gallons	Contains 22% kelp (microbe food) derived from Nerecystis Luetkeana and .4 % Humic acid from Leonardite Shale	Soil Conditioner
Malibu Compost	7-cubic feet	Organic dairy cow manure based compost	Fertilizer
Molasses	35-gallons	Molasses	Molasses for plants! Earth Juice Hi-Brix is the original source of plant carbohydrates and nutrients that has been specially made for indoor and outdoor gardens. May be used with other fertilizers and is highly recommended for brewing teas.
Mykos	4.4-pounds	Mycorrhizae fungi	MYKOS® mycorrhizae is a natural and organic species of beneficial soil fungi that create a "sponge-like" mass which collects and stores nutrients and water, increasing the uptake of both. This single species of arbuscular mycorrhizal fungi contains only Rhizophagus intraradices, formally known as Glomus intraradices.
Nitro Bat Guano	50-pounds	9-3-1 100% Natural Bat Guano	Nitro Bat Guano has been specially selected (and harvested using bat friendly methods) to contain a high quantity of available nitrogen, as well as smaller amounts of phosphorous, potassium and calcium. It provides a comprehensive nutrient charge to your plants with organic bat guano which is also known for increasing the taste of consumables.
Oyster Shell	50-pounds	Oyster shells	Calcium (min.) 33.0%/Calcium (max.) 38.0%,
Plant Therapy	5-gallons	Soy oil, peppermint essencial oil, citric acid, soap, alcohol, sodium citrate, water	Pesticide, Fungicide
Serenade Rtu	64-ounces	Contains a unique, patented strain (QST 713) of Bacillus subtilis	Controls diseases such as Fire Blight, Botrytis, Sour Rot, Rust, Sclerotinia, Powdery Mildew, Bacterial Spot and White Mold and more.

Biological and Chemical Pest Management Plan

The use of repellants, insecticides, and fungicides will include products that are exempt from tolerance requirements, and either exempt from registration requirements, or have labels broad enough to include use on cannabis per California Food and Agriculture Code, Division 6 Pest Control Operations and Division 7 Agriculture Chemical; Chapter 1 – 3.6 and California Code of Regulations, Division 6 Pest Control Operations (Table 1).

Pesticides and fungicides will be stored off the ground in a completely enclosed, locked cabinet under the carport, which has a non-permeable floor surface. Applicant will store and use pesticides and fungicides according to the protocols it uses for pesticide storage and use. pesticides and fungicides will be kept in secondary containment totes to further prevent leaching. Applicant also has a metal drum with a lockable lid for the disposal of pesticides and fungicides if necessary. Applicant will use all pesticides and fungicides according to the label and use personal protective equipment as required by labels. Applicant seeks out and uses pesticides and fungicides that are OMRI Certified and advertised as naturally-based. Before making a pesticide or fungicide application, operators will evaluate equipment, weather conditions, and the property to be treated and surrounding areas to determine the likelihood of substantial drift or harm to non-target crops, contamination, or the creation of a health hazard. The applicant would comply with the following pesticide and fungicide application and storage protocols:

- ☐ Comply with all pesticide label directions;
- ☐ Store chemicals in their original containers in a secure building or shed to prevent access by wildlife;
- ☐ Chemicals in their original containers shall be placed in secondary containment;
- ☐ Chemical containers shall be handled with care to avoid destroying labels;
- ☐ Contain any chemical leaks and immediately clean up any spills;
- ☐ Preventing offsite drift;
- ☐ Do not apply pesticides when pollinators are present;
- ☐ Do not allow drift to flowering plants attractive to pollinators;
- ☐ 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;
- ☐ Do not apply pesticides when they may reach surface water or groundwater;
- ☐ Use only properly labeled pesticides; and
- ☐ Do not use pesticides within 100 feet of any spring, top of bank of any creek or seasonal stream, edge of lake, delineated wetland or vernal pool.

Cultural Pest Management Plan

Cultural pest management will include the interplanting of companion plants and border plantings of flowering perennials that attract pest predators and/or deter pests.

Appendix C.

Site Documentation			
State License #	**County License #**	**Assessor's Parcel #**	**Farm Name**
LCA18-0015461	12679	081-051-013/014-000	Emerald Triangle Medicinals, LLC

Cannabis Waste Management Plan

Cannabis waste for this operation will be processed onsite (composted) as indicated on the Property Diagram.

Compost Facility Design

- Site must meet 200-foot setbacks[1] from any watercourse, wetland, spring or groundwater well.
- Site must not exceed 750 square feet.
- Site must be contained[2] to prevent surface runoff from leaving the site.
- Site must facilitate the infiltration of tailwater[3].
- Site must be monitored and maintained[5] to ensure the functionality of the composting process. These elements include but are not limited to:
  - temperature, moisture content, carbon to nitrogen ratio, and oxygen content.

Site Assessment	
Distance from nearest water feature.	>200-feet
Average slope.	1%
Distance from cultivation site.	50-feet
Site footprint (square feet).	200
Containment strategy.	Wattle
Infiltration strategy.	Swale and mulch
Type of composting system.	Static
Additives.	Straw
Amendments.	Straw

Setbacks[1]: If 200-feet is not possible then site must have redundant systems of discharge prevention and nutrient processing.
Contained[2]: Containment includes wattles, straw bales, berms, swales or vegetative buffer strips.
Infiltration of tailwater[3]: Stormwater should be excluded from the site (tarp, roof) as much as possible; however, redundant systems to infiltrate any tailwater (stormwater that has left the site) must be remediated and infiltrated.
Exclusionary fencing[4]: Fencing that excludes wildlife, domestic animals and unauthorized personnel.
Monitored and maintained[5]: Regularly scheduled monitoring for functionality and maintenance protocols (adding additives) to maintain functionality of the system. This includes keeping seasonal records of the composting process.

Composting Methods

Green waste will be placed in the designated area as shown on the applicant's site map. The applicant may follow the Procedure for Managing the Three-Bin Composting System (University of California UCCE Cooperative Extension). The following steps are recommended when using this procedure:

Appendix C.

1. Add yard waste to one of the end bins. Mix in "green" materials like grass clippings or other fresh plant waste with "brown" materials like dried leaves, wood chips or shredded branches.
2. If only a very little green waste is available, add about 1 cup of a fertilizer that contains some nitrogen, such as a 2-2-3 composted chicken manure or similar natural analysis fertilizer. Kitchen scraps or grass clippings will generally not need additional fertilizer since these already have a lot of nitrogen compared to carbon.
3. Add a layer of garden soil to introduce some of the microorganisms that do the composting.
4. Once the composting process is under way, it is not necessary to add more soil. Page-1
5. Check the temperature of the compost from time to time, ideally with a compost thermometer (see graphic). The pile should be warm in the middle. After the middle has reached 140 to 150^{o}F, turn the pile from the original bin into the adjacent center bin.
6. Close monitoring of the temperature is essential only for the most rapid composting since the process will go on at varying rates even if close attention is not given to temperature.
7. Additional yard waste can be placed on the recently turned compost, but turn the pile back into the original end bin when the temperature has been up around 150^{o}
8. Turning should be repeated whenever the temperature gets high enough. Over time, less frequent turning will be needed, and the composted material can be held in one of the end bins until you are ready to use it in the yard or garden.
9. Repeat the process using the vacant end bin and alternate turning between that bin and the center bin.
10. Use the compost in the original end bin until it is gone; then you can start the composting process again in the vacated end bin.
11. Once set up, the three-bin composting system will consist of one bin with yard waste being composted; one bin empty, to or from which the compost is turned; and one bin containing finished, or nearly finished, compost (see graphic).

Nearly 1 cubic yard of compost can be produced per bin in the three bin composting system. However, the rate of composting differs greatly according to the kinds of materials placed in the system and the precision with which you manage the composting process.

Title 14 of the California Code of Regulations at Chapter 3.1
Section 17855. Excluded Activities.

(a) Except as provided otherwise in this Chapter, the activities listed in this section do not constitute compostable material handling operations or facilities and are not required to meet the requirements set forth herein. Nothing in this section precludes the EA or the Department from inspecting an excluded activity to verify that the activity is being conducted in a manner that qualifies as an excluded activity or from taking any appropriate enforcement action.

(4) Composting green material, agricultural material, food material, and vegetative food material, alone or in combination, is an excluded activity if the total amount of feedstock and compost on-site at any one time does not exceed 100 cubic yards and 750 square feet.

§5055. Cannabis Waste Management

(a) A licensee may not sell cannabis waste.
(b) Licensees shall comply with all applicable waste management laws including, but not limited to, Division 30 of the Public Resources Code.
(c) A licensee shall dispose of cannabis waste in a secured waste receptacle or in a secured area on the licensed premises. For the purposes of this section, “secure waste receptacle” or “secured area” means that physical access to the receptacle or area is restricted to the licensee and its employees and the local agency, local agency franchiser, or permitted private waste hauler. Public access to the designated receptacle or area is prohibited.
(d) If a licensee is composting cannabis waste on the licensed premises, a licensee shall do so in compliance with *Title 14 of the California Code of Regulations at Chapter 3.1* (commencing with Section 17850).
(e) If a local agency, a local agency franchiser, or permitted private waste hauler is being used to collect and process cannabis waste, a licensee shall do all the following:

(1) Provide the Bureau with the name of the entity hauling the waste;
(2) Obtain documentation from the entity hauling the waste that indicates the date and time of each collection of cannabis waste at the licensed premises; and
(3) Obtain a copy of the certified weight ticket, or other documentation prepared by the entity hauling the waste confirming receipt of the cannabis waste.

(f) If a licensee is self-hauling cannabis waste to one, or more, of the solid waste facilities in subsection (e)(3) of this section, a licensee shall obtain for each delivery of cannabis waste by the licensee a copy of a certified weight ticket or receipt documenting delivery from the solid waste facility. Only the licensee or its employees may transport self-hauled cannabis waste.

Authority: Section 26013, Business and Professions Code. Reference: Section 26070, Business and Professions Code.

Title 14 of the California Code of Regulations at Chapter 3.1
Section 17867. General Operating Standards.

(a) All compostable materials handling operations and facilities shall meet the following requirements:
(1) All handling activities are prohibited from composting any material specified in section 17855.2 of this Chapter.
(2) All handling activities shall be conducted in a manner that minimizes odor impacts so as to not cause a nuisance.
(3) All handling activities shall be conducted in a manner that minimizes vectors, litter, hazards, nuisances, and noise impacts; and minimizes human contact with, inhalation, ingestion, and transportation of dust, particulates, and pathogenic organisms.
(4) Random load checks of feedstocks, additives, and amendments for contaminants shall be conducted.
(5) Contamination of compostable materials that has undergone pathogen reduction, pursuant to section 17868.3 of this Chapter, with feedstocks, compost, or wastes that have not undergone pathogen reduction, pursuant to section 17868.3 of this Chapter, or additives shall be prevented.
(6) Unauthorized human or animal access to the facility shall be prevented.
(7) Traffic flow into, on, and out of the composting operation or facility shall be controlled in a safe manner.
(9) The operator shall provide fire prevention, protection and control measures, including, but not limited to, temperature monitoring of windrows and piles, adequate water supply for fire suppression, and the isolation of potential ignition sources from combustible materials. Firelanes shall be provided to allow fire control equipment access to all operation areas.
(10) The operator shall provide telephone or radio communication capability for emergency purposes.
(11) Physical Contaminants and refuse removed from feedstock, compost, or chipped and ground material shall be removed from the site within 7 days and transported to an appropriate facility.
(12) Enclosed operations and facilities shall provide ventilation to prevent adverse public health effects from decomposition gases.
(13) The operator shall ensure that leachate is controlled to prevent contact with the public.
(14) The operator shall prevent or remove physical contaminants in compost and chipped and ground materials that may cause injury to humans.

Definitions

(1) "Active Compost" means compost feedstock that is in the process of being rapidly decomposed and is unstable. Active compost is generating temperatures of at least 50 degrees Celsius (122 degrees Fahrenheit) during decomposition; or is releasing carbon dioxide at a rate of at least 15 milligrams per gram of compost per day, or the equivalent of oxygen uptake.
(2) "Additives" means material mixed with feedstock or active compost in order to adjust the moisture level, carbon to nitrogen ratio, or porosity to create a favorable condition. Additives include, but are not limited to, fertilizers and urea. Additives do not include septage, biosolids, or compost feedstock.
(3) "Aerated Static Pile" means a composting process that uses an air distribution system to either blow or draw air through the pile. Little or no pile agitation or turning is performed.
(4) "Aerobic Decomposition" means the biological decomposition of organic substances in the presence of oxygen.
(4.5) “Agricultural By-Product Material” means post-harvest agricultural by-products separated at a processing facility.
(A) Agricultural By-product Material includes, but is not limited to, solid or semi-solid materials from fruit, nut, cotton, and vegetable processing facilities such as stems, leaves, seeds, nut hulls and shells, peels, and off-grade, over-ripe, or under-ripe produce.
(B) Agricultural By-product Material does not contain packaging material, physical contaminants, or hazardous materials, and does not include wastewater, sludges, or additives.

Appendix C.

(5) "Agricultural Material" means waste material of plant or animal origin, which results directly from the conduct of agriculture, animal husbandry, horticulture, aquaculture, silviculture, vermiculture, viticulture and similar activities undertaken for the production of food or fiber for human or animal consumption or use, which is separated at the point of generation, and which contains no other solid waste. With the exception of grape pomace or material generated during nut or grain hulling, shelling, and processing, agricultural material has not been processed except at its point of generation and has not been processed in a way that alters its essential character as a waste resulting from the production of food or fiber for human or animal consumption or use. Material that is defined in this section 17852 as “food material” or “vegetative food material” is not agricultural material. Agricultural material includes, but is not limited to, manures, orchard and vineyard prunings, grape pomace, and crop residues.

(7) "Amendments" means materials added to stabilized or cured compost to provide attributes for certain compost products, such as product bulk, product nutrient value, product pH, and soils blend. Amendments do not include septage, biosolids, or compost feedstock.

(8) "Anaerobic Decomposition" means the biological decomposition of organic substances in the absence of oxygen.

(11) "Compostable Material" means any organic material that when accumulated will become active compost as defined in section 17852(a)(1).

(13) "Curing" means the final stage of the composting process that occurs after compost has undergone pathogen reduction, as described in section 17868.3, and after most of the readily metabolized material has been decomposed.

(17) "Enclosed Composting Process" means a composting process where the area that is used for the processing, composting, stabilizing, and curing of organic materials, is covered on all exposed sides and rests on a stable surface with environmental controls for moisture and airborne emissions present.

(20) "Food Material" means a waste material of plant or animal origin that results from the preparation or processing of food for animal or human consumption and that is separated from the municipal solid waste stream. Food material includes, but is not limited to, food waste from food facilities as defined in Health and Safety Code section 113789 (such as restaurants), food processing establishments as defined in Health and Safety Code section 111955, grocery stores, institutional cafeterias (such as, prisons, schools and hospitals) and residential food scrap collection. Food material does not include any material that is required to be handled only pursuant to the California Food and Agricultural Code and regulations adopted pursuant thereto.

(A) “Vegetative Food Material" means that fraction of food material, defined above, that is a plant material and is separated from other food material and the municipal solid waste stream. Vegetative food material may be processed or cooked but must otherwise retain its essential natural character and no salts, preservatives, fats or oils, or adulterants shall have been added. Vegetative food material includes, but is not limited to, fruits and vegetables, edible flowers and plants, outdated and spoiled produce, and coffee grounds. Vegetative food material contains no greater than 1.0 percent of physical contaminants by dry weight, and meets the requirements of section 17868.5.

(21) "Green Material" means any plant material except food material and vegetative food material that is separated at the point of generation, contains no greater than 1.0 percent of physical contaminants by dry weight, and meets the requirements of section 17868.5. Green material includes, but is not limited to tree and yard trimmings, untreated wood wastes, natural fiber products, wood waste from silviculture and manufacturing, and construction and demolition wood waste. Green material does not include food material, vegetative food material, biosolids, mixed material, material separated from commingled solid waste collection or processing, wood containing lead-based paint or wood preservative, or mixed construction and demolition debris. Agricultural material, as defined in this section 17852(a)(5), that meets this definition of “green material” may be handled as either agricultural material or green material.

(32) "Physical Contamination" or "Contaminants" means human-made inert material contained within compostable material, digestate, or compost, including, but not limited to, glass, metal, and plastic.

(37) "Static Pile" means a composting process that is similar to the aerated static pile except that the air source may or may not be controlled.

(40) "Windrow Composting Process" means the process in which compostable material is placed in elongated piles. The piles or "windrows" are aerated and/or mechanically turned on a periodic basis.

(43) "Yard Trimmings" means any wastes generated from the maintenance or alteration of public, commercial or residential landscapes including, but not limited to, yard clippings, leaves, tree trimmings, prunings, brush, and weeds.

Waste and Materials Management

a. Solid Waste Management

Solid waste deposal, storage, compost and recycling will be conducted in compliance with Humboldt County Municipal Code. The applicant delivers solid waste as needed to the Eureka Transfer Station. The solid waste is stored based on specific materials protocols. Domestic waste and recyclables would be stored and disposed of at the Eureka Transfer Station. All materials are secured from wildlife.

b. Hazardous Materials Management

Hazardous waste would be restricted to the materials outlined in the fertilizers, amendments, and pesticides data and use table as well as materials associated with domestication and property management. All hazardous waste would be hauled to the Eureka Transfer Station. The applicant does not manufacture cannabis at the site. Fertilizers would be natural or organic if possible, and future use of repellants, insecticides, and fungicides will include products that are exempt from tolerance requirements, per California Food and Agriculture Code, Division 6 Pest Control Operations and Division 7 Agriculture Chemical; Chapter 1 – 3.6 and California Code of Regulations, Division 6 Pest Control Operations.

Spill Prevention Protocols

1. Hazardous materials will be transported in approved containers with secondary containment.
2. Hazardous materials will be transferred by individuals who are familiar with the specific MSDS requirements.
3. Hazardous materials must be stored in a secure structure. Agricultural-based materials must be stored in a separate facility from gas, oil and other domestic based chemicals.
4. Materials Safety Data Sheets must be posted and appropriate spill kits must be stored in the corresponding storage facility.
5. All hazardous materials must be stored in secondary containment.
6. Power equipment that requires gas/oil should be kept in good working condition. The refueling and maintenance of power equipment should take place in the corresponding storage or maintenance facility.
7. Power equipment such as gasoline/diesel generators must be placed in certified secondary containment under a secure structure.
8. Appropriate fire suppression must be associated with all material storage facilities that store flammable materials.

Spill Clean Up Protocol (liquids)

1. Applicator should wear gloves, safety goggles, and a dust mask during cleanup.
2. Reference the associated MSDS for specific cleanup protocols.
3. Confine the leaking or spilled container to secondary containment.
4. Spread clay-based, “clumping kitty-litter” on the spill site at a rate of 1/2”-thick.
5. Allow litter to dry.
6. Use a flat-nosed shovel and broom to pickup the dry litter and double bag it.

7. Take to a licensed hazardous waste disposal facility.

Spill Clean Up Protocol (solids)

1. Applicator should wear gloves, safety goggles, and a dust mask during cleanup.
2. Reference the associated MSDS for specific cleanup protocols.
3. Confine the leaking or spilled container to secondary containment.
4. Use a flat-nosed shovel and broom to pickup the dry material.
5. Repackage materials that are safe to still use or take to a licensed hazardous waste disposal facility.

c. Bulk Agricultural Materials

The following protocols identify how bulk materials will be stored, mixed applied and how empty containers will be disposed of.

1. Areas will be outside of the minimum setbacks from surface water.
2. Materials for containment, covering and the clean up of bulk materials will be onsite prior to delivery.
3. Individuals responsible for receiving deliveries, storing, mixing and applying materials will be familiar with the specific MSDS requirements.
4. Materials will be stored, mixed and applied per manufactures recommendations.
5. Delivery sites will be cleaned and secured after materials are deployed per specific clean up protocols.
6. Empty containers will be returned, recycled or disposed of based on manufacturers recommendations.

Soil Map—Humboldt County, South Part, California

Map Scale: 1:614 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Humboldt County, South Part, California
Survey Area Data: Version 7, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Nov 6, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
187	Pepperwood-Shivelyflat complex, 0 to 2 percent slopes	1.6	100.0%
Totals for Area of Interest		**1.6**	**100.0%**

Humboldt County, South Part, California

187—Pepperwood-Shivelyflat complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1v5w3
Elevation: 50 to 490 feet
Mean annual precipitation: 40 to 70 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pepperwood and similar soils: 60 percent
Shivelyflat and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pepperwood

Setting

Landform: Flood-plain steps
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sedimentary sources

Typical profile

Ap - 0 to 8 inches: fine sandy loam
C1 - 8 to 16 inches: fine sandy loam
C2 - 16 to 28 inches: very fine sandy loam
C3 - 28 to 31 inches: very fine sandy loam
Ab1 - 31 to 50 inches: loam
Ab2 - 50 to 55 inches: silt loam
C4 - 55 to 79 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 20 to 39 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Shivelyflat

Setting

Landform: Flood-plain steps
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sedimentary sources

Typical profile

Ap - 0 to 9 inches: silt loam
A1 - 9 to 18 inches: silt loam
A2 - 18 to 28 inches: silt loam
C1 - 28 to 47 inches: very fine sandy loam
C2 - 47 to 63 inches: very fine sandy loam
C3 - 63 to 71 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Eelriver

Percent of map unit: 5 percent
Landform: Flood-plain steps
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Cottoneva

Percent of map unit: 3 percent
Landform: Flood-plain steps
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Weott

Percent of map unit: 2 percent
Landform: Depressions, flood-plain steps, backswamps
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Humboldt County, South Part, California
Survey Area Data: Version 7, Sep 13, 2018

SECTION 2 – REQUIREMENTS RELATED TO WATER DIVERSIONS AND WASTE DISCHARGE FOR CANNABIS CULTIVATION

The following Requirements apply to any water diversion or waste discharge related to cannabis cultivation.

No.	TERM
Land Development and Maintenance, Erosion Control, and Drainage Features	
Limitations on Earthmoving	
1.	Cannabis cultivators shall not conduct grading activities for cannabis cultivation land development or alteration on slopes exceeding 50 percent grade, or as restricted by local county or city permits, ordinances, or regulations for grading, agriculture, or cannabis cultivation; whichever is more stringent shall apply. The grading prohibition on slopes exceeding 50 percent does not apply to site mitigation or remediation if the cannabis cultivator is issued separate WDRs or an enforcement order for the activity by the Regional Water Board Executive Officer.
2.	Finished cut and fill slopes, including side slopes between terraces, shall not exceed slopes of 50 percent and should conform to the natural pre-grade slope whenever possible.
3.	Cannabis cultivators shall not drive or operate vehicles or equipment within the riparian setbacks or within waters of the state unless authorized under 404/401 CWA permits, a CDFW LSA Agreement, coverage under the Cannabis General Order water quality certification, or site-specific WDRs issued by the Regional Water Board. This requirement does not prohibit driving on established, maintained access roads that are in compliance with this Policy.
4.	Cannabis cultivation land development and access road construction shall be designed by qualified professionals. Cannabis cultivators shall conduct all construction or land development activities to minimize grading, soil disturbance, and disturbance to aquatic and terrestrial habitat.
5.	The cannabis cultivator shall control all dust related to cannabis cultivation activities to ensure dust does not produce sediment-laden runoff. The cannabis cultivator shall implement dust control measures, including, but not limited to, pre-watering of excavation or grading sites, use of water trucks, track-out prevention, washing down vehicles or equipment before leaving a site, and prohibiting land disturbance activities when instantaneous wind speeds (gusts) exceed 25 miles per hour. Cannabis cultivators shall grade access roads in dry weather while moisture is still present in soil to minimize dust and to achieve design soil compaction, or when needed use a water truck to control dust and soil moisture.
Construction Equipment Use and Limitations	

6.	Cannabis cultivators shall employ spill control and containment practices to prevent the discharge of fuels, oils, solvents and other chemicals to soils and waters of the state.
7.	Cannabis cultivators shall stage and store equipment, materials, fuels, lubricants, solvents, or hazardous or toxic materials in locations that minimize the potential for discharge to waters of the state. At a minimum, the following measures shall be implemented: 1. Designate an area outside the riparian setback for equipment storage, short-term maintenance, and refueling. Cannabis cultivator shall not conduct any maintenance activity or refuel equipment in any location where the petroleum products or other pollutants may enter waters of the state as per Fish and Game Code section 5650 (a)(1). 2. Frequently inspect equipment and vehicles for leaks. 3. Immediately clean up leaks, drips, and spills. Except for emergency repairs that are necessary for safe transport of equipment or vehicles to an appropriate repair facility, equipment or vehicle repairs, maintenance, and washing onsite is prohibited. 4. If emergency repairs generate waste fluids, ensure they are contained and properly disposed or recycled off-site. 5. Properly dispose of all construction debris off-site. 6. Use dry cleanup methods (e.g., absorbent materials, cat litter, and/or rags) whenever possible. Sweep up, contain, and properly dispose of spilled dry materials.
Erosion Control	
8.	The cannabis cultivator shall use appropriate erosion control measures to minimize erosion of disturbed areas, potting soil, or bulk soil amendments to prevent discharges of waste. Fill soil shall not be placed where it may discharge into surface water. If used, weed-free straw mulch shall be applied at a rate of two tons per acre of exposed soils and, if warranted by site conditions, shall be secured to the ground.
9.	The cannabis cultivator shall not plant or seed noxious weeds. Prohibited plant species include those identified in the California Invasive Pest Plant Council's database, available at: www.cal-ipc.org/paf/. Locally native, non-invasive, and non-persistent grass species may be used for temporary erosion control benefits to stabilize disturbed land and prevent exposure of disturbed land to rainfall. Nothing in this term may be construed as a ban on cannabis cultivation that complies with the terms of this Policy.
10.	Cannabis cultivators shall incorporate erosion control and sediment detention devices and materials into the design, work schedule, and implementation of the cannabis cultivation activities. The erosion prevention and sediment capture measures shall be effective in protecting water quality. • Interim erosion prevention and sediment capture measures shall be implemented within seven days of completion of grading and land disturbance activities, and

	shall consist of erosion prevention measures and sediment capture measures including: ○ Erosion prevention measures are required for any earthwork that uses heavy equipment (e.g., bulldozer, compactor, excavator, etc.). Erosion prevention measures may include surface contouring, slope roughening, and upslope storm water diversion. Other types of erosion prevention measures may include mulching, hydroseeding, tarp placement, revegetation, and rock slope protection. ○ Sediment capture measures include the implementation of measures such as gravel bag berms, fiber rolls, straw bale barriers, properly installed silt fences, and sediment settling basins. • Long-term erosion prevention and sediment capture measures shall be implemented as soon as possible and prior to the onset of fall and winter precipitation. Long-term measures may include the use of heavy equipment to reconfigure access roads or improve access road drainage, installation of properly-sized culverts, gravel placement on steeper grades, and stabilization of previously disturbed land. • Maintenance of all erosion protection and sediment capture measures is required year round. Early monitoring allows for identification of problem areas or underperforming erosion or sediment control measures. Verification of the effectiveness of all erosion prevention and sediment capture measures is required as part of winterization activities.
11.	Cannabis cultivators shall only use geotextiles, fiber rolls, and other erosion control measures made of loose-weave mesh (e.g., jute, coconut (coir) fiber, or from other products without welded weaves). To minimize the risk of ensnaring and strangling wildlife, cannabis cultivators shall not use synthetic (e.g., plastic or nylon) monofilament netting materials for erosion control for any cannabis cultivation activities. This prohibition includes photo- or bio-degradable plastic netting.
12.	Cultivation sites constructed on or near slopes with a slope greater than or equal to 30 percent shall be inspected for indications of instability. Indications of instability include the occurrence of slope failures at nearby similar sites, weak soil layers, geologic bedding parallel to slope surface, hillside creep (trees, fence posts, etc. leaning downslope), tension cracks in the slope surface, bulging soil at the base of the slope, and groundwater discharge from the slope. If indicators of instability are present, the cannabis cultivator shall consult with a qualified professional to design measures to stabilize the slope to prevent sediment discharge to surface waters.
13.	For areas outside of riparian setbacks or for upland areas, cannabis cultivators shall ensure that rock placed for slope protection is the minimum amount necessary and is part of a design that provides for native plant revegetation. If retaining walls or other structures are required to provide slope stability, they shall be designed by a qualified professional.
14.	Cannabis cultivators shall monitor erosion control measures during and after each storm event that produces at least 0.5 in/day or 1.0 inch/7 days of precipitation, and repair or replace, as needed, ineffective erosion control measures immediately.

