CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 1 For Dairies

Does Your Dairy Need an NPDES Stormwater Permit?

Federal law and regulations require that certain dairies have a National Pollutant Discharge Elimination System (NPDES) permit issued under the federal Clean Water Act. This fact sheet provides information to help you determine if your dairy must have an NPDES stormwater permit. In the discussion below, an "Animal Unit" (AU) is 1,000 pounds of animal(s), and "surface water" is a water of the state.

Question: ***What are the typical surface water quality problems associated with a dairy?***

Answer Wastewater from a dairy is high in nitrogen, ammonia, salts, and organic material (manure and other solids). When nitrogen and ammonia are discharged to a creek or stream, they can be poisonous to the plants and animals living in the waters. Organic material can reduce or remove the dissolved oxygen in a creek or stream, thereby suffocating the fish that live there. In addition, manure, like any other waste produced by warm-blooded animals, contains bacteria that could pose a threat to human health and/or sources of drinking water. Any of these pollutants, if discharged from a sewage treatment plant to surface water, would be regulated by an NPDES permit.

Question: ***When does a dairy need an NPDES stormwater permit?***

Answer: A dairy is required to have an NPDES stormwater permit if it has the potential to discharge to surface water, and:

1. the dairy has over 1,000 AU (more than 700 or more milk and/or dry cows) confined or corralled for 45 or more days during any 12 months period, or
2. the dairy has 301 to 1,000 AU (200 to 700 milk and dry cows) and animal waste was discharged to surface water through a man-made conveyance (ditch, pipe, etc.), or was discharged into a surface water drainage course passing through the dairy (originating and ending outside the dairy), or
3. the dairy has been designated as a concentrated animal feeding operation (CAFO) by the Regional Water Quality Control Board (Regional Board) as a potential or actual significant contributor to pollution of surface waters.

Question: ***Can a dairy be exempt from obtaining an NPDES stormwater permit?***

Answer: Regardless of herd size, a dairy does not need an NPDES stormwater permit if it is managed such that discharges to surface water occur only during storm events greater than the 25-year 24-hour storm event. (The 25-year 24-hour storm event is rainfall in a 24-hour period expected to occur once every 25 years.)

Question: ***How does a dairy operator determine the size of the 25-year 24-hour storm?***

Answer: The National Oceanic and Air Administrator of the National Weather Service has determined the water amounts in a 25-year 24-hour storm. For example, in the San Joaquin Valley, the 25-year 24-hour storm will generate about 2.5 inches of rain. Contact your local weather service or the local office of the National Resources Conservation Service to obtain actual rainfall values for your area. County building and road departments also often have this information.

Question: ***How can a dairy operator determine whether the dairy qualifies for an exemption?***

Answer: Many waste ponds may not be large enough too contain: (1) the runoff generated by the 25-year 24-hour storm event, (2) the runoff generated by rain prior to the 25-year 24-hour storm, and (3) any process washwater generated on-site, and still maintain adequate freeboard in the ponds. If you have determined how much storage capacity you need to contain the 25-year 24-hour storm, previous rainfall runoff, and washwater, and your pond system always has this much capacity with adequate freeboard, then you may qualify for an exemption.

Question: ***How is an NPDES stormwater permit obtained?***

Answer: Contact the dairy regulatory staff at your Regional Board office listed below. They can assist you in determining what type of NPDES permit (stormwater of individual) is most appropriate for your dairy.

Question: ***If a dairy has an NPDES stormwater permit, what is it allowed to do during severe weather conditions?***

Answer: The NPDES stormwater permit allows a properly operated dairy to discharge from its waste management system during periods of continuous rain or catastrophic events in order to prevent overtopping of the pond or other waste system failure. The discharge should cease as soon as conditions allow the waste to be retained on the dairy and associated cropland. Such a discharge by a dairy with an NPDES stormwater permit is not a violation of the federal Clean Water Act. Violators of the Clean Water Act are subject to fines up to $27,500 a day. They may also be sued by a third party for these violations.

Example: Dairy A has an NPDES permit and a waste handling system with the ability to collect and contain the volume of runoff expected to be generated by a 25-year 24-hour storm event. It rains heavily for three weeks (a chronic rainfall), but the rainfall in any 24-hour period never exceeds the 25-year 24-hour storm value. Dairy A's waste handling system reaches capacity and discharges to waters of the United States. That discharge is not considered a violation of the Clean Water Act.

Dairy B is identical to Dairy A, except that Dairy B does not have an NPDES stormwater permit. Dairy B's discharges to the waters of the United States during a chronic storm event would be a violation of the Clean Water Act with potential penalties up to $27,500 for each day of violation.

Even if a dairy is not required to have an NPDES stormwater permit, it may be in your best interest to have one. Also, dairy operators should be aware that in addition to the NPDES program they are subject to regulation under California's Water Code (see Fact Sheets No. 2 and No. 3 for Dairies). For further information, or to obtain an application for an NPDES permit (the General Industrial Stormwater Permit form), contact the Regional Board dairy regulatory staff at one of the following offices:

- Sacramento (916) 255-3000
- Fresno (559) 445-5116
- Redding (916) 224-4845

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 2 For Dairies

Proper Waste Management for Protection of Water Quality

This fact sheet provides information on dairy waste management practices that comply with state and federal laws for protection of water quality (applicable state regulations are summarized on Page 2 of this Fact Sheet). Compliance with laws and regulations for management of animal waste at dairies is usually achieved through voluntary actions by the dairy owner/operator. Essentially, the regulations require that animal wastes be contained in an appropriate storage area until they are applied to cropland at a reasonable rate. The following information is provided to help clarify those requirements.

- "Animal wastes" includes animal manure and urine and materials that have mixed with manure and urine (for example, washwater from a milk barn, rainwater runoff that has passed through a manure storage area, and irrigation tailwater that contains manure). Runoff from a silage storage area is not animal waste, but is a waste that must also be contained and managed (it can be added to a dairy wastewater storage pond).

- An "appropriate storage area" means a facility designed to prevent animal wastes from contacting surface water or groundwater or moving off the dairy property. A holding pond that meets the construction standards in the California Code of Regulations, Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1 is appropriate for long-term storage. The holding pond should be able to contain all wastewater and stormwater generated during the rainy season (approximately 120 days) plus a 25-year 24-hour storm. A ditch or field that is blocked off for storage of wastewater is only appropriate for short-term storage in an emergency. A concrete slab is an appropriate long-term manure storage area. Unpaved soil is only appropriate for short-term storage of wet manure such as might occur for a few days when solids are removed from a holding pond. A corral is not an appropriate wastewater storage area and should not have standing water for more than three days following a heavy rain.

