Cooperative Extension • Washington State University

Potassium and Northwest Forages

Are you receiving lab results indicating high levels of potassium (K) in your grass forages? High K concentrations in forages can contribute to the incidence of grass tetany and milk fever in cows. What can be done to reduce the K concentration in grass silage?

Potassium is the seventh most abundant element on earth. It is a cation with a single, positive charge and is an important nutrient for crop production. On the fertilizer bag, K is listed third, after nitrogen (N) and phosphorus (P). A strong relationship exists between N and K in the soil and plant. Adequate amounts of both N and K are needed for maximal crop development and yield. If K is restricted, N efficiency is greatly reduced.

Agronomists at Puyallup have found that some Washington soils release greater amounts of K to plants than other soils. Higher K-supplying soils include those considered "valley" soils. Examples of these include Bow, Chehalis, Kelso, Puget, Puyallup, and Sultan. These soils require less K fertilization to provide an equivalent amount of K to the forage crop. Your County ils Survey (or farm plan from SCS) will have the soil series listed for your county. Test soils and forages from suspected high K soils.

Potassium leaches from soil, although less readily than nitrates. Leaching increases as soil type changes from clay to loamy to sandy soil. Leaching also increases in wetter years. Potassium in the soil is available to plants through a "soil solution pool" which is also the leachable pool. When the soil solution pool of K is reduced by plant uptake or leaching, more soil K will be released from an "exchangeable-nonexchangeable" storage pool.

Many plants take up large amounts of K quickly after harvest and in amounts greater than the plant actually needs. This is often referred to as "luxury consumption." The plant transports nutrients to active growing tissues, so young forage plants usually have higher K concentrations than mature plants. Changing from a four-week to a three-week harvesting interval will likely increase K in grass silage. If you can delay ısting (realizing that fiber will increase) K ntration in the grass will decrease.

Potassium is the most abundant cation found in plants, and it interacts with other mineral constituents. Calcium (Ca) and Magnesium (Mg) are cations but carry two positive charges. Plants try to keep these three cations in balance. In many plant species, higher K applications reduce both Ca and Mg in the plant. If the ratio of K to (Ca + Mg) in the plant is 2.2 or greater, animals consuming the forage are more susceptible to grass tetany. Therefore, if you have high K grass forage, both Ca and Mg concentrations should be monitored as well. Calcium (and Mg) is often applied to field by limestone (dolomite). By liming soil, soil pH will increase, which will also decrease K leaching.

Forage species differ in K concentrations. Blazer compared forage K concentration in mixed orchardgrass and alfalfa with increasing application rates of K. He found both plant species to be similar (> 3.5 % K) at high rates of K applied (> 350 pounds per acre) but orchardgrass maintained much higher tissue K levels at lower K application rates. With no applied K, orchardgrass had nearly three times the concentration of K as compared with alfalfa. A possible solution to the high K grass silage problem is to re-introduce more legumes into existing grass stands. Grasses are more competitive than legumes for excess N. To maintain the legume species in the field, increased soil liming and reduced N will be necessary.

The solution to high K grass silage on your farm will take some investigative work. Determine the soil series and if they have high K supplying capacity. Conduct soil sampling of fields known or suspected to produce high K grass silage. Test grass silage for Ca and Mg if cows are not as healthy or productive as you expect. Determine what grasses are growing in your fields and consider re-introducing legumes. Change manure management and fertilization according to soil tests. Because K leaches at a much slower rate than N, it is going to take some time to resolve the high K problems that Northwest producers currently face.

—Steven C. Fransen,
Extension Agronomist,WSU Puyallup

NebGuide

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Manure Applicator Calibration

Rick Koelsch, Extension Engineer—Livestock Systems

Calibration methods for manure spreaders are discussed here.

Applying manure to land often is considered a waste disposal process rather than a fertilization process. Applying manure as a waste product is causing growing concerns about groundwater and surface water contamination. Increasing commercial fertilizer costs and regulatory mandates will encourage application of manure as a nutrient source in the future.