Access Road/Land Development and Drainage	
15.	Access roads shall be constructed consistent with the requirements of California Code of Regulations Title 14, Chapter 4. The Road Handbook describes how to implement the regulations and is available at <http://www.pacificwatershed.com/PWA-publications-library>. Existing access roads shall be upgraded to comply with the Road Handbook.
16.	Cannabis cultivators shall obtain all required permits and approvals prior to the construction of any access road constructed for cannabis cultivation activities. Permits may include section 404/401 CWA permits, Regional Water Board WDRs (when applicable), CDFW LSA Agreement, and county or local agency permits.
17.	Cannabis cultivators shall ensure that all access roads are hydrologically disconnected to receiving waters to the extent possible by installing disconnecting drainage features, increasing the frequency of (inside) ditch drain relief as needed, constructing out-sloped roads, constructing energy dissipating structures, avoiding concentrating flows in unstable areas, and performing inspection and maintenance as needed to optimize the access road performance.
18.	New access road alignments should be constructed with grades (slopes) of 3- to 8-percent, or less, wherever possible. Forest access roads should generally be kept below 12-percent except for short pitches of 500 feet or less where road slopes may go up to 20-percent. These steeper access road slopes should be paved or rock surfaced and equipped with adequate drainage. Existing access roads that do not comply with these limits shall be inspected by a qualified professional to determine if improvements are needed.
19.	Cannabis cultivators shall decommission or relocate existing roads away from riparian setbacks whenever possible. Roads that are proposed for decommissioning shall be abandoned and left in a condition that provides for long-term, maintenance-free function of drainage and erosion controls. Abandoned roads shall be blocked to prevent unauthorized vehicle traffic.
20.	If site conditions prohibit drainage structures (including rolling dips and ditch-relief culverts) at adequate intervals to avoid erosion, the cannabis cultivator shall use bioengineering techniques[12] as the preferred measure to minimize erosion (e.g., live fascines). If bioengineering cannot be used, then engineering fixes such as armoring (e.g., rock of adequate size and depth to remain in place under traffic and flow conditions) and velocity dissipaters (e.g., gravel-filled "pillows" in an inside ditch to trap sediment) may be used for problem sites. The maximum distance between water breaks shall not exceed those defined in the Road Handbook.
21.	Cannabis cultivators shall have a qualified professional design the optimal access road alignment, surfacing, drainage, maintenance requirements, and spoils handling

[12] A Primer on Stream and River Protection for the Regulator and Program Manager: Technical Reference Circular W.D. 02-#1, San Francisco Bay Region, California Regional Water Board (April 2003) http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stream_wetland/streamprotectioncircular.pdf.

	procedures.
22.	Cannabis cultivators shall ensure that access road surfacing, especially within a segment leading to a waterbody, is sufficient to minimize sediment delivery to the wetland or waterbody and maximize access road integrity. Road surfacing may include pavement, chip-seal, lignin, rock, or other material appropriate for timing and nature of use. All access roads that will be used for winter or wet weather hauling/traffic shall be surfaced. Steeper access road grades require higher quality rock (e.g., crushed angular versus river-run) to remain in place. The use of asphalt grindings is prohibited.
23.	Cannabis cultivators shall install erosion control measures on all access road approaches to surface water diversion sites to reduce the generation and transport of sediment to streams.
24.	Cannabis cultivators shall ensure that access roads are out-sloped whenever possible to promote even drainage of the access road surface, prevent the concentration of storm water flow within an inboard or inside ditch, and to minimize disruption of the natural sheet flow pattern off a hill slope to a stream.
25.	If unable to eliminate inboard or inside ditches, the cannabis cultivator shall ensure adequate ditch relief culverts to prevent down-cutting of the ditch and to reduce water runoff concentration, velocity, and erosion. Ditches shall be designed and maintained as recommended by a qualified professional. To avoid point-source discharges, inboard ditches and ditch relief culverts shall be discharged onto vegetated or armored slopes that are designed to dissipate and prevent runoff channelization. Inboard ditches and ditch relief culverts shall be designed to ensure discharges into natural stream channels or watercourses are prevented.
26.	Cannabis cultivators shall ensure that access roads are not allowed to develop or show evidence of significant surface rutting or gullying. Cannabis cultivators shall use water bars and rolling dips as designed by a qualified professional to minimize access road surface erosion and dissipate runoff.
27.	Cannabis cultivators shall only grade ditches when necessary to prevent erosion of the ditch, undermining of the banks, or exposure of the toe of the cut slope to erosion. Cannabis cultivators shall not remove more vegetation than necessary to keep water moving, as vegetation prevents scour and filters out sediment.
28.	Access road storm water drainage structures shall not discharge onto unstable slopes, earthen fills, or directly to a waterbody. Drainage structures shall discharge onto stable areas with straw bales, slash, vegetation, and/or rock riprap.
29.	Sediment control devices (e.g., check dams, sand/gravel bag barriers, etc.) shall be used when it is not practical to disperse storm water before discharge to a waterbody. Where potential discharge to a wetland or waterbody exists (e.g., within 200 feet of a waterbody) access road surface drainage shall be filtered through vegetation, slash, other appropriate material, or settled into a depression with an outlet with adequate drainage. Sediment basins shall be engineered and properly sized to allow sediment settling, spillway stability, and maintenance activities.

Drainage Culverts (See also Watercourse Crossings)	
30.	Cannabis cultivators shall regularly inspect ditch-relief culverts and clear them of any debris or sediment. To reduce ditch-relief culvert plugging by debris, cannabis cultivators shall use 15- to 24-inch diameter pipes, at minimum. In forested areas with a potential for woody debris, a minimum 18-inch diameter pipe shall be used to reduce clogging. Ditch relief culverts shall be designed by a qualified professional based on site-specific conditions.
31.	Cannabis cultivators shall ensure that all permanent watercourse crossings that are constructed or reconstructed are capable of accommodating the estimated 100-year flood flow, including debris and sediment loads. Watercourse crossings shall be designed and sized by a qualified professional.
Cleanup, Restoration, and Mitigation	
32.	Cannabis cultivators shall limit disturbance to existing grades and vegetation to the actual site of the cleanup or remediation and any necessary access routes.
33.	Cannabis cultivators shall avoid damage to native riparian vegetation. All exposed or disturbed land and access points within the stream and riparian setback with damaged vegetation shall be restored with regional native vegetation of similar native species. Riparian trees over four inches diameter at breast height shall be replaced by similar native species at a ratio of three to one (3:1). Restored areas must be mulched, using at least 2 to 4 inches of weed-free, clean straw or similar biodegradable mulch over the seeded area. Mulching shall be completed within 30 days after land disturbance activities in the areas cease. Revegetation planting shall occur at a seasonally appropriate time until vegetation is restored to pre-cannabis or pre-Legacy condition or better. Cannabis cultivators shall stabilize and restore any temporary work areas with native vegetation to pre-cannabis cultivation or pre-Legacy conditions or better. Vegetation shall be planted at an adequate density and variety to control surface erosion and re-generate a diverse composition of regional native vegetation of similar native species.
34.	Cannabis cultivators shall avoid damage to oak woodlands. Cannabis cultivator shall plant three oak trees for every one oak tree damaged or removed. Trees may be planted in groves in order to maximize wildlife benefits and shall be native to the local county.
35.	Cannabis cultivators shall develop a revegetation plan for: • All exposed or disturbed riparian vegetation areas, • any oak trees that are damaged or removed, and • temporary work areas. Cannabis cultivators shall develop a monitoring plan that evaluates the revegetation plan for five years. Cannabis cultivators shall maintain annual inspections for the purpose of assessing an 85 percent survival and growth of revegetated areas within a five-year period. The presence of exposed soil shall be documented for three years following revegetation work. If the revegetation results in less than an 85 percent success rate, the unsuccessful vegetation areas shall be replanted. Cannabis cultivators shall identify the location and extent of exposed soil associated with the site; pre- and post-revegetation

	work photos; diagram of all areas revegetated, the planting methods, and plants used; and an assessment of the success of the revegetation program. Cannabis cultivators shall maintain a copy of the revegetation plan and monitoring results onsite and make them available, upon request, to Water Boards staff or authorized representatives. An electronic copy of monitoring results is acceptable in Portable Document Format (PDF).
36.	Cannabis cultivators shall revegetate soil exposed as a result of cannabis cultivation activities with native vegetation by live planting, seed casting, or hydroseeding within seven days of exposure.
37.	Cannabis cultivators shall prevent the spread or introduction of exotic plant species to the maximum extent possible by cleaning equipment before delivery to the cannabis cultivation Site and before removal, restoring land disturbance with appropriate native species, and post-cannabis cultivation activities monitoring and control of exotic species. Nothing in this term may be construed as a ban on cannabis cultivation that complies with the terms of this Policy.
Stream Crossing Installation and Maintenance	
Limitations on Work in Watercourses and Permanently Ponded Areas	
38.	Cannabis cultivators shall obtain all applicable permits and approvals prior to doing any work in or around waterbodies or within the riparian setbacks. Permits may include section 404/401 CWA permits, Regional Water Board WDRs (when applicable), and a CDFW LSA Agreement.
39.	Cannabis cultivators shall avoid or minimize temporary stream crossings. When necessary, temporary stream crossings shall be located in areas where erosion potential and damage to the existing habitat is low. Cannabis cultivators shall avoid areas where runoff from access roadway side slopes and natural hillsides will drain and flow into the temporary crossing. Temporary stream crossings that impede fish passage are strictly prohibited on permanent or seasonal fish-bearing streams.
40.	Cannabis cultivators shall avoid or minimize use of heavy equipment[13] in a watercourse. If use is unavoidable, heavy equipment may only travel or work in a waterbody with a rocky or cobbled channel. Wood, rubber, or clean native rock temporary work pads shall be used on the channel bottom prior to use of heavy equipment to protect channel bed and preserve channel morphology. Temporary work pads and other channel protection shall be removed as soon as possible once the use of heavy equipment is complete.
41.	Cannabis cultivators shall avoid or minimize work in or near a stream, creek, river, lake, pond, or other waterbody. If work in a waterbody cannot be avoided, activities and associated workspace shall be isolated from flowing water by directing the water around the work site. If water is present, then the cannabis cultivator shall develop a site-specific plan prepared by a qualified professional. The plan shall consider partial or full stream diversion and dewatering. The plan shall consider the use of coffer dams upstream and downstream of the work site and the diversion of all flow from upstream of the upstream

[13] Heavy equipment is defined as large pieces of machinery or vehicles, especially those used in the building and construction industry (e.g., bulldozers, excavators, backhoes, bobcats, tractors, etc.).

	dam to downstream of the downstream dam, through a suitably sized pipe with intake screens that protect and prevent impacts to fish and wildlife. Cannabis cultivation activities and associated work shall be performed outside the waterbody from the top of the bank to the maximum extent possible.
Temporary Watercourse Diversion and Dewatering: All Live Watercourses	
42.	Cannabis cultivators shall ensure that coffer dams are constructed prior to commencing work and as close as practicable upstream and downstream of the work area. Cofferdam construction using offsite materials, such as clean gravel bags or inflatable dams, is preferred. Thick plastic may be used to minimize leakage, but shall be completely removed and properly disposed of upon work completion. If the coffer dams or stream diversion fail, the cannabis cultivator shall repair them immediately.
43.	When any dam or other artificial obstruction is being constructed, maintained, or placed in operation, the cannabis cultivator shall allow sufficient water at all times to pass downstream to maintain aquatic life below the dam pursuant to Fish and Game Code section 5937.
44.	If possible, gravity flow is the preferred method of water diversion. If a pump is used, the cannabis cultivator shall ensure that the pump is operated at the rate of flow that passes through the cannabis cultivation site. Pumping rates shall not dewater or impound water on the upstream side of the coffer dam. When diversion pipe is used it shall be protected from cannabis cultivation activities and maintained to prevent debris blockage.
45.	Cannabis cultivators shall only divert water such that water does not scour the channel bed or banks at the downstream end. Cannabis cultivator shall divert flow in a manner that prevents turbidity, siltation, and pollution and provides flows to downstream reaches. Cannabis cultivators shall provide flows to downstream reaches during all times that the natural flow would have supported aquatic life. Flows shall be of sufficient quality and quantity, and of appropriate temperature to support fish and other aquatic life both above and below the diversion. Block netting and intake screens shall be sized to protect and prevent impacts to fish and wildlife.
46.	Once water has been diverted around the work area, cannabis cultivators may dewater the site to provide an adequately dry work area. Any muddy or otherwise contaminated water shall be pumped to a settling tank, dewatering filter bag, or upland area, or to another location approved by CDFW or the appropriate Regional Water Board Executive Officer prior to re-entering the watercourse.
47.	Upon completion of work, cannabis cultivators shall immediately remove the flow diversion structure in a manner that allows flow to resume with a minimum of disturbance to the channel substrate and that minimizes the generation of turbidity.
Watercourse Crossings	
48.	Cannabis cultivators shall ensure that watercourse crossings are designed by a qualified professional.
49.	Cannabis cultivators shall ensure that all access road watercourse crossing structures allow for the unrestricted passage of water and shall be designed to accommodate the

	estimated 100-year flood flow and associated debris (based upon an assessment of the streams potential to generate debris during high flow events). Consult CAL FIRE 100 year Watercourse Crossings document for examples and design calculations, available at: http://calfire.ca.gov/resource_mgt/downloads/100%20yr%20revised%208-08-17%20(final-a).pdf.
50.	Cannabis cultivators shall ensure that watercourse crossings allow migration of aquatic life during all life stages supported or potentially supported by that stream reach. Design measures shall be incorporated to ensure water depth and velocity does not inhibit migration of aquatic life. Any access road crossing structure on watercourses that supports fish shall be constructed for the unrestricted passage of fish at all life stages, and should use the following design guidelines: • CDFW's *Culvert Criteria for Fish Passage;* • CDFW's *Salmonid Stream Habitat Restoration Manual, Volume 2, Part IX: Fish Passage Evaluation at Stream Crossings; and* • National Marine Fisheries Service, Southwest Region *Guidelines for Salmonid Passage at Stream Crossings.*
51.	Cannabis cultivators shall conduct regular inspection and maintenance of stream crossings to ensure crossings are not blocked by debris. Refer to California Board of Forestry Technical Rule No. 5 available at: http://www.calforests.org/wp-content/uploads/2013/10/Adopted-TRA5.pdf.
52.	Cannabis cultivators shall only use rock fords for temporary seasonal crossings on small watercourses where aquatic life passage is not required during the time period of use. Rock fords shall be oriented perpendicular to the flow of the watercourse and designed to maintain the range of surface flows that occur in the watercourse. When constructed, rock shall be sized to withstand the range of flow events that occur at the crossing and rock shall be maintained at the rock ford to completely cover the channel bed and bank surfaces to minimize soil compaction, rutting, and erosion. Rock must extend on either side of the ford up to the break in slope. The use of rock fords as watercourse crossings for all-weather access road use is prohibited.
53.	Cannabis cultivators shall ensure that culverts used at watercourse crossings are designed to direct flow and debris toward the inlet (e.g., use of wing-walls, pipe beveling, rock armoring, etc.) to prevent erosion of road fill, debris blocking the culvert, and watercourses from eroding a new channel.
54.	Cannabis cultivators shall regularly inspect and maintain the condition of access roads, access road drainage features, and watercourse crossings. At a minimum, cannabis cultivators shall perform inspections prior to the onset of fall and winter precipitation and following storm events that produce at least 0.5 in/day or 1.0 inch/7 days of precipitation. Cannabis cultivators are required to perform all of the following maintenance: • Remove any wood debris that may restrict flow in a culvert. • Remove sediment that impacts access road or drainage feature performance. Place any removed sediment in a location outside the riparian setbacks and stabilize the sediment. • Maintain records of access road and drainage feature maintenance and consider

	redesigning the access road to improve performance and reduce maintenance needs.
55.	Cannabis cultivators shall compact access road crossing approaches and fill slopes during installation and shall stabilize them with rock or other appropriate surface protection to minimize surface erosion. When possible, cannabis cultivators shall ensure that access roads over culverts are equipped with a critical dip to ensure that, if the culvert becomes blocked or plugged, water can flow over the access road surface without washing away the fill prism. Access road crossings where specific conditions do not allow for a critical dip or in areas with potential for significant debris accumulation, shall include additional measures such as emergency overflow culverts or oversized culverts that are designed by a qualified professional.
56.	Cannabis cultivators shall ensure that culverts used at watercourse crossings are: 1) installed parallel to the watercourse alignment to the extent possible, 2) of sufficient length to extend beyond stabilized fill/sidecast material, and 3) embedded or installed at the same level and gradient of the streambed in which they are being placed to prevent erosion.
Soil Disposal and Spoils Management	
57.	Cannabis cultivators shall store soil, construction, and waste materials outside the riparian setback except as needed for immediate construction needs. Such materials shall not be stored in locations of known slope instability or where the storage of construction or waste material could reduce slope stability.
58.	Cannabis cultivators shall separate large organic material (e.g., roots, woody debris, etc.) from soil materials. Cannabis cultivators shall either place the large organic material in long-term, upland storage sites, or properly dispose of these materials offsite.
59.	Cannabis cultivators shall store erodible soil, soil amendments, and spoil piles to prevent sediment discharges in storm water. Storage practices may include use of tarps, upslope land contouring to divert surface flow around the material, or use of sediment control devices (e.g., silt fences, straw wattles, etc.).
60.	Cannabis cultivators shall contour and stabilize stored spoils to mimic natural slope contours and drainage patterns (as appropriate) to reduce the potential for fill saturation and slope failure.
61.	For soil disposal sites cannabis cultivators shall: • revegetate soil disposal sites with a mix of native plant species, • cover the seeded and planted areas with mulched straw at a rate of two tons per acre, and • apply non-synthetic netting or similar erosion control fabric (e.g., jute) on slopes greater than 2:1 if the site is erodible.
62.	Cannabis cultivators shall haul away and properly dispose of excess soil and other debris as needed to prevent discharge to waters of the state.

Riparian and Wetland Protection and Management	
63.	Cannabis cultivators shall not disturb aquatic or riparian habitat, such as pools, spawning sites, large wood, or shading vegetation unless authorized under a CWA section 404 permit, CWA section 401 certification, Regional Water Board WDRs (when applicable), or a CDFW LSA Agreement.
64.	Cannabis cultivators shall maintain existing, naturally occurring, riparian vegetative cover (e.g., trees, shrubs, and grasses) in aquatic habitat areas to the maximum extent possible to maintain riparian areas for streambank stabilization, erosion control, stream shading and temperature control, sediment and chemical filtration, aquatic life support, wildlife support, and to minimize waste discharge.
Water Storage and Use	
Water Supply, Diversion, and Storage	
65.	Cannabis cultivators shall only install, maintain, and destroy wells in compliance with county, city, and local ordinances and with California Well Standards as stipulated in California Department of Water Resources Bulletins 74-90 and 74-81.[14]
66.	All water diversions for cannabis cultivation from a surface stream, subterranean stream flowing through a known and definite channel (e.g., groundwater well diversions from subsurface stream flows), or other surface waterbody are subject to the surface water Numeric and Narrative Instream Flow Requirements. This includes lakes, ponds, and springs (unless the spring is deemed exempt by the Deputy Director). See Section 3. Numeric and Narrative Instream Flow Requirements of this Attachment A for more information.
67.	Groundwater diversions may be subject to additional requirements, such as a forbearance period, if the State Water Board determines those requirements are reasonably necessary to implement the purposes of this Policy.
68.	Cannabis cultivators are encouraged to use appropriate rainwater catchment systems to collect from impermeable surfaces (e.g., roof tops, etc.) during the wet season and store storm water in tanks, bladders, or off-stream engineered reservoirs to reduce the need for surface water or groundwater diversions.
69.	Cannabis cultivators shall not divert surface water unless it is diverted in accordance with an existing water right that specifies, as appropriate, the source, location of the point of diversion, purpose of use, place of use, and quantity and season of diversion. Cannabis cultivators shall maintain documentation of the water right at the cannabis cultivation site. Documentation of the water right shall be available for review and inspection by the Water Boards, CDFW, and any other authorized representatives of the Water Boards or CDFW.

[14] California Well Standards are available at: http://www.water.ca.gov/groundwater/well_info_and_other/california_well_standards/well_standards_content.html.

70.	Cannabis cultivators shall ensure that all water diversion facilities are designed, constructed, and maintained so they do not prevent, impede, or tend to prevent the passing of fish, as defined by Fish and Game Code section 45, upstream or downstream, as required by Fish and Game Code section 5901. This includes but is not limited to the supply of water at an appropriate depth, temperature, and velocity to facilitate upstream and downstream aquatic life movement and migration. Cannabis cultivators shall allow sufficient water at all times to pass past the point of diversion to keep in good condition any fish that may be planted or exist below the point of diversion as defined by Fish and Game Code section 5937. Cannabis cultivators shall not divert water in a manner contrary to or inconsistent with these Requirements.
71.	Cannabis cultivators issued a Cannabis SIUR by the State Water Board shall not divert surface water unless in compliance with all additional Cannabis SIUR conditions required by CDFW.
72.	Water diversion facilities shall include satisfactory means for bypassing water to satisfy downstream prior rights and any requirements of policies for water quality control, water quality control plans, water quality certifications, waste discharge requirements, or other local, state or federal instream flow requirements. Cannabis cultivators shall not divert in a manner that results in injury to holders of legal downstream senior rights. Cannabis cultivators may be required to curtail diversions should diversion result in injury to holders of legal downstream senior water rights or interfere with maintenance of downstream instream flow requirements.
73.	Fuel powered (e.g., gas, diesel, etc.) diversion pumps shall be located in a stable and secure location outside of the riparian setbacks unless authorized under a 404/401 CWA permits, a CDFW LSA Agreement, coverage under the Cannabis General Order water quality certification, or site-specific WDRs issued by the Regional Water Board. Use of non-fuel powered diversion pumps (solar, electric, gravity, etc.) is encouraged. In all cases, all pumps shall: 1. be properly maintained, 2. have suitable containment to ensure any spills or leaks do not enter surface waterbodies or groundwater, and 3. have sufficient overhead cover to prevent exposure of equipment to precipitation.
74.	No water shall be diverted unless the cannabis cultivator is operating the water diversion facility with a CDFW-approved water-intake screen (e.g. fish screen). The water intake screen shall be designed and maintained in accordance with screening criteria approved by CDFW. The screen shall prevent wildlife from entering the diversion intake and becoming entrapped. The cannabis cultivator shall contact the regional CDFW Office, LSA Program for information on screening criteria for diversion(s).[15] The cannabis cultivator shall provide evidence that demonstrates that the water intake screen is in good condition whenever requested by the Water Boards or CDFW. Points of re-diversion from off-stream storage facilities that are open to the environment shall have a water intake screen, as required by CDFW.

[15] CDFW's Lake and Streambed program information is available at: https://www.wildlife.ca.gov/Conservation/LSA .

75.	Cannabis cultivators shall inspect, maintain, and clean water intake screens and bypass appurtenances as directed by CDFW to ensure proper operation for the protection of fish and wildlife.
76.	Cannabis cultivators shall not obstruct, alter, dam, or divert all or any portion of a natural watercourse prior to obtaining all applicable permits and approvals. Permits may include a valid water right, 404/401 CWA permits, a CDFW LSA Agreement, coverage under the Cannabis General Order water quality certification, or site-specific WDRs issued by the Regional Water Board.
77.	Cannabis cultivators shall plug, block, cap, disconnect, or remove the diversion intake associated with cannabis cultivation activities during the surface water forbearance period, unless the diversion intake is used for other beneficial uses, to ensure no water is diverted during that time.
78.	Cannabis cultivators shall not divert from a surface water or from a subterranean stream for cannabis cultivation at a rate more than a maximum instantaneous diversion rate of 10 gallons per minute, unless authorized under an existing appropriative water right.
82.	Onstream storage reservoirs are prohibited unless either: • The cannabis cultivator has an existing water right with irrigation as a designated use, issued prior to October 31, 2017, that authorizes the onstream storage reservoir, or • The cannabis cultivator obtains an appropriative water right permit with irrigation as a designated use prior to diverting water from an onstream storage reservoir for cannabis cultivation. Cannabis cultivators with a pending application or an unpermitted onstream storage reservoir shall not divert for cannabis cultivation until the cannabis cultivator has obtain a valid water right.
83.	Cannabis cultivators are encouraged to install separate storage systems for water diverted for cannabis irrigation and water diverted for any other beneficial uses,[16] or otherwise shall install separate measuring devices to quantify diversion to and from each storage facility, including the quantity of water diverted and the quantity, place, and purpose of use (e.g., cannabis irrigation, other crop irrigation, domestic, etc.) for the stored water.
84.	The cannabis cultivator shall install and maintain a measuring device(s) for surface water or subterranean stream diversions. The measuring device shall be, at a minimum equivalent to the requirements for direct diversions greater than 10 acre-feet per year in California Code of Regulations, Title 23, Division 3, Chapter 2.7[17]. The measuring device(s) shall be located as close to the point of diversion as reasonable. Cannabis cultivators shall maintain daily diversion records for water diverted for cannabis cultivation.

[16] Other beneficial uses of water include: domestic, irrigation, power, municipal, mining, industrial, fish and wildlife preservation and enhancement, aquaculture, recreational, stockwatering, water quality, frost protection, and heat control. (California Code of Regulations, Title 23 sections 659-672).

[17] Additional information on measuring devices may be found at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/diversion_use/water_use.shtml#measurement

	Cannabis cultivators shall maintain separate records that document the amount of water used for cannabis cultivation separated out from the amount of water used for other irrigation purposes and other beneficial uses of water (e.g., domestic, fire protection, etc.). Cannabis cultivators shall maintain daily diversion records at the cultivation site and shall make the records available for review or by request by the Water Boards CDFW, or any other authorized representatives of the Water Boards or CDFW. Daily diversion records shall be retained for a minimum of five years. Compliance with this term is required for any surface water diversion for cannabis cultivation, even those under 10 acre-feet per year.
85.	The State Water Board intends to develop and implement a basin-wide program for real-time electronic monitoring and reporting of diversions, withdrawals, releases and streamflow in a standardized format if and when resources become available. Such real-time reporting will be required upon a showing by the State Water Board that the program and the infrastructure are in place to accept real-time electronic reports. Implementation of the reporting requirements shall not necessitate amendment to this Requirement.
86.	Cannabis cultivators shall not use off-stream storage reservoirs and ponds to store water for cannabis cultivation unless they are sited and designed or approved by a qualified professional in compliance with Division of Safety of Dams (DSOD), county, and/or city requirements, as applicable. If the DSOD, county, and/or city do not have established requirements they shall be designed consistent with the Natural Resource Conservation Service National Engineering Manual. Reservoirs shall be designed with an adequate overflow outlet that is protected and promotes the dispersal and infiltration of flow and prevents channelization. All off-stream storage reservoirs and ponds shall be designed, managed, and maintained to accommodate average annual winter period precipitation and storm water inputs to reduce the potential for overflow. Cannabis cultivators shall plant native vegetation along the perimeter of the reservoir in locations where it does not impact the structural integrity of the reservoir berm or spillway. The cannabis cultivator shall control vegetation around the reservoir berm and spillway to allow for visual inspection of berm and spillway condition and control burrowing animals as necessary.
87.	Cannabis cultivators shall implement an invasive species management plan prepared by a Qualified Biologist for any existing or proposed water storage facilities that are open to the environment. The plan shall include, at a minimum, an annual survey for bullfrogs and other invasive aquatic species. If bullfrogs or other invasive aquatic species are identified, eradication measures shall be implemented under the direction of a qualified biologist, if appropriate after consultation with CDFW (pursuant to Fish and Game Code section 6400). Eradication methods can be direct or indirect. Direct methods may include hand-held dip net, hook and line, lights, spears, gigs, or fish tackle under a fishing license (pursuant to Fish and Game Code section 6855). An indirect method may involve seasonally timed complete dewatering and a drying period of the off-stream storage facility under a Permit to Destroy Harmful Species (pursuant to Fish and Game Code section 5501) issued by CDFW.
88.	Water storage bladders are not encouraged for long-term use. If bladders are used, the cannabis cultivator shall ensure that the bladder is designed and properly installed to store water and that the bladder is sited to minimize the potential for water to flow into a

	watercourse in the event of a catastrophic failure. If a storage bladder has been previously used, the cannabis cultivator shall carefully inspect the bladder to confirm its integrity and confirm the absence of any interior residual chemicals prior to resuming use. Cannabis cultivators shall periodically inspect water storage bladders and containment features to ensure integrity. Water storage bladders shall be properly disposed of or recycled and not resold when assurance of structural integrity is no longer guaranteed.
89.	Cannabis cultivators shall not use water storage bladders unless the bladder is safely contained within a secondary containment system with sufficient capacity to capture 110 percent of a bladder's maximum possible contents in the event of bladder failure (i.e., 110 percent of bladder's capacity). Secondary containment systems shall be of sufficient strength and stability to withstand the forces of released contents in the event of catastrophic bladder failure. In addition, secondary containment systems that are open to the environment shall be designed and maintained with sufficient capacity to accommodate precipitation and storm water inputs from a 25-year, 24-hour storm event.
90.	Cannabis cultivators shall not cause or allow any overflow from off-stream water storage facilities that are closed to the environment (e.g., tanks and bladders) if the off-stream facilities are served by a diversion from surface water or groundwater. Cannabis cultivators shall regularly inspect for and repair all leaks of the diversion and storage system.
91.	Water storage tanks, bladders, and other off-stream water storage facilities that are closed to the environment shall not be located in a riparian setback or next to equipment that generates heat. Cannabis cultivators shall place water storage tanks, bladders, and other off-stream water storage facilities that are closed to the environment in areas that allow for ease of installation, access, maintenance, and minimize road development.
92.	Cannabis cultivators shall install vertical and horizontal tanks according to manufacturer's specifications and shall place tanks on properly compacted soil that is free of rocks and sharp objects and capable of bearing the weight of the tank and its maximum contents with minimal settlement. Tanks shall not be located in areas of slope instability. Cannabis cultivators shall install water storage tanks capable of containing more than 8,000 gallons only on a reinforced concrete pad providing adequate support and enough space to attach a tank restraint system (anchor using the molded-in tie down lugs with moderate tension, being careful not to over-tighten) per the recommendations of a qualified professional.
93.	To prevent rupture or overflow and runoff, cannabis cultivators shall only use water storage tanks and bladders equipped with a float valve, or equivalent device, to shut off diversion when storage systems are full. Cannabis cultivators shall install any other measures necessary to prevent overflow of storage systems to prevent runoff and the diversion of more water than can be used and/or stored.
94.	Cannabis cultivators shall ensure that all vents and other openings on water storage tanks are designed to prevent the entry and/or entrapment of wildlife.