- Application to cropland "at a reasonable rate" means that the amount of nutrients contained in the animal wastes do not exceed the amount required by the crop(s) where the wastes are applied. Furthermore, the application should occur when the crops will use the nutrients. The application rate should be specifically determined for each dairy. However, the basic rule is that the total amount of manure produced by five Holstein dairy cows is appropriate for one acre of double-cropped land (for example, land planted in oats and then in corn). If the ratio of cows to acres exceeds 5:1, then it is probably necessary to export manure solids and/or wastewater to other cropland. If wastewater is exported, it must be done with permission of the owner of the pipeline. In general, wastewater should be applied evenly to all available cropland at a dairy rather than limiting application to one area. The application of wastes to cropland must <u>not</u> result in tailwater runoff containing manure odor or color. Such tailwater will contain materials that are toxic to aquatic organisms and must be captured and reused instead of being allowed to enter an area drain.

The RWQCB may issue Waste Discharge Requirements (WDRs) for a dairy if it appears that waste management practices at the dairy can adversely impact water quality. The WDRs contain monitoring and reporting requirements including submission of annual reports to the RWQCB. Failure to submit required reports or comply with other requirements in WDRs can result in enforcement action by the RWQCB (see Fact Sheet No. 3 "Enforcement of Water Quality Laws And Regulations That Apply To Dairies" for additional information).

SUMMARY OF ANIMAL WASTE MANAGEMENT REGULATIONS
(From California Code of Regulations, Subdivision 1, Chapter 7, Subchapter 2)

General Standards For Surface Water

The discharger shall prevent animals at a confined animal facility from entering any surface water within the confined area.

Wastewater Management

(a) **Design Storm (for Run-On/Run-Off Control)** - Confined animal facilities shall be designed and constructed to retain all facility wastewater generated, together with all prescription on, and drainage through, manured areas during a 25-year, 24-hour storm.

(b) **Manured Area Run-On Exclusion** - All precipitation and surface drainage outside of manured areas, including that collected from roofed areas, and runoff from tributary areas during the storm events described in part (a), shall be diverted away from manured areas, unless such drainage is fully retained. RWQCBs can waive application of such requirements only in specific instances where upstream land use changes have altered surface drainage patterns such that retention of flood flows is not feasible.

(c) **Design Storm (for Flood Protection)**

(1) Retention ponds and manured areas at confined animal facilities in operation on or after November 27, 1984, shall be protected from inundation or washout by overflow from any stream channel during 20-year peak stream flows.

(2) Existing facilities that were in operation on-or-before November 27, 1984 and that are protected against 100-year peak stream flows must continue to provide such protection. Facilities, or portions thereof, which begin operating after November 27, 1984 shall be protected against 100-year peak stream flows.

(3) The determination of peak stream flows shall be from data provided by a recognized federal, state, local, or other agency.

(d) **Retention Pond Design** - Retention ponds shall be lined with, or underlain by, soils which contain at least 10 percent clay and not more than 10 percent gravel or be lined with artificial materials of equivalent impermeability.

(e) **Discharge To Disposal/Use Fields** - The RWQCB shall allow the discharge of facility wastewater and of collected precipitation and drainage waters to use or disposal fields only if such discharge is in accordance with the regulations in the following section titled "Use or Disposal Field Management". Other allowable discharge is to wastewater treatment facilities approved by the RWQCB.

Use or Disposal Field Management

(a) **Reasonable Soil Amendment Rate** - Application of manure and wastewater to disposal fields or crop lands shall be at rates which are reasonable for the crop, soil, climate, special local situations, management system, and type of manure.

(b) **Run-Off & Percolation** - Discharges of facility wastewater to disposal fields shall not result in surface runoff from disposal fields and shall be managed to minimize percolation to ground water.

Management of Manured Areas

Manured areas shall be managed to minimize infiltration of water into underlying soils.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 3 For Dairies

Enforcement of Water Quality Laws And Regulations For Confined Animal Facilities

The **California Water Code** (the Porter-Cologne Water Quality Control Act) requires that manure and other wastes be managed to protect water quality. State regulations that apply to dairies and other confined animal facilities have been established pursuant to the Water Code and are contained in the California Code of Regulations, Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1 (see Fact Sheet for Dairies No. 2). Any dairy that causes a pollution of surface water or groundwater can be required to conduct an assessment of the water body and clean up the pollution. In addition, the dairy operator and owner may be subject to fines if wastes are discharged off their property.

To ensure compliance with the Water Code, Regional Water Quality Control Boards (RWQCBs) can impose Waste Discharge Requirements for individual facilities. The RWQCBs can also take enforcement action by issuing a Notice of Violation, Cleanup and Abatement Order, Cease and Desist Order, or Administrative Civil Liability Complaint. These actions are described below.

Waste Discharge Requirements (WDRs) may be established after a dairy provides a Report of Waste Discharge (RWD) and pays a $2,000 filing fee. Dairies are usually requested to file a RWD only when it appears that waste management practices at the facility can adversely impact water quality. If review of the RWD indicates a waiver is appropriate, WDRs are not issued and a portion of the filing fee may be refunded. WDRs specify certain actions that must be met, prohibit other actions, and establish monitoring and reporting requirements including submission of annual reports to the RWQCB.

A Notice of Violation (NOV) can be issued to the operator and owner of any facility where wastes are discharged in violation of laws, regulations, or orders. The NOV will specify the problem that must be corrected and generally will require that a time schedule be established for necessary improvements. If the improvements are completed within the approved time schedule, the RWQCB generally does not assess oversight charges in conjunction with the NOV. If the problem is not corrected, and/or required information is not submitted, a RWQCB can initiate enforcement actions that may result in imposition of monetary penalties.

A Cleanup and Abatement (C&A) Order can be issued when wastes have been, or threaten to be, improperly discharged and corrective action is needed to protect water quality. The C&A Order will identify the discharge of concern and establish a schedule for corrective actions. The C&A Order may provide for reimbursement of RWQCB staff time to oversee corrective action. However, in cases where corrective actions are completed quickly, charges for staff time are minimal and may even be waived as not worth the administrative effort to collect.

A Cease and Desist (C&D) Order can be issued when Waste Discharge Requirements are violated. It is similar to a C&A Order in that it will specify the problem that must be corrected, will require that a time schedule be established for necessary improvements, and may provide for reimbursement for staff time. An ACL may be issued concurrently with a C&D Order.

An Administrative Civil Liability (ACL) is a monetary assessment issued to a facility that violates Waste Discharge Requirements or an enforcement order. The amount of the ACL is related to the violation that occurred up to a maximum of $25,000 for each day of occurrence. Failure to pay an ACL can result in referral to the Attorney General's office for prosecution.