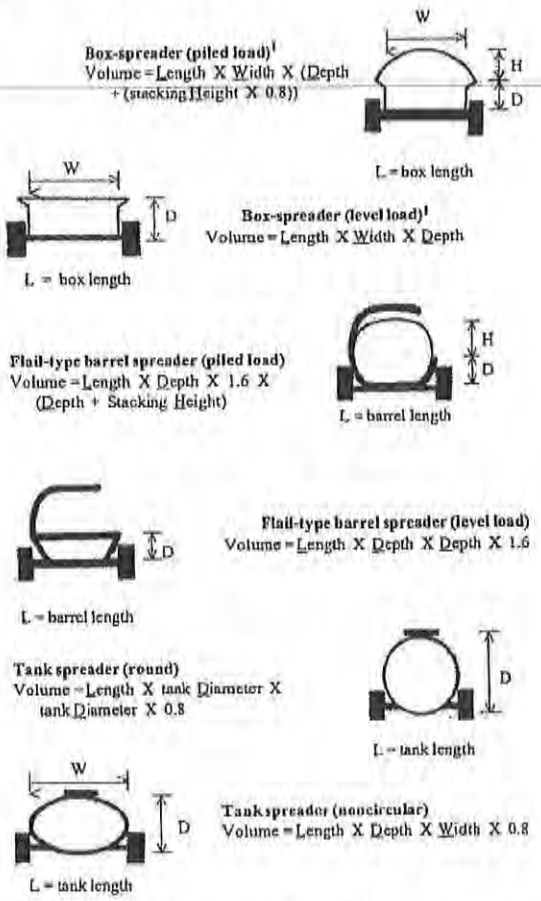
Calibration of manure spreaders, like calibration of any fertilizer spreader, is a key component of efficient nutrient use. Manure application rate needs to be based upon knowledge of crop nutrient needs, concentration of manure nutrients, and availability of nutrients in the soil.

This publication illustrates several calibration methods. Methods are included for direct calibration of manure spreaders when spreader capacity or weight is known (Method 1) or unknown (Method 2). An indirect measure can be based upon spreader loads applied to a field (Method 3). Manure application rates through irrigation systems can be determined by Methods 4 and 5. Select the method most easily adapted to your application.

Manure Spreader Volume

Many calibration procedures require knowledge of manure spreader holding capacity. Ideally, several spreader loads should be weighed, the empty spreader weight subtracted, and an average net weight calculated. However, scales are not always accessible.

Spreader volume can be estimated by calculations illustrated in *Figure 1*. A volume estimate from *Figure 1* and Calibration Method 1 provides a reasonable determination of application rate for liquid manure spreaders. Estimates from *Figure 1* are less accurate for solid and semisolid manure where stacking heights and manure density vary. If weighing is not possible, calibration by Calibration Method 2 is suggested for solid and semisolid spreaders.



[1]For a box spreader with sloping sides, use average width.

Figure 1. Procedures for estimating the manure volume held by a manure spreader. If dimensions are measured in feet, volumes will be in cubic feet. Conversion to other units of measure are given in *Table I*.

7. Weigh bucket, plastic and manure (m). Subtract empty weight of plastic and bucket.

Net weight of sheet = _____ lbs. − _____ lbs. = _____ lbs.
$b + p + m$ $b + p$ m

8. Determine application rate from *Table II* or by following formula:

Application rate (tons/ac) = $\frac{\text{lbs. of manure} \times 22^*}{\text{area of sheet (sq. ft.)}}$

= _____ X 22*

= _____ tons/acre

*22 is a factor for converting pounds to tons and square feet to acres.
22 = 43,560 ft²/ac ÷ 2,000 lb/ton

9. Repeat steps 6, 7, and 8 for each sheet

10. Compute average application rate of three plastic sheet samples.

Average application rate = $\frac{(\quad + \quad + \quad)}{3}$

11. Repeat process for commonly used tractor speeds and spreader emptying speeds (PTO speeds or hydraulic settings).

Table II. Manure application rates (tons/acre) based on manure weight (pounds) collected on different sizes of plastic sheets. Be sure to deduct weight of plastic sheet and bucket. 48" dimension is selected to fit between tractor tires.

Manure collected (lbs)	*Size of plastic sheet* 48" x 48"	48" x 66"	48" x 96"
	tons/acre		
6	8	6	4
8	11	8	5
10	14	10	7
12	16	12	8
14	19	14	10
16	22	16	11
18	25	18	12
20	27	20	14
22	30	22	15
24	33	24	16
26	35	26	18
28	38	28	19
30	41	30	20
32	44	32	22
34	46	34	23
36	49	36	25
38	52	38	26
40	54	40	27

Method 3. Application Rate Based on Spreader Loads Applied to Field

This method provides a means of estimating manure application rate after manure spreading is completed. Usually, a method that estimates rate prior to application is preferred. This method assumes an even application of manure has been spread across the field. Uniformity of application often depends upon the commitment and interest of the operator. This method is best used to provide a final check of calibration estimates made by the previous measures.

1. Determine a spreader's known volume by *Figure 1*, manufacturer's rating, or weighing representative sample of spreader loads. This approach is not accurate for solid and semisolid manure where capacity is difficult to estimate unless sample loads are weighed.