95.	Cannabis cultivators shall retain, for a minimum of five years, appropriate documentation for any hauled water[18] used for cannabis cultivation. Documentation for hauled water shall include, for each delivery, all of the following: 1. A receipt that shows the date of delivery and the name, address, license plate number, and license plate issuing state for the water hauler, 2. A copy of the Water Hauler's License (California Health and Safety Code section 111120), 3. A copy of proof of the Water Hauler's water right, groundwater well, or other authorization to take water, and the location of the water source, and 4. The quantity of water delivered or picked up from a water source, in gallons. Documentation shall be made available, upon request, to Water Boards or CDFW staff and any other authorized representatives of the Water Boards or CDFW.
Water Conservation and Use	
96.	Cannabis cultivators shall regularly inspect their entire water delivery system for leaks and immediately repair any leaky faucets, pipes, connectors, or other leaks.
97.	Cannabis cultivators shall use weed-free mulch in cultivation areas that do not have ground cover to conserve soil moisture and minimize evaporative loss.
98.	Cannabis cultivators shall implement water conserving irrigation methods (e.g., drip or trickle irrigation, micro-spray, or hydroponics).
99.	Cannabis cultivators shall maintain daily records of all water used for irrigation of cannabis. Daily records may be calculated by the use of a measuring device or, if known, by calculating the irrigation system rates and duration of time watered (e.g., irrigating for one hour twice per day using 50 half-gallon drips equates to 50 gallons per day (1*2*50*0.5) of water used for irrigation). Cannabis cultivators shall retain, for a minimum of 5 years, irrigation records at the cannabis cultivation site and shall make all irrigation records available for review by the Water Boards, CDFW and any other authorized representatives of the Water Boards or CDFW.
Irrigation Runoff	
100.	Cannabis cultivators shall regularly inspect for leaks in mainlines[19], laterals[20], in irrigation connections, sprinkler heads, or at the ends of drip tape and feeder lines and immediately repair any leaks found upon detection.
101.	The irrigation system shall be designed to include redundancy (e.g., safety valves) in the event that leaks occur, so that waste of water and runoff is prevented and minimized.
102.	Cannabis cultivators shall regularly replace worn, outdated, or inefficient irrigation system components and equipment to ensure a properly functioning, leak-free irrigation system at

[18] Water hauler means any person who hauls water in bulk by any means of transportation.
[19] Mainlines are pipes that go from the water source to the control valves.
[20] Laterals are the pipes between the control valve and the sprinkler heads.

	all times.
103.	Cannabis cultivators shall minimize irrigation deep percolation[21] by applying irrigation water at agronomic rates.
Fertilizers, Pesticides, and Petroleum Products	
104.	Cannabis cultivators shall not mix, prepare, over apply, or dispose of agricultural chemicals/products (e.g., fertilizers, pesticides[22], and other chemicals as defined in the applicable water quality control plan) in any location where they could enter the riparian setback or waters of the state. The use of agricultural chemicals inconsistently with product labeling, storage instructions, or DPR requirements for pesticide applications[23] is prohibited. Disposal of unused product and containers shall be consistent with labels.
105.	Cannabis cultivators shall keep and use absorbent materials designated for spill containment and spill cleanup equipment on-site for use in an accidental spill of fertilizers, petroleum products, hazardous materials, and other substances which may degrade waters of the state. The cannabis cultivator shall immediately notify the California Office of Emergency Services at 1-800-852-7550 and immediately initiate cleanup activities for all spills that could enter a waterbody or degrade groundwater.
106.	Cannabis cultivators shall establish and use a separate storage area for pesticides, and fertilizers, and another storage area for petroleum or other liquid chemicals (including diesel, gasoline, oils, etc.). All such storage areas shall comply with the riparian setback Requirements, be in a secured location in compliance with label instructions, outside of areas of known slope instability, and be protected from accidental ignition, weather, and wildlife. All storage areas shall have appropriate secondary containment structures, as necessary, to protect water quality and prevent spillage, mixing, discharge, or seepage.

[21] Deep percolation occurs when excess irrigation water is applied and percolates below the plant root zone.

[22] Pesticide is defined as follows:

- Per California Code of Regulations Title 3. Division 6. Section 6000:

  (a) Any substance or mixture of substances that is a pesticide as defined in the Food and Agricultural Code and includes mixtures and dilutions of pesticides;

  (b) As the term is used in Section 12995 of the California Food and Agricultural Code, includes any substance or product that the user intends to be used for the pesticidal poison purposes specified in Sections 12753 and 12758 of the Food and Agricultural Code.

- Per California Food and Agricultural Code section 12753(b), the term "Pesticide" includes any of the following: Any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in Section 12754.5, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever.
- In laymen's terms: "pesticide" includes: rodenticides, herbicides, insecticides, fungicides, and disinfectants.

[23] More information on DPR requirements is available at: http://www.cdpr.ca.gov/docs/legbills/laws_regulations.htm, http://www.cdpr.ca.gov/docs/county/cacltrs/penfltrs/penf2017/2017atch/attach0301.pdf, and http://www.cdpr.ca.gov/docs/cannabis/index.htm

	Storage tanks and containers must be of suitable material and construction to be compatible with the substances stored and conditions of storage, such as pressure and temperature.
107.	Throughout the wet season, Cannabis Cultivators shall ensure that any temporary storage areas have a permanent cover and side-wind protection or be covered during non-working days and prior to and during rain events.
108.	Cannabis cultivators shall only use hazardous materials[24] in a manner consistent with the product's label.
109.	Cannabis cultivators shall only keep hazardous materials in their original containers with labels intact, and shall store hazardous materials to prevent exposure to sunlight, excessive heat, and precipitation. Cannabis cultivators shall provide secondary containment for hazardous materials to prevent possible exposure to the environment. Disposal of unused hazardous materials and containers shall be consistent with the label.
110.	Cannabis cultivators shall only mix, prepare, apply, or load hazardous materials outside of the riparian setbacks.
111.	Cannabis cultivators shall not apply agricultural chemicals within 48 hours of a predicted rainfall event of 0.25 inches or greater with a probability greater than 50-percent. In the Lake Tahoe Hydrologic Unit, cannabis cultivators shall not apply agricultural chemicals within 48 hours of any weather pattern that is forecast to have a 30 percent or greater chance of precipitation greater than 0.1 inch per 24 hours. This requirement may be updated based on amendments to the Lahontan Regional Water Board construction storm water general order.
Fertilizers and Soils	
112.	To minimize infiltration and water quality degradation, Cannabis cultivators shall irrigate and apply fertilizer to consistent with the crop need (i.e., agronomic rate).
113.	When used, cannabis cultivators shall apply nitrogen to cannabis cultivation areas consistent with crop need (i.e., agronomic rate). Cannabis cultivators shall not apply nitrogen at a rate that may result in a discharge to surface water or groundwater that causes or contributes to exceedance of water quality objectives, and no greater than 319 pounds/acre/year unless plant tissue analysis performed by a qualified individual demonstrates the need for additional nitrogen application. The analysis shall be performed by an agricultural laboratory certified by the State Water Board's Environmental Laboratory Accreditation Program.
114.	Cannabis cultivators shall ensure that potting soil or soil amendments, when not in use, are placed and stored with covers, when needed, to protect from rainfall and erosion, to prevent discharge to waters of the state, and to minimize leaching of waste constituents into

[24] A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

	groundwater.
Pesticides and Herbicides	
115.	Cannabis cultivators shall not apply restricted materials, including restricted pesticides, or allow restricted materials to be stored at the cannabis cultivation site.
116.	Cannabis cultivators shall implement integrated pest management strategies where possible to reduce the need and use of pesticides and the potential for discharges to waters of the state.[25]
Petroleum Products and Other Chemicals	
117.	Cannabis cultivators shall only refuel vehicles or equipment outside of riparian setbacks. Cannabis cultivators shall inspect all equipment using oil, hydraulic fluid, or petroleum products for leaks prior to use and shall monitor equipment for leakage. Stationary equipment (e.g., motors, pumps, generators, etc.) and vehicles not in use shall be located outside of riparian setbacks. Spill and containment equipment (e.g., oil spill booms, sorbent pads, etc.) shall be stored onsite at all locations where equipment is used or staged.
118.	Cannabis cultivators shall store petroleum, petroleum products, and similar fluids in a manner that provides chemical compatibility, provides secondary containment, and protection from accidental ignition, the sun, wind, and rain.
119.	Use of an underground storage tank(s) for the storage of petroleum products is allowed if compliant with all applicable federal, state, and local laws; regulations; and permitting requirements.
Cultivation-Related Waste	
120.	Cannabis cultivators shall contain and regularly remove all debris and trash associated with cannabis cultivation activities from the cannabis cultivation site. Cannabis cultivators shall only dispose of debris and trash at an authorized landfill or other disposal site in compliance with state and local laws, ordinances, and regulations. Cannabis cultivators shall not allow litter, plastic, or similar debris to enter the riparian setback or waters of the state. Cannabis plant material may be disposed of onsite in compliance with any applicable CDFA license conditions.
121.	Cannabis cultivators shall only dispose or reuse spent growth medium (e.g., soil and other organic media) in a manner that prevents discharge of soil and residual nutrients and chemicals to the riparian setback or waters of the state. Spent growth medium shall be covered with plastic sheeting or stored in water tight dumpsters prior to proper disposal or reuse. Spent growth medium should be disposed of at an authorized landfill or other disposal site in compliance with state and local laws, ordinances, and regulations. Proper reuse of spent growth medium may include incorporation into garden beds or spreading on a stable surface and revegetating the surface with native plants. Cannabis cultivators shall use erosion control techniques, as needed, for any reused or stored spent growth medium

[25] https://www.epa.gov/safepestcontrol/integrated-pest-management-ipm-principles

	to prevent polluted runoff.
Refuse and Domestic Waste	
122.	Cannabis cultivators shall ensure that debris, soil, silt, bark, slash, sawdust, rubbish, creosote-treated wood, raw cement and concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to any life stage of fish and wildlife or their habitat (includes food sources) does not contaminate soil or enter the riparian setback or waters of the state.
123.	Cannabis cultivators shall not dispose of domestic wastewater unless it meets applicable local agency and/or Regional Water Board requirements. Cannabis cultivators shall ensure that human or animal waste is disposed of properly. Cannabis cultivators shall ensure onsite wastewater treatment systems (e.g., septic system) are permitted by the local agency or applicable Regional Water Board.
124.	If used, chemical toilets or holding tanks shall be maintained in a manner appropriate for the frequency and conditions of usage, sited in stable locations, and comply with the riparian setback Requirements.
Winterization	
125.	Cannabis cultivators shall implement all applicable Erosion Control and Soil Disposal and Spoils Management Requirements in addition to the Winterization Requirements below by the onset of the winter period.
126.	Cannabis cultivators shall block or otherwise close any temporary access roads to all motorized vehicles no later than the onset of the winter period each year.
127.	Cannabis cultivators shall not operate heavy equipment of any kind at the cannabis cultivation site during the winter period, unless authorized for emergency repairs contained in an enforcement order issued by the State Water Board, Regional Water Board, or other agency having jurisdiction.
128.	Cannabis cultivators shall apply linear sediment controls (e.g., silt fences, wattles, etc.) along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow length[26] at the frequency specified below.

Slope (percent)	Sheet Flow Length Not to Exceed (feet)
0 – 25	20
25 – 50	15
>50	10

[26] Sheet flow length is the length that shallow, low velocity flow travels across a site.

129.	Cannabis cultivators shall maintain all culverts, drop inlets, trash racks and similar devices to ensure they are not blocked by debris or sediment. The outflow of culverts shall be inspected to ensure erosion is not undermining the culvert. Culverts shall be inspected prior to the onset of fall and winter precipitation and following precipitation events that produce at least 0.5 in/day or 1.0 inch/7 days of precipitation to determine if maintenance or cleaning is required.
130.	Cannabis cultivators shall stabilize all disturbed areas and construction entrances and exits to control erosion and sediment discharges from land disturbance.
131.	Cannabis cultivators shall cover and berm all loose stockpiled construction materials (e.g., soil, spoils, aggregate, etc.) that are not actively (scheduled for use within 48 hours) being used as needed to prevent erosion by storm water. The cannabis cultivator shall have adequate cover and berm materials available onsite if the weather forecast indicates a probability of precipitation.
132.	Cannabis cultivators shall apply erosion repair and control measures to the bare ground (e.g., cultivation area, access paths, etc.) to prevent discharge of sediment to waters of the state.
133.	As part of the winterization plan approval process, the Regional Water Board may require cannabis cultivators to implement additional site-specific erosion and sediment control requirements if the implementation of the Requirements in this section do not adequately protect water quality.

BMPs for Site Maintenance and Operations (per standard conditions)

The following BMPs are intended to address compliance with the standard conditions. Individual or multiple BMPS may be selected to address compliance with a given standard condition depending on site-specific conditions. BMPs are considered enforceable conditions as applicable to a given site.

A. Site Maintenance, Erosion Control, Drainage Features

70. Drainage of roads, clearings, fill prisms, and terraced areas is critical to ensuring their integrity and to prevent or minimize sediment discharges to watercourses. Proper design and location of roads and other features is critical to ensuring that a road or other feature be adequately drained and is best accomplished through consultation with a qualified professional. If inspection identifies surface rills or ruts, surfacing and drainage likely needs maintenance.

71. Surfacing of exposed/disturbed/bare surfaces can greatly reduce erosion associated with runoff. BMP features such as vegetative ground cover, straw mulch, slash, wood chips, straw wattles, fiber rolls, hay bales, geotextiles, and filter fabric fences may be combined and implemented on exposed/disturbed/bare surfaces as appropriate to prevent or minimize sediment transport and delivery to surface waters. Non-invasive, non-persistent grass species (e.g. barley grass) may be used for their temporary erosion control benefits to stabilize bare slopes and prevent exposure of bare soils to rainfall. If utilized, straw mulch shall be applied at a rate of 2 tons per acre of exposed soils and, if warranted by site conditions, shall be secured to the ground. Consultation with a qualified professional is recommended for successful site-specific selection and implementation of such surface treatments. Guidance literature pertaining to such BMPs is referenced in section IV. of this document.

72. Road surfacing, especially within a segment leading to a watercourse, is critical to prevent and minimize sediment delivery to a watercourse and maintain road integrity for expected uses. Road surfacing can include pavement, chip-seal, lignin, rock, or other material appropriate for timing and nature of use. Steeper sections of road require higher quality rock (e.g. crushed angular versus river- run) to remain in place.

73. Road shaping to optimize drainage includes out-sloping and crowning; shaping can minimize reliance on inside ditches. Drainage structures can include rolling dips and water bars within the road surface and ditch-relief culverts to drain inside ditches. Adequate spacing of drainage structures is critical to reduce erosion associated with runoff. Generally speaking, steep slopes require greater frequency of drainage structures. The drainage structures shall be maintained to ensure capture of and capacity for expected flow. The outlets of the structures shall be placed in such a manner as to avoid discharge onto fill, unstable areas, or areas that can enter a watercourse. If site conditions prohibit drainage structures at an adequate interval to avoid erosion, bioengineering techniques2 are the preferred solution (e.g. live fascines), but other techniques may also be appropriate including armoring (i.e. rock of adequate size and depth to remain in place under traffic and flow conditions) and velocity dissipaters (e.g. gravel-filled “pillows” in an inside ditch to trap sediment). In the case that inside ditches need maintenance, grade ditches only when and where necessary, since frequent routine mechanical grading can cause erosion of the ditch, undermine banks, and expose the toe of the cutslope to erosion. Do not remove more leaves and vegetation than necessary to keep water moving, as vegetation prevents scour and filters out sediment.

74. Road drainage shall be discharged to a stable location away from a watercourse. Use sediment control devices, such as check dams, sand/gravel bag barriers, and other acceptable techniques, when it is neither practical nor environmentally sound to disperse ditch water immediately before the ditch reaches a stream. Within areas with potential to discharge to a watercourse (i.e. within riparian areas of at least 200 feet of a stream) road surface drainage shall be filtered through vegetation, slash, or other appropriate material or settled into a depression with an outlet with adequate drainage. Caution should always be exercised with catchment basins in the event of failure.

75. Any spoils associated with site maintenance shall be placed in a stable location where it cannot enter a watercourse. Sidecasting shall be minimized and shall be avoided on unstable areas or where it has the potential to enter a watercourse.

76. Do not sidecast when the material can enter the stream directly or indirectly as sediment. Sidecast material can indirectly enter the stream when placed in a position where rain or road runoff can later deliver it to a channel

that connects with the stream.

77. Disconnect road drainage from watercourses (drain to hill slopes), install drainage structures at intervals to prevent erosion of the inboard ditch or gull formation at the hill slope outfall, outslope roads.

78. Ditch-relief culverts shall also be inspected regularly, and cleared of debris and sediment. To reduce plugging, 15 to 24-inch diameter pipes shall be the minimum size considered for ditch relief culverts and shall be informed by site-specific conditions.

79. Grade ditches only when and where necessary, since frequent routine mechanical grading can cause erosion of the ditch, undermine banks, and expose the toe of the cutslope to erosion. Do not remove more grass and weeds than necessary to keep water moving, as vegetation prevents scour and filters out sediment.

80. Use sediment control devices, such as check dams, sand/gravel bag barriers, and other acceptable techniques, when it is neither practical nor environmentally sound to disperse ditch water immediately before the ditch reaches a stream.

B. Stream Crossing Maintenance

81. Proper maintenance of stream crossings is critical to ensure support of beneficial uses of water. Regular inspection and maintenance is necessary to identify, in a timely manner, if problems are occurring. Crossings include rock fords3, armored fills with culverts3, and bridges3.

82. Rock fords are appropriate when temporary and minor moisture or over-land flow is expected, not typically when a bed and bank is present; exceptions may be justified if warranted by site specific conditions. Additionally, rock fords are appropriate if aquatic life is not present. An adequate layer of crushed angular rock shall be maintained at rock fords such that soil compaction is minimized under expected traffic levels.

83. Stream crossings consisting of armored fills with culverts and bridges are appropriate for streams with defined bed and bank2. They shall be sized to ensure the 100-year streamflow event can pass unimpeded. Additionally, crossings shall allow migration of aquatic life during all life stages potentially supported by that stream reach; water depth and velocity can inhibit migration of adult and juvenile fish species.

84. Stream crossing design and installation is best accomplished with the assistance of a qualified professional. Site conditions can change over time (e.g. channel filling or incision); consultation with a qualified professional is appropriate to evaluate maintenance or replacement needs and opportunities.

85. Regular inspection of the stream crossing is appropriate to identify changed conditions within the stream channel (e.g., bank erosion, headward incision, and channel filling).

86. The roadway adjacent to and over the crossing is an area of potential discharge. All road surfaces approaching a crossing shall be drained before the crossing, adequately filtered through vegetation or other material, and not discharged to a watercourse. If turbid water is discharged at a stream crossing, additional measures to control erosion at the source(s) or to remove sediment prior to discharge shall be implemented. Road surfaces shall be of rock, pavement, or other material appropriate for type and level of use.

87. If a culvert is used, the approaches and fill slopes shall be properly compacted during installation and shall be stabilized with rock or other appropriate surface protection to minimize surface erosion and slumping to the receiving waters. If possible, the road surface over the culvert shall have a critical-dip to ensure that if the culvert becomes plugged, water can flow over the road surface without washing away the fill prism. If site-specific conditions do not allow for a critical dip, alternatives such as emergency overflow culverts, oversized culvers, flared inlets, and debris racks may be warranted.

C. Riparian and Wetland Protection and Management:

88. Buffer width will be in compliance with Tier category.

89. Trees within riparian areas shall be retained for natural recruitment to streams. Large woody debris (LWD) shall be retained in stream or within riparian areas. The size of wood that can be beneficial to the stream will vary

depending on the size of the stream (i.e., larger pieces of wood are necessary to withstand flows in large streams). In the event that LWD or trees are disturbed during excavation, care shall be taken to separate the LWD from soil. The pieces shall be stockpiled separately until they can be replaced in appropriate locations to enhance instream or riparian conditions. Placement of instream wood for habitat enhancement should be done under the consultation of a qualified professional and in conformance with applicable regulatory permits.

90. Avoidance of disturbance in riparian areas (within 200 feet of a watercourse) should result in protection and restoration of the quality/health of the riparian stand so as to promote: 1) shade and microclimate controls; 2) delivery of wood to channels, 3) slope stability and erosion control, 4) ground cover, and 5) removal of excess nutrients. This recognizes the importance of the riparian zone with respect to temperature protection, sediment delivery, its importance with respect to the potential for recruitment of large wood, and removal of nutrients transported in runoff. In the event that past disturbance has degraded riparian conditions, replanting with native species capable of establishing a multi-storied canopy will ensure these riparian areas can perform these important ecologic functions.

D. Spoils Management

To ensure spoil pile stability and to reduce the potential for spoil pile slope failure or transport to waters of the state, the following measures shall be implemented when placing or disposing of spoils onsite:

91. Rip compacted soils prior to placing spoils to prevent the potential for ponding under the spoils that could result in spoil site failure and subsequent sedimentation;

92. Compact and contour stored spoils to mimic the natural slope contours and drainage patterns to reduce the potential for fill saturation and failure;

93. Ensure that spoil materials are free of woody debris, and not placed on top of brush, logs or trees.

94. Spoils shall not be placed or stored in locations where soils are wet or unstable, or where slope stability could be adversely affected.

95. Do not locate spoil piles in or immediately adjacent to wetlands and watercourses.

96. Store spoil piles in a manner (e.g. cover pile with plastic tarps and surround base of pile with straw wattle) or location that would not result in any runoff from the spoil pile ending up in wetlands and watercourses.

97. Separate organic material (e.g., roots, stumps) from the dirt fill and store separately. Place this material in long-term, upland storage sites, as it cannot be used for fill.

98. Keep temporary disposal sites out of wetlands, adjacent riparian corridors, and ordinary high water areas as well as high risk zones, such as 100-year floodplain and unstable slopes.

99. After placement of the soil layer, track walk the slopes perpendicular to the contour to stabilize the soil until vegetation is established. Track walking creates indentations that trap seed and decrease erosion of the reclaimed surfaces.

100. Revegetate the disposal site with a mix of native plant species. Cover the seeded and planted areas with mulched straw at a rate of 2 tons per acre. Apply jute netting or similar erosion control fabric on slopes greater than 2:1 if site is erosive.

E. Water Storage and Use

WATER USE

101. Conduct operations on a size and scale that considers available water sources and other water use and users in the planning watershed.

102. Implement water conservation measures such as rainwater catchment systems, drip irrigation, mulching, or irrigation water recycling. (Also see BMPs for Irrigation, below)

103. Take measures to minimize water diversion during low flow periods.

104. Options for documentation of water diversions and/or water usage may include the use of water meter devices and date-stamped photographs of water meter readings.

105. Hauled water utilized for irrigation shall be documented via receipt or similar, and show the date, name, and license plate of the water hauler, and the quantity of water purchased.

106. Apply water at agronomic rates (do not overwater plants).

WATER STORAGE

107. If using a water storage tank, do not locate the tank in a flood plain or next to equipment that generates heat. Locate the tank so it is easy to install, access, and maintain.

108. Vertical tanks should be installed according to manufacturer's specifications and placed on firm, compacted soil that is free of rocks/sharp objects and capable of bearing the weight of the tank and its maximum contents. In addition, a sand or pea gravel base with provisions for preventing erosion is highly recommended. Installation sites for tanks 8,000 gallons or more must be on a reinforced concrete pad providing adequate support and enough space to attach a tank restraint system (anchor using the molded-in tie down lugs with moderate tension, being careful not to over-tighten), especially where seismic or large wind forces are present.

109. Horizontal tanks shall be secured with bands and/or hoops to prevent tank movement.

110. Design and construct storage ponds in properly sited locations, off-stream. Plant vegetation along the perimeter of the pond. Construct berms or excess freeboard space around the perimeter of the pond to allow for sheet flow inputs.

111. Provide adequate outlet drainage for overflow of ponds, including low impact designs, to promote dispersal and infiltration of flows.

112. Place proper lining or sealing in ponds to prevent water loss.

113. Storage bladders are not encouraged for long term water storage reliability. If they are utilized, ensure that they are designed to store water, and that they are sited to minimize potential for water to flow into a watercourse in the event of a catastrophic failure. Used bladders (e.g. military surplus bladders) shall be checked for interior residual chemicals and integrity prior to use. Inspect bladder and containment features periodically to ensure integrity.

F. Irrigation Runoff

114. Irrigate at rates to avoid or minimize runoff.

115. Regularly inspect for leaks in mains and laterals, in irrigation connections, or at the ends of drip tape and feeder lines. Repair any found leaks.

116. Design irrigation system to include redundancy (i.e., safety valves) in the event that leaks occur, so that waste of water is prevented and minimized.

117. Recapture and reuse irrigation runoff (tailwater) where possible, through passive (gravity-fed) or active (pumped) means.

118. Construct retention basins for tailwater infiltration; percolation medium may be used to reduce pollutant concentration in infiltrated water. Constructed treatment wetlands may also be effective at reducing nutrient loads in water. Ensure that drainage and/or infiltration areas are located away from unstable or potentially unstable features.

119. Regularly replace worn, outdated or inefficient irrigation system components and equipment.

120. Use mulches (e.g. wood chips or bark) in cultivation areas that do not have ground cover to prevent erosion and minimize evaporative loss.

121. Leave a vegetative barrier along the property boundary and interior watercourses to act as a pollutant filter.

122. Employ rain-triggered shutoff devices to prevent irrigation after precipitation.

G. Fertilizers, Soil Amendments, Pesticides, Petroleum Products, and Other Chemicals

123. Evaluate irrigation water, soils, growth media, and plant tissue to optimize plant growth and avoid over-fertilization.

124. Reference Department of Pesticide Regulations Guidance (see Attachments E-1 and E-2 of Order No. R1-2015-0023)

125. All chemicals shall be stored in a manner, method, and location that ensures that there is no threat of discharge to waters of the state.

126. Products shall be labeled properly and applied according to the label.

127. Use integrated pest management strategies that apply pesticides only to the area of need, only when there is an economic benefit to the grower, and at times when runoff losses are least likely, including losses of organic matter from dead plant material.

128. Periodically calibrate pesticide application equipment.

129. Use anti-backflow devices on water supply hoses, and other mixing/loading practices designed to reduce the risk of runoff and spills.

130. Petroleum products shall be stored with a secondary containment system.

131. Throughout the rainy season, any temporary containment facility shall have a permanent cover and side-wind protection, or be covered during non-working days and prior to and during rain events.

132. Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.

133. Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials shall be covered during non- working days and prior to rain events.

134. Have proper storage instructions posted at all times in an open and conspicuous location.

135. Prepare and keep onsite a Spill Prevention, Countermeasures, and Cleanup Plan (SPCC Plan) if applicable4.

136. Keep ample supply of appropriate spill clean-up material near storage areas.

H. Cultivation-Related Wastes

137. Cultivation-related waste shall be stored in a place where it will not enter a stream. Soil bags and other garbage shall be collected, contained, and disposed of at an appropriate facility, including for recycling where available. Pots shall be collected and stored where they will not enter a waterway or create a nuisance. Plant waste and other compostable materials be stored (or composted, as applicable) at locations where they will not enter or be blown into surface waters, and in a manner that ensures that residues and pollutants within those materials do not migrate or leach into surface water or groundwaters.

138. Imported soil for cultivation purposes shall be minimized. The impacts associated with importation of soil include, but are not limited to increased road maintenance and the increased need for spoils management. Use of compost increases the humic acid content and water retention capacity of soils while reducing the need for fertilizer application. In

the event that containers (e.g. grow bags or grow pots) are used for cultivation, reuse of soil shall be maximized to the extent feasible.

139. Spent growth medium (i.e. soil and other organic medium) shall be handled to minimize discharge of soil and residual nutrients and chemicals to watercourses. Proper handling of spent soil could include incorporating into garden beds, spreading on a stable surface and revegetation, storage in watertight dumpsters, covering with tarps or plastic sheeting prior to proper disposal, and use of techniques to reduce polluted runoff described under Item F. Irrigation Runoff.

140. Other means of handling cultivation-related waste may be considered on a site- specific basis.

I. Refuse and Human Waste

141. Trash containers of sufficient size and number shall be provided and properly serviced to contain the solid waste generated by the project. Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers. Use lined bins or dumpsters to reduce leaking of liquid waste. Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater. Make sure trash container areas are screened or walled to prevent off-site transport of trash. Consider using refuse containers that are bear-proof and/or secure from wildlife. Refuse shall be removed from the site on a frequency that does not result in nuisance conditions, transported in a manner that they remain contained during transport, and the contents shall be disposed of properly at a proper disposal facility.

142. Ensure that human waste disposal systems do not pose a threat to surface or ground water quality or create a nuisance. Onsite treatment systems should follow applicable County ordinances for human waste disposal requirements, consistent with the applicable tier under the State Water Resources Control Board Onsite Waste Treatment System Policy5.

Winterization Protocols for Statewide Cannabis Order
North Coast Region

Winterization must be completed by the onset of the winter period (**November 15** – April 1). Maintenance of all erosion protection and sediment capture measures is required year-round. Proactive monitoring allows for identification of problem areas or underperforming erosion or sediment control measures. Verification of the effectiveness of all erosion prevention and sediment capture measures is required as part of winterization activities.

Winterization Measures for ALL SITES:

- Cannabis cultivators shall implement all applicable Erosion Control and Soil Disposal and Spoils Management Requirements in addition to the Winterization Requirements below by the onset of the winter period (November 15).

- Cannabis cultivators shall block or otherwise close any temporary access roads to all motorized vehicles no later than the onset of the winter period each year.

- Cannabis cultivators shall not operate heavy equipment of any kind at the cannabis cultivation site during the winter period, unless authorized for emergency repairs contained in an enforcement order issued by the State Water Board, Regional Water Board, or other agency having jurisdiction.

- Cannabis cultivators shall apply linear sediment controls (e.g., silt fences, wattles, etc.) along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow length at the frequency specified below.