In addition to the state laws and regulations enforced by the RWQCBs, there are state laws and regulations enforced by other state agencies such as the Department of Fish and Game. There are also federal laws and local regulations that apply to dairies. The most important federal laws are discussed below. The state and federal agencies that may be involved in enforcing compliance with the laws are also discussed below.

The **Clean Water Act** (CWA) is federal law established for protection of surface water, and is enforced by the USEPA and the RWQCBs. The CWA establishes the NPDES program (described in Fact Sheet No. 1 for Dairies) and provides for enforcement actions including fines of up to $ 27,500 per day of violation. The CWA allows for "third party" lawsuits under which part of a fine is given to the person reporting the violation.

The **Safe Drinking Water Act** is federal law established for protection of groundwater. The law is enforced by the USEPA, and sets allowable levels of specific chemicals, including nitrate, in drinking water supplies.

The following agencies are involved in protection of the environment and enforce state and/or federal laws and regulations that apply to the management and disposal of animal wastes:

State Department of Fish and Game (CDFG) This agency has regulations prohibiting discharges of waste that can adversely impact aquatic habitat. Any fines imposed for violation of CDFA regulations are in addition to any enforcement actions taken by the RWQCB or other regulatory agencies.

United States Environmental Protection Agency (USEPA) The USEPA enforces the Clean Water Act and the Safe Drinking Water Act and can impose fines for violation of those laws. Many dairies must obtain a federal NPDES storm water permit (please see *Fact Sheet No. 1 For Dairies* for more information on this subject). If a dairy does not have a NPDES storm water permit, and wastewater is discharged into a water course other that during a 25-year 24-hour storm, the USEPA can impose substantial fines. The fines imposed by USEPA are in addition to any enforcement actions taken by the RWQCB or other regulatory agencies.

County Health Departments Depending on the county, the local health department may have requirements for design and/or management of waste facilities at dairies. The county may be able to impose penalties for improper management of animal wastes or may refer cases to the county district attorney's office for enforcement.

Attorneys and Special Prosecutors County District Attorneys, the California State Attorney General, attorneys from the U.S. Department of Justice, and other state and federal prosecutors can request courts to order corrections in waste management practices that do not comply with applicable federal, state, and local laws. The courts can also impose financial penalties for violations of those laws. In addition, the courts can impose criminal penalties, including a jail sentence, for certain violations. The orders and/or penalties imposed by state and federal courts can be in addition to any enforcement actions taken by the RWQCB or other regulatory agencies.

For more information about the water quality programs that apply to confined animal facilities, contact the RWQCB dairy regulatory staff at the following offices:

- Sacramento (916) 255-3000
- Fresno (559) 445-5116
- Redding (916) 224-4845

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 4 For Dairies

Nutrient and Irrigation Water Management Plan

Question: What is a Nutrient and Irrigation Water Management Plan (NIWMP)?

Answer: A NIWMP is a written description of the procedures used to select and apply crop nutrients (manure and commercial fertilizers) and water to cropland, including pasture. The NIWMP includes a description of the process used to determine **how much** manure and commercial fertilizer is needed by the crops and a description of **when and how** nutrients and irrigation water (including wastewater) are applied. Although a NIWMP can be used in any farming operation, the following information specifically applies to dairies where manure and wastewater are applied to cropland.

Question: Why is a NIWMP prepared?

Answer: A NIWMP is used to ensure that crops receive an optimum amount of nutrients and water. If insufficient nutrients are applied, crop yields will be reduced. If excessive nutrients are applied, or if improper irrigation practices are utilized, adverse environmental impacts can result from nutrients entering surface or groundwater. In addition, over fertilization can reduce crop yields and is a waste of valuable resources (fertilizer purchases can be reduced and excess manure can be sold or used elsewhere).

Question: When should a NIWMP be prepared?

Answer: A NIWMP is *required* for confined animal feeding operations in the Central Valley Region of California if the facility has general waste discharge requirements issued by the Regional Water Quality Control Board (Board). A NIWMP may also be required by the Board as part of a Cleanup and Abatement Order or other enforcement action or by a county regulatory agency. However, a NIWMP is *recommended* for all confined animal-feeding operations because it will help to optimize crop yields and protect the environment.

Question: Who prepares the NIWMP?

Answer: A NIWMP can be prepared by any person who understands crop nutrient and water requirements, has information on the properties of animal wastes, and has the essential site-specific information for the facility for which the NIWMP is being prepared. The site-specific information that is needed includes information on the waste management practices and the farming operations and generally must be obtained from the person(s) who manage the confined animal feeding operation and the cropland.

Question: What format is used for the NIWMP?

Answer: The Dairy Farm Advisors at the University of California Extension Service are developing a guidance document for preparation of a NIWMP. The guidance document should help anyone preparing a NIWMP by identifying essential information, providing generally accepted values, and presenting a logical format to follow. However, until the guidance document is available, there is no "standard" format to follow. Therefore, anyone required to prepare a NIWMP must develop their own format for a NIWMP. The following information is provided by staff in the Board's Sacramento office to assist dairy operator's who must prepare a NIWMP before the Extension Service's guidance document becomes available.

Tables 1 and 2 can be used to estimate the amount of nitrogen available to crops from manure produced at a dairy. Table 1 is used to calculate the Animal Units (1,000 lbs each) at the dairy. Table 2 is used to estimate the nitrogen loading if the manure is applied to cropland. An alternate and superior way to evaluate the nitrogen loading is to have the holding pond contents and manure stockpiles analyzed periodically and to then use the reported nutrient values along with the wastewater and manure application rates to determine the nutrient-loading rate.