   Solid Manure (use *Table 1* to estimate tons):

   Bushels = _____ *Cubic feet* = _____

   Tons = _____

   Liquid Manure (use *Table 1* to estimate tons):

   Gallons = _____ *Tons* = _____

2. Count number of loads applied to field.

   Loads = _____

3. Determine area of field.

   Acres = _____

4. Calculate manure application rate.

Application rate (gallons/acre) = $\frac{\text{Gallons per load} \times \text{loads}}{\text{Acres}}$

= _____ X _____

= _____ gallons/ acre

Application rate (tons/acre) = $\frac{\text{Tons per Load} \times \text{loads}}{\text{Acre}}$

= _____ X _____

= _____ tons/ acre

Method 4. Application Rates through Irrigation System

Irrigation systems often apply manure at excess rates. Waste water or manure volumes need to be measured at a location prior to its dilution with clean water. Meters are available for measuring manure and waste water volumes. High cost and reliability in high solids applications have limited their use. If a direct measure of volume is not available, the following procedure may be helpful when pumping from a lagoon or manure storage. **The following method is for a traveling gun irrigation system.**

1. Measure surface area of lagoon or storage. Make these measures at the liquid level and not at the top of the storage.

Area = *Length* X *width*

= _____ X _____

= _____ square feet

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$1.50

Calculating Dairy Manure Nutrient Application Rates

T. Downing

Whether your goal is to manage manure application to balance for nitrogen or for phosphorus, knowing how much nutrient you are applying is a crucial step toward ideal manure management. Determining the relationship between volume of waste and the amount of nutrients applied is essential.

This publication describes how to calibrate waste-handling equipment and to calculate nutrient application rates. It covers typical equipment found on dairies and uses nitrogen in the examples. The same techniques can be used with phosphorus.

Generally, it is desirable to apply no more than 100 pounds N per acre at a time. See the publications listed under "For more information" on page 6 to learn how to determine appropriate nutrient application rates for your situation.

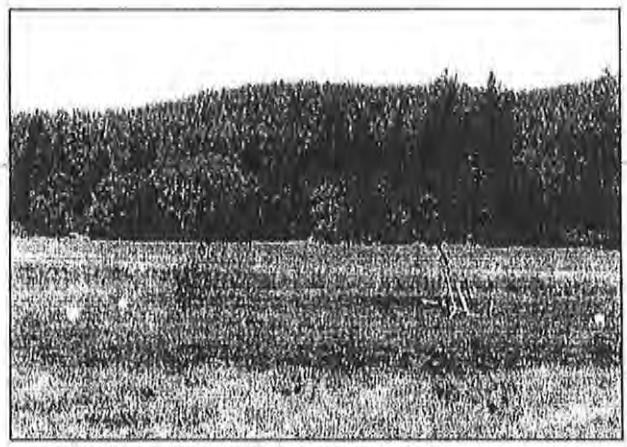

Figure 1. Place several straight-sided, flat-bottom buckets in the area where the gun is to apply liquid.

Doing the calculations

To calculate nutrient application rates, you need to know three things:

- The concentration of nitrogen in the manure—For example, if you apply 100 pounds or 100 gallons of manure, you must know how much nitrogen is in each pound or gallon. Having a sample analyzed by a lab is the best way to determine nutrient concentration, but using book values usually puts you in the ballpark.
- How much manure (pounds or gallons) you have applied
- The area (square feet or acres) that received the application

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1. ***Calculate the area covered.*** Multiply the 240-foot width by the 1,000-foot pass to determine that you covered 240,000 square feet. This represents 5.5 acres.

$$\frac{240{,}000\ \text{ft}^2}{43{,}560\ \text{ft}^2\ \text{per acre}} = 5.5\ \text{acres}$$

2. ***Measure the amount of liquid applied.*** During the application, place several buckets throughout the pass area. Combine the liquid waste collected in all the buckets into one bucket and measure the depth of the liquid. Divide this amount by the number of buckets to determine how many inches you applied. For example, let's say your application averaged ⅛ inch.

3. ***Convert the inches applied to gallons.***

   a. **First,** convert the square inches to cubic feet by dividing 240,000 by 36 (⅛ inch in the bucket is ⅛₈ of a foot). This is equivalent to 6,667 cubic feet of manure.

$$\frac{240{,}000\ \text{ft}^2}{36} = 6{,}667\ \text{ft}^3$$

   b. **Now,** convert the cubic feet to gallons. There are 7.5 gallons in a cubic foot, so multiply 6,667 cubic feet by 7.5. The result is 50,002 gallons.

4. ***Calculate the total amount of nitrogen applied.*** If the manure contains 8 pounds of nitrogen (N) per 1,000 gallons, and you applied 50,002 gallons, then you applied 400 pounds N.

$$\frac{50{,}002\ \text{gal} \times 8\ \text{lb N}}{1{,}000\ \text{gal}} = 400\ \text{lb N}$$

5. ***Calculate the amount of N applied per acre.*** Four hundred pounds of N applied over 5.5 acres equals around 73 pounds per acre.

$$\frac{400\ \text{lb N}}{5.5\ \text{acres}} = 73\ \text{lb N per acre}$$

6. ***Calculate application rates at various speeds.*** From these calculations, you can generate a table that easily demonstrates the amount of nitrogen applied at various speeds (see Table 1 for an example). In the example above, the speed was 6 feet per minute. At 3 feet per minute, the application rate would be twice that at 6 feet, or 146 pounds N per acre.