Slope (percent)	Sheet Flow Length Not to Exceed (feet)
0 – 25	20
25 – 50	15
>50	10

- Cannabis cultivators shall maintain all culverts, drop inlets, trash racks and similar devices to ensure they are not blocked by debris or sediment. The outflow of culverts shall be inspected to ensure erosion is not undermining the culvert. Culverts shall be inspected prior to the onset of fall and winter precipitation and following precipitation events that produce at least 0.5 inch/day or 1.0 inch/7 days of precipitation to determine if maintenance or cleaning is required.

- Cannabis cultivators shall stabilize all disturbed areas and construction entrances and exits to control erosion and sediment discharges from land disturbance.

- Cannabis cultivators shall cover and berm all loose stockpiled construction materials (e.g., soil, spoils, aggregate, etc.) that are not actively (scheduled for use within 48 hours) being used as needed to prevent erosion by storm water. The cannabis cultivator shall have adequate cover and berm materials available onsite if the weather forecast indicates a probability of precipitation.

- Cannabis cultivators shall apply erosion repair and control measures to the bare ground (e.g., cultivation area, access paths, etc.) to prevent discharge of sediment to waters of the state.

- **All sites shall report winterization procedures implemented, any outstanding measures, and the schedule for completion, within the Facility Status section of their Annual Report, due every year on March 1st.**

Additional Monitoring for Moderate and High Risk Sites:

The following monitoring and reporting activities are required on a monthly basis, including during the winter period (November 15 – April 1):

Observations	Description
Surface Water Runoff	Report any conditions of surface water runoff, including location, duration, source of runoff (irrigation water, storm water, etc.)
Soil Erosion Control	Report any indications of soil erosion (e.g., gullying, turbid water discharge, landslide, etc.)
Sediment Capture	Report the status of sediment capture measures (e.g., silt fence, fiber rolls, settling basin, etc.)
Erosion/Sediment Capture Maintenance	Report maintenance activities to maintain the effectiveness of erosion control and sediment capture measures (e.g., reinstallation of straw mulch, hydroseeding, tarp placement, removal or stabilization of sediment captured, removal of settled sediment in a basin, etc.)
Stabilization of Disturbed Areas	Dischargers characterized as high risk (with any portion of the disturbed area within the setbacks), shall provide a status report describing activities performed to stabilize the disturbed area within the setback
Material(s) Storage Erosion/Spills Prevention	Report materials delivered or stored at the site that could degrade water quality if discharged off-site (e.g., potting soil, manure, chemical fertilizer, gasoline, herbicides, pesticides, etc.)
Holding Tank, Septic Tank, or Chemical Toilet Servicing	Septic Tank, or Chemical Toilet Servicing Report the dates, activity, and name of the servicing company for servicing holding tanks or chemical toilets

The following monitoring and reporting activities are required on a monthly basis for **ALL MONTHS** until winterization procedures are completed:

Constituent	Frequency
Turbidity	Once per calendar month when precipitation exceeds 0.25 in/day or when storm water runoff from the site is generated
pH	Once per calendar month when precipitation amount is forecast to exceed 0.25 in/day

See Attachment B of the Statewide Cannabis Order WQ 2017-0023-DWQ for details on sampling procedures

- **Although monitoring is required on a monthly basis, reporting of monthly observations shall be included in the Annual Report, due every year on March 1st.**

- Additional details on the components of the Site Management Plan involving winterization plans may be found in Attachment D of the Statewide Cannabis Order WQ 2017-0023-DWQ.

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BIODYNAMIC FARMING & COMPOST PREPARATION

ALTERNATIVE FARMING SYSTEMS GUIDE

ATTRA is the national sustainable agriculture information center funded by the USDA's Rural Business -- Cooperative Service.

Abstract: *Biodynamic agriculture was the first ecological farming system to arise in response to commercial fertilizers and specialized agriculture after the turn of the century, yet it remains largely unknown to the modern farmer and land-grant university system. The contribution of biodynamics to organic agriculture is significant, however, and warrants more attention. The following provides an overview of biodynamic farming and includes additional details and resources on the specialized practice of biodynamic composting.*

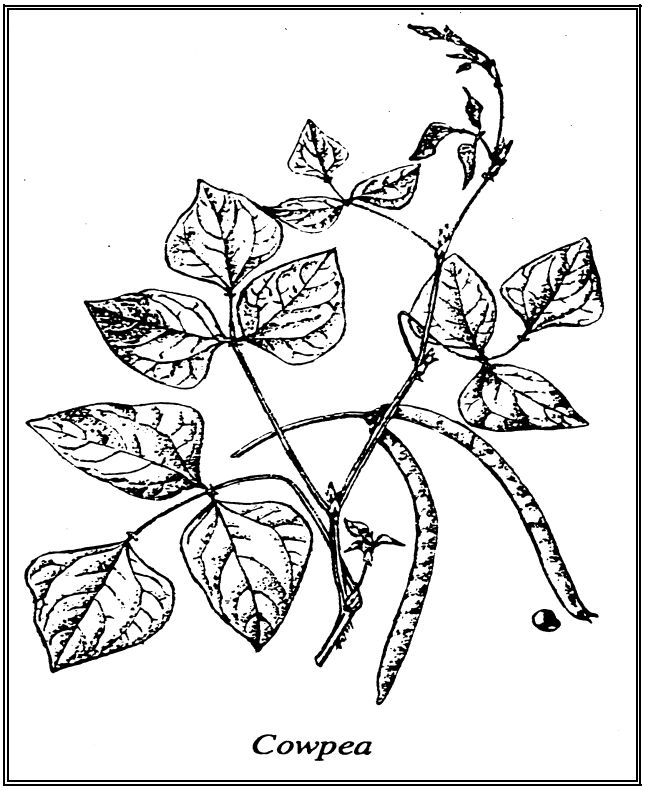
By Steve Diver — NCAT Agriculture Specialist
February 1999

Introduction

Biodynamic agriculture is an advanced organic farming system that is gaining increased attention for its emphasis on food quality and soil health.

Biodynamic agriculture developed out of eight lectures on agriculture given in 1924 by Rudolf Steiner (1861–1925), an Austrian scientist and philosopher, to a group of farmers near Breslau (which was then in the eastern part of Germany and is now Wroclaw in Poland). These lectures, as well as four supplemental lessons, are published in a book titled *Spiritual Foundations for the Renewal of Agriculture*, originally published in English as *An Agricultural Course* (1).

Contents



Cowpea

The Agriculture Course lectures were taught by Steiner in response to observations from farmers that soils were becoming depleted following the introduction of chemical fertilizers at the turn of the century. In addition to degraded soil conditions, farmers noticed a deterioration in the health and quality of crops and livestock. Thus, biodynamic agriculture was the first ecological farming system to develop as a grassroots alternative to chemical agriculture.

A basic ecological principle of biodynamics is to conceive of the farm as an organism, a self-contained entity. A farm is said to have its own

individuality. Emphasis is placed on the integration of crops and livestock, recycling of nutrients, maintenance of soil, and the health and wellbeing of crops and animals; the farmer too is part of the whole. Thinking about the interactions within the farm ecosystem naturally leads to a series of holistic management practices that address the enviromental, social, and financial aspects of the farm. A comparison of objectives between biodynamic and conventional agriculture systems in Appendix I summarizes these ideas in table format.

A fundamental tenet of biodynamic agriculture is that food raised biodynamically is nutritionally superior and tastes better than foods produced by conventional methods. This is a common thread in alternative agriculture, because other ecological farming systems make similar claims for their products. Demeter, a certification program for biodynamically grown foods, was established in 1928. As such, Demeter was the first ecological label for organically produced foods.

Today biodynamic agriculture is practiced on farms around the world, on various scales, and in a variety of climates and cultures. However, most biodynamic farms are located in Europe, the United States, Australia, and New Zealand.

While biodynamics parallels organic farming in many ways — especially with regard to cultural and biological farming practices — it is set apart from other organic agriculture systems by its association with the spiritual science of anthroposophy founded by Steiner, and in its emphasis on farming practices intended to achieve balance between the physical and higher, non-physical realms†; to acknowledge the influence of cosmic and terrestrial forces; and to enrich the farm, its products, and its inhabitants with life energy‡. Appendix II is a table that illustrates cosmic and terrestrial influences on yield and quality.

In a nutshell, biodynamics can be understood as a combination of "biological dynamic" agriculture practices. "Biological" practices include a series of well-known organic farming techniques that improve soil health. "Dynamic" practices are intended to influence biological as well as metaphysical aspects of the farm (such as increasing vital life force), or to adapt the farm to natural rhythms (such as planting seeds during certain lunar phases).

The concept of dynamic practice — those practices associated with non-physical forces in nature like *vitality*, *life force*, *ki*, *subtle energy* and related concepts — is a commonality that also underlies many systems of alternative and complementary medicine. It is this latter aspect of biodynamics which gives rise to the characterization of biodynamics as a spiritual or mystical approach to alternative agriculture. See the following table for a brief summary of biological and dynamic farming practices.

† The higher, non-physical realms include etheric, astral, and ego. It is the complicated terminology and underlying metaphysical concepts of Steiner which makes biodynamics hard to grasp, yet these are inherent in the biodynamic approach and therefore they are listed here for the reader's reference.

‡ Life energy is a colloquial way of saying *etheric* life force. Again, Steiner's use of terms like etheric forces and astral forces are part and parcel of biodynamic agriculture. Biodynamic farmers recognize there are forces that influence biological systems other than gravity, chemistry, and physics.

Bio-Dynamic Farming Practices	
Biological Practices	**Dynamic Practices**
Green manures	Special compost preparations
Cover cropping	Special foliar sprays
Composting	Planting by calendar
Companion planting	Peppering for pest control
Integration of crops and livestock	Homeopathy
Tillage and cultivation	Radionics

Dr. Andrew Lorand provides an insightful glimpse into the conceptual model of biodynamics in his Ph.D. dissertation *Biodynamic Agriculture — A Paradigmatic Analysis*, published at Pennsylvania State University in 1996 (2).

Lorand uses the paradigm model described by Egon Guba in *The Alternative Paradigm Dialog* (3) to clarify the essential beliefs that underpin the practices of biodynamics. These beliefs fall into three categories:

1. Beliefs about the nature of reality with regard to agriculture (ontological beliefs)
2. Beliefs about the nature of the relationship between the practitioner and agriculture (epistemological beliefs); and,
3. Beliefs about how the practitioner should go about working with agriculture (methodological beliefs).

Lorand's dissertation contrasts the ontological, epistemological, and methodoligical beliefs of four agricultural paradigms: Traditional Agriculture, Industrial Agriculture, Organic Agriculture, and Biodynamic Agriculture. A summary of these four paradigms can be found in Tables 1–4, Appendix III.

The Biodynamic Preparations

A distinguishing feature of biodynamic farming is the use of nine biodynamic preparations described by Steiner for the purpose of enhancing soil quality and stimulating plant life. They consist of mineral, plant, or animal manure extracts, usually fermented and applied in small proportions to compost, manures, the soil, or directly onto plants, after dilution and stirring procedures called dynamizations.

The original biodynamic (BD) preparations are numbered 500–508. The BD 500 preparation (horn-manure) is made from cow manure (fermented in a cow horn that is buried in the soil for six months through autumn and winter) and is used as a soil spray to stimulate root growth and humus formation. The BD 501 preparation (horn-silica) is made from powdered quartz (packed inside a cow horn and buried in the soil for six months through spring and summer) and applied as a foliar spray to stimulate and regulate growth. The next six preparations, BD 502–507, are used in making compost.

Finally, there is BD preparation 508 which is prepared from the silica-rich horsetail plant (*Equisetum arvense*) and used as a foliar spray to suppress fungal diseases in plants.

The BD compost preparations are listed below:

- No. 502 Yarrow blossoms (*Achillea millefolium*)
- No. 503 Chamomile blossoms (*Chamomilla officinalis*)
- No. 504 Stinging nettle (whole plant in full bloom) (*Urtica dioca*)
- No. 505 Oak bark (*Quercus robur*)
- No. 506 Dandelion flowers (*Taraxacum officinale*)
- No. 507 Valerian flowers (*Valeriana officinalis*)

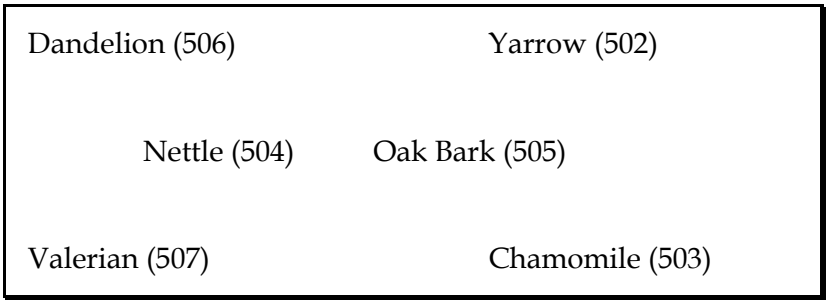
Biodynamic preparations are intended to help moderate and regulate biological processes as well as enhance and strengthen the life (etheric) forces on the farm. The preparations are used in homeopathic quantities, meaning they produce an effect in extremely diluted amounts. As an example, just 1/16th ounce — a level teaspoon — of each compost preparation is added to seven- to ten-ton piles of compost.

Biodynamic Compost

Biodynamic compost is a fundamental component of the biodynamic method; it serves as a way to recycle animal manures and organic wastes, stabilize nitrogen, and build soil humus and enhance soil health. Biodynamic compost is unique because it is made with BD preparations 502–507. Together, the BD preparations and BD compost may be considered the cornerstone of biodynamics. Here again, "biological" and "dynamic" qualities are complementary: biodynamic compost serves as a source of humus in managing soil health and biodynamic compost emanates energetic frequencies to vitalize the farm.

The traditional manner in which the biodynamic compost is made is rather exacting. After the compost windrow is constructed, Preparations 502–506 are strategically placed 5–7 feet apart inside the pile, in holes poked about 20 inches deep. Preparation No. 507, or liquid valerian, is applied to the outside layer of the compost windrow by spraying or hand watering.

Figure 1. Use of Biodynamic Preparations in a Compost Pile



Valerian (507) is mixed into a liquid; a portion is poured into one hole, andthe rest is sprinkled over the top of the compost pile.

More specific instructions on biodynamic preparations, placement in the compost, compost making, and compost use can be found in the following booklets, available through the Biodynamic Farming and Gardening Association (BDFGA) in San Francisco, California (4):

Blaser, Peter, and Ehrenfried Pfeiffer. 1984. *Bio-Dynamic Composting on the Farm; How Much Compost Should We Use?* Biodynamic Farming and Gardening Association, Inc., Kimberton, PA. 23p.

Corrin, George. 1960. *Handbook on Composting and the Bio-Dynamic Preparations*. Bio-Dynamic Agricultural Association, London. 32 p.

Koepf, H.H. 1980. *Compost – What It Is, How It Is Made, What It Does*. Biodynamic Farming and Gardening Association, Inc., Kimberton, PA. 18 p.

Pfeiffer, Ehrenfried. 1984. *Using the Bio-Dynamic Compost Preparations & Sprays in Garden, Orchard, & Farm*. Bio-Dynamic Farming and Gardening Association, Inc., Kimberton, PA. 64 p.

Dr. Ehrenfried Pfeiffer (1899–1961), a soil microbiologist and agronomic researcher who worked directly with Steiner, conducted extensive research on the preparation and use of biodynamic compost. For many years Pfeiffer served as a compost consultant to municipal compost facilities, most notably Oakland, CA, as well as countries in the Caribbean, Europe, and the Far East.

Pfeiffer's research into the microbiology of compost production led to the development of a compost inoculant, BD Compost Starter®, that contains all the BD compost preparations (502–507) plus stirred BD No. 500, as well as 55 different types of microorganisms (mixed cultures of bacteria, fungi, actinomycetes, yeasts). BD Compost Starter® is widely used by biodynamic farmers because it is easy to apply while building the compost pile. Today, the starter is prepared and sold through the Josephine Porter Institute (JPI) for Applied Biodynamics (5) in Woolwine, Virginia.

While use of BD compost preparations and/or BD Compost Starter® is universal in biodynamic composting, the actual construction and maintenance of compost piles — including frequency of aeration and length till maturity — may vary among farming operations.

The static pile method is the traditional biodynamic choice. In static piles materials are formed into a windrow, inoculated with BD preparations, covered with straw, and left undisturbed for 6 months to one year prior to use. A small amount of soil is commonly sprinkled onto the outside of the pile prior to covering with straw. Soil can also be added during the windrow construction process, when brown (carbon) and green (nitrogen) feedstock materials are laid in alternating layers.

On larger farms that handle massive volumes of compost feedstock, the piles are often managed with a compost turner, so the time to maturity is much shorter, for example 2–3 months. A new development is the aerated static pile (ASP), wherein ventilation pipes are inserted into a static pile to increase oxygen supply and reduce the length of time to compost biomaturity.

Contrasting viewpoints exist in the compost industry as well as amongst on-farm compost makers as to which method is best. When push comes to shove, most people agree that the best compost method is one that fits the individual farmer's situation.

Recent biodynamic research supports the static pile approach as a viable compost option. In the July–August 1997 issue of *Biodynamics* , Dr. William Brinton (6) of Woods End Agricultural Research Institute published "Sustainability of Modern Composting: Intensification Versus Costs and Quality." Brinton argues that low-tech composting methods are just as effective in stabilizing nutrients and managing humus as the management and capital intensive compost systems that employ compost turners and daily monitoring. These findings are particularly encouraging to farmers choosing the low-input approach to this age-old practice of transforming organic matter into valuable humus. The full report can be viewed on Woods End Institute's website at: <www.woodsend.org/sustain.pdf>.

At the other end of the compost spectrum are the high intensity windrow systems — for example the Controlled Microbial Composting system promoted by the Siegfried Luebke family of Austria and the Advanced Compost System promoted by Edwin Blosser of

Midwestern Biosystems in Illinois — that emphasize specialized compost turners, microbial inoculation, frequent turning, daily monitoring for temperature and CO_2, compost fleece to cover and protect the windrow, and qualitative testing for finished compost. In addition to efficient handling of organic wastes, premium-grade compost is a goal.

It should be noted these highly mechanized systems seem to fit operations that generate large volumes of animal manures or other compost feedstocks, such as a dairy farm or food processing plant. On-farm production of compost is often matched with sale of bagged or bulk compost to local horticultural operations as a supplemental income.

Ultimately, the choice of composting method will depend to a large extent on the scale of farming operation, equipment and financial resources on hand, and intended goals for compost end-use.

Research at Washington State University (WSU) by Dr. Lynn Carpenter-Boggs and Dr. John Reganold found that biodynamic compost preparations have a significant effect on compost and the composting process (7). Biodynamically treated composts had higher temperatures, matured faster, and had higher nitrates than control compost piles inoculated with field soil instead of the preparations. The WSU research is unique for two reasons: it was the first biodynamic compost research undertaken at a land-grant university, and it demonstrated that biodynamic preparations are not only effective, but effective in homeopathic quantities.

A summary of this research can be found on the USDA-Agriculture Research Service's Tektran Website at:

Effects of Biodynamic Preparations on Compost Development
www.nal.usda.gov/ttic/tektran/data/000009/06/0000090623.html

In related research, Carpenter-Boggs and Reganold found that biodynamically managed

soils (i.e., treated with biodynamic compost and biodynamic field sprays) had greater capacity to support heterotrophic microflora activity, higher soil microorganism activity, and different types of soil microrganisms than conventionally managed soils (i.e., treated with mineral fertilizers and pesticides).

A summary of this latter research can be found on the USDA-Agriculture Research Service's Tektran Website at:

Biodynamic Compost and Field Preparations: Effects on Soil Biological Community
www.nal.usda.gov/ttic/tektran/data/000009/06/0000090640.html

Because compost is often at a premium on farms, European biodynamic researcher Maria Thun developed Barrel Compost. Consisting of fresh cow manure that has been treated with the original preparations as well as egg shells and basalt rock dust — then allowed to ferment in a pit for about 3 months, finished Barrel Compost is diluted in water and applied directly to the fields as a spray. Use of Barrel Compost compensates to some degree for lack of sufficient compost. A variation on Barrel Compost is mixing stinging nettle with fresh cow manure in a 50:50 volume to volume ratio.

Some notable concepts and practices relating to soil and compost management from the biodynamic experience:

- **Microbial inoculation:** Dr. Ehrenfried Pfeiffer's work with composts in the 1940's and 50's led to the development of the BD Compost Starter®, one of the earliest compost inoculants in commercial use in the United States.

- **Soil in Compost:** The addition of soil to compost was an early biodynamic practice prescribed by Steiner. Dr. Pfeiffer discussed the reasons and benefits for adding soils to compost in the 1954 edition of *Bio-Dynamics Journal* (Vol. 12, No. 2) in an article titled "Raw Materials Useful for Composting." He said that soil is an essential ingredient to

- compost and should be added at 10%-20% of the windrow volume.

Mineralized Compost: The addition of rock powders (greensand, granite dust) to compost piles is a long-time biodynamic practice known as mineralized compost. The dusts add mineral components to the compost and the organic acids released during the decomposition process help solubilize minerals in the rock powders to make nutrients more available to plants.

- **Phases of Compost:** An outgrowth of Dr. Pfeiffer's compost research was a clearer understanding of the *Breakdown* and *Buildup* compost phases:

  The Breakdown Phase: In the breakdown phase organic residues are decomposed into smaller particles. Proteins are broken down into amino acids, amines, and finally to ammonia, nitrates, nitrites, and free nitrogen. Urea, uric acids, and other non-protein nitrogen-containing compounds are reduced to ammonia, nitrites, nitrates, and free nitrogen. Carbon compounds are oxidized to carbon dioxide (aerobic) or reduced methane (anaerobic). The identification and understanding of breakdown microorganisms led to the development of a microbial inoculant to moderate and speed up the breakdown phase. The BD Compost Starter® developed by Dr. Pfeiffer contains a balanced mixture of the most favorable breakdown organisms, ammonifiers, nitrate formers, cellulose, sugar, and starch digesters in order to bring about the desired results. The microbial inoculant also works against organisms that cause putrefaction and odors.

  The Buildup Phase: In the build-up phase simple compounds are re-synthesized into complex humic substances. The organisms responsible for transformation to humus are aerobic and facultative aerobic, sporing and non-sporing and nitrogen fixing bacteria of the azotobacter and nitrosomonas group.

Actinomycetes and streptomycetes also play an important role. The addition of soil, 10%

by volume, favors the development and survival of these latter organisms. The development of humus is evident in color changes in the compost, and through qualitative tests such as the circular chromatography method.

- **Compost & Soil Evaluation:** Biodynamic research into compost preparation and soil humus conditions has led to the development or specialized use of several unique qualitative tests. A notable contribution of biodynamics is the image-forming qualitative methods of analysis; e.g., circular chromatography, sensitive crystallization, capillary dynamolysis, and the drop-picture method. Other methods focus on the biological-chemical condition; e.g., The Solvita® Compost Test Kit and The Solvita® Soil Test Kit (8), colorimetric humus value, and potential pH.

Cover Crops and Green Manures

Cover crops play a central role in managing cropland soils in biological farming systems. Biodynamic farmers make use of cover crops for dynamic accumulation of soil nutrients, nematode control, soil loosening, and soil building in addition to the commonly recognized benefits of cover crops like soil protection and nitrogen fixation. Biodynamic farmers also make special use of plants like phacelia, rapeseed, mustard, and oilseed radish in addition to common cover crops like rye and vetch. Cover crop strategies include undersowing and catch cropping as well as winter cover crops and summer green manures.

Green manuring is a biological farming practice that receives special attention on the biodynamic farm. Green manuring involves the soil incorporation of any field or forage crop while green, or soon after flowering, for the purpose of soil improvement. The decomposition of green manures in soils parallels the composting process in that distinct phases of organic matter breakdown and humus buildup are moderated by microbes. Many biodynamic farmers, especially those who

follow the guidelines established by Dr. Ehrenfried Pfeiffer, spray the green residue with a microbial inoculant (BD Field Spray®) prior to plowdown. The inoculant contains a mixed culture of microorganisms that help speed decomposition, thereby reducing the time until planting. In addition, the inoculant enhances formation of the clay-humus crumb which provides numerous exchange sites for nutrients and improves soil structure.

Further information on this topic can be found in the ATTRA publication *Overview of Cover Crops and Green Manures* <www.attra.org/attra-pub/covercrop.html>.

Crop Rotations & Companion Planting

Crop rotation — the sequential planting of crops — is honed to a fine level in biodynamic farming. A fundamental concept of crop rotation is the effect of different crops on the land. Koepf, Pettersson, and Schaumann speak about "humus-depleting" and "humus-restoring" crops; "soil-exhausting" and "soil-restoring" crops; and "organic matter exhausting" and "organic matter restoring" crops in different sections of *Bio-Dynamic Agriculture: An Introduction* (9).

Seemingly lost to modern agriculture with its monocrops and short duration corn-soybean rotations, soil building crop rotations were understood more clearly earlier in this century when the USDA published leaflets like *Soil-Depleting, Soil-Conserving, and Soil-Building Crops* (10) in 1938.

Companion planting, a specialized form of crop rotation commonly used in biodynamic gardening, entails the planned association of two or more plant species in close proximity so that some cultural benefit (pest control, higher yield) is derived. In addition to beneficial associations, companion planting increases biodiversity on the farm which leads to a more stable agroecosystem. See the ATTRA publication *Companion Planting: Basic*

Concepts and Resources
<www.attra.org/attra- pub
/complant.html> for more information.

Liquid Manures and Herbal Teas

Herbal teas, also called liquid manures or garden teas, are an old practice in organic farming and gardening — especially in biodynamic farming — yet little is published on this topic outside of the practitioner literature. A complementary practice is the use of compost teas.

In reality, herbal teas usually consist of one fermented plant extract, while liquid manures are made by fermenting a mixture of herb plants in combination with fish or seaweed extracts. The purpose of herbal teas and liquid manures are manyfold; here again, they perform dual roles by supporting *biological* as well as *dynamic* processes on the farm; i.e., source of soluble plant nutrients; stimulation of plant growth; disease-suppression; carrier of cosmic and earthly forces. To reflect their multi-purpose use, they are sometimes referred to as immune-building plant extracts, plant tonics, biotic substances, and biostimulants.

Further insight into foliar-applied plant extracts, liquid manures, and compost teas can be understood by viewing biological farming practices in the way they influence the *rhizosphere* or *phyllosphere*. (Those microbially-rich regions surrounding the root and leaf surfaces). Herbal teas and liquid manures aim to influence the phyllosphere; composts, tillage, and green manures influence the rhizosphere.

In addition to physical modification of the leaf surface to inhibit pathogen spore germination or the promotion of antagonistic (beneficial) microbes to compete against disease-causing organisms (pathogens), foliar-applied biotic extracts can sometimes initiate a systemic whole plant response known as induced resistance.

Horsetail tea is extracted from the common horsetail (*Equisetum arvense*), a plant especially rich in silica. Horsetail is best seen as a prophylactic (disease-preventing, not disease-curing) spray with a mild fungus-suppressing effect. During the months when green plants are not readily available, you can prepare an extract by covering dry plants with water and allowing them to ferment in a sunny place for about ten days. Dried equisetum, available through the Josephine Porter Institute for Applied Biodynamics (5) in Woolwine, Virginia, can also be used to make horsetail tea.

Stinging nettle tea is extracted from whole nettle plants (*Urtica dioica*) at any stage of growth up to seed–set. To make nettle tea, use about three pounds of fresh plants for every gallon of water, allow the mixture to ferment for about ten days, then filter it and spray a diluted tea. Dilution rates of 1:10 to 1:20 are suggested in the biodynamic literature. A biodynamic nettle tea is prepared by adding BD preparations 502, 503, 505, 506, and 507 prior to the soaking period.

Chamomile tea is derived from the flowers of true chamomile (*Matricaria chamomilla*) which have been picked and dried in the sun. Fresh flowers may be used too, but they are only available during a short part of the growing season. To prepare the tea, steep about one cup of tightly packed flowers per gallon of hot water. Stir well, and spray the filtered tea when cool. Chamomile is high in calcium, potash, and sulfur; it is good for leafy crops and flowers and promotes health of vegetables in general.

Comfrey tea is another tea commonly used in organic farming and gardening. Comfrey is a rich source of nutrients; it is especially good for fruiting and seed filling crops. It can be made by packing a barrel three-quarters full with fresh cut leaves, followed by topping the barrel full of water. It is allowed to steep for 7–14 days, then filtered and diluted in half with water prior to use.

The Biodynamic Farming & Gardening Association (4) can supply literature on herbal teas. Two pamplets you may be interested to know about are:

> Pfeiffer, Ehrenfried. 1984. *Using the Bio-Dynamic Compost Preparations & Sprays in Garden, Orchard, & Farm*. Bio-Dynamic

Farming and Gardening Association, Inc., Kimberton, PA. 64 p.
Koepf, H.H. 1971. *Bio-Dynamic Sprays*. Bio-Dynamic Farming and Gardening Association, Inc., Kimberton, PA. 16 p.

Compost teas are gaining wider recognition in biodynamic and organic farming for their disease suppressive benefits as well as for their ability to serve as a growth-promoting microbial inoculant. See the ATTRA publication *Compost Teas for Plant Disease Control* for more detailed information at: <www.attra.org/attra-pub/comptea.html>.

Planetary Influences

Lunar and astrological cycles play a key role in the timing of biodynamic practices, such as the making of BD preparations and when to plant and cultivate. Recognition of celestial influences on plant growth are part of the biodynamic awareness that subtle energy forces affect biological systems. A selection of resources are listed below. On examination of the variations in agricultural calendars that have sprung from the biodynamic experience, it is apparent that differing viewpoints exist on which lunar, planetary, and stellar influences should be followed.