TABLE 1: CALCULATION OF ANIMAL UNITS (AU)

			A.	B.	C.	D.	E.	F.
	ANIMAL	Factor	Freestalls		Flushed Corrals		Scraped Corrals	
			Head	AU[1]	Head	AU[1]	Head	AU[1]
1.	Milk Cows	1.0						
2.	Dry Cows	0.8						
3.	Heifers (2 years and older)	0.73						
4.	Heifers (1 year to breeding)	0.73						
5.	Calves (3 months to 1 year)	0.35						
6.	Baby Calves (< 3 months)	0.21						
7.	Subtotals							

TOTAL AU	
Value From	
B.7	
D.7	
F.7	
TOTAL	

Adjustments for Animal Breed: The AU values above are based on 1,000 pound AU per Title 40 Code of Federal Regulations, Section 122, and can be used directly for Jersey cows. For Guernseys, multiply the Milk Cow and AU values by 1.2 before using them in Table 2; for Holsteins, multiply the Milk Cow and AU values by 1.4 before using them in Table 2

TABLE 2: CALCULATION OF NITROGEN LOADING [2]

Value from Table 1[3]	Liquid Waste Factor	Liquid Waste Nitrogen	Solid Waste Factor	Solid Waste Nitrogen
B.7	x 0.8 x 0.45 x 0.25 x 365			
B.1	x 0.8 x 0.11 x 0.25 x 365			
B.7			x 0.2 x 0.45 x 0.25 x 365	
B.1			x 0.2 x 0.11 x 0.25 x 365	
D.7	x 0.6 x 0.45 x 0.25 x 365			
D.1	x 0.6 x 0.11 x 0.25 x 365			
D.7			x 0.4 x 0.45 x 0.25 x 365	
D.1			x 0.4 x 0.11 x 0.25 x 365	
F.1	x 0.1 x 056 x 0.25 x 365			
F.1			x 0.9 x 0.56 x 0.25 x 365	
F.7-F.1			x 1.0 x 0.45 x 0.25 x 365	
Subtotal				
Increase if wastewater is stored less than 30 days		x 2.0		
TOTALS (pounds of N)				

The total pounds of nitrogen as calculated above are the total amount available to crops where the wastewater and solid manure is applied. If solid manure is hauled off-site or wastewater is applied to adjacent property, an adjusted value for available nitrogen should be considered relative to crop needs at the dairy. Information on calculating crop nitrogen need is presented on the following page.

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1 Animal Units (AU) are calculated by multiplying the number of Head by the appropriate factor.

2 The following assumptions used in calculating nitrogen values are consistent with assumptions used by staff in Merced County: The animals are housed for 365 days/year; the nitrogen excretion rate is 0.56 lbs./Animal Unit/day for milk cows and 0.45 lbs./Animal Unit/day for other cows; 80% and 60% of the manure in freestalls and flushed corrals, respectively, is handled as a liquid. For milk cows in dry corrals or where alleys are scraped, 10% of the manure is in washwater at the milk barn. When wastewater held less than 30 days is applied to cropland there is a 50% loss of nitrogen loss, and when wastewater held more than 60 days is applied to cropland, there is a 75% loss of nitrogen. There is a 75% loss of nitrogen from storage and application of dry manure. These values are based on various studies and reports; however, the values may be modified in the future as new information becomes available.

3 For Guernseys and Holsteins, use adjusted values.

The following table can be used to identify the nitrogen needs of specific crops. The nitrogen requirement values are primarily taken from the Western Fertilizer Handbook (8th Edition, 1995) that also lists other crops and nutrients in addition to nitrogen. The county Farm Advisor may be able to provide requirements for specific crop varieties.

TABLE 3: NITROGEN REQUIREMENTS FOR CERTAIN CROPS

CROP	YIELD (tons)	LBS. N PER ACRE
Alfalfa	8	480
Almonds	1.5	200
Barley	2.5	160
Bermudagrass	4	225
Bromegrass	5	220
Clover-grass	6	300
Corn (grain)	5	240
Corn (silage)	30	250
Cotton (lint)	0.75	180
Grain sorghum	4	250

CROP	YIELD (tons)	LBS. N PER ACRE
Oats	1.6	115
Orchardgrass	6	300
Prunes	15	90
Safflower	2	200
Sorghum-sudan	8	325
Sugar Beets	30	255
Tomatoes	30	180
Timothy	4	150
Vetch	7	390
Wheat	3	175

Using information obtained from Table 3 or other sources, the nitrogen requirements for cropland at a dairy can be calculated as shown in Table 4.

TABLE 4: CROPLAND NITROGEN REQUIREMENTS

Field Number or Name	Nitrogen Needs (lbs. N/acre)[4]				Field Acres	Total lbs. N per Field (Field Acres x Total N)
	First Crop	Second Crop	Third Crop	Total N		
			Total Acres →			
					↑Total N (lbs./year)↑	

Evaluation of Nutrient Requirements: Using the total pounds of nitrogen available value from Table 2 and the total nitrogen requirement value from Table 4, an initial determination can be made as to the relationship between nitrogen availability and nitrogen need and whether or not it is necessary to export manure or to import fertilizer. As with any farming operation, periodic measurements of nitrogen in cropland and/or crops should be made in order to better determine nutrient requirements for optimum yield.

Developing the Nutrient and Irrigation Water Management Plan: A summary of the nitrogen availability and nitrogen need values and of the decision on exporting manure or importing fertilizer is the basis for the nutrient management plan. Although nitrogen is usually the nutrient of concern at confined animal facilities because of the potential for impacts to water quality, other nutrients should also be considered. Other information that may be included in the nutrient management plan includes a determination of the cropland characteristics and a description of when and how the manure and wastewater will be applied to cropland. The information on *when* can be presented in relation to crop planting and growth. The information on *how* can be related to the Water Pollution Prevention Plan, Stormwater Management Plan, or other document(s) related to waste and water management.

The relationship of cropland characteristics to irrigation water management should be considered when developing a NIWMP. The cropland characteristics that should be addressed in the NIWMP include the depth to groundwater, soil type(s), field dimensions and topography, irrigation method(s), drainage controls, and annual rainfall patterns.

Careful management of irrigation water is necessary to ensure that nutrients are applied to cropland at the desired rate and that adverse impacts to the environment are minimized. Proper irrigation results in even application of nutrients to cropland and prevents excessive percolation and runoff that can, respectively, result in adverse impacts to groundwater and surface water.

[4] From Table 3 or equivalent source. May be adjusted for crop yield.

The Irrigation Water Management component of a NIWMP is a written description of procedures that are followed for proper irrigation, and should address the following topics:

- Procedures that are used to mix wastewater and "clean" irrigation water
- The irrigation system used to apply wastewater to cropland
- The methods used to determine and control the rate of application
- Procedures followed to determine when sufficient water has been applied
- Physical and management controls used to prevent tailwater containing manure from moving off of the dairy
- Controls that will be used if it becomes necessary to apply wastewater to land during the rainy season
- Procedures used to prevent irrigation with wastewater from creating nuisance conditions.

In addition, the NIWMP should contain figures that show the location of cropland where manure and wastewater is applied. The figures should show nearby water courses and ditches, the slope of irrigated lands, the location of wells and pumps, and points from which tailwater can be discharged. If wastewater is applied to property under different ownership than the dairy, a copy of agreements on the application of wastewater to the property should be included.