7. ***Estimate the pump rate per minute.*** At 6 feet per minute, it takes 166 minutes to complete a 1,000-foot pass.

$$\frac{1{,}000\ \text{ft}}{6\ \text{ft per minute}} = 166\ \text{minutes}$$

Divide the total gallons pumped by the total minutes pumped. For this example, 50,002 gallons divided by 166 minutes equals 301 gallons per minute.

Table 1.—Example calibration chart.

Traveler speed (feet/minute)	Inches applied	N applied per acre (lb) (if 8 lb N/ 1,000 gal)	Total N applied (lb)		
			500 ft hose pulled	1,000 ft hose pulled	1,500 ft hose pulled
2.0	1	219	600	1,200	1,800
4.0	0.5 inches	109	300	600	900
6.0	**0.33 inches**	**73**	200	**400**	600
8.0	0.25 inches	55	150	300	450
10.0	0.20 inches	44	120	240	360

Divide this number by the number of pans. The result is the inches of liquid manure applied. Let's assume you applied ½ inch.

2. ***Convert the inches applied to gallons applied per acre.***

   a. **First,** convert the inches to cubic feet per acre by dividing 43,560 (the number of square feet in an acre) by 24 (½ inch in the bucket is 1/24 of a foot). This is equivalent to 1,815 cubic feet of liquid manure per acre.

$$\frac{43{,}560\ \text{ft}^2}{24} = 1{,}815\ \text{ft}^3\ \text{per acre}$$

   b. Now, convert the cubic feet per acre to gallons per acre. There are 7.5 gallons per cubic foot, so multiply 1,815 cubic feet by 7.5. The result is 13,612 gallons per acre.

3. ***Calculate the nitrogen application rate.*** If the concentration of nitrogen is 10 pounds per 1,000 gallons, the rate of N applied is 136 pounds per acre.

$$\frac{13{,}612\ \text{gal/a} \times 10\ \text{lb N}}{1{,}000\ \text{gal}} = 136\ \text{lb N/a}$$

Calculating rates with a solids spreader

The following are two ways to calibrate solids spreaders.

The most common method

Calculate the nutrient (e.g., nitrogen) content of each spreader load and multiply that number by loads per acre or per field.

1. ***Calculate the capacity (in cubic feet) of your spreader.*** If your spreader is 16 feet long, 5 feet wide, and 5 feet deep, it holds 400 cubic feet per load.

$$16\ \text{ft} \times 5\ \text{ft} \times 5\ \text{ft} = 400\ \text{ft}^3$$

2. ***Calculate the nitrogen application rate.*** If your solid manure has a concentration of 10 pounds N per 100 cubic feet, you are applying 40 pounds of N per load of solids.

$$\frac{400\ \text{ft}^3 \times 10\ \text{lb N}}{100\ \text{ft}^3} = 40\ \text{lb N}$$

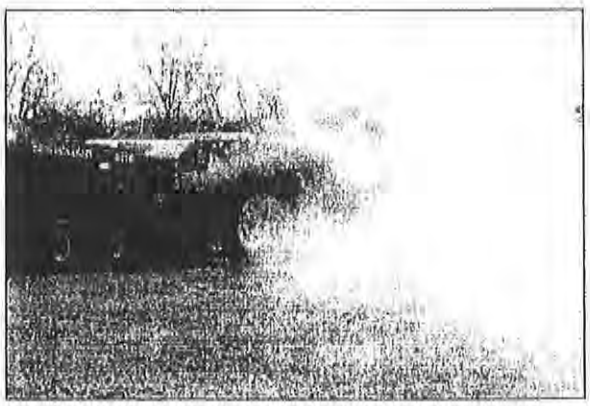


Figure 4. Place a tarp or piece of plastic in the field and apply solids over the area.

3. ***Calculate the amount of N applied to the field.*** Record the number of loads hauled on each field. Multiply the number of loads by the amount of N per load. For example, if you hauled 25 loads of solids, multiply 25 loads by 40 pounds N per load, for a total application of 1,000 pounds N.

4. ***Calculate the number of pounds of N applied per acre.*** Divide the total amount of N applied by the number of acres, in this example 10 acres.

$$\frac{1{,}000\ \text{lb total N}}{10\ \text{acres}} = 100\ \text{lb N per acre}$$

A second method

This method measures the pounds of solids applied to a small area and uses that quantity to calculate the volume applied over the entire field. It assumes that the application rate is constant. For example:

1. ***Measure the amount of solids applied.*** Place a tarp or piece of plastic in the field and apply solids over the area (Figure 4). A 10' x 10' tarp measures 100 square feet, which represents 1/435 of an acre.

$$\frac{100\ \text{ft}^2}{43{,}560\ \text{ft}^2\ \text{per acre}} = 1/435\ \text{acre}$$

Nutrient Application Equipment Calibration:

Calibrate application equipment to ensure uniform distribution and accurate application rates.