Stella Natura – The Kimberton Hills Biodynamic Agricultural Calendar, available through BDFGA for $11.95, is the biodynamic calendar edited by Sherry Wildfeur and the most prominently known calendar of this type in the United States. It contains informative articles interspersed with daily and monthly astrological details, and lists suggested times for planting root, leaf, flowering, and fruiting crops.

Working with the Stars: A Bio-Dynamic Sowing and Planting Calendar, available through JPI for $12.95, is the biodynamic calendar based on Maria Thun's research and is more prominently used in Europe. Of the three calendars mentioned here, Thun's calendar relies more heavily on planetary and stellar influences. It contains research briefs as well as daily and monthly astrological details, again with suggested planting times.

Astronomical Gardening Guide, available through Agri-Synthesis in Napa, California (11) for a self-addressed stamped envelope, is the biodynamic gardening guide compiled by Greg Willis of Agri-Synthesis. This calender, which is a simple 2-sheet information leaflet, focuses on lunar phases.

Community Supported Agriculture

In its treatment of the farm as a self-contained entity or farm organism, biodynamics completes the circle with appropriate marketing schemes to support the economic viability of farms. The Demeter label for certified biodynamically grown foods is one avenue. A second outgrowth of this view is the Community Supported Agriculture movement.

Community Supported Agriculture, or CSA, is a direct marketing alternative for small-scale growers. In a CSA, the farmer grows food for a group of shareholders (or subscribers) who pledge to buy a portion of the farm's crop that season. This arrangement gives growers up-front cash to finance their operation and higher prices for produce, since the middleman has been eliminated. Besides receiving a weekly box or bag of fresh, high-quality produce, shareholders also know that they're directly supporting a local farm.

Farms of Tomorrow Revisited: Community Supported Farms, Farm Supported Communities (12) by Trauger Groh and Steven McFadden is a 294-page book that discusses the principles and practices of CSA's with insights to the biodynamic perspective and farm case studies. The ATTRA publication *Community Supported Agriculture* — located on the ATTRA website at <www.attra.org/attra-pub/csa.html> — provides a summary of ideas and business practices for CSA farms, accompanied by extensive resource listings.

Food Quality

A host of biodynamic researchers have looked into the quality of biodynamically grown foods. Though nutritional comparisons between foods

raised by organic and conventional production methods is controversial — certainly mainstream science adheres to the view that no differences exist — notable contributions from biodynamic researchers include image-forming qualitative methods of analysis (e.g., sensitive crystallization, circular chromatography, capillary dynamolysis, and the drop-picture method) and studies that report on nutritional analysis (13–15).

Research into Biodynamics

Research in Biodynamic Agriculture: Methods and Results (16) by Dr. H. Herbert Koepf is an 84-page booklet that presents an overview of biodynamic research from the early 1920s to the present. It includes testing methods, farm trials, university studies, and a complete bibliography. This pamphlet is especially useful because much of the research features German studies which are otherwise inaccessible to most Americans. It lists for $9.95 in the BDFGA catalog.

Dr. John Reganold published a study in the April 16, 1993 issue of *Science* — "Soil Quality and Financial Performance of Biodynamic and Conventional Farms in New Zealand" — that contrasted soil quality factors and the financial performance of paired biodynamic and conventional farms in New Zealand (17). In a comparison of 16 adjacent farms, the biodynamic farms exhibited superior soil physical, biological, and chemical properties and were just as financially viable as their conventional counterparts.

Agriculture of Tomorrow (18) contains research reports from 16 years of field and laboratory work conducted by the German researchers Eugen and Lilly Kolisko. Unlike much of the biodynamic research by Koepf, Reganold, Pfeiffer, and Brinton which focuses on compost and soil agronomic conditions, the Koliskos dive right into the esoteric nature of biodynamics: the moon and plant growth; the forces of crystallization in nature; planetary influences on plants; homeopathy in agriculture; experiments with animals to study the influence of homeopathic quantities; capillary dynamolysis; research on the biodynamic preparations.

Journals & Newsletters

Biodynamics, started by Dr. Ehrenfried Pfeiffer in 1941, is the leading journal on biodynamics published in the United States. Contents includes scientific articles as well as practical reports on: composts, soils, biodynamic preparations, equipment, research trials, laboratory methods, biodynamic theory, and farm profiles. Subscriptions are $35 per year for six issues, available through BDFGA (4).

Applied Biodynamics is the newsletter of the Josephine Porter Institute for Applied Bio-Dynamics, which makes and distributes biodynamic preparations. The journal features articles on use of the preparations, compost making procedures, and other biodynamic methods from a practical perspective. Subscriptions are $30 per year for three issues, available through JPI (5).

The Voice of Demeter is the newsletter of the Demeter Association, which is the official certification organization for biodynamically grown foods. It is published twice yearly as an insert to *Biodynamics*; separate copies are available by request from Demeter Association (19).

Star and Furrow is the journal published by the Bio-Dynamic Agricultural Association (BDAA) in England. Established in 1953, the *Star and Furrow* follows earlier publications of the BDAA dating back to the 1930s. Issued twice ('Summer' and 'Winter') per year, overseas (airmail) subscriptions are £6 British pounds. Contact:

Star and Furrow
Bio-Dynamic Agricultural Association
Rudolf Steiner House
35 Park Road
London NW1 6XT
England

Harvests is the current publication of the New Zealand Biodynamic Farming and Gardening Association (NZ-BDGA), published four times per year. The NZ-BDGA has published a newsletter or journal since 1947. Subscriptions are NZ$55 per year. Contact:

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NZ–BDGA
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The News Leaf is the quarterly journal of the Biodynamic Farming and Gardening Association of Australia Inc. (BDFGAA), in print since 1989. Subscriptions are $US25. Contact:

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Summary –Viewpoint – Conclusion

Biodynamics uses scientifically sound organic farming practices that build and sustain soil productivity as well as plant and animal health. The philosophical tenets of biodynamics — especially those that emphasize energetic forces and astrological influences — are harder to grasp, yet they are part and parcel of the biodynamic experience.

That mainstream agriculture does not accept the subtle energy tenets of biodynamic agriculture is a natural result of conflicting paradigms. In mainstream agriculture the focus is on physical-chemical-biological reality. Biodynamic agriculture, on the other hand, recognizes the existence of subtle energy forces in nature and promotes their expression through specialized "dynamic" practices.

A third view, expressed by a local farmer, accepts the premise that subtle energy forces exist and may affect biological systems, but holds there is not enough information to evaluate these influences nor make practical agronomic use of them.

The fact remains that biodynamic farming is practiced on a commercial scale in many countries and is gaining wider recognition for its contributions to organic farming, food quality, community supported agriculture, and qualitative tests for soils and composts. From a practical viewpoint biodynamics has proved to be productive and to yield nutritious, high-quality foods.

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4) Biodynamic Farming and Gardening Association
25844 Butler Road
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5) Josephine Porter Institute
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276-930-2463
info@jpibiodynamics.org
www.jpibiodynamics.org

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207-293-2456
Contact: Dr. William Brinton
E-mail: info@woodsend.org
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P.O. Box 10007
Napa, CA 94581
707-258-9300
707-258-9393 Fax
Contact: Greg Willis
info@agsyn.com
www.agsyn.com

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http://igg.com/bdnow/jpi/
JPI makes and distributes the full range of BD Preparations, as well as the BD Compost Starter® and the BD Field Starter®. Publisher of Applied Biodynamics, a quarterly newsletter.

Contacts: (continued)

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Educational seminars and training on biodynamic farming and gardening.

Demeter Association, Inc.
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Contact: Anne Mendenhall
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Demeter® certification for biodynamic produce; publisher of The Voice of Demeter.

Michael Fields Agricultural Institute
W2493 County Rd. ES
P.O. Box 990
East Troy, WI 53120
262-642-3303
www.michaelfieldsaginst.org
Research and extension in biodynamics, publications, conferences and short courses.

Suggested Reading on Biodynamic Farming:

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E-mail Discussion Groups:

BDNOW! — E-mail discussion group
www.igg.com/bdnow
Send mail to listproc@envirolink.org, and type SUBSCRIBE BDNOW YOUR NAME in the body of the message.

BDNOW! E-mail archives
http://csf.colorado.edu/biodynamics/

BDA Discussion Forum
www.biodynamics.com/discussion

World Wide Web Links:

What is Biodynamics? by Sherry Wildfeuer
www.angelic-organics.com/intern/biodynamics.html

Biodynamics: A Science of Life and Agriculture by Sherry Wildfeur
www.twelvestar.com/Earthlight/issue06/Biodynamics.html

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Rudolf Steiner Archive and e.Library
www.elib.com/Steiner

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www.biodynamic.net

Biodynamic Farming and Gardening Association
www.biodynamics.com

The Josephine Porter Institute of Applied Biodynamics
http://igg.com/bdnow/jpi

BDNOW! — Allan Balliett's Web Site
www.igg.com/bdnow

American Biodynamic Association
www.biodynamics.org

Rudolf Steiner College
www.steinercollege.org

Videos:

Bio-Dynamic Gardening: A How to Guide video
www.bestbeta.com/biodynamic.htm

Rudolf Steiner and the Science of Spiritual Realities, A Video Documentary
www.bestbeta.com/steiner.htm

Publishers – Distributors of Biodynamic & Steiner Literature:

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Woods End publishes noteworthy manuals on compost, soil organic matter, and green manures.

The electronic version of Biodynamic Farming & Compost Preparation is located at:
http://www.attra.org/attra-pub/biodynamic.html

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February 1999

The ATTRA Project is operated by the National Center for Appropriate Technology under a grant from the Rural Business-Cooperative Service, U.S. Department of Agriculture. These organizations do not recommend or endorse products, companies, or individuals. ATTRA is located in the Ozark Mountains at the University of Arkansas in Fayetteville at P.O. Box 3657, Fayetteville, AR 72702. ATTRA staff members prefer to receive requests for information about sustainable agriculture via the toll-free number 800-346-9140.

APPENDIX I

Objectives in Biodynamic and Conventional Farming*	
'Biodynamic' objectives	**'Conventional' objectives**
A. Organization	
Ecological orientation, sound economy, efficient labor input	Economical orientation, mechanization, minimizing labor input
Diversification, balanced combination of enterprises	Specialization, disproportionate development of enterprises
Best possible self-sufficiency regarding manures and feed	Self-sufficiency is no objective; importation of fertilizer and feed
Stability due to diversification	Programme dictated by market demands
B. Production	
Cycle of nutrients within the farm	Supplementing nutrients
Predominantly farm-produced manuring materials	Predominantly or exclusively bought-in fertilizers
Slowly soluble minerals if needed	Soluble fertilizers and lime
Weed control by crop rotation, cultivation, thermal	Weed control by herbicides (cropping, cultivation, thermal)
Pest control based on homeostasis and inoffensive substances	Pest control mainly by biocides
Mainly home-produced feed	Much or all feed bought in
Feeding and housing of livestock for production and health	Animal husbandry mainly oriented towards production
New seed as needed	Frequently new seed
C. Modes of influencing life processes	
Production is integrated into environment, building healthy landscapes; attention is given to rhythm	Emancipation of enterprises from their environment by chemical and technical manipulation
Stimulating and regulating complex life processes by biodynamic preparations for soils, plants, and manures	No equivalent biodynamic preparations; use of hormones, antibiotics, etc.
Balanced conditions for plants and animals, few deficiencies need to be corrected	Excessive fertilizing and feeding, correcting deficiencies
D. Social implication; human values	
National economy; optimum input : output ratio regarding materials and energy	National economy; poor input : output ratio regarding materials and input
Private economic : stable monetary results	Private economic : high risks, gains at times
No pollution	Worldwide considerable pollution
Maximum conservation of soils, water quality, wild life	Using up soil fertility, often erosion, losses in water quality and wild life
Regionalized mixed production, more transparent consumer-producer relationship; nutritional quality	Local and regional specialization, more anonymous consumer-producer relation; interested in grading standards
Holistic approach, unity between world conception and motivation	Reductionist picture of nature, emancipated, mainly economic motivation

* Koepf, H.H. 1981. The principles and practice of biodynamic agriculture. p. 237–250. *In:* B. Stonehouse (ed.) Biological Husbandry: A Scientific Approach to Organic Farming. Butterworths, London.

Appendix II

Yield and Quality Under the Influence of Polar Opposite Growth Factors*

Earthly influence	Cosmic Influence
Include among others:	
Soil life, nutrient content of soil; water supply; average atmospheric humidity.	Light, warmth and other climatic conditions; and their seasonal and daily rhythms.
Vary locally according to:	
Clay, nutrient, humus, lime and nitrogen content of the soil; nutrient and water holding capacity; temperature and precipitation.	Sun; cloudiness; rain; geographical latitude; altitude and degree of exposure; aspect of land; annual weather pattern; silica content of soils.
Normal influences on growth:	
High yields protein and ash content.	Ripening; flavor; keeping quality; seed quality.
One-sided (unbalanced) effects:	
Lush growth; susceptibility to diseases and pests; poor keeping quality.	Low yields; penetrating or often bitter taste; fibrous woody tissue; hairy fruit; pests and diseases.
Managerial measures for optimum effects:	
Liberal application of manure and compost treated with biodynamic preparations; sufficient legumes in rotation; compensating for deficiencies; irrigation; mulching.	Use of manures; no overfertilization; compensating for deficiencies; suitable spacing of plants; amount of seed used.
Use of Preparation No. 500	Use of Preparation No. 501

* Koepf, Herbert H., B.D. Pettersson, and Wolfgang Schaumann. 1976. Bio-Dynamic Agriculture: An Introduction. The Anthroposophic Press, Spring Valley, NY. p. 209.

APPENDIX III

Table 1. Traditional Agriculture Paradigm*

Ontology	Epistemology	Methodology
Traditional agriculture varies from culture to culture, from region to region, sometimes from tribe to tribe within a culture and a region. It is often a complex, living and dynamic web of relationships, in which:	The traditional practitioner stands in relationship to farming that is characterized by customs, rituals, generational wisdoms, tribal rules, superstitions, religious mores and often other external values.	The traditional practitioner practices often rote patterns of seasonal preparations, planting, cultivation, and harvesting based on convention handed by parents, tribal elders and consistent with customs.
the earth is a living being within a living universe;		Innovations are not continually sought out and typically are slow in acceptance.
forces are at work in all that is both animate and inanimate;		Biodiversity is part of the traditional practices, stemming from the farmer's need for self-sufficiency with as much variety as possible.
celestial rhythms play a role in health and prosperity;		
animals and humans are an integral part of the whole		
the farm is not considered a distinct being; and		
although these elements form a whole, the image of health is not necessarily discernable		

Table 2. Industrial Agriculture Paradigm*

Ontology	Epistemology	Methodology
Industrial agriculture is an economic enterprise aimed at maximum short-term profit based on the most efficient use of resources and maximization of labor and technological efficiencies, in which:	The industrial practitioner stands in an exploitative business relationship with the "factory" farm. Observation, analysis and policy decisions are made on a bottom line basis.	The industrial practitioner is successful to the extent that economic profit is maximized. Consequently, methods and practices that lead to efficiencies of technology and labor are employed, assessed, and refined.
the earth is a relatively unlimited source of exploitable resources;	A technological framework shapes and restrains the thinking, problem identification and analysis of the practitioner.	Innovations are constantly sought out, but evaluated on the basis of their contribution to added profit from the business enterprise; which may come from increased output or decreased input.
substances are analyzed for a mechanical/manipulative use;	Biodiversity is seen to be economically inconsistent with efficiency. Monocrop production is the rule in the industrial paradigm.	
the influences of natural conditions are limited by technology;		
animals and humans are seen in the context of output of cash flow; and		
the farm is often seen as a machine or "factory" (mechanical perspective)		

Table 3. Organic Agriculture Paradigm*

Ontology	Epistemology	Methodology
Organic agriculture recognizes life as a complex ecosystem in which:	The organic practitioner stands in a benevolent appreciation of the complexity of the ecosystem and attempts to work within the framework of this ecosystem towards sustainability (zero-sum net gains or losses).	The organic practitioner seeks a sustainable subsistence, and restricts his/her activities to non-exploitative practices that "do no harm," and thus that support ongoing sustainability.
nature, on earth, is a living ecosystem; albeit purely material;		Organic production does not emphasize biodiversity as an essential principle, and monocrop production is common.
substances are analyzed for balanced, ecological use;		
natural conditions are accepted and adjusted to;		
domestic animals are often excluded for ethical values; and		
the farm is seen as an integral part of larger ecosystem (ecological perspective)		

Table 4. Biodynamic Agriculture Paradigm*

Ontology	Epistemology	Methodology
Biodynamics is a complex living and dynamic (spiritual) system of agriculture, in which:	The biodynamic practitioner stands in both a supportive and remedial relationship to this complex, living, dynamic farm individuality**.	From the diagnostic-therapeutic relationship follows that the biodynamic practitioner's activities are divided into supportive (preventative) maintenance and remedial (therapeutic) inteventions.
the earth is a living being in a living universe, characterized by a spiritual-physical matrix;	Observation, diagnosis and therapy development are the central themes of the practitioner's relationship with the farm.	In practice, there is a strong focus on balance, biodiversity, and plant and animal immunity.
substances are carriers of forces that create life;		
celestial rhythms directly effect terrestrial life;		
animals and humans emancipate from celestial rhythms; and		
the farm is a living, dynamic, spiritual individuality** (spiritual perspective)		

* Lorand, Andrew Christopher. 1996. Biodynamic Agriculture — A Paradigmatic Analysis. The Pennsylvania State University, Department of Agricultural and Extension Eduation. PhD Dissertation. 114 p.

** Where Lorand uses the terminology of Steiner (*individuality*), other authors instead use the term *organism*

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A Guide to *Multifunctional Hedgerows* in Western Oregon

J. Hobbs and D. McGrath

Hedgerows, also known as shelterbelts or windbreaks, are rows of trees, shrubs, and low-growing plants that divide or border fields and/or suburban lots. In England, many farms are surrounded by ancient hedgerows that conserve soil and water, provide a home to wildlife, and serve as barriers. In the United States, a similar tradition never developed, although trees sometimes were left along field margins. In the 1930s, tree planting for windbreaks on the prairies was briefly supported by the U.S. Department of Agriculture's Shelterbelt Program.

In recent years, as people have become more interested in sustainable farming methods, the many benefits of hedgerows have been rediscovered. Hedgerows can enhance the beauty, productivity, and biodiversity of farms.

For example, they:

- Enhance wildlife habitat
- Diversify farm income
- Reduce soil erosion
- Decrease wind damage
- Conserve water
- Create borders and privacy screens

Hedgerows can enhance the beauty, productivity, and biodiversity of farms.

OREGON STATE UNIVERSITY EXTENSION SERVICE

Jude Hobbs, farm and landscape designer, Agro-Ecology Northwest; and Dan McGrath, Extension horticulture agent, Willamette Valley, Oregon State University.

Enhance wildlife

Hedgerows provide habitat for a large variety of mammal, bird, reptile, and insect species, many of which are beneficial. Some examples of Northwest native plants that attract wildlife are oak, madrone, cedar, blue elderberry, hawthorn, Oregon ash, serviceberry, Oregon grape, salal, and kinnikinnick.

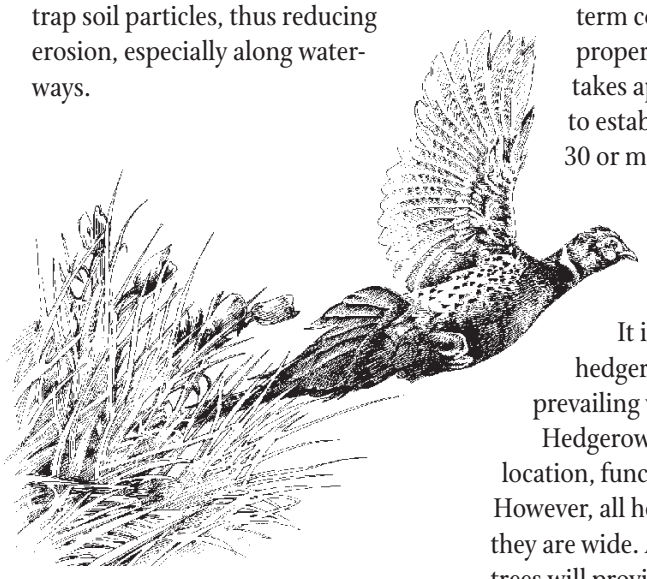
Diversify farm income

Trees, shrubs, and herbaceous plants can be selected for additional sources of income. Products that can be grown in hedgerows include nuts, fruits and berries, medicinal herbs (leaves, flowers, seeds, bark, and roots), seeds for collection, nursery stock, flowers, floral greenery, willows for craft material, and secondary wood products such as lumber, veneer, and firewood.

Many game birds such as quail, pheasant, and sage grouse are attracted to hedgerows. They can provide a potential source of revenue for landowners.

Reduce soil erosion

Rain, irrigation, clean cultivation, and vacant field borders can increase erosion potential. Hedgerows provide a barrier that can slow water flow and trap soil particles, thus reducing erosion, especially along waterways.



Decrease wind damage

Wind can disturb pollination and damage fruit and flowers when plant parts thrash against each other. Plants under wind stress put energy into growing stronger roots and stems. The results are smaller yields and delayed maturity. Strong winds also cause lodging of grain and grass crops, making harvest more difficult. Properly designed hedgerows can reduce wind speed by as much as 75 percent and improve crop performance.

Conserve water

Well-planned hedgerows retain water and reduce evaporation by blocking drying summer winds.

Create borders and privacy screens

Hedgerows are attractive borders. They can serve as privacy screens along roadsides and between properties. As they mature and become dense, they can reduce noise and dust and can function as barriers.

Establishing and maintaining hedgerows

Establishing hedgerows is a long-term commitment. With proper planning and care, it takes approximately 4 to 8 years to establish a hedgerow and 30 or more years for it to reach maturity.

A north-south planting direction is ideal, but not essential. It is most efficient to orient hedgerows perpendicular to prevailing winds.

Hedgerow layout depends on the location, function, and plants selected. However, all hedgerows are longer than they are wide. Although a single line of trees will provide some benefits, four or more rows of plants provide optimal windbreaks, water and soil conservation, and wildlife habitat. Place the plants that are tallest at maturity in the center row, with shorter ones interplanted between them and along the edges.

The location, function, and size of hedgerows are the most important factors influencing plant selection. A wide variety of plants is most beneficial. The plant lists on page 3 provide examples of plants available in western Oregon.

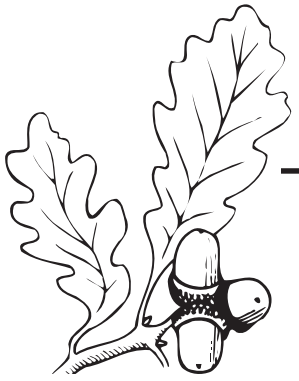
Avoid plants that are an alternate host for pests or diseases or that are invasive. Some perennial species such as blackberry, which are endemic, can provide excellent wildlife habitat and food crops but are highly invasive and require frequent maintenance.

Soil preparation is one of the keys to plant survival. An easy way to establish planting areas in existing grass or pasture is to apply a thin layer of compost or manure, followed by several layers of cardboard, and then a mulch such as straw or leaves. In large areas, this method may not be practical, so you can use cover crops instead. These crops improve soil fertility, reduce weeds, and attract beneficial insects.

When planting in heavy clay soil, you might till the ground in spring and plant an early cover crop such as crimson clover, followed by buckwheat. Till or disc in late summer and replant with an over-wintering cover crop such as crimson clover, field peas, or vetch. Till again in spring.

The ideal time for planting is March or April so that plants will have time to establish roots. You can apply amendments such as compost or manure as a top dressing.

Use seedlings in 2- to 4-inch planting tubes or 1-gallon containers. Some bareroot plants are more difficult to establish.



Plants for hedgerows

The list below provides *examples* of trees, shrubs, groundcovers, and perennial plants for hedgerows. These plants grow well to 600 feet above sea level. *Remember, proper site selection and plant requirements must be considered in hedgerow planning.*

Sun-tolerant plants that grow over 25'

Botanical name	Common name
Abies grandis	Grand fir
Acer macropyllum	Bigleaf maple
Alnus rubra	Red alder*
Calocedrus decurrens	Incense-cedar
Castanea	Chestnut
Chrysolepis chrysophylla	Golden chinkapin
Fraxinus latifolia	Oregon ash*
Ilex species	Holly
Juglans regia	English walnut
Picea species	Spruce
Pinus ponderosa 'Willamette Valley'	Ponderosa pine
Populus trichocarpa	Black cottonwood
Prunus subcordata	Klamath plum*
Pseudotsuga menziesii	Douglas-fir
Quercus garryana	Oregon white oak
Robinia pseudoacacia	Black locust
Thuja plicata	Western redcedar

Sun-tolerant plants that grow under 25'

Botanical name	Common name
Malus spp.	Apple
Arbutus spp.	
Ceanothus veluntinus	Tobacco brush
Crataegus douglasii	Hawthorn
Crataegus oxycantha	English hawthorn
Diospyros kaki	Japanese persimmon
Diospyros virginiana	American persimmon
Eleagnus umbellata	Autumn olive
Malus fusca	West coast crabapple
Myrica pennsylvanica	Bayberry
Ribes sanguineum	Red flowering currant*•
Ribes divariculatum	Black gooseberry*•
Ribes nigra	Black currant*•
Rosa nutkana	Nootka rose•
Salix fluviatalis	Columbia River willow*
Salix hookeriana	Hooker's willow*
Sambucus cerulea	Blue elderberry*
Spiraea douglasii	Western spiraea*
Vaccinium corybosum	Blueberry*•

Plants for pond edges

Botanical name	Common name
Typha latifolia	Cattail*
Ledum grandulosum	Labrador tea*

Plants that tolerate shade

Botanical name	Common name
Chrysolepis chrysophylla	Golden chinkapin
Cornus nuttallii	Western flowering dogwood*
Corylus cornuta	Hazel*
Physocarpus capitatus	Ninebark
Polystichum munitum	Sword fern
Sambucus racemosa	Red elderberry*
Prunus virginiana	Chokecherry

Plants that tolerate partial shade to shade

Botanical name	Common name
Acer circinatum	Vine maple *
Amelanchier alnifolia	Serviceberry
Berberis aquifolium	Oregon grape•
Gaultheria shallon	Salal
Cornus stolinifera	Red-osier dogwood•
Holodiscus discolor	Ocean spray
Lonicera involucrata	Twinberry•
Oemleria cerasiformis	Indian plum
Philadelphus lewisii	Mock orange
Rhamnus purshiana	Cascara sagrada
Taxus brevifolia	Western yew*
Vaccinium ovatum	Evergreen huckleberry•

Edge plantings

Botanical name	Common name
Achillea millefolium	Yarrow•
Berberis nervosa	Cascade Oregon grape•
Calendula officinalis	Calendula•
Cichorium intybus	Chicory•
Foeniculum vulgare	Fennel•
Frageria chiloensis	Wild strawberry
Gaultheria shallon	Salal•
Lavendula angustifolia	English lavender•
Medicago sativa	Alfalfa•

Bamboo

Botanical name	Common name
Phyllostachys aurea	Yellow groove*
Phyllostachys bambusoides	Giant timber *
Phyllostachys nigra	Black bamboo*
Phyllostachys bissetii	Bisset bamboo*
*Phyllostachys congesta**	
*Phyllostachys meyeri**	

**Grows in wet soils •Easily maintained to 5 feet tall*

A variety of techniques can inhibit unwanted plants within the hedgerow. The simplest method is to leave alleys between plant rows for mowing, cultivation, or mulching until plants are well established. As plants mature, they eventually will shade out most annual crop weeds.

Mulching heavily with leaves, straw, sawdust, or cardboard is effective. Ideally, an area 6 to 8 feet wide around the hedgerow can be mowed, flailed, or tilled for weed management, fire protection, and rodent control. If necessary, protect young plants from animals with wire mesh, plastic-coated cardboard, or other materials. If you use chemicals, it is essential to protect riparian zones along rivers, creeks, and ponds from contamination.

Some plants may need supplemental water the first 3 years. Methods include swales, furrows, flood, and/or drip irrigation. You also can extend overhead crop irrigation to hedgerow plantings.

Costs of establishment

Planting hedgerows does not have to be expensive. Seedling plants are available at low cost, and propagating from existing plantings is feasible.

Government programs are available to assist landowners with hedgerow development. Many counties have riparian lands tax exemption programs and wildlife habitat conservation and management programs.

For more information

Agro-Ecology Northwest
Pacific Northwest Hedgerow Project
1161 Lincoln Street
Eugene, OR 97401
541-342-1160 (Jude Hobbs)

OSU Extension Service
Marion County office
3180 Center Street NE #1361
Salem, OR 97301
503-588-5301 (Daniel McGrath)

Oregon Department of Fish and Wildlife
170 NE Vandenberg Avenue
Corvallis, OR 97330-9446
541-757-4186 (Steve Smith)

Plant resources

Hortus Northwest
P.O. Box 379
Hubbard, OR 97032
503-570-0859 or 800-704-7927
A Pacific Northwest native plant directory and journal

Oregon Association of Nurserymen
2780 SE Harrison Street, Suite 102
Milwaukie, OR 97222
800-342-6401
List of nurseries

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Published October 1998.