Additional information related to the preparation of Nutrient and Irrigation Water Management Plans is available in the "Environmental Stewardship Short Course for California Dairy Operators" presented by the University of California Cooperative Extension in cooperation with the California Farm Bureau, Milk Producers Council, and Western United Dairymen. For more information about the water quality programs that apply to confined animal facilities, contact the RWQCB dairy regulatory staff at one of the following offices:

- Sacramento (916) 255-3000
- Fresno (559) 445-5116
- Redding (916) 224-4845

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 5 For Dairies

Soil And Groundwater Assessments For Dairies

Introduction

The California Water Code requires that animal wastes be managed to protect water quality. To help achieve protection, regulations established pursuant to the Water Code (reference California Code of Regulations, Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1, Section 22562d) require that holding ponds utilized for animal wastes be lined with, or underlain by, soils which contain at least 10 percent clay and not more than 10 percent gravel or be lined with artificial materials of equivalent impermeability. In addition, the Tulare Basin Water Quality Control Plan and some county ordinances require a 5-foot separation between the bottom of a holding pond and the highest anticipated groundwater elevation.

Title 27 also requires that manured areas (including corrals) be managed to minimize infiltration of water into underlying soils. Consequently, corrals and manure storage areas are usually designed and managed to reduce the potential for standing water ("ponding"). There are no state regulations that specify soil characteristics for corrals or manure storage areas. However, soils with low levels of clay and without underlying restrictive layers (such as a hardpan) are likely to allow significant infiltration. Studies conducted at dairies by the Central Valley Regional Water Quality Control Board have identified impacts to groundwater from corrals and manure storage areas.

The following information is provided to assist dairy owners who want to obtain soil and groundwater information related to environmental issues at existing or proposed dairy sites. Obtaining site-specific information is useful in developing recommendations for dairy design and operation. The following are not requirements, but can serve as a guide for discussions with consultants who conduct environmental assessments.

Assessments of Holding Pond Sites

Clay and gravel content in the sides and bottom of holding ponds is best evaluated by collecting samples from the pond excavation. However, an initial evaluation of soils can be made by using soil borings before the start of pond construction. The borings can also provide information on expected depth to groundwater. Cuttings or cores from the borings can be examined in the field by a geologist or soil scientist to assess soil type and soil variability at the site. If desired, soil samples from borings can be submitted for laboratory analysis to evaluate clay content and/or nitrogen levels. Borings can be also be used to evaluate several potential pond locations and the site with the "best soils" for a pond can be identified.

Assessments of Corrals

Soil borings in existing or proposed corrals can provide information on soil conditions including the presence of conditions that will restrict percolation. Analysis of soil samples from the borings can provide information on nitrogen levels under the corrals. Subsequent soil sampling and analysis can identify any changes in nitrogen levels to help assess the potential for corrals to impact groundwater.

Soil Borings

Soil borings can be completed with a drill rig or with direct-push technology. An alternative is to use a backhoe to construct trenches that can be used to examine site conditions and to collect soil samples. A qualified consultant can recommend the choice of technology based on expected site conditions and on cost and time considerations. The consultant can also recommend the placement and number of soil borings.

If a drill rig is used, continuous coring is recommended to allow an accurate assessment of soil conditions; an alternate but inferior method is to have a geologist log cuttings to evaluate the soil profile. When using a drill rig, soil samples can be collected at selected intervals by using a drive sampler. If direct-push technology is used, a cross section of the soil column is obtained inside plastic tubes that can then be sectioned to obtain soil samples to send for analysis.

Evaluation of Soil Samples

Soils from borings or excavations can be visually and tactually assessed in the field by a qualified geologist or soil scientist (reference ASTM Standard D2488 "Practice for Description and Identification of Soils - Visual-Manual Procedure"). Samples can be analyzed in a laboratory to evaluate clay and gravel content (reference ASTM Standard D422 "Particle Analysis of Soils"). Samples to be evaluated for nitrogen should be analyzed for nitrate (NO_3) and for total Keljdahl Nitrogen (TKN) by a state-certified laboratory using approved methods. There are also a number of soils tests that can be run to assess engineering properties of soils that may be useful in evaluating suitability of sites for buildings or other facilities.

Evaluation of Groundwater

Initial information on expected groundwater conditions can often be obtained from regional sources such as state or county agencies or irrigation districts. Local information may be available from wells constructed at nearby properties. Leaving a backhoe excavation open overnight may indicate if the groundwater elevation is higher that the base of the excavation. However, obtaining site-specific groundwater information generally requires the installation of monitoring wells. In some cases, temporary monitoring wells can be installed using direct-push technology, but such wells may not be allowed in some counties and will generally not be adequate for long-term monitoring. Permanent monitoring wells are usually installed with a drill rig and must meet county construction and administrative requirements. A minimum of three wells is generally required in order to assess groundwater gradients and evaluate upgradient ("background") water quality. Well head elevations need to be surveyed to a common reference point (usually mean sea level) and the depth to water needs to be periodically recorded (usually at the time of sampling) to establish groundwater gradients. Water samples should initially be analyzed for standard minerals, total dissolved solids (TDS), and nitrogen-containing compounds to obtain information that can be evaluated to assess impacts to water quality. An ongoing groundwater monitoring program may be focused at parameters of most concern (for example, TDS and NO_3) for periodic sampling and involve only an occasional wider range of tests.

Presentation of Results

A report should be prepared describing the field investigations and presenting the reported analytical results for samples submitted for analysis. Figures should be used to identify the locations of soil borings and sample collection. Photographs may be used to supplement the figures. Soil profiles should be presented graphically using boring logs. Groundwater gradient information should be presented in figures and tables and regional and local groundwater information should be summarized in a narrative format. Reported analytical results should be summarized in tables and graphs and the laboratory reports should be included as an appendix. A grain size distribution chart is useful for presenting results of clay and gravel content assessments of soil samples.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 6 For Dairies

Evaluation of Proposed Waste Holding Pond Sites

Introduction

The California Code of Regulations (Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1, Section 22562d) requires that holding ponds utilized for animal wastes be lined with, or underlain by, soils which contain at least 10 percent clay and not more than 10 percent gravel or be lined with artificial materials of equivalent impermeability. In addition, the Tulare Basin Water Quality Control Plan and some county ordinances require a 5-foot separation between the bottom of a holding pond and the highest anticipated groundwater elevation. The following information is provided to assist dairy owners who want to construct a dairy waste holding pond and need to document that the pond meets the legal requirements.

Initial Assessments of Soils at Proposed Holding Pond Sites

An initial evaluation of soils at proposed holding pond locations can be made by using soil borings before the start of pond construction (see Fact Sheet No. 5 for Dairies). The borings can also provide information on expected depth to groundwater. Cuttings or cores from the borings can be examined by a geologist or soil scientist to assess soil type. If desired, soil samples from borings can be submitted for laboratory analysis to evaluate clay and gravel content.