Commercial Fertilizer Application Equipment Calibration:
The nitrogen applicator, the commercial broadcast spreaders, and corn planter will be set per the manufacturers recommendations then filled with a known amount and checked over known acreage. Adjustments will be made to achieve the planned rates.

Manure Spreader Calibration
There are several methods that can be used to calibrate the application rate of a manure spreader. The two best methods are the load-area method and the plastic sheet method. It is desirable to repeat the calibration procedure 2 to 3 times and average the results to establish a more accurate calibration.

Before calibrating a manure spreader, the spreader settings such as splash plates should be adjusted so that the spread is uniform. Most spreaders tend to deposit more manure near the spreader than at the edge of the spread pattern. Overlapping can make the overall application more uniform. Calibration of application rates when overlapping requires measuring the width of two spreads and dividing by two to get the effective spread width.

Calibration should take place annually or whenever manure is being applied from a different source or consistency.

Load-Area Method
The load-area method is the most accurate and can be used for most types of manure handling. This method consists of determining the amount (volume or weight) of manure in a spreader and the total area over which it is applied. The most accurate method to determine the amount of manure in a spreader is to weigh the spreader when it is full of manure and again when it is empty (portable pad scales work well for this). The difference is the quantity of manure applied over the area covered. Spreader capacities listed by the manufacturers can be used to determine the amount of manure in the spreader. However care must be taken when using manufactures spreader capacities. Heaped loads, loading methods and manure type may vary considerably from what is listed by manufacturers of box and side delivery manure spreaders. Spreader capacities for liquid tankers are accurate provided the tanker is filled to the manufactures recommended levels, and no foam is present in the tank.

The area of spread is determined from measuring the length and width of the spread pattern. Measuring can be done with a measuring wheel, measuring tape or by pacing.

The application rate is calculated using the following formula:

$$\frac{\text{Spreader capacity (tons or gallons) X 43560 sq. ft/acre}}{\text{Distance traveled X Spreading width}} = \text{Application Rate tons or Gallons/Acre}$$

Plastic Sheet Method
The plastic sheet method can only be used with solid or semi-solid manure. This method of calibrating spreader application rates involves 1) cutting a plastic sheet to the specified dimensions (56 inches X 56 inches), 2) weighing the clean plastic sheet, 3) laying out the plastic sheet on the ground and driving the manure spreader (applying manure at a recorded speed and spreader setting) over the sheet, 4) weighing the plastic sheet with the manure on it, and 4) determine the net weight of the manure on the sheet (weight of manure and sheet - weight of the clean sheet), and 5) the net pounds of manure equals tons per acre applied.

When calibrating manure spreaders, all details regarding tractor speed and manure spreader settings and date(s) of each calibration should be recorded with manure application information, and directly on the equipment. Mark equipment to ensure a known application rate is applied each time the referenced tractor speed and spreader settings are used. Manure spreader settings can include such things as: fast and slow settings on some box spreaders, gate position on side delivery spreaders and splash plate position and fill levels on liquid tankers.

Irrigation System Calibration:
Place 3-5 buckets throughout the irrigation spray pattern and collect samples while operating the pump at a given rpm and pressure (for a traveling gun record the ground speed also). At the end of the planned sample period measure the amount of liquid collected in inches (average the samples). The following chart shows how many gallons per acre applied per inch applied.

Gallons applied per inch of liquid manure applied.

Inches Liquid Manure Applied via Irrigation	Gallons per Acre
.20	5,430
.30	8,146
.40	10,860
.50	13,577
.75	20,365
1.0	27,154
1.25	33,942
1.5	40,731

Soft Hose Injection System with Irrigation Hose:
Alternative 1. Use a flow meter mounted on the injector system and calculate the distance and width to determine amount applied over a measured area. Example the flow meter measures 1000 gallons over a distance of 600 feet and 10 feet wide.

Formula:
Gallons Applied (1000 gal) X 43560 sq. ft/acre = Application Rate (7260 gallons/acre)
Distance traveled (600 ft) X Application width (10 ft)

Alternative 2. (Requires a 10-20 gallon graduated measuring container)
Step 1) In the field, measure the flow out of one injector for 5 seconds into the graduated measuring container and record gallons, repeat three (3) times and average the results. **Step 2)** Multiply the average amount collected from one injector by the number of injectors (equals amount applied for the whole system for 5 seconds). **Step 3)** Multiply the results of Step 2 times