Hedgerows
Benefits on Farms

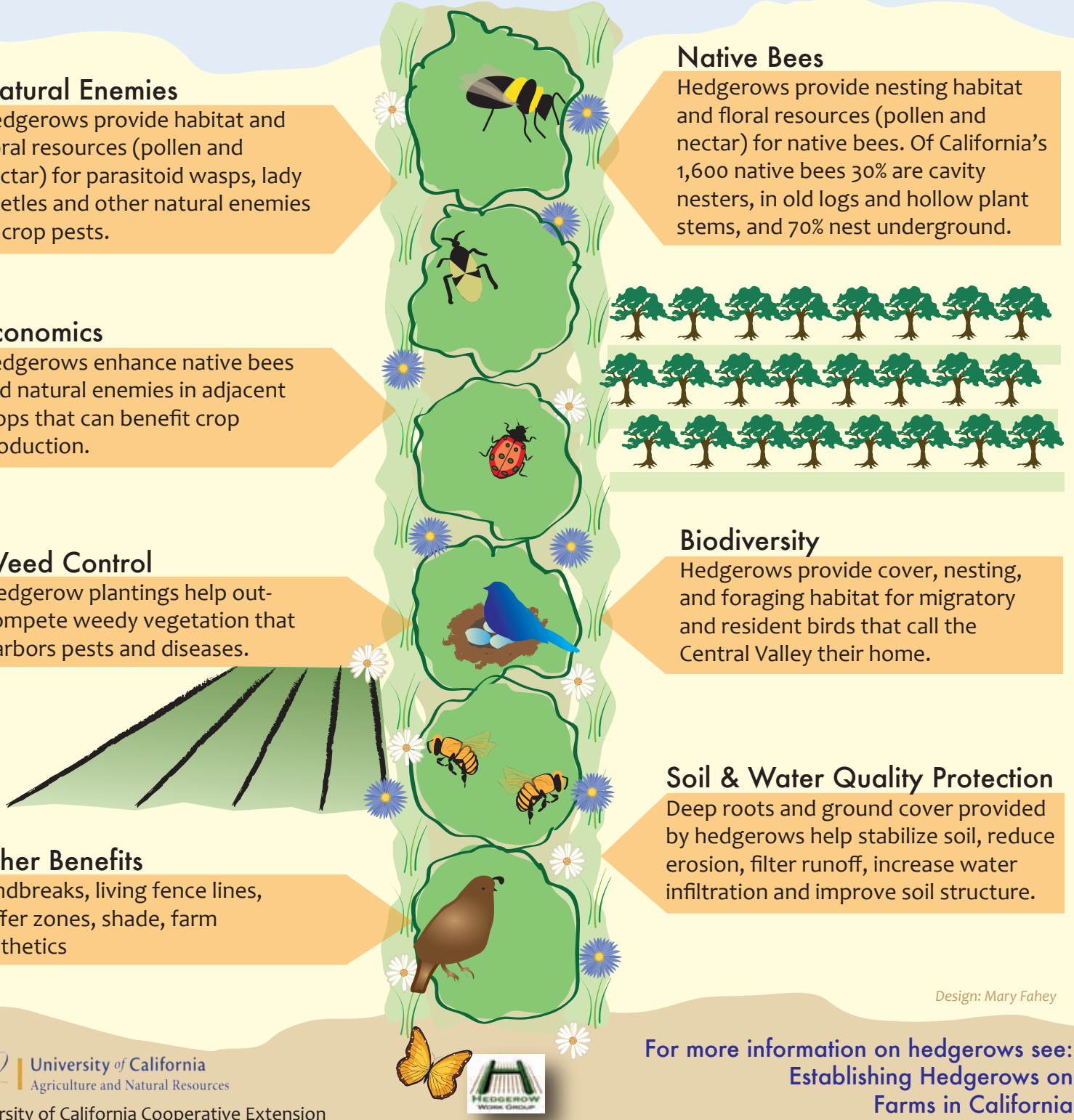
A hedgerow is a row of trees, shrubs, bunch grasses and forbs on field edges.

Natural Enemies
Hedgerows provide habitat and floral resources (pollen and nectar) for parasitoid wasps, lady beetles and other natural enemies of crop pests.

Economics
Hedgerows enhance native bees and natural enemies in adjacent crops that can benefit crop production.

Weed Control
Hedgerow plantings help out-compete weedy vegetation that harbors pests and diseases.

Other Benefits
Windbreaks, living fence lines, buffer zones, shade, farm aesthetics



Native Bees
Hedgerows provide nesting habitat and floral resources (pollen and nectar) for native bees. Of California's 1,600 native bees 30% are cavity nesters, in old logs and hollow plant stems, and 70% nest underground.

Biodiversity
Hedgerows provide cover, nesting, and foraging habitat for migratory and resident birds that call the Central Valley their home.

Soil & Water Quality Protection
Deep roots and ground cover provided by hedgerows help stabilize soil, reduce erosion, filter runoff, increase water infiltration and improve soil structure.

Design: Mary Fahey

University of California
Agriculture and Natural Resources

University of California Cooperative Extension
70 Cottonwood St., Woodland, CA 95695
530-666-8734 (office) | http://ceyolo.ucdavis.edu

For more information on hedgerows see:
Establishing Hedgerows on Farms in California
http://anrcatalog.ucdavis.edu
(publication #8390)

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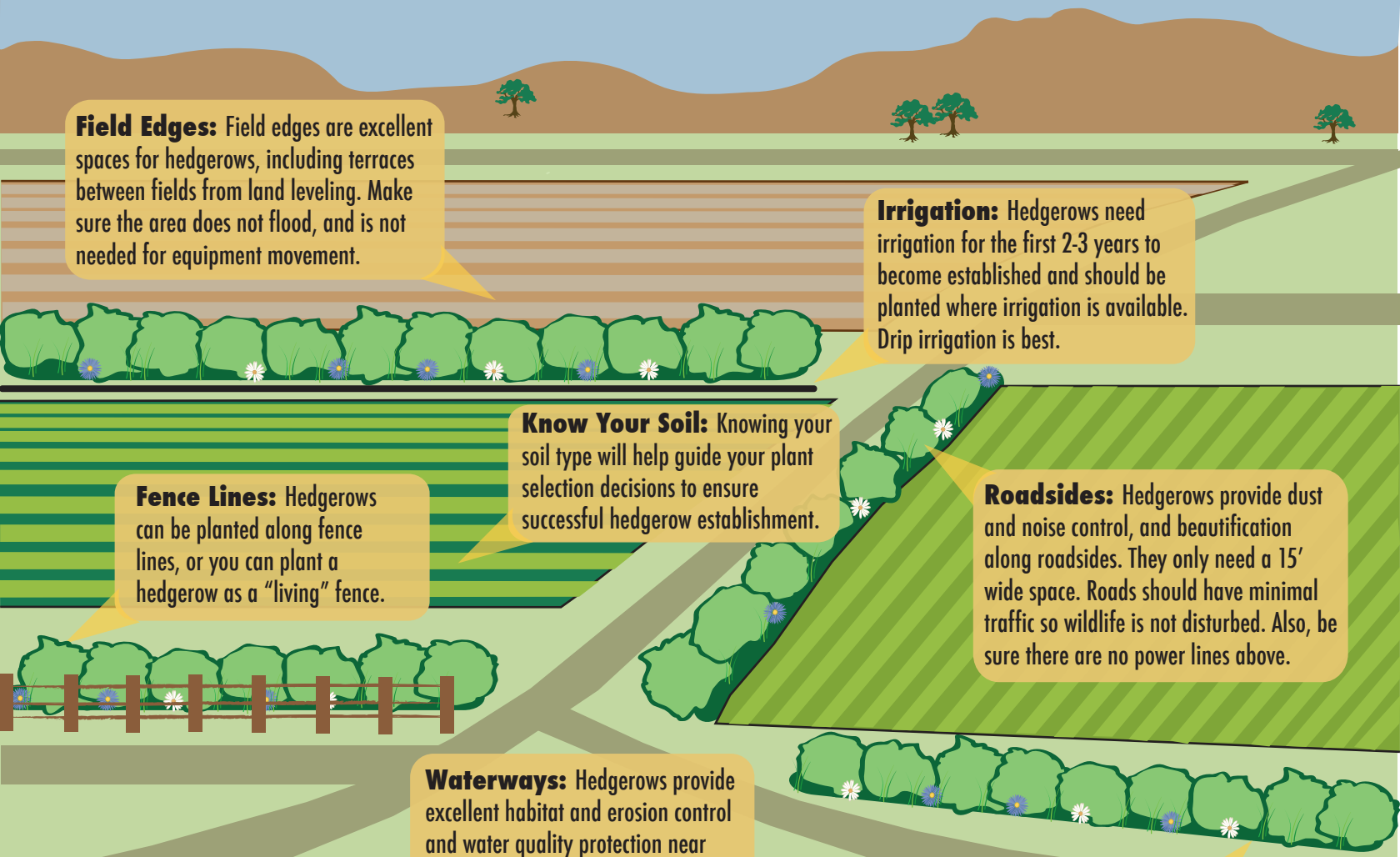
Hedgerows
Best Locations on Farms



Field Edges: Field edges are excellent spaces for hedgerows, including terraces between fields from land leveling. Make sure the area does not flood, and is not needed for equipment movement.

Irrigation: Hedgerows need irrigation for the first 2-3 years to become established and should be planted where irrigation is available. Drip irrigation is best.

Know Your Soil: Knowing your soil type will help guide your plant selection decisions to ensure successful hedgerow establishment.

Fence Lines: Hedgerows can be planted along fence lines, or you can plant a hedgerow as a "living" fence.

Roadsides: Hedgerows provide dust and noise control, and beautification along roadsides. They only need a 15' wide space. Roads should have minimal traffic so wildlife is not disturbed. Also, be sure there are no power lines above.

Waterways: Hedgerows provide excellent habitat and erosion control and water quality protection near waterways, including ponds, streams, sloughs and drains.

Unproductive Areas: Many farms have odd-shaped areas that are not productive. These are perfect places to install a hedgerow to beautify the area, suppress weeds, and attract beneficial insects such as pollinators.

Design: Mary Fahey

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Hedgerow Work Group

For more information on hedgerows see:
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(publication #8390)

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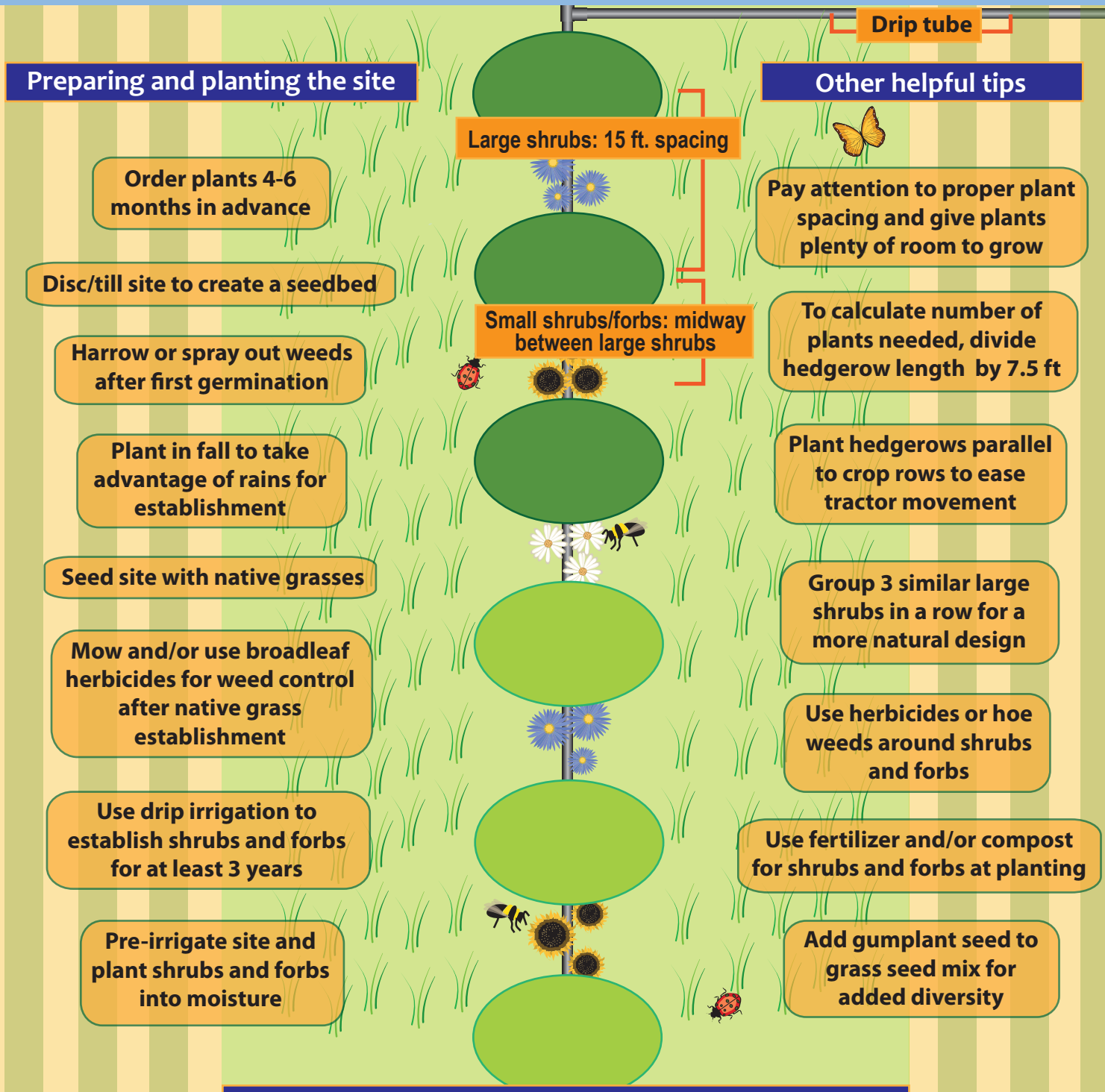
Inside Hedgerows

The Dynamics of a Hedgerow Planting



Preparing and planting the site

- Order plants 4-6 months in advance
- Disc/till site to create a seedbed
- Harrow or spray out weeds after first germination
- Plant in fall to take advantage of rains for establishment
- Seed site with native grasses
- Mow and/or use broadleaf herbicides for weed control after native grass establishment
- Use drip irrigation to establish shrubs and forbs for at least 3 years
- Pre-irrigate site and plant shrubs and forbs into moisture

Other helpful tips

- Pay attention to proper plant spacing and give plants plenty of room to grow
- To calculate number of plants needed, divide hedgerow length by 7.5 ft
- Plant hedgerows parallel to crop rows to ease tractor movement
- Group 3 similar large shrubs in a row for a more natural design
- Use herbicides or hoe weeds around shrubs and forbs
- Use fertilizer and/or compost for shrubs and forbs at planting
- Add gumplant seed to grass seed mix for added diversity

Hedgerow width is minimum 15 ft., and usually a field length

See our Hedgerow Plant List to choose the right shrubs, forbs and native grasses for your farm

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Companion Plants for Cannabis

Welcome back, this week on the Bounty Blog we're going to talk about the many benefits of using companion plants in your cannabis garden.

Companion planting is the act of planting different crops in close proximity to each other in an effort to recycle nutrients, improve flavors, and most importantly, as an organic tool for pest management. By incorporating specific companion plants for cannabis you will improve your garden's overall health and resistance to disease.

Pests plague almost all cannabis growers. Indoor growers typically encounter pests such as aphids, fungus gnats, spider mites, thrips and whiteflies, but they have the ability to control their growing environment more easily. Outdoor growers on the other hand have a grader time combatting nature's pesty invaders such as caterpillars, slugs, snails, rodents, and basically any insect nature's playground harbors. This is why companion plants for cannabis are especially helpful for organic outdoor growers who do not want to use potentially harmful pesticides on their growing ladies.

So, let's explore some specific companion plants for cannabis that will help control pests in your medical marijuana gardens.

Companion Plants for Cannabis that Deter Pests

Some plants release chemicals that naturally repel pests and this can help prevent any neighboring plants from infestation.

- *Chrysanthemum* flowers contain pyrethrin, a natural insecticide
- Aromatic herbs such as *basil* release insect repellants from their foliage
- Slugs typically steer clear of *basil, fennel, rosemary,* and *mint* (others)
- *Coriander* repels aphids, spider mites and potato beetles
- *Costmary* helps to repel moths

Companion Plants for Cannabis that Attract Pest Predators

If you can't get a certain pest to stay away, then invite their predators to the party. Implementing these plants attracts the predators of the pests munching away at your garden. Good thing we're at the top of the food chain!

- *Dill, Fennel, Parsnip, Anise, Cumin, Chamomile,* and *Parsley* are magnets for predatory bugs such as wasps that prey on aphids and caterpillars

Host Plants for Cannabis; Companion Plants that Pest Can Infest

Here is a genius decoy— get a plant that pests absolutely ADORE and let them infest it. Just don't plant this trap in the same pot as your cannabis, but place her nearby.

Butterflies although cute can be a nuisance to an outdoor cannabis grower. Butterflies love *Milkweed*, *Dill*, *Fennel*, *Parsley* and many other garden favorites. So planting a few pots near your cannabis garden can discourage hungry butterflies, and future hungrier caterpillars, away from your girls.

Aphids, which don't have the cute cover butterflies do, are especially attracted to *Nasturtium*, *Roses, Milkweed*, & *Mums*.

Basil and *Chives* are rumored to improve flavor while *Chamomile* is said to increase oil production in surrounding plants such as carrots and tomatoes; some food for thought for cannabis growers looking to intensify flavors and increase resin production.

Companion Plants for Cannabis that Recycle Nutrients

Companion planting doesn't only amplify health, oil production, and flavor, but also can be key players in the ever-recycling nutrient ecosystem.

Legumes (peas, beans, lentils, etc) are able to do a really, really cool thing– break the triple bonds of atmospheric nitrogen with the help of Rhizobium bacteria. In doing so, these companion plants are able to contribute to the pool of readily available nitrogen — these plants have been termed *givers* in some gardens.

- *Alfalfa*: fixes the soil with nitrogen while also accumulating iron, magnesium, phosphorous and potassium

- *Beans:* all bean enrich the soil with nitrogen, which is why they are perfect for heavy nitrogen users– think of that nitrogen thirsty strain in your stable
- *Chamomile*: accumulates calcium, potassium and sulfur

Companion plants can also change the composition of the medium itself, loosening compacted soils and making it easier for air and water to penetrate.
From rosemary for home-cooked-meals to pretty flowers serving as eye candy– incorporating companion plants benefits the ecosystem surrounding your medicinal garden. Planting accompanying herbs and plants alongside your girls help recycle and to an extent buffer nutrient uptake, amplify flavors, and serves as leverage in pest management. Now go out there and plant something pretty! Hope this helped, happy companion plant growing!

About missmmjgeek
Miss MMJGeek is an official guest blogger for North County Bounty, chosen for her outstanding growing knowledge and activism in the medical marijuana community. She has a strong background in neuroscience and plant physiology and, as you can see, is an awesome writer as well. You can find her on Instagram @missmmjgeek or at her WordPress site.

*If you're looking for a more detailed list of great accompanying plants check this link out!

Many plants have natural substances in their roots, flowers, leaves etc. that can alternately repel (anti-feedants) and/or attract insects depending on your needs. In some situations they can also help enhance the growth rate and flavor of other varieties. Experience shows us that using companion planting through out the landscape is an important part of integrated pest management. In essence companion planting helps bring a balanced eco-system to your landscape, allowing nature to do its' job. Nature integrates a diversity of plants, insects, animals, and other organisms into every ecosystem so there is no waste. The death of one organism can create food for another, meaning symbiotic relationships all around. We consider companion planting to be a holistic concept due to the many intricate levels in which it works with the ecology.

By using companion planting, many gardeners find that they can discourage harmful pests without losing the beneficial allies. There are many varieties of herbs, flowers, etc. that can be used for companion plants. Be open to experimenting and find what works for you. Some possibilities would be using certain plants as a border, backdrop or interplanting in your flower or vegetable beds where you have specific needs. Use plants that are native to your area so the insects you want to attract already know what to look for! Plants with open cup shaped flowers are the most popular with beneficial insects.

Companion planting can combine beauty and purpose to give you an enjoyable, healthy environment. Have fun, let your imagination soar. There are many ways you can find to incorporate these useful plants in your garden, orchard, flower beds etc.

PLANT GUIDE

ALFALFA: Perennial that roots deeply. Fixes the soil with nitrogen, accumulates iron, magnesium, phosphorous and potassium. Withstands droughts with it's long taproot and can improve just about any soil! Alfalfa has the ability to break up hard clay soil and can even send its' roots through rocks! Now that is a tenacious plant! Alfalfa is practically pest and disease free. It needs only natural rainfall to survive.

AMARANTH: A tropical annual that needs hot conditions to flourish. Good with sweet corn, it's leaves provide shade giving the corm a rich, moist root run. Host to predatory ground beetles. Eat the young leaves in salads.

ANISE: Licorice flavored herb, good host for predatory wasps which prey on aphids and it is also said to repel aphids. Deters pests from brassicas by camouflaging their odor. Improves the vigor of any plants growing near

it. Used in ointments to protect against bug stings and bites. Good to plant with coriander.

ARTEMISIAS: See Wormwood

ASPARAGUS: Friends: Aster family flowers, dill ,coriander, tomatoes, parsley, basil, comfrey and marigolds. Avoid: Onions, garlic and potatoes.

BASIL: Plant with tomatoes to improve growth and flavor. Basil also does well with peppers, oregano, asparagus and petunias. Basil can be helpful in repelling thrips. It is said to repel flies and mosquitoes. Do not plant near rue or sage.

BAY LEAF: A fresh leaf bay leaf in each storage container of beans or grains will deter weevils and moths. Sprinkle dried leaves with other deterrent herbs in garden as natural insecticide dust. A good combo: Bay leaves, cayenne pepper, tansy and peppermint.

*

For ladybug invasions try spreading bay leaves around in your house anywhere they are getting in and congregating. They should leave.

BEANS: All bean enrich the soil with nitrogen fixed form the air. In general they are good company for carrots, celery, chards, corn, eggplant, peas, potatoes, brassicas, beets, radish, strawberry and cucumbers. Beans are great for heavy nitrogen users like corn and grain plants because beans fix nitrogen from the air into the soil so the nitrogen used up by the corn and grains are replaced at the end of the season when the bean plants die back. French Haricot beans, sweet corn and melons are a good combo. Summer savory deters bean beetles and improves growth and flavor. Keep beans away from the alliums.

BEE BALM (Oswego, Monarda): Plant with tomatoes to improve growth and flavor. Great for attracting beneficials and bees of course. Pretty perennial that tends to get powdery mildew.

BEET: Good for adding minerals to the soil. The leaves are composed of 25% magnesium making them a valuable addition to the compost pile if you don't care to eat them. Beets are also beneficial to beans with the exception of runner beans. Runner or pole beans and beets stunt each other's growth. Companions for beets are lettuce, onions and brassicas. Beets and kohlrabi grow perfectly together. Beets are helped by garlic and mints. Garlic improves growth and flavor. Rather than planting invasive mints around beets use your mint clippings as a mulch.

BORAGE: Companion plant for tomatoes, squash, strawberries and most plants. Deters tomato hornworms and cabbage worms. One of the best bee and wasp attracting plants. Adds trace minerals to the soil and a good addition the compost pile. The leaves contain vitamin C and are rich in calcium, potassium and mineral salts. Borage may benefit any plant it is growing next to via increasing resistance to pests and disease. It also makes a nice mulch for most plants. Borage and strawberries help each other and strawberry farmers always set a few plants in their beds to enhance the fruits flavor and yield. Plant near tomatoes to improve growth and disease resistance. After you have planned this annual once it will self seed. Borage flowers are edible.

BRASSICA: Benefit from chamomile, peppermint, dill, sage, and rosemary. They need rich soil with plenty of lime to flourish. Avoid planting with mustards, nightshades (tomatoes, peppers, etc).

BUCKWHEAT: (Member of the family Polygonaceae) Accumulates calcium and can be grown as an excellent cover crop aka green manure. Buckwheat’s shallow white blossoms attract beneficial insects that control or parasitize aphids, mites and other pests. The beneficials it attracts include the following: hover flies (Syrphidae),

predatory wasps, minute pirate bugs, insidious flower bugs, tachinid flies and lady beetles. Flowering may start within three weeks of planting and continue for up to 10 weeks. Buckwheat will take up phosphorus and some minor nutrients that are otherwise unavailable to plants. These nutrients are released as the residue of the buckwheat breaks down and are then available for later crops. The fine roots makes topsoil loose and friable with only minimal tillage.

CABBAGE: Celery, dill, onions and potatoes are good companion plants. Celery improves growth and health. Clover interplanted with cabbage has been shown to reduce the native cabbage aphid and cabbageworm populations by interfering with the colonization of the pests and increasing the number of predatory ground beetles. Plant Chamomile with cabbage as it Improves growth and flavor. Cabbage does not get along with strawberries, tomatoes, peppers, eggplants, rue, grapes and pole beans.

CARAWAY: Good for loosening compacted soil with it's deep roots so it's also compatible next to shallow rooted crops. Plant it with strawberries. Caraway can be tricky to establish. The flowers attract a number of beneficial insects especially the tiny parasitic wasps. Keep it away from dill and fennel.

CARROTS: Their pals are leaf lettuce, onions and tomatoes. Plant dill and parsnips away from carrots. Flax produces an oil that may protect root vegetables like carrots from some pests. One drawback with tomatoes and carrots: tomato plants can stunt the growth of your carrots but the carrots will still be of good flavor.

CATNIP: Deters flea beetles, aphids, Japanese beetles, squash bugs, ants and weevils. We have found it repels mice quite well: mice were wreaking havoc in our outbuildings, we spread sprigs of mint throughout and the mice split! Use sprigs of mint anywhere in the house you want deter mice and ants. Smells good and very safe.

CELERY: Companions: Bean, cabbage family, leek, onion, spinach and tomato. Flowers for celery: cosmos, daisies and snapdragons. Foe: Corn.

CHAMOMILE, GERMAN: Annual. Improves flavor of cabbages, cucumbers and onions. Host to hoverflies and wasps. Accumulates calcium, potassium and sulfur, later returning them to the soil. Increases oil production from herbs. Leave some flowers unpicked and German chamomile will reseed itself. Roman chamomile is a low growing perennial that will tolerate almost any soil conditions. Both like full sun. Growing chamomile of any type is considered a tonic for anything you grow in the garden.

CHARDS: Companions: Bean, cabbage family and onion.

CHERVIL: Companion to radishes, lettuce and broccoli for improved growth and flavor. Keeps aphids off lettuce. Said to deter slugs. Likes shade.

CHIVES: Improves growth and flavor of carrots and tomatoes. A friend to apples, carrots, tomatoes, brassica (broccoli, cabbage, mustard, etc) and many others. Keeps aphids help to keep aphids away from tomatoes, mums and sunflowers. Chives may drive away Japanese beetles and carrot rust fly. Planted among apple trees it helps prevent scab and among roses it prevents black spot. You will need patience as it takes about 3 years for plantings of chives to prevent the 2 diseases. A tea of chives may be used on cucumbers and gooseberries to prevent downy and powdery mildews. Avoid planting near beans and peas. See chive tea on disease page.

CHRYSANTHEMUMS: C. coccineum kills root nematodes. (the bad ones) It's flowers along with those of C. cineraruaefolium have been used as botanical pesticides for centuries. (i.e. pyrethrum) White flowering chrysanthemums repel Japanese beetles. To the right is a picture of the painted daisy from which pyrethrum is extracted.

CLOVER: Long used as a green manure and plant companion and is especially good to plant under grapevines.

Attracts many beneficials. Useful planted around apple trees to attract predators of the woolly aphid. Clover interplanted with cabbage has been shown to reduce the native cabbage aphid and cabbageworm populations by interfering with the colonization of the pests and increasing the number of predator ground beetles.

COMFREY: Accumulates calcium, phosphorous and potassium. Likes wet spots to grow in. Comfrey is beneficial to avocado and most other fruit trees. Traditional medicinal plant. Good trap crop for slugs. More on comfrey.

CORIANDER: Repels aphids, spider mites and potato beetle. A tea from this can be used as a spray for spider mites. A partner for anise.

CORN: Amaranth, beans, cucumber, white geranium, lamb's quarters, melons, morning glory, parsley, peanuts, peas, potato, pumpkin, soybeans, squash and sunflower. A classic example is to grow climbing beans up corn while inter-planting pumpkins. The corn provides a natural trellis for the beans, pumpkins smother the weeds and helps corn roots retain moisture. Corn is a heavy feeder and the beans fix nitrogen from air into the soil. The beans do not feed the corn will it is growing but when the bean plants die back they return nitrogen to the soil that was used up by the corn. A win-win situation. Another interesting helper for corn is the weed Pig's Thistle which raises nutrients from the subsoil to where the corn can reach them. Keep corn away from celery and tomato plants.

COSTMARY: This 2-3 foot tall perennial of the chrysanthemum family helps to repel moths.

CUCUMBERS: Cucumbers are great to plant with corn and beans. The three plants like the same conditions warmth, rich soil and plenty of moisture. Let the cucumbers grow up and over your corn plants. A great duet is to plant cukes with sunflowers. The sunflowers provide a strong support for the vines. Cukes also do well with peas, beets, radishes and carrots. Radishes are a good deterrent against cucumber beetles. Dill planted with cucumbers helps by attracting beneficial predators. Nasturtium improves growth and flavor. Keep sage, potatoes and rue away from cucumbers.

DAHLIAS: These beautiful, tuberous annuals that can have up to dinner plate size flowers repels nematodes!

DILL: Improves growth and health of cabbage. Do not plant near carrots, caraway or tomatoes. Best friend for lettuce. Attracts hoverflies and predatory wasps. Repels aphids and spider mites to some degree. Also may repel the dreaded squash bug! (scatter some good size dill leaves on plants that are suspect to squash bugs, like squash plants.) Dill goes well with lettuce, onions, cabbage, sweet corn and cucumbers. Dill does attract the tomato horn worm so it would be useful to plant it somewhere away from your tomato plants to keep the destructive horn worm away from them. Do plant dill in an appropriate spot for the swallowtail butterfly caterpillars to feed on. Even their caterpillars are beautiful.

EGGPLANT: Plant with amaranth, beans, peas, spinach, tarragon, thyme and marigold. Eggplant is a member of the nightshade family and does well with peppers. Avoid planting fennel near eggplant.