For some proposed pond locations, observations or available information (such as a county soil survey) may indicate that soil will not meet the required clay and gravel limits. In such instances, no samples of native soil are collected, and the pond is constructed with a liner of imported soil that meets the required clay content. Samples of the completed liner should be collected and analyzed as described below to document that the required values are met.

Visual and Tactile Assessments of Soils in Pond Excavations

In most instances, clay and gravel content in the sides and bottom of holding ponds is evaluated by collecting samples from the pond excavation. The number and location of samples depends on site specific conditions as determined by visual and tactile assessment. The visual assessment documents soil appearance that indicates different soil types are present in the excavation. Tactile assessment refers to an evaluation of the soil "feel" when it is dry and wet. Such assessments when conducted by a trained or experienced person (i.e., a "qualified person") can indicate the presence of significant amounts of sand and clay. The results of the visual and tactile assessments should be documented as discussed below.

It is normal to find horizontal layers of soil with different properties. In most instances, the different layers have different appearances (color or structure) and/or a different "feel". A written description of the visual assessment and tactile assessment (i.e., feel of soil in the different layers) should be prepared. The written description should be supplemented by drawings as appropriate (see attached example). The drawing can be done by hand or computer. Photographs may also be used to document the visual assessment. Each significant layer should be assessed, and the description should focus on observations related to clay and gravel content. At least one composite sample of soil from each significant layer should be collected and analyzed as described below.

Collection of Soil Samples

Representative samples of soil in pond excavations should be collected and submitted for analysis of clay and gravel content. As previously noted, the number of samples will depend on the observed conditions in the pond excavation. If the pond excavation has homogenous soils in the sidewalls and bottom (an unusual condition), only one composite sample[1] may be adequate if the clay content is significantly greater than 10%. More often, several individual or composite samples are submitted in order to document uniformity and to assess each soil layer that appears to be different. Each composite sample may be composed of soil collected from several (3 to 10) locations within the excavation as long as the soil in each location appears to be essentially the same. Diagrams should be used to show the locations of the samples that were used to create each composite (see attached example). If the clay content is expected to be relatively low, more individual samples should be collected to assess spatial variability and minimum clay content in different locations.

When imported soil is used to create a pond liner, a composite sample of the constructed liner should be collected and analyzed. Any damage done to the liner as a result of sample collection should be repaired. If the liner does not cover the entire excavation (i.e., bottom and sidewalls), one or more composite samples of the exposed native material should also be collected. Again, diagrams should be used to show the locations of the samples that were used to create each composite.

Analysis of Soil Samples

The soil samples collected from the pond excavation should be submitted to a commercial laboratory for soil particle size analysis. When using a laboratory for the first time, it is desirable to review their qualifications and quality assurance / quality control (QA/QC) procedures. Although the focus is on clay and gravel content, the laboratory should be requested to also report the percentages of silt and sand in the sample; there will be little or no additional cost for such reporting. Most laboratories will also provide QA/QC information at no additional cost when reporting analytical results.

Groundwater Assessments

In locations where the county or regional board requires a 5-foot separation between the base of a holding pond and highest anticipated groundwater, documentation should be provided showing that the proposed pond location meets the criteria. Information on the depth to groundwater and historical fluctuations in groundwater elevations may be obtained from soil borings, wells, and/or from historical information provided by county or local agencies.

Presentation of Results

A report should be prepared presenting a summary of the visual and tactile soil assessments, a description of the soil sampling and compositing procedures, the reported analytical results, and relevant information on groundwater. Figures should be used to describe the observed soil conditions in the excavation and to identify the sample collection sites. Photographs may be used to supplement the figures. Reported analytical results should be summarized in tables and the laboratory reports should be included as an appendix. Groundwater information should be summarized relative to the pond construction. Relevant groundwater data should be included as an appendix.

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[1] A composite soil sample is obtained by thoroughly mixing equal quantities (by weight or volume) of soil from two or more locations. For example, five 1-pound samples may be mixed in a 5-gallon pail, and a single 1-pound composite sample removed and sent for analysis. For holding pond site evaluations, composite samples are used only when the soil in each location appears to be essentially the same based on visual and tactile assessment. Composite samples should not be created from soil samples that have different appearances or feel.

EXAMPLE: HOLDING POND SITE ASSESSMENT
Nosuch Dairy
1234 Road Y, Pleasant, California

The pond location is shown on the attached map. The pond excavation was completed on 15 August 1998. As shown on the attached sketch, the pond excavation is approximately 200 feet by 500 feet by 17 feet deep. Some of the excavated soil was used to create a raised berm that is 5-feet high and 10-feet wide so that the finished pond with a 2 foot thick clay liner is approximately 20 feet deep. The remaining excavated soil was used in corrals.

An initial assessment of soil in the excavation indicated that there are five soil layers as shown on the attached sketch: The soil texture classifications are based on a visual and tactile assessment conducted by Mr. William Jones. Mr. Jones' business address, phone number, and qualifications for conducting soil assessments are attached. The five identified soil layers are:

1. A brown sandy loam to approximately 3 feet below grade
2. A dark brown sandy clay loam approximately 2 feet thick
3. A reddish-brown sandy loam approximately 4 feet thick
4. A hardpan (claypan) approximately 1 to 2 feet thick (see attached photograph)
5. Light brown loamy sand to the base of the excavation