12 to get gallons per minute. **Step 4)** Place the injector in the soil at the planned depth and operating speed and record the distance traveled in 1 minute (average 3 different measurements). **Step 5)** Determine the effective application width (number of injectors X injector spacing in feet). **Step 6)** Multiply the effective width times the distance traveled in 1 minute (this gives the square feet covered in 1 minute). **Step 7)** Divide the result of Step 6 by 43,560 (this gives the acres covered in 1 minute). **Step 8)** Divide the results of Step 3 (gallons per minute) by the results of Step 7 (acres covered in 1 minute) - (this gives the gallons applied per acre. Example:

Step 1) Collected an average of 6 gallons from one injector for 5 seconds.
Step 2) Applicator has 8 injectors (8 injectors X 6 gallons per injector = 48 gallons for 5 seconds)
Step 3) 48 gallons in 5 seconds X 12 = 576 gallons/minute applied
Step 4) Average distance covered in 1 minute was 250 feet.
Step 5) Average width of the applicator is 12 feet.
Step 6) 12 feet wide X 250 feet long = 3000 square feet
Step 7) 3000 square feet divided by 43,560 square feet/acre = .0688 acres covered in 1 minute
Step 8) 576 gallons/minute divided by .0688 acres/minute = 8,372 gallons/acre.

Field No.	Type of Equipment	Calibration Date	Name of Person Calibrating	Calibration Data and Units	Comments/Changes Made

APPENDIX C

Soils Map

Soils Description

Soil & Manure Sampling Guidelines

Soil Interpretation Information

Recordkeeping Worksheets

Table 1. Crop Information
Table 1 is a record of current cropping information. This table can be used to evaluate how cultural management practices influence crop yields. Yield goals can also be compared to actual crop yields to determine how realistic your yield goals are.

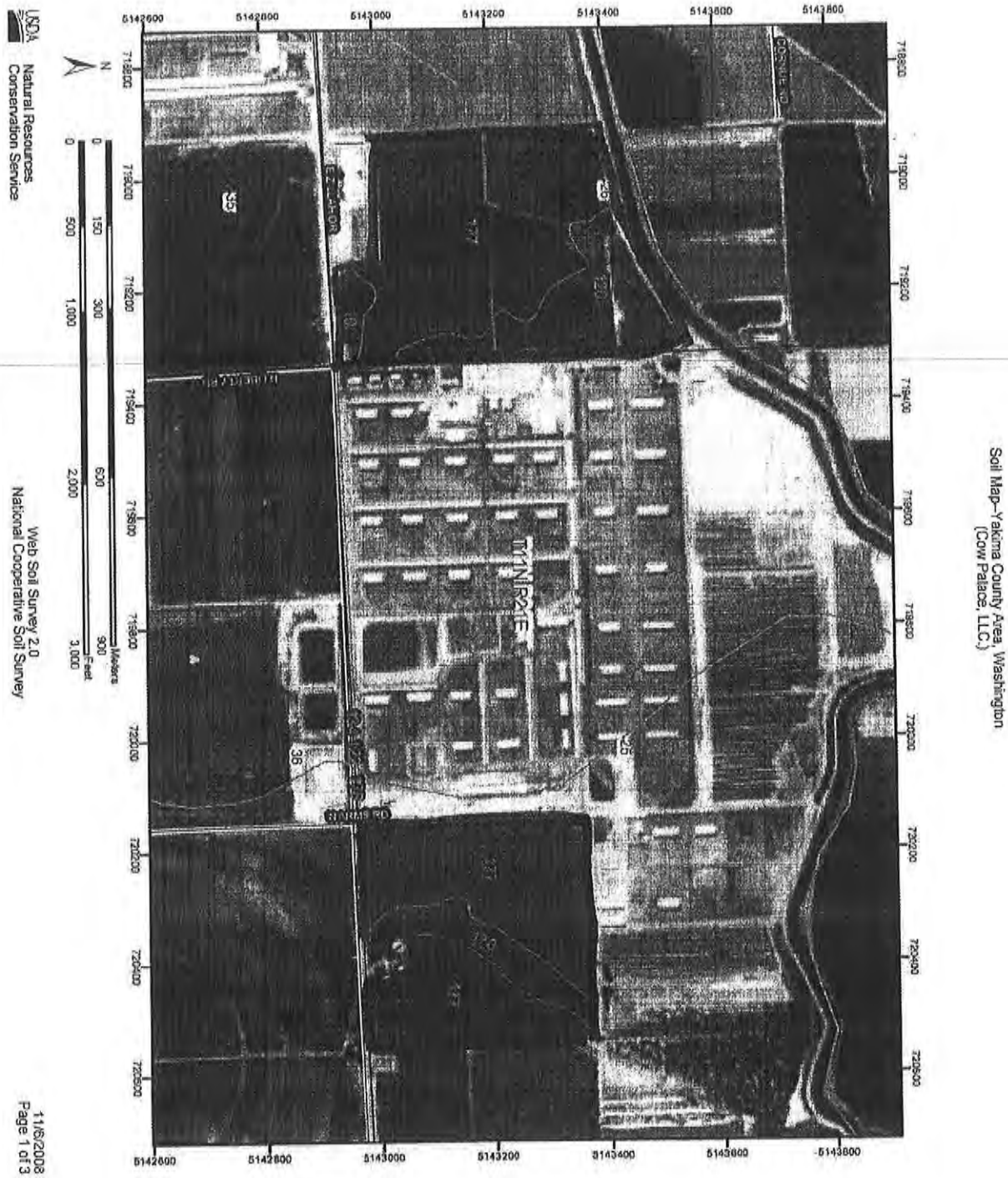
Table 2. Soil Test Summary
Table 2 provides a brief history of a field's soil fertility. This table helps evaluate how your crop and nutrient management program is influencing the nutrient status of each field.