ELDERBERRY: A spray (see insect treatments) made from the leaves can be used against aphids, carrot root fly, cucumber beetles and peach tree borers. Put branches and leaves in mole runs to banish them. Elderberry leaves added to the compost pile speeds up the decomposing process.

FLAX: Plant with carrots, and potatoes. Flax contains tannin and linseed oils which may offend the Colorado potato bug. Flax is an annual from 1-4 feet tall with blue or white flowers that readily self sows.

FOUR-O'CLOCKS: Draws Japanese beetles like a magnet which then dine on the foliage. The foliage is pure poison to them and they won't live to have dessert! It is important to mention that Four O'clock are also

poisonous to humans and animals. Please be careful where you plant them if you have children and pets. They are a beautiful annual plant growing from 2-3 feet high with a bushy growth form.

GARLIC: Plant near roses to repel aphids. It also benefits apple trees, pear trees, cucumbers, peas, lettuce and celery. Garlic accumulates sulfur: a naturally occurring fungicide which will help in the garden with disease prevention. Garlic is systemic in action as it is taken up the plants through their pores and when garlic tea is used as a soil drench it is also taken up by the plant roots. Has value in offending codling moths, Japanese beetles, root maggots, snails, and carrot root fly. Researchers have observed that time-released garlic capsules planted at the bases of fruit trees actually kept deer away. It's certainly worth a try! Concentrated garlic sprays have been observed to repel and kill whiteflies, aphids and fungus gnats among others with as little as a 6-8% concentration! It is safe for use on orchids too.

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Try concentrated Garlic Barrier Insect Repellent!

GERANIUM: -Repels cabbage worms and Japanese beetles, plant around grapes, roses, corn, tomatoes, peppers and cabbage. Geraniums help to distract beet leafhoppers, carrier of the curly top virus.

GOPHER PURGE: Deters gophers, and moles.

GRAPES: Hyssop is beneficial to grapes as are basil, beans, geraniums, oregano, clover, peas, or blackberries. Keep radishes and cabbage away from grapes. Planting clover increases the soil fertility for grapes. Chives with grapes help repel aphids. Plant your vines under Elm or Mulberry trees.

HEMP: Repels many types of beetles which attack brassicas.

HORSERADISH: Plant in containers in the potato patch to keep away Colorado potato bugs. Horseradish increases the disease resistance of potatoes. There are some very effective insect sprays that can be made with the root. Use the bottomless pot method to keep horseradish contained. Also repels Blister beetles. We have observed that the root can yield anti-fungal properties when a tea is made from it. (See: Horseradish: Disease)

HOREHOUND: (Marrubium Vulgare) like many varieties in the mint family, the many tiny flowers attract Braconid and Icheumonid wasps, and Tachnid and Syrid flies. The larval forms of these insects parasitize or otherwise consume many other insects pests. It grows where many others fail to thrive and can survive harsh winters. Blooms over a long season, attracting beneficial insects almost as long as you are likely to need them. For best results use horehound directly as a companion plant. Stimulates and aids fruiting in tomatoes and peppers.

HYSSOP: Companion plant to cabbage and grapes, deters cabbage moths and flea beetles. Do not plant near radishes. Hyssop may be the number one preference among bees and some beekeepers rub the hive with it to encourage the bees to keep to their home. It is not as invasive as other members of the mint family making it safer for interplanting.

KELP: When used in a powder mixture or tea as a spray, this versatile sea herb will not only repel insects but feed the vegetables. In particular we have observed that kelp foliar sprays keep aphids and Japanese beetles away when used as a spray every 8 days before and during infestation times. If you have access to seaweed, use it as a mulch to keep slugs away.

KOHLRABI: May be planted with cucumber, onion and chives. Kohlrabi and beets are perfect to grow with one another! Do not plant kohlrabi with pole beans, pepper, strawberry or tomatoes.

LAMIUM: This will repel potato bugs- a big problem for many gardeners!

LARKSPUR: An annual member of the Delphinium family, larkspur will attract Japanese beetles. They dine and die! Larkspur is poisonous to humans too.

LAVENDER: Repels fleas and moths. Prolific flowering lavender nourishes many nectar feeding and beneficial insects. Lavenders can protect nearby plants from insects such as whitefly, and lavender planted under and near fruit trees can deter codling moth. Use dried sprigs of lavender to repel moths. Start plants in winter from cuttings, setting out in spring.

LEEKS: Use leeks near apple trees, carrots, celery and onions which will improve their growth. Leeks also repel carrot flies. Avoid planting near legumes.

LEMON BALM: Sprinkle throughout the garden in an herbal powder mixture to deter many bugs. Lemon balm has citronella compounds that make this work: crush and rub the leaves on your skin to keep mosquitoes away! Use to ward off squash bugs!

LETTUCE: Does well with beets, bush beans, pole beans, cabbage, carrots, cucumbers, onion, radish and strawberries. It grows happily in the shade under young sunflowers.

LOVAGE: Improves flavor and health of most plants. Good habitat for ground beetles. A large plant, use one planted as a backdrop. Similar to celery in flavor.

MARIGOLDS: (Calendula): Given a lot of credit as a pest deterrent. Keeps soil free of bad nematodes; supposed to discourage many insects. Plant freely throughout the garden. The marigolds you choose must be a scented variety for them to work. One down side is that marigolds do attract spider mites and slugs.

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French Marigold (T. patula) has roots that exude a substance which spreads in their immediate vicinity killing nematodes. For nematode control you want to plant dense areas of them. There have been some studies done that proved this nematode killing effect lasted for several years after the plants were These marigolds also help to deter whiteflies when planted around tomatoes and can be used in greenhouses for the same purpose. Whiteflies hate the smell of marigolds. Do not plant French marigolds next to bean plants.
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Mexican marigold (T. minuta) is the most powerful of the insect repelling marigolds and may also overwhelm weed roots such as bind weed! It is said to repel the Mexican bean beetle and wild bunnies! Be careful it can have an herbicidal effect on some plants like beans and cabbage.

MARJORAM: As a companion plant it improves the flavor of vegetables and herbs. Sweet marjoram is the most commonly grown type.

MELONS: Companions: Corn, pumpkin, radish and squash. Other suggested helpers for melons are as follows: Marigold deters beetles, nasturtium deters bugs and beetles. Oregano provides general pest protection.

MINT: Deters white cabbage moths, ants, rodents, flea beetles, fleas, aphids and improves the health of cabbage and tomatoes. Use cuttings as a mulch around members of the brassica family. Mint flowers attract hoverflies and predatory wasps. Earthworms are quite attracted to mint plantings. Be careful where you plant it as mint is an incredibly invasive perennial. We have found that placing peppermint cuttings (fresh or dried) where mice

are a problem is very effective in driving them off!

MOLE PLANTS: (castor bean plant) Deter moles and mice if planted here and there throughout the garden. Drop a seed of this in mole runs to drive them away. This is a poisonous plant. See Moles: Critter Trouble

MORNING GLORIES: They attract hoverflies. Plus if you want a fast growing annual vine to cover something up morning glory is an excellent choice.

NASTURTIUMS: Nasturtium is an excellent companion for many plants. It is a companion to radishes, cabbage family plants (cabbage, collards, cauliflower, kale, kohlrabi, broccoli and mustards), deterring aphids, squash bugs, and striped pumpkin beetles, and improving growth and flavor. Plant as a barrier around tomatoes, cabbage, cucumbers, and under fruit trees. Deters wooly aphids, whiteflies, cucumber beetles and other pests of the cucurbit family. Great trap crop for aphids (in particular the black aphids) which it does attract, especially the yellow flowering varieties. It likes poor soil with low moisture and no fertilizer. Keeping that in mind there is no reason not to set potted nasturtiums among your garden beds. It has been the practice of some fruit growers that planting nasturtiums every year in the root zone of fruit trees allow the trees to take up the pungent odor of the plants and repel bugs. Studies say it is among the best at attracting predatory insects. It has no taste effect on the fruit. A nice variety to grow is Alaska which has attractive green and white variegated leaves. The leaves, flowers and seeds of nasturtiums are all edible and wonderful in salads!
Try our recipe for: Nasturtium Salad

NETTLES, STINGING: The flowers attract bees. Sprays made from these are rich in silica and calcium. Invigorating for plants and improves their disease resistance. Leaving the mixture to rot, it then makes an excellent liquid feed. Comfrey improves the liquid feed even more. Hairs on the nettles' leaves contain formic acid which "stings" you.

OKRA: (Hibiscus esculentus) Plant lettuce around your okra plants and they will shade the lettuce in the summer giving you some more growing time. Okra also does well with peppers and eggplants as it helps protect these brittle stemmed plants from high winds. It also gets along with basil, cucumbers, melons, and black eyed peas. For planting with the peas plant your Okra first. When the okra is up and established plant the peas around the edges of the okra planting. You may find that the peas are far less bothered by aphids when near okra.

ONIONS: Planting chamomile and summer savory with onions improves their flavor. Other companions are carrot, leek, beets, kohlrabi, strawberries, brassicas, dill, lettuce and tomatoes. Intercropping onions and leeks with your carrots confuses the carrot and onion flies! Onions planted with strawberries help the berries fight disease. Keep onions away from peas and asparagus.

OPAL BASIL: An annual herb that is pretty, tasty and said to repel hornworms! Like the other basils it also does well with peppers, oregano, asparagus and petunias. Keep away from rue and sage.

OREGANO: Can be used with most crops but especially good for cabbage. Plant near broccoli, cabbage and cauliflower to repel cabbage butterfly and near cucumbers to repel cucumber beetle. Also benefits grapes.

PARSLEY: Allies: Asparagus, carrot, chives, onions, roses and tomato. Sprinkle the leaves on tomatoes, and asparagus. Use as a tea to ward off asparagus beetles. Attracts hoverflies. Let some go to seed to attract the tiny parasitic wasps and hoverflies. Parsley increases the fragrance of roses when planted around their base. Rose problems? See: Rose Rx for answers. Mint and parsley are enemies. Keep them well away from one another.

PEAS: Peas fix nitrogen in the soil. Plant next to corn. Companions for peas are bush beans, Pole Beans, Carrots, Celery, Chicory, Corn Cucumber, Eggplant, Parsley, Early Potato, Radish, Spinach, Strawberry, Sweet pepper and Turnips. Do not plant peas with onions.

PEPPERMINT: Repels white cabbage moths, aphids and flea beetles. It is the menthol content in mints that acts as an insect repellant. Bees and other good guys love it.

PEPPERS, BELL (Sweet Peppers): Plant peppers near tomatoes, parsley, basil, geraniums, marjoram, lovage, petunia and carrots. Onions make an excellent companion plant for peppers. They do quite well with okra as it shelters them and protects the brittle stems from wind. Don't plant them near fennel or kohlrabi. They should also not be grown near apricot trees because a fungus that the pepper is prone to can cause a lot of harm to the apricot tree. Peppers can double as ornamentals, so tuck some into flowerbeds and borders. Harvesting tip: The traditional bell pepper, for example, is harvested green, even though most varieties will mature red, orange, or yellow. Peppers can be harvested at any stage of growth, but their flavor doesn't fully develop until maturity.

PEPPERS, HOT: Chili peppers have root exudates that prevent root rot and other Fusarium diseases. Plant anywhere you have these problems. While you should always plant chili peppers close together, providing shelter from the sun with other plants will help keep them from drying out and provide more humidity. Tomato plants, green peppers, and okra are good protection for them. Teas made from hot peppers can be useful as insect sprays. Hot peppers like to be grouped with cucumbers, eggplant, escarole, tomato, okra, Swiss chard and squash. Herbs to plant near them include: basils, oregano, parsley and rosemary. Never put them next to any beans, broccoli, cabbage, cauliflower, Brussels sprouts or fennel.

PENNYROYAL: Repels fleas. The leaves when crushed and rubbed onto your skin will repel chiggers, flies, gnats, mosquitoes and ticks. Warning: Pennyroyal is highly toxic to cats. It should not be planted where cats might ingest it and never rubbed onto their skin.

PETUNIAS: They repel the asparagus beetle, leafhoppers, certain aphids, tomato worms, Mexican bean beetles and general garden pests. A good companion to tomatoes, but plant everywhere. The leaves can be used in a tea to make a potent bug spray.

POACHED EGG PLANT: Grow poached egg plant with tomatoes, they will attract hover flies and hover flies eat aphids.

POTATO: Companions for potatoes are bush bean, members of the cabbage family, carrot, celery, corn, dead nettle, flax, horseradish, marigold, peas, petunia, onion and Tagetes marigold. Protect them from scab by putting comfrey leaves in with your potato sets at planting time. Horseradish, planted at the corners of the potato patch, provides general protection. Don't plant these around potatoes: asparagus, cucumber, kohlrabi, parsnip, pumpkin, rutabaga, squash family, sunflower, turnip and fennel. Keep potatoes and tomatoes apart as they both can get early and late blight contaminating each other.

PUMPKINS: Pumpkin pals are corn, melon and squash. Marigold deters beetles. Nasturtium deters bugs, beetles. Oregano provides general pest protection.

PURSLANE: This edible weed makes good ground cover in the corn patch. Use the stems, leaves and seeds in stir-frys. Pickle the green seed pod for caper substitutes. If purslane is growing in your garden it means you have healthy, fertile soil!

RADISH: One of the workhorses for the garden. Companions for radishes are: radish, beet, bush beans, pole beans, carrots, chervil, cucumber, lettuce, melons, nasturtium, parsnip, peas, spinach and members of the squash family. Why plant radishes with your squash plants? Radishes may protect them from squash borers. Anything that will help keep them away is worth a try. Radishes are a deterrent against cucumber beetles and rust flies. Chervil and nasturtium improve radish growth and flavor. Planting them around corn and letting them go to seed will also help fight corn borers. Chinese Daikon and Snow Belle radishes are favorites of flea beetles. Plant

these at 6 to 12 inch intervals amongst broccoli. In one trial, this measurably reduced damage to broccoli. Radishes will lure leafminers away from spinach. The damage the leafminers do to radish leaves does not stop the radish roots from growing, a win-win situation. Keep radishes away from hyssop plants, cabbage, cauliflower, Brussels sprouts and turnips. For some good eating try our delicious Radish varieties.

RHUBARB: A good companion to all brassicas. Try planting cabbage and broccoli plants your rhubarb patch watch them thrive. Rhubarb protects beans against black fly. Some other interesting companions for rhubarb are the beautiful columbine flowers, garlic, onion and roses! It helps deter red spider mites from the columbines. A spray made from boiled rhubarb leaves, which contain the poison oxalic acid may be used to prevent blackspot on roses and as an aphicide.

ROSEMARY: Companion plant to cabbage, beans, carrots and sage. Deters cabbage moths, bean beetles, and carrot flies. Use cuttings to place by the crowns of carrots for carrot flies. Zones 6 and colder can overwinter rosemary as houseplants or take cuttings.

RUE: Deters aphids, fish moths, flea beetle, onion maggot, slugs, snails, flies and Japanese beetles in roses and raspberries. Companions for rue are roses, fruits (in particular figs), raspberries and lavender. To make it even more effective with Japanese beetles: crush a few leaves to release the smell. Has helped repel cats for us. You should not plant rue near cucumbers, cabbage, basil or sage. A pretty perennial with bluish-gray leaves. May be grown indoors in a sunny window. Rue may cause skin irritation in some individuals. Remedy: See cats and dogs: Rue spray.

RYE: An excellent use of plant allelopathy is the use of mow-killed grain rye as a mulch. The allelochemicals that leach from the rye residue prevent weed germination but do not harm transplanted tomatoes, broccoli, or many other vegetables.

SAGE: Use as a companion plant with broccoli, cauliflower, rosemary, cabbage, and carrots to deter cabbage moths, beetles, black flea beetles and carrot flies. Do not plant near cucumbers, onions or rue. Sage repels cabbage moths and black flea beetles. Allowing sage to flower will also attract many beneficial insects and the flowers are pretty. There are some very striking varieties of sage with variegated foliage that can be used for their ornamental as well as practical qualities. More on sage.

SPINACH: Plant with peas and beans as they provide natural shade for the spinach. Gets along with cabbage, cauliflower, celery, eggplant, onion, peas, strawberries.

SOUTHERNWOOD: Plant with cabbage, and here and there in the garden. Wonderful lemony scent when crushed or brushed in passing. Roots easily from cuttings. Does not like fertilizer! It is a perennial that can get quite bushy. We have started to cut it back every spring and it comes back in not time. A delightful plant that is virtually pest free.

SOYBEANS: They add nitrogen to the soil making them a good companion to corn. They repel chinch bugs and Japanese beetles. Why not try soybeans, they are good for you. They are many tasty ways to prepare them.

SQUASH: Companions: Corn, cucumbers, icicle radishes, melon and pumpkin. Helpers: Borage deters worms, improves growth and flavor. Marigolds deters beetle. Nasturtium deters squash bugs and beetles. Oregano provides general pest protection.

STRAWBERRY: Friends are beans, borage, lettuce, onions, spinach and thyme. Foes: Cabbage, broccoli, Brussels sprouts, cauliflower and kohlrabi. Allies: Borage strengthens resistance to insects and disease. Thyme, as a border, deters worms.

SUMMER SAVORY: Plant with beans and onions to improve growth and flavor. Discourages cabbage moths, Mexican bean beetles and black aphids. Honey bees love it.

SUNFLOWERS: Planting sunflowers with corn is said by some to increase the yield. Aphids a problem? Definitely plant a few sunflowers here and there in the garden. Step back and watch the ants herd the aphids onto them. We have been doing this for years and it is remarkable. The sunflowers are so tough that the aphids cause very little damage and you will have nice seed heads for the birds to enjoy. Sunflowers also attract hummingbirds which eat whiteflies. Talk about a symbiotic relationship!

SWEET ALYSSUM: Direct seed or set out starts of sweet alyssum near plants that have been attacked by aphids in the past. Alyssum flowers attract hoverflies whose larva devour aphids. Another plus is their blooms draw bees to pollinate early blooming fruit trees. They will reseed freely and make a beautiful groundcover every year.

TANSY: Plant with fruit trees, roses and raspberries keeping in mind that it can be invasive and is not the most attractive of plants. Tansy which is often recommended as an ant repellant may only work on sugar type ants. These are the ones that you see on peonies and marching into the kitchen. At least for us placing tansy clippings by the greenhouse door has kept them out. Deters flying insects, Japanese beetles, striped cucumber beetles, squash bugs, ants and mice! Tie up and hang a bunch of tansy leaves indoors as a fly repellent. Use clippings as a mulch as needed. Don't be afraid to cut the plant up as tansy will bounce back from any abuse heaped on it! It is also a helpful addition to the compost pile with its' high potassium content.

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Tansy Warning: You do not want to plant Tansy anywhere that livestock can feed on it as it is toxic to many animals. Do not let it go to seed either as it may germinate in livestock fields.

TARRAGON: Plant throughout the garden, not many pests like this one. Recommended to enhance growth and flavor of vegetables.

THYME: Deters cabbage worms. Wooly thyme makes a wonderful groundcover. You may want to use the upright form of thyme in the garden rather than the groundcover types. Thyme is easy to grow from seeds or cuttings. Older woody plants should be divided in spring.

TOMATOES: Tomato allies are many: asparagus, basil, bean, carrots, celery, chive, cucumber, garlic, head lettuce, marigold, mint, nasturtium, onion, parsley, pepper, marigold, pot marigold and sow thistle. One drawback with tomatoes and carrots: tomato plants can stunt the growth of your carrots but the carrots will still be of good flavor. Basil repels flies and mosquitoes, improves growth and flavor. Bee balm, chives and mint improve health and flavor. Borage deters tomato worm, improves growth and flavor. Dill, until mature, improves growth and health, mature dill retards tomato growth. Enemies: corn and tomato are attacked by the same worm. Kohlrabi stunts tomato growth. Keep potatoes and tomatoes apart as they both can get early and late blight contaminating each other. Keep cabbage and cauliflower away from them. Don't plant them under walnut trees as they will get walnut wilt: a disease of tomatoes growing underneath walnut trees.

WHITE GERANIUMS: These members of the pelargonum family draw Japanese beetles to feast on the foliage which in turn kills them.

WORMWOOD: Keeps animals out of the garden when planted as a border. An excellent deterrent to most insects. Don’t plant wormwood with peas or beans. A tea made from wormwood will repel cabbage moths, slugs, snails, black flea beetles and fleas effectively. The two best varieties for making insect spray are Silver King and Powis Castle. Adversely Powis castle attracts ladybugs which in turn breed directly on the plant.

Silver Mound is great as a border plant and the most toxic wormwood. Note: As wormwood actually produces a botanical poison do not use it directly on food crops.
See More on wormwood. for more details.
For insect spray: See wormwood spray

YARROW: Yarrow has insect repelling qualities and is an excellent natural fertilizer. A handful of yarrow leaves added to the compost pile really speeds things up. Try it! It also attracts predatory wasps and ladybugs to name just two. It may increase the essential oil content of herbs when planted among them. Yarrow has so many wonderful properties to it and is an ingredient in our own Golden Harvest Fertilizer.

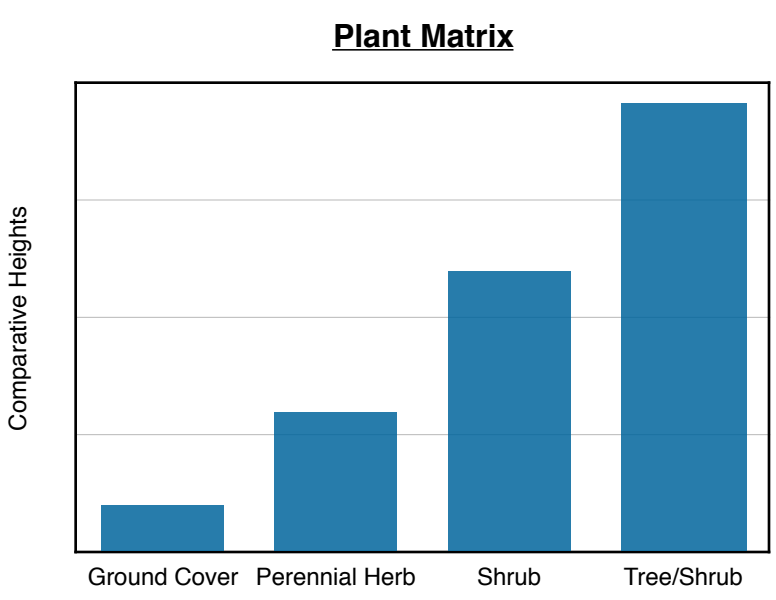
ZINNIA: Pretty zinnias attract hummingbirds which eat whiteflies. Alternately the pastel varieties of zinnias can be used as a trap crop for Japanese beetles. All zinnias attract bees and other insect pollinators.

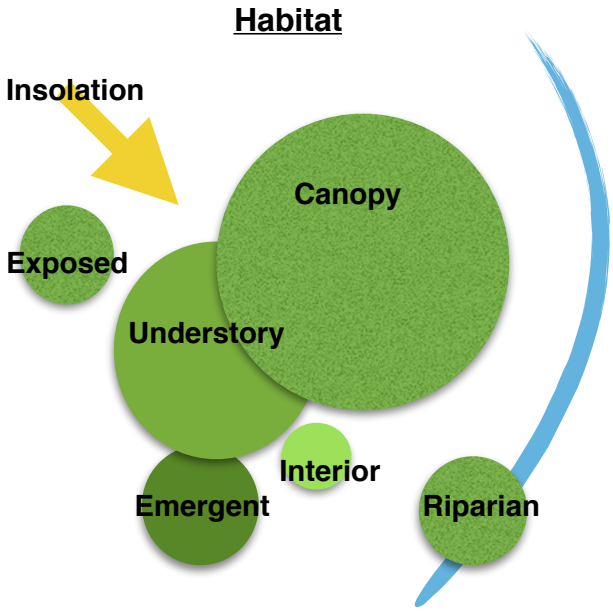
California Native Plant Species for Integrated Pest Management (IPM)

	Scientific Name	Common Name	Plant Type	Bloom Months	Habitat
1	Achillea millefolium	Yarrow	Perennial Herb	April-August	Exposed Understory
2	Asclepias fascicularis	Narrow Leaf Milkweed	Perennial Herb	June-September	Wetland
3	Aster chilensis Symphyotrichum chil.	California Aster Pacific Aster	Perennial Herb	July-August	Emergent
4	Ceanothus thyrsiflorus	Blue Blossom	Tree/Shrub	March-May	Understory
5	Clematis lasiantha & ligusticifolia	Pipestem Creek Clematis	Perennial Herb Vine	March-July	Riparian
6	Cornus nuttallii & sericea	Mountain Dogwood Red Osier Dogwood	Tree/Shrub	April-May	Understory
7	Erigeron glaucus	Seaside Daisey	Annual/Perennial Herb	May-June	Exposed
8	Euthamia occidentalis	Western Goldenrod	Perennial Herb	August-October	Meadows Riparian
9	Fragaria vesca	Woodland Strawberry	Perennial Herb Ground Cover	February-May	Interior
10	Gnaphalium margaritacea	Pearly Everlasting	Perennial Herb	June-August	Meadows
11	Helianthus bolanderi & exelis	Bolander's Sunflower Serpentine Sunflower	Annual/Perennial Herb	June-October	Wetland
12	Heracleum maximum	Common Cowparsnip	Perennial Herb	June-July	Emergent
13	Lycopus uniflorus	Northern Bugleweed	Perennial Herb	July-September	Wetland
14	Oenothera elate & wolfii	Evening Primrose Wolf's Primrose	Perennial Herb	May-October	Exposed
15	Oxypolis occidentalis	Western Cow Bane	Perennial Herb	July-August	Wetland
16	Perideridia kelloggii	Yampah	Perennial Herb	June-August	Exposed
17	Polygonum bolanderi	Bolander's Polygonum	Perennial Herb	June-November	Exposed
18	Potentilla anserina & sericea	Pacific Cinquefoil	Perennial Herb Ground Cover	June-July	Emergent
19	Prunella vulgaris	Self Heal	Perennial Herb Ground Cover	July-August	Interior
20	Prunus virginiana	Chokecherry	Tree/Shrub	April-May	Emergent
21	Pycnanthemum californicum	California Mint	Perennial Herb	June-September	Exposed

California Native Plant Species for Integrated Pest Management (IPM)					
	Scientific Name	Common Name	Plant Type	Bloom Months	Habitat
22	Rhamnus purshiana	Cascara Buckthorn	Shrub	April-June	Understory
23	Rhus aromatica & ovata	Fragrant Sumac Sugar Bush	Shrub	April-June	Exposed
24	Rosa californica & gymnocarpa	California Rose Nootka Rose	Shrub	May-June	Interior Understory
25	Rubus ursinus	California Blackberry	Vine/Shrub	February-May	Emergent
26	Rudbeckia californica	California Cone Flower	Perennial Herb	July-August	Meadows
27	Salix lasiolepsis & lucida ssp. las.	Arroyo Willow Shining Willow	Tree/Shrub	February-March	Riparian
28	Sambucus nigra & racemosa	Blue Elderberry Red Elderberry	Shrub	March-July	Emergent Understory
29	Solidago spatuklata	Coast Goldenrod	Perennial Herb	August- September	Emergent Understory
30	Symphoricarpos albus	Common Snowberry	Shrub	June-July	Emergent
31	Viburnum ellipticum	Common Viburnum	Shrub	May-June	Exposed

List compiled by John Trewin of *Back To The Garden* from: CalFlora.org; "What Grows Here" Wizard, Humboldt County Native; Floral Host Plants of Syrphidae and Tachinidae (Diptera) of Central Illinois; JOHN F. TOOKER, MARTIN HAUSER, AND LAWRENCE M. HANKS Department of Entomology, University of Illinois at Urbana-Champaign, Urbana, IL 61801.





Bloom Dates

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Vegetative Filter Strips for Nonpoint Source Pollution Control in Agriculture

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VEGETATIVE FILTER STRIPS: WHAT ARE THEY?

Orchards, vineyards, and row crops have the greatest erosion rates in irrigated agriculture, especially those that are managed with bare soil between tree or vine rows. The vegetative filter strip (VFS) offers one way to control erosion rates and keep soil in the field rather than letting it be carried off site in drainage water. A VFS is an area of vegetation that is planted intentionally to help remove sediment and other pollutants from runoff water (Dillaha et al., 1989).

Vegetative filter strips protect surface water bodies in a number of ways:

- They intercept surface water runoff and trap as much as 75 to 100 percent of the water's sediment.
- They capture nutrients in runoff, both through plant uptake and through adsorption to soil particles.
- They promote degradation and transformation of pollutants into less-toxic forms.
- They remove over 60 percent of certain pathogens from the runoff.

KEY DESIGN ELEMENTS FOR VEGETATIVE FILTER STRIPS

The United States Environmental Protection Agency (EPA) encourages growers to use engineered vegetative treatment systems such as VFSs at sites where these systems are likely to bring about a significant reduction in nonpoint source (NPS) pollution (US EPA, 2002). You can establish VFSs downslope from crop fields or animal production sites to control NPS pollutants that would otherwise escape with runoff. In orchards, you can use multiple VFSs installed perpendicular to the direction of surface water runoff to reduce soil erosion and even avoid expenses associated with herbicide application. The strips also have the potential to reduce the level of some pesticides in runoff by enhancing water infiltration and retention in the field. For example, contaminants such as phosphorus and certain pesticides such as pyrethroids that bind strongly to soil particles get trapped and retained in VFSs.

Key elements to consider when designing VFSs are discussed at the US EPA's Web site (http://www.epa.gov/OWOW/NPS/MMGI/Chapter7/index.html) under section II.C., "Management Measure for Vegetated Treatment Systems." These elements include

- **Slope.** Vegetative filter strips work best on slopes of less than 5 percent and are not recommended for slopes greater than 15 percent. They are ineffective on hilly plots or in terrain that allows concentrated water flow. If you see evidence of concentrated flow in the form of channels or rills you should use other erosion control strategies instead, such as establishing terraces, dykes, berms, or vegetative barriers.