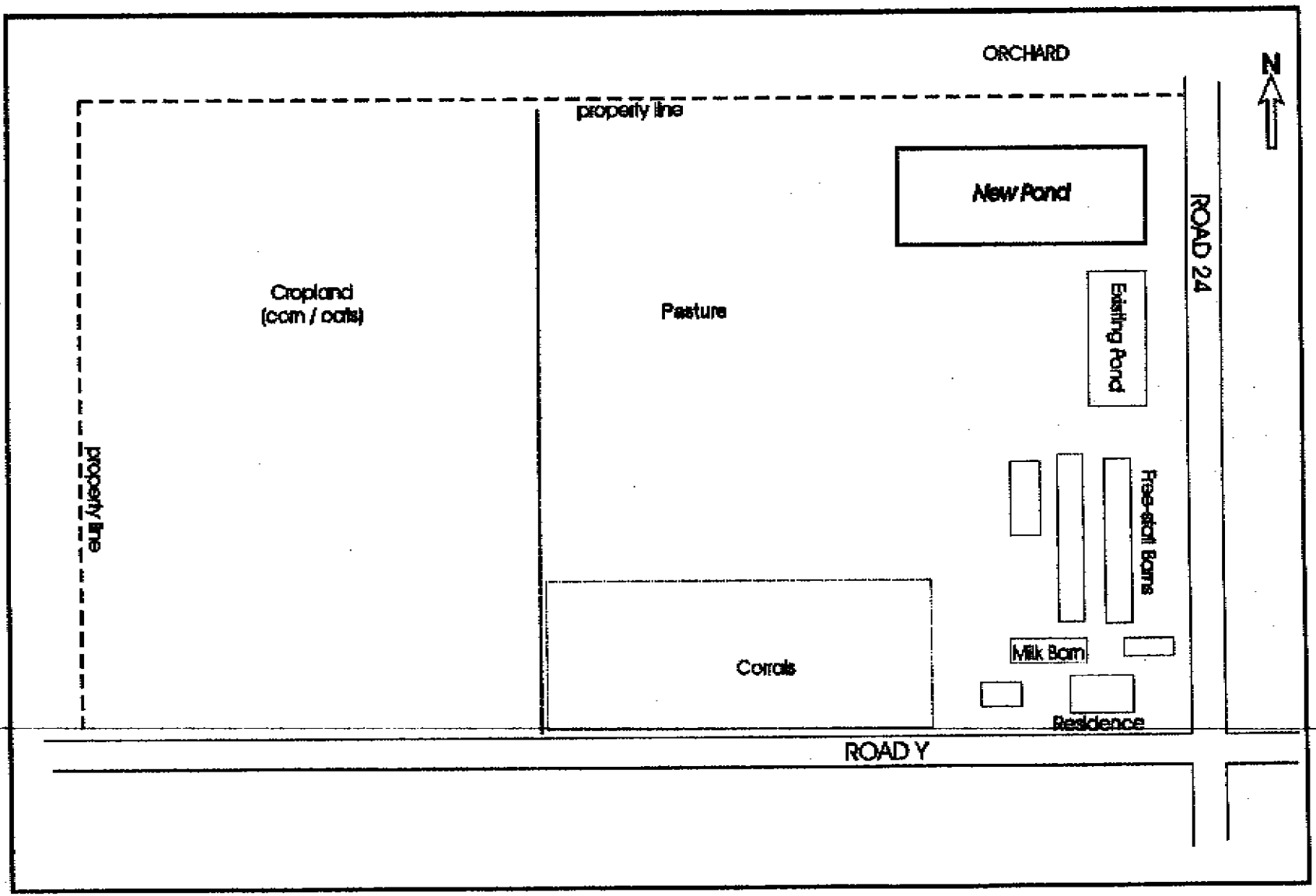
Based on the visual inspection of the soil, it was determined that a 2-foot thick liner consisting of imported clay soil would be placed in the bottom of the excavation and would extend approximately 6 feet up the sidewalls. The imported soil was obtained from McNoughts Soil Products in Ione, California. The liner was completed on September 2, 1998.

Three 1-pound composite soil samples from the excavation and liner were submitted to Z&Z Laboratories in Mercer California. The composites were made from 1-pound individual samples collected by excavating an area approximately 4" by 4" by 6" deep. The individual samples were composited by thoroughly mixing the individual samples in a plastic bucket and then removing a sample. The composite samples are described below:

Sample ID	Sample Description
S1	Composite of eight 1-pound soil samples of the first sandy loam layer (two from each sidewall and endwall) collected approximately 3 to 5feet below ground surface (bgs)
S2	Composite of eight 1-pound soil samples of the second sandy loam layer (two from each sidewall and endwall) collected approximately 8 to 11 feet bgs
L1	Composite of four 1-pound soil samples of the liner after placement (see sketch).

No samples of the sandy clay loam layer were collected because the layer had significantly more clay than the sandy loam layers that were above and below it. No samples of the hardpan or the loamy sand layer were collected because they were covered with the imported clay soil. The analytical results for the submitted samples are summarized below. The laboratory reports are attached. Available groundwater information (copy attached) indicates that the highest recorded local groundwater is approximately 10 feet below the base of the pond excavation.

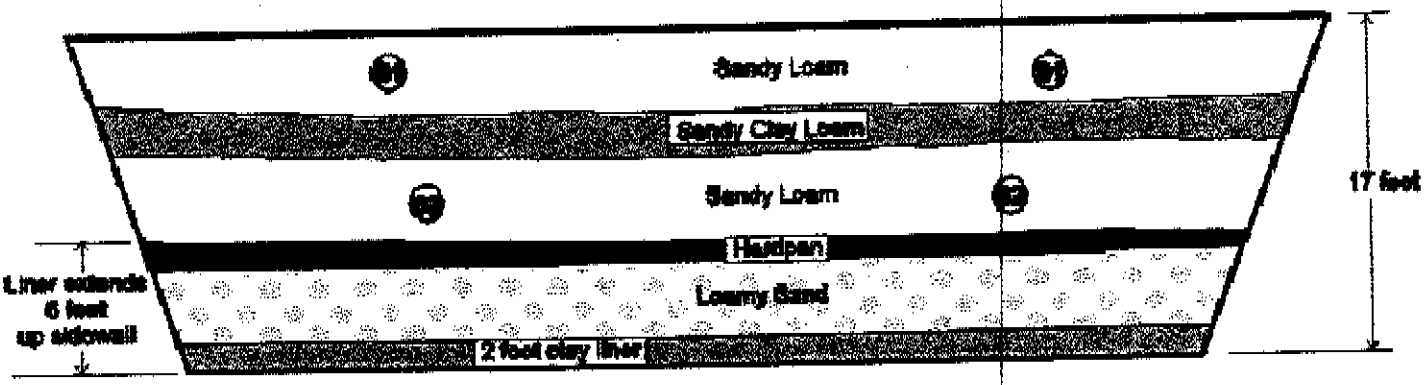
Sample ID	% Sand	% Silt	% Clay	Soil Texture
S1	63	24	13	Sandy Loam
S2	53	35	12	Sandy Loam
L1	22	28	50	Clay