Table 3. Nutrient Planning
This table is used to determine the amount of fertilizer nutrients needed to produce a crop after appropriate nutrient credits are subtracted from fertilizer recommendations. This will help maximize profit and prevent the over-application of fertilizer nutrients.

Table 4. Nutrient Applications
The source of nutrients, actual application dates, and rate for the field are recorded on this table.

Table 5. Private Applicator Pesticide Use Records
On this table, record information about herbicides, insecticides, fungicides, and nematocides. Recording all pesticide applications optimizes pest control strategies for the upcoming year, and helps to evaluate previous pesticides and their performance.

Off-Site Manure Record
On this form, record information about where your liquid and solid manure is going, if it is not used on your acres.



Soil Map–Yakima County Area, Washington
(Cow Palace, LLC - South of East Zillah Drive)

USDA Natural Resources Conservation Service

Web Soil Survey 2.0
National Cooperative Soil Survey

11/6/2008
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Snyder Exhibit 5

MAP LEGEND

- Area of Interest (AOI)
  - Area of Interest (AOI)
- Soils
  - Soil Map Units
- Special Point Features
  - Blowout
  - Borrow Pit
  - Clay Spot
  - Closed Depression
  - Gravel Pit
  - Gravelly Spot
  - Landfill
  - Lava Flow
  - Marsh
  - 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
  - Gully
  - Short Steep Slope
  - Other
- Political Features
- Public Land Survey
  - Township and Range
  - Section
- Municipalities
  - Cities
  - Urban Areas
- Water Features
  - Oceans
  - Streams and Canals
- Transportation
  - Rails
- Roads
  - Interstate Highways
  - US Routes
  - State Highways
  - Local Roads
  - Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N

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

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 9, May 27, 2008

Date(s) aerial images were photographed: 6/29/1993

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.

USDA Natural Resources Conservation Service

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Page 2 c

Map Unit Legend

Yakima County Area, Washington (WA677)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
32	Esquatzel silt loam, 0 to 2 percent slopes	2.2	0.5%
38	Finley silt loam, 2 to 5 percent slopes	3.7	0.8%
120	Scoon silt loam, 2 to 5 percent slopes	11.6	2.4%
121	Scoon silt loam, 5 to 8 percent slopes	12.4	2.6%
122	Scoon silt loam, 8 to 15 percent slopes	4.2	0.9%
134	Shano silt loam, 8 to 15 percent slopes	5.8	1.2%
177	Warden silt loam, 2 to 5 percent slopes	267.9	56.0%
178	Warden silt loam, 5 to 8 percent slopes	100.6	21.0%
179	Warden silt loam, 8 to 15 percent slopes	64.4	13.5%
180	Warden silt loam, 15 to 30 percent slopes	5.8	1.2%
Totals for Area of Interest (AOI)		478.4	100.0%

Map Unit Legend

Yakima County Area, Washington (WA677)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10	Burke silt loam, 2 to 5 percent slopes	2.3	2.7%
120	Scoon silt loam, 2 to 5 percent slopes	12.8	14.8%
122	Scoon silt loam, 8 to 15 percent slopes	0.1	0.1%
134	Shano silt loam, 8 to 15 percent slopes	0.0	0.0%
177	Warden silt loam, 2 to 5 percent slopes	65.5	75.6%
178	Warden silt loam, 5 to 8 percent slopes	5.9	6.8%
179	Warden silt loam, 8 to 15 percent slopes	0.0	0.0%
Totals for Area of Interest (AOI)		86.7	100.0%

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Report—Chemical Soil Properties

Chemical Soil Properties– Yakima County Area, Washington								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
32—Esqualzel silt loam, 0 to 2 percent slopes								
Esqualzel	0-17	5.0-10	—	6.6-7.8	0	0	0	0
	17-60	5.0-10	—	7.4-8.4	1-5	0	0.0-2.0	0
	60-64	5.0-10	—	7.4-8.4	1-5	0	0.0-2.0	0
38—Finley silt loam, 2 to 5 percent slopes								
Finley	0-12	5.0-10	—	6.6-8.4	0	0	0	0
	12-30	5.0-10	—	7.4-8.4	5-20	0	0.0-2.0	0
	30-60	5.0-10	—	7.4-8.4	10-20	0	0.0-2.0	0
120—Scoon silt loam, 2 to 5 percent slopes								
Scoon	0-6	10-20	—	7.4-8.4	0	0	0	0
	6-16	10-20	—	7.4-8.4	1-5	0	0	0
	16-60	—	—	—	—	—	—	—
121—Scoon silt loam, 5 to 8 percent slopes								
Scoon	0-6	10-20	—	7.4-8.4	0	0	0	0
	6-16	10-20	—	7.4-8.4	1-5	0	0	0
	16-60	—	—	—	—	—	—	—