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- **Site preparation.** The land where filter strips are to be planted should be roughened by disking and harrowing or by raking to prepare a good seedbed. After that you can seed the strips with a mixture of grasses and legumes to establish a stand.
- **Soil conditioning.** Before planting, apply any soil amendments that would ordinarily be used for crops grown on your land including fertilizer, lime, compost, or gypsum.
- **Width.** Strip width is an important variable influencing the effectiveness of VFSs because the period of contact between runoff water and vegetation in the filter strip increases as the strip's width increases (Tables 1 and 2). Generally speaking, the wider the filter strip, the better it will perform. One effective approach in sloping terrain is to plant grasses in bands about 6 feet (1.8 m) wide along hillside contours every 10 to 100 feet (3–30 m), depending on slope. The bands run crosswise on the hillside, perpendicular to the line of the slope. A single, dense VFS about 30 feet (9 m) wide is appropriate when you are protecting riparian areas, especially when an in-field system of strips is not possible. On flat terrain, 10- to 15-foot (3–4.5 m) wide filter strips at field boundaries and along irrigation ditches and roads are effective (Figure 1). One suggested design criterion is that the combined width of VFSs for a field should be at least as great as the width of the runoff-contributing area, though this may in fact be an impractical standard.
- **Vegetation.** Sturdy, tall perennial grasses do the best job of trapping sediment. Generally, hardy perennial native grass species that are capable of withstanding summer drought conditions are preferred, though it is important to consider local conditions and cultural practices. Short, flexible grasses are much less effective. Legumes are less effective than grasses at trapping sediment, but they work well when mixed with grasses because they boost nitrogen levels in the soil. Filter strips can also include other vegetation planted parallel to the grass strips, such as poplar, walnut, or shrubs. Note that soils that are subject to prolonged saturated conditions may require special wetland plant species. The USDA–NRCS "VegSpec" Web site (http://ironwood.itc.nrcs.usda.gov/Netdynamics/Vegspec/pages/HomeVegspec.htm) is an excellent Web-based support system that can help you select appropriate plant species for filter strips and other vegetative establishment practices.

Table 1. Minimum width for vegetative filter strips

Slope	Minimum width of buffer strip
1–3%	25 ft
4–7%	35 ft
8–10%	50 ft

Source: Standards and Specifications No. 393, USDA–NRCS Field Office Technical Guide, 2004.

Table 2. Examples of pollutant removal efficiency for vegetative filter strips

Filter type	Nutrient source	Plot length	Pollutant	Removal efficiency %	Reference
Bermudagrass buffer strip	cropland runoff	16 ft (4.8 m)	chlorpyrifos dicamba 2,4-D mecroprop	62–99 90–100 89–98 89–95	Cole et al., 1997
Bermudagrass-crabgrass mixture	cropland runoff	14–17 ft (4.3–5.3 m)	P (total) N (total)	26 50	Parsons et al., 1991
Bluegrass and fescue sod (9% slope)	cropland runoff	15 ft (4.6 m) 30 ft (9.1 m) 45 ft (13.7 m)	NH_4-N atrazine NH_4-N atrazine NH_4-N atrazine	92 93 100 100 97 98	Barfield et al., 1992
Corn-oat or orchardgrass mixture (4% slope)	feedlot	45 ft (13.7 m)	P (total) N (total)	88 87	Young et al., 1980
Fescue (10% slope)	dairy waste on silt loam soil	5 ft (1.5 m) 13 ft (4.0 m)	P dissolved NO_3 P dissolved NO_3	8 57 62 68	Doyle et al., 1977
Orchardgrass (5–16% slope)	simulated feedlot	15 ft (4.6 m) 30 ft (9.1 m)	P (total) N (total) P (total) N (total)	39 43 52 52	Dillaha et al., 1988
Orchardgrass (5–16% slope)	cropland runoff	15 ft (4.6 m) 30 ft (9.1 m)	P (total) N (total) P (total) N (total)	75 61 87 61	Dillaha et al., 1989
Ryegrass	cropland runoff	20, 40, & 60 ft (6, 12, & 18 m)	suspended solids atrazine isoproturon diflufenican NO_3 P (soluble)	87–100 44–100 99 97 47–100 22–89	Patty et al., 1997
Sorghum-Sudan-grass mix (4% slope)	feedlot	45 ft (13.7 m)	P (total) N (total)	81 84	Young et al., 1980
Vegetated drainage ditch	simulated runoff	13 ft (4 m)	atrazine pyrethroid	98 100	Moore et al., 2001

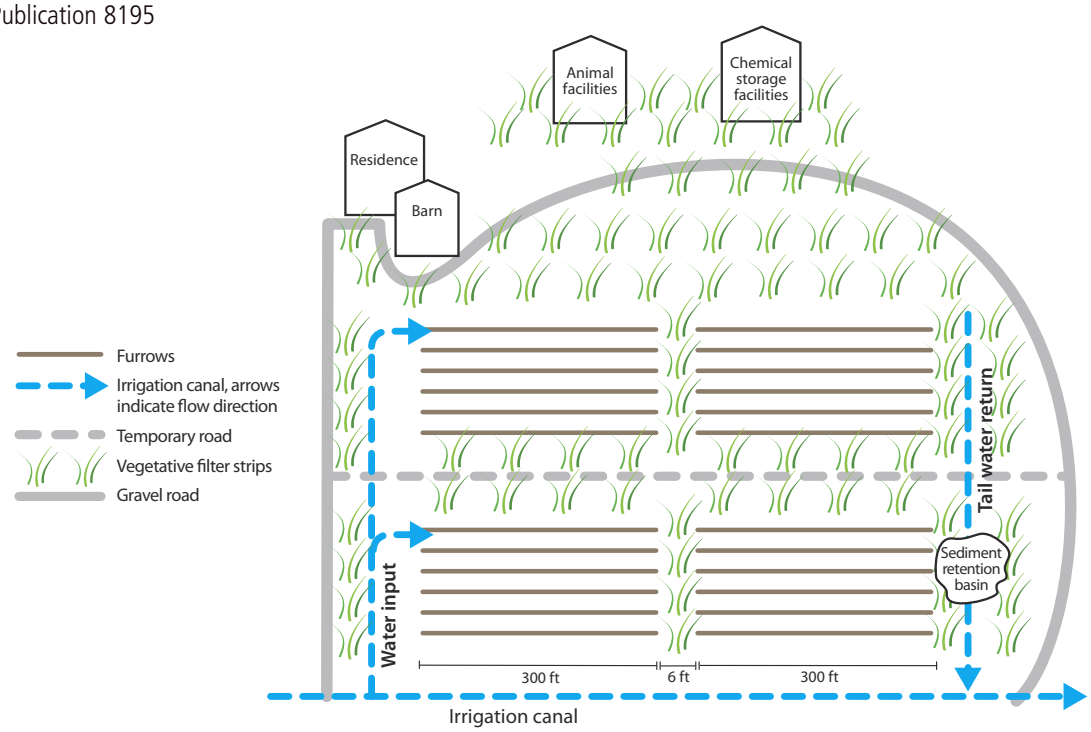

Figure 1. Farm plan indicating potential locations for vegetative filter strips.

- **Placement.** It is best to place the filter strips strategically so as to maximize the efficiency of contaminant removal. As a land manager, you have to identify where water flows on the property in order to identify the locations where VFSs will have the best chance of intercepting runoff. For instance, filter strips along stream banks are helpful since these areas can be subject to concentrated surface runoff from the surrounding landscape, but if you move the filter strips further up-slope within fields or orchards they can do their work before concentrated runoff occurs and that will yield better results. In irrigated row crop systems, wide filter strips along field boundaries would be most practical. A sample layout for VFS placement is illustrated in Figure 1. There are several critical placement areas: along roads, ditches, and animal confinement facilities, interspaced with the crop within the field, and at the field boundaries. Vegetated irrigation ditches can also be an effective strategy to trap pollutants.
- **Maintenance.** Vegetative filter strips require minimal maintenance, but you should consider the following operations:
  - Inspect the strips regularly for bare spots and other signs of erosion, especially after intense rain or runoff events.
  - Shallow, sheetlike flow of water must be maintained. If you find any evidence of channels and rills, repair it and reseed those areas.
  - Remove excess sediment buildup to keep water from diverting to a new, easier drainage route. If sediment accumulation is high (more than 6 inches deep), you will need to cultivate and reseed the affected areas.
  - Irrigate occasionally in summer if the vegetation that you plant requires it.
  - Mow the strips occasionally to a height of 4 to 10 inches to deter noxious weeds.
  - If pathogens such as bacteria are present in runoff water, mow the strips short to introduce sunlight and air that will desiccate the bacteria.
  - Noxious weeds must be controlled in and around the filter strips. You

may have to apply spot treatments of herbicide to control perennial noxious weeds.

- Limit traffic within filter strips.
- Occasionally harvest the filter strip vegetation and remove the cut biomass to prevent nutrient buildup.

- **Monitoring.** Some thought and effort should be given to monitoring the performance of the filter strips after installation. That way it will be possible for you to gauge your success and make later adaptations (such as redesign or replanting) to ensure regulatory compliance.

OBSERVED NONPOINT SOURCE POLLUTION CONTROL USING VEGETATIVE FILTER STRIPS

The effectiveness of VFSs for control of several NPS pollutants from cropland and feedlot runoff has been the subject of study, as has their effectiveness on sediment removal from surface mining and urban runoff (see Table 2). Based on empirical studies, trapping or removal efficiency frequently exceeded 90 percent of sediments, 50 to 80 percent of nutrients, and 44 to 100 percent of the herbicide atrazine. The ability of VFSs to trap pesticides varies depending on the nature of the compound and the design and maintenance of the filter strip. Vegetative filter strips are better at removing pesticides such as pyrethroids that bind to soil particles.

POLLUTANT-FILTERING MECHANISMS OF VEGETATIVE FILTER STRIPS

A vegetative filter strip functionally consists of three distinct layers—surface vegetation, root zone, and subsoil horizon—and as a result, the flow of water and pollutants through the filter strip can be a complex process. Once surface flow enters a VFS, infiltration is followed by saturation of the shallow subsurface. When the inflow rate exceeds the strip's infiltration capacity, overland flow occurs. In the root zone, some water infiltrates deeper into the subsoil while the remainder becomes lateral subsurface flow or *interflow* (Figure 2).

Runoff is less from hill slopes that have VFSs than from those that have none, a result of increased infiltration rates in the vegetated area. The vegetative strip's root zone allows high infiltration rates via macropores that arise with the generally

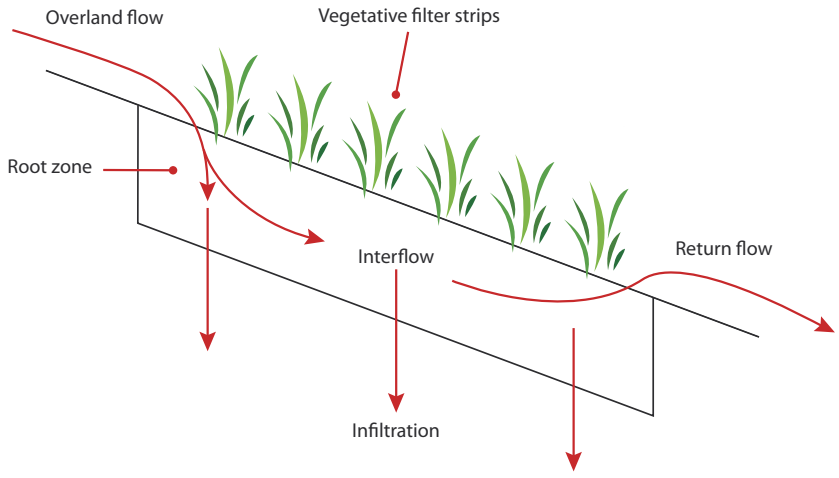

Figure 2. Cross-section of the patterns of water flow through hillside vegetative filter strips.

improved soil structure created by plant roots and other biological activities. The most important pollutant-trapping mechanism of VFSs is infiltration, followed by storage in the surface layer.

The soil constituent with the greatest influence on pesticide transport or pollutant retention and degradation is organic matter in the root zone and overlying surface litter layer. Greater biological activity in a soil improves its ability to effectively deal with pesticides and pollutants, and that kind of activity is more prevalent in a soil rich in plant roots, soil micro- and macro-fauna, and bacteria than in a soil without those organisms. Soil microorganisms play an essential role in the degradation of contaminants and soil organic matter is chemically reactive with the contaminants. For these reasons, you can expect degradation and adsorption of herbicides and pesticides to be greater in the filter strip's root zone than in adjacent fallow soils.

Vegetative filter strips on sloping land are subject to horizontal interflow within the root zone, in which case some pesticides may be filtered out, adsorbing onto soil organic matter. When the interflow water reappears on the surface as return flow it may have a lower pesticide concentration than the water that has flowed above ground. When infiltration is high in a VFS, the microbial- and plant-uptake processes cause denitrification, degradation of chemicals, and reduction of chemical concentrations in the surface layer between runoff events.

The effectiveness of VFSs depends on field conditions such as soil type, rainfall intensity, slope, micro-topography (surface soil roughness), the infiltration capacity of the vegetated area, the width of the strip, and the height of its plants. Slope and micro-topography affect overland flow velocity and uniformity and also appear to have an effect on the ability of VFSs to retain sediment and pollutants in runoff. Of course, the steeper the slope, the greater the sediment yield, all other factors being equal. Infiltration capacity and interflow within the VFSs influence the fate and path of dissolved nutrients and chemicals. The width of VFSs determines the strips' sediment-removing capacity and the amount of time the pollutant can be expected to remain in soil layers where adsorption and degradation processes are active.

You can find additional information at USDA–NRCS's "Buffer Strips Common Sense Conservation" Web site (http://www.nrcs.usda.gov/feature/buffers/). For more information on vegetative filter strips and incentive programs for land managers, contact your local UC Cooperative Extension office, Natural Resources Conservation Service office, Resource Conservation District, or Farm Service Agency office.

GLOSSARY

Absorption: the uptake of matter by a substance (such as a sponge) or living tissue (such as a plant).

Adsorption: a process whereby contaminants in water are drawn to and retained on the surfaces of soil solids by a chemical or physical binding mechanism.

Decomposition: a process whereby complex chemical compounds such as pesticides or organic materials are transformed into simpler compounds such as carbon dioxide gas.

Denitrification: the anaerobic conversion of nitrate-nitrogen into nitrogen gas by microbes.

Deposition: the retention of a transported material (such as waterborne chemicals) in a new, stationary position.

Infiltration: the entry of water into soil.

Interflow: water that moves through a filter strip as subsurface flow.

Volatilization: the transformation of a compound from liquid phase to gas phase.

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FOR MORE INFORMATION

You'll find related information in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

The Farm Water Quality Plan, Publication 9002

Practices for Reducing Nonpoint Source Pollution from Irrigated Agriculture, Publication 8075

Developing a Nonpoint Source Pollution Evaluation Program, Publication 8087

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This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Land, Air, and Water Sciences.

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Hoop House Anchor Row Protection

Description and Benefits

Hoop house Figure A: Filter fabric along roofline

Plastic hoophouses as used on the Central Coast provide valuable production benefits and a challenge for runoff management, especially on sloped lands. As conventionally configured, plastic covers can reduce the available permeable surface of a field's production area by over 90%, dramatically increasing the volume of water likely to run off a field in a storm event. Also, rainfall impact on the soil is concentrated along the roof edges of hoophouse anchor (or 'post") rows. Methods that have been used to address these challenges range from soil armoring and cover crops on anchor rows, weather-responsive placement of plastic covers, gutter and drain systems for diverting and directing 'roof' runoff, and increased spacings between hoophouse rows at intervals planted with grass or other vegetative cover. Filter fabric and cover crops in these rows provide the additional benefit of weed suppression.

When to use Hoop House Anchor Row Protection

Oleg Daugovishi, UCCE Ventura

Hoop house Figure B: Anchor-row barley cover crop

If a land manager anticipates a field set with hoophouses will experience rainfall while the plastic sheeting is up, anchor row protections will protect the soil from 'drip line' impacts, reducing maintenance and erosion risks along anchor rows. The degree to which these measures can be taken will depend on the land manager's resources, the acreage and density of hoophouses to be placed, the erosive potential of the field (soil texture and slope), the number of acres draining to individual collection points, and the manager's capacity to manage accumulated runoff through the field and at the field bottom (or low, collection point).

Implementation

There is very little guidance currently available regarding hoophouse runoff management in the United States. Hoophouse manufacturers and university extension guidance documents understandably focus almost exclusively on crop production factors. That said, for small, semi-permanent structures there are gutter systems available (Figure C., next page), although we have not observed them adapted for the predominant style of hoophouses in use for large-scale production on the Central Coast. Other novel approaches for using in-field drain-pipe to manage drainage of runoff collected along anchor rows are under investigation by growers but not yet verified in terms of effectiveness in a production context.

Hoop house Figure C: Gutter drains to tank

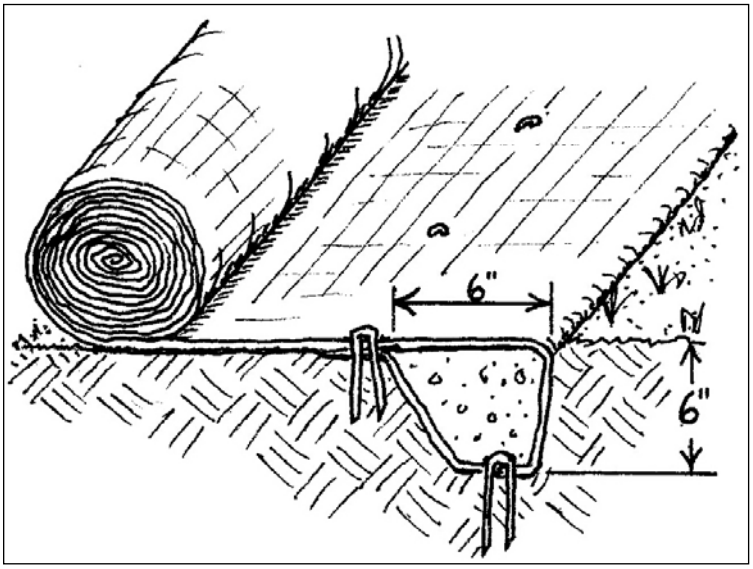
While USDA NRCS provides runoff management guidelines for the 'high tunnel' (hoophouse) practice, it is intended for application on less than 10% of a given farm's acreage. Those guidelines are incorporated into this section

When setting anchor rows, minimize vehicle traffic if possible in the anchor furrow to maintain maximum infiltration capacity.

Armoring can be made with a permeable material such as filter fabric, straw or fiber mulch or crushed rock (only for permanent installations). The outlet of each anchor row should be further armored to protect from erosion of collected runoff water as it spills into the field end ditch or road. See "Ditch Plastic and Grass for Road Protection" (page 27) and "Underground Outlets" (page 33) for treatments to protect roads and ditches carrying water off field. Where possible, drain anchor rows to lightly sloped, densely vegetated areas.

Oleg Daugovishi, UCCE Ventura

The California Storm-water BMP Handbook recommends covering the soil surface with geotextiles to reduce erosion from rainfall impact and hold soil in place. Woven and nonwoven materials with minimum tensile strength of 80 lbs can be used in anchor rows. The materials must be resistant to degradation by ultraviolet (UV) radiation (70% retained after 500 hours) and to biological and chemical environments normally found in soils. Geotextile mats should extend at least 2 feet under the anchor rows and cover the length of the hoophouse. The mat must be secured in place with wire staples and the ends and sides should be anchored in a 6 in. deep by 6 in. wide trench (Figure D). Backfill the trench and tamp the earth firmly to secure the mat.



Hoop house Figure D: Geotextile Anchor Trench

UC Cooperative Extension researchers in Ventura County are still investigating the runoff and sediment attenuation benefits of grass cover crops planted along hoophouse post rows, but their preliminary results indicated a definitely observable benefit. Depending on the type of hoophouse or cover, any increase in the spacing between houses with the addition of vegetated cover will have a corresponding benefit in erosion and runoff reduction. Any such spacing should be made to accommodate mowing or weed trimming, depending upon the scale of the operation. In the example shown to the left,

Cover crop planted along hoopehouse post rows by Wayne Gularte

the hoophouse 'buffers' are also tied into a field drainage system. The inclusion of buffers or gaps between houses is dependent upon professional consultation, the limitations of hoophouse construction or form, the need relative to slope and soil type, and crop production needs. The Rational Method, as described earlier in this Manual, could potentially be very useful for gauging potential runoff rates of different arrangements of hoophouses for the sake of field planning relative to the site's capacity for handling that runoff.

Resources

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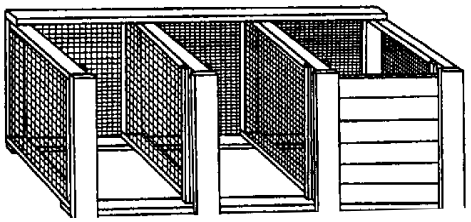
Composting 101

Procedure For Managing The Three-Bin Composting System



1. Add yard waste to one of the end bins. Mix in "green" materials like grass clippings or other fresh plant waste with "brown" materials like dried leaves, wood chips or shredded branches.
2. If only a very little green waste is available, add about 1 cup of a fertilizer that contains some nitrogen, such as an 8-8-8 or similar analysis fertilizer. Kitchen scraps or grass clippings will generally not need additional fertilizer since these already have a lot of nitrogen compared to carbon.
3. Add a layer of garden soil to introduce some of the microorganisms that do the composting. Once the composting process is under way, it is not necessary to add more soil.
4. Check the temperature of the compost from time to time, ideally with a compost thermometer *(see graphic)*. The pile should be warm in the middle. After the middle has reached 140 to 150ºF, turn the pile from the original bin into the adjacent center bin. Close monitoring of the temperature is essential only for the most rapid composting since the process will go on at varying rates even if close attention is not given to temperature.
5. Additional yard waste can be placed on the recently turned compost, but turn the pile back into the original end bin when the temperature has been up around 150º.
6. Turning should be repeated whenever the temperature gets high enough. Over time, less frequent turning will be needed, and the composted material can be held in one of the end bins until you are ready to use it in the yard or garden.

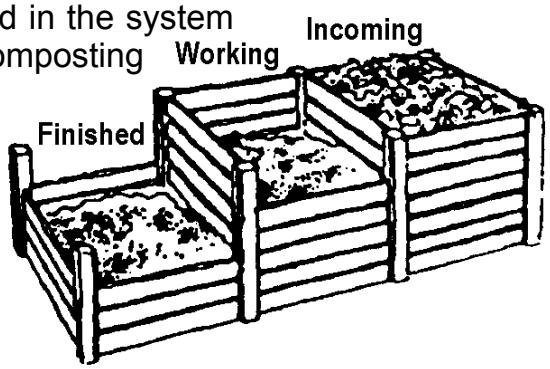
UNIVERSITY OF CALIFORNIA UC CE **COOPERATIVE EXTENSION**

Placer County
11477 E Avenue *(Bldg 306, DeWitt Center)*
Auburn, California 95603
(530) 889-7385
FAX (530) 889-7397
E-Mail: ceplacer@ucdavis.edu

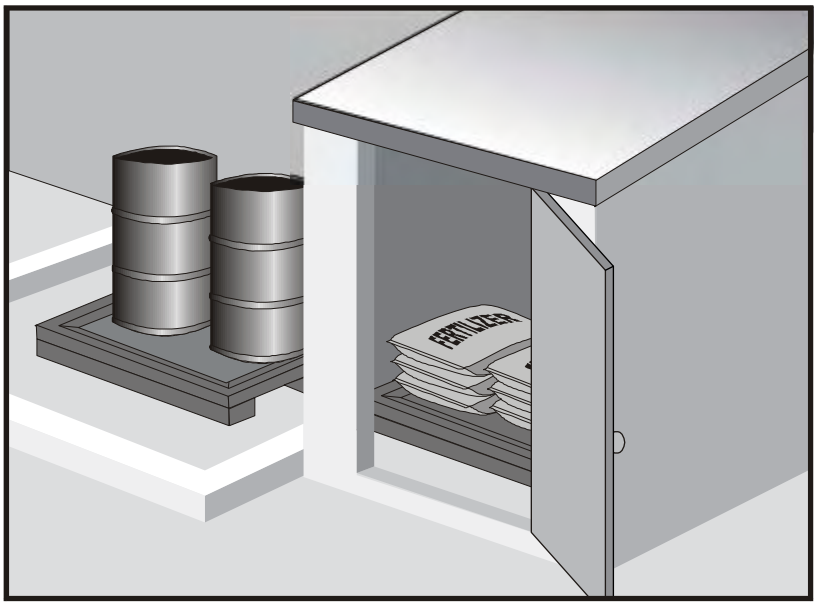
Nevada County
255 So Auburn *(Veterans Memorial Building)*
Grass Valley, California 95945
(530) 273-4563
FAX (530 273-4769
E-Mail: cenevada@ucdavis.edu

7. Repeat the process using the vacant end bin and alternate turning between that bin and the center bin.
8. Use the compost in the original end bin until it is gone; then you can start the composting process again in the vacated end bin.
9. 9. Once set up, the three-bin composting system will consist of one bin with yard waste being composted; one bin empty, to or from which the compost is turned; and one bin containing finished, or nearly finished, compost *(see graphic)*.

Nearly 1 cubic yard of compost can be produced per bin in the three-bin composting system. However, the rate of composting differs greatly according to the kinds of materials placed in the system and the precision with which you manage the composting process.



Material Delivery and Storage WM-1



Categories

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

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
    - Avoid transport near drainage paths or waterways.
    - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
    - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

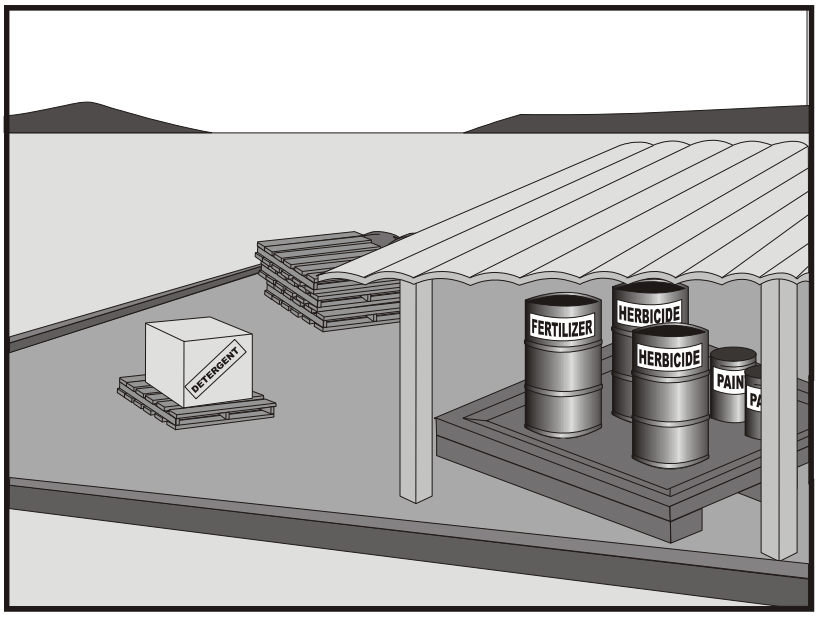
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

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

Material Use WM-2



Categories

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

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

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 the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

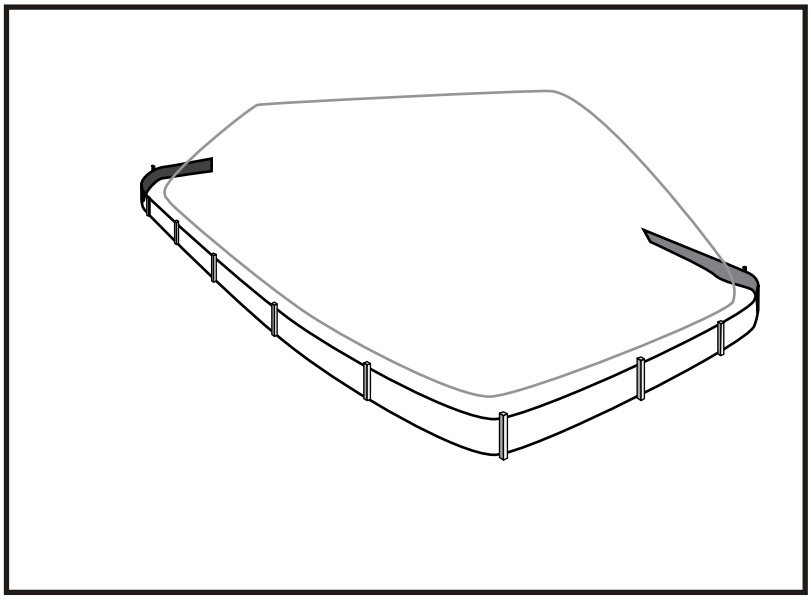
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

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

Stockpile Management WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
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WM	Waste Management and Materials Pollution Control	☑

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

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of plastic materials should be avoided when feasible and photodegradable plastics should not be used.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater run-on using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- Cover and project soil stockpiles with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Consider temporary vegetation for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Provide covers and protect these stockpiles with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cover cold mix stockpiles and place them on plastic sheeting (or comparable material) and surround the stockpiles with a berm all times.

Stockpiles of fly ash, stucco, hydrated lime

- Cover stockpiles of materials that may raise the pH of runoff (i.e., basic materials) with plastic and surround the stockpiles with a berm at all times.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate)

- Cover treated wood with plastic sheeting (or comparable material) and surround with a berm at all times.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.