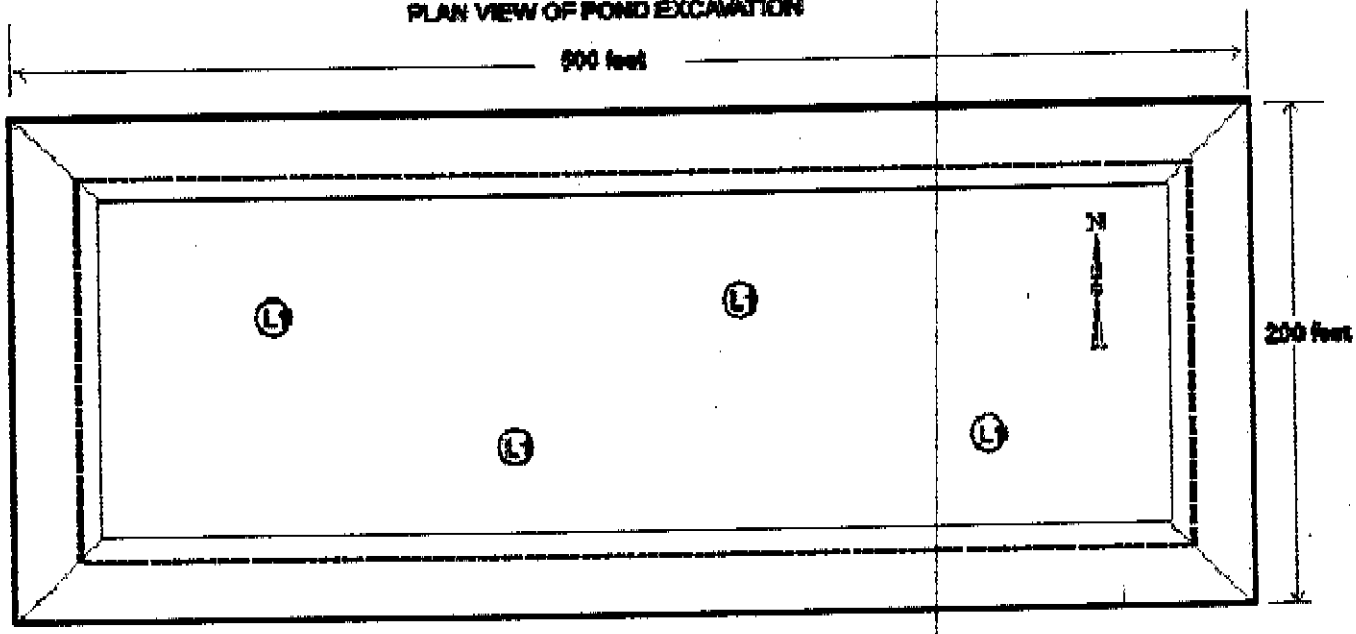
Nosuch Dairy
1234 Road Y
Pleasant, California

WASTEWATER HOLDING POND EXCAVATION
NOSUCH DAIRY
PLEASANT, CALIFORNIA

SOIL LAYERS IN POND EXCAVATION
TYPICAL SIDEWALL / ENDWALL VIEW (not to scale)



PLAN VIEW OF POND EXCAVATION



DRAWN BY W. JONES
SEPTEMBER 5, 1998

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 7 For Dairies

Construction of Animal Waste Holding Ponds

Introduction

The State of California has laws and regulations that apply to the design and construction of holding ponds used for storage of animal wastes. The Professional Engineers Act (Business and Professions Code Sections 6700-6799) and the California Code of Regulations (CCR) Title 16, Sections 400-474.5 identify activities that are considered civil engineering including "studies or activities in connection with fixed works for irrigation (and) drainage ." The Board of Registration for Professional Engineers and Land Surveyors considers the design of holding ponds for animal wastes to be civil engineering.

In addition, the General Construction Criteria for Class II Waste Management units in CCR Title 27, Division 2, Section 20310(e) states that "Containment structures shall be designed by, and construction shall be supervised and certified by, a registered civil engineer or certified engineering geologist (CEG)." Staff from the State Board of Registration for Geologists and Geophysicists has stated that a CEG can design holding ponds for animal waste.

It is unlawful for anyone to practice or offer to practice civil engineering unless currently registered by the Board of Registration. However, an unregistered or unlicensed person is allowed to perform civil engineering services if the person is:

- a federal officer or employee, or
- under the responsible charge and direct supervision of a registered professional engineer.

Additional regulations that apply to design requirements for holding ponds utilized for animal wastes are contained in CCR Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1, Section 22562. These regulations require that such ponds be protected from stream-channel overflows during 100-year peak flows. They also require ponds to be lined with, or underlain by, soils which contain at least 10 percent clay and not more than 10 percent gravel or be lined with artificial materials of equivalent impermeability. Information on evaluating the clay content of holding ponds is presented in the Central Valley Regional Water Quality Control Board's ("Regional Board's") Fact Sheet No. 6 For Dairies "Evaluating Proposed Waste Holding Pond Sites." When lining is necessary, the Regional Board requires that a registered civil engineer design the liner and certify that it complies with the state regulations.

Design of Animal Waste Holding Ponds

The design of animal waste holding ponds is largely dependent on site-specific conditions including the depth to groundwater and the soil type. As discussed in Regional Board Fact Sheet No. 5 "Soil And Groundwater Assessments For Dairies," an initial assessment of site conditions may be performed before the pond design is finalized and construction is started. If the pond will include a liner, the liner type may influence the shape and depth of the pond excavation. If a lined pond will be mechanically cleaned, the pond design should consider the need to protect the liner. The pond design should also meet local requirements such as mosquito abatement district requirements for access and planning department requirements for setbacks from wells, housing, and property lines. There may also be applicable regulations that specify the minimum separation between the base of the pond and highest anticipated groundwater.

Construction of Animal Waste Holding Ponds

The actual construction of an animal waste holding pond may be done by a contractor that is not a registered civil engineer. However, the contractor cannot perform the duties of a civil engineer including:

- the selection and comparison of engineering alternatives;
- the selection or development of design standards or methods, and materials to be used;
- the selection or development of techniques or methods of testing to be used in the evaluation of construction methods or controls;
- the evaluation of test results, materials, and workmanship affecting the integrity of the completed work; or
- the development and control of operating and maintenance procedures.

Documentation of Pond Construction and Operation

The facility owner should retain records documenting that animal waste holding ponds are adequately constructed and maintained. Such documentation includes

- any report describing assessments of soil and groundwater conditions in the vicinity of the pond prior to the start of pond construction;
- a report summarizing the sampling procedures and the reported analytical results for soil samples collected from the pond excavation and from any clay liner used in the pond;
- engineering specifications for the pond and, if applicable, the pond liner and an engineers description of any maintenance activities necessary to maintain the pond integrity;
- documentation that the pond was constructed according to the design specifications. Such documentation may include photographs, inspection logs, test results documenting proper construction of any liner, and an engineer's statement describing the completed pond;
- documentation that the pond has been maintained according to the design specifications. Such documentation may include inspection logs and records of pond cleaning and maintenance activities.

Contacts for Further Information

For more information about the water quality programs that apply to confined animal facilities in the Central Valley, contact Regional Board dairy regulatory staff at the following offices:

- Sacramento (916) 255-3000
- Fresno (559) 445-5116
- Redding (916) 224-4845