Chemical Soil Properties– Yakima County Area, Washington

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
122—Scoon silt loam, 8 to 15 percent slopes								
Scoon	0-6	10-20	—	7.4-8.4	0	0	0	0
	6-16	10-20	—	7.4-8.4	1-5	0	0	0
	16-60	—	—	—	—	—	—	—
134—Shano silt loam, 8 to 15 percent slopes								
Shano	0-4	5.0-10	—	6.6-8.4	0	0	0	0
	4-30	5.0-12	—	7.4-8.4	0	0	0.0-2.0	0
	30-60	5.0-14	—	7.4-9.0	0-30	0	0.0-2.0	0
177—Warden silt loam, 2 to 5 percent slopes								
Warden	0-5	5.0-15	—	6.6-8.4	0	0	0	0
	5-19	5.0-10	—	6.6-8.4	0	0	0	0
	19-60	5.0-10	—	6.6-8.4	0-5	0	0.0-2.0	0
178—Warden silt loam, 5 to 8 percent slopes								
Warden	0-5	5.0-15	—	6.6-8.4	0	0	0	0
	5-19	5.0-10	—	6.6-8.4	0	0	0	0
	19-60	5.0-10	—	6.6-8.4	0-5	0	0.0-2.0	0
179—Warden silt loam, 8 to 15 percent slopes								
Warden	0-5	5.0-15	—	6.6-8.4	0	0	0	0
	5-19	5.0-10	—	6.6-8.4	0	0	0	0
	19-60	5.0-10	—	6.6-8.4	0-5	0	0.0-2.0	0

Chemical Soil Properties–Yakima County Area, Washington								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
180—Warden silt loam, 15 to 30 percent slopes								
Warden	0-5	5.0-15	—	6.6-8.4	0	0	0	0
	5-19	5.0-10	—	6.6-8.4	0	0	0	0
	19-60	5.0-10	—	6.6-8.4	0-5	0	0.0-2.0	0

Data Source Information

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 9, May 27, 2008

WASTEWATER APPLICATION WORKSHEET

1) Determine the wastewater application rate in gallons per acre (gal/ac) by multiplying the inches of wastewater applied by 27,154 (gal/ac-in.)

Example: 1.1 in x 27,154 (gal/ac-in) = 30,000 (gal/ac)

Your Numbers: _____ in x 27,154 (gal/ac-in) = _____ (gal/ac)

2) The pounds of N applied per acre (lb N/ac) are calculated by multiplying the wastewater application rate from **Step 1** by the pounds of N per thousand gallons of wastewater and then dividing by 1000.

Example: 30,000 (gal/ac) x 5 lb (N/1000 gal) ÷ 1000 = 150 lb N/ac

Your Numbers: _____ (gal/ac) x _____ lb (N/1000 gal) ÷1000 = _____ (lb N/ac)

OR

1) To determine the volume of wastewater (gal/ac) to apply divide the desired number of pounds of N per acre (lb N/ac) by the number of pounds of N in a thousand gallons of wastewater (lb N/1000 gal) and then multiply by 1000.

Example: 150 lb (N /ac) ÷ 5 lb (N/1000 gal) x 1000 = 30,000 (gal/ac)

Your Numbers: _____ lb N/ac ÷ _____ lb N/1000 gal x 1000 = gal/ac

2) Convert the volume of wastewater required (gal/ac) from **Step 1** to inches by dividing by the conversion factor 27,154 (gal/ac-in.)

Example: 30,000 (gal/ac) ÷ 27,154 (gal/ac-in) = 1.1 in

Your Numbers: _____ (gal/ac) ÷ 27,154 (gal/ac-in) = _____ (inches)

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties– Yakima County Area, Washington														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/in*	*Pct*	*Pct*					
32—Esquatzel silt loam, 0 to 2 percent slopes														
Esquatzel	0-17	—	—	2-5	1.10-1.30	4.00-14.00	0.19-0.23	0.0-2.9	1.0-2.0	.55	.55	5	5	56
	17-60	—	—	5-15	1.20-1.40	4.00-14.00	0.19-0.23	0.0-2.9	0.0-1.0	.55	.55			
	60-64	—	—	5-15	1.25-1.55	4.00-14.00	0.18-0.23	0.0-2.9	0.0-1.0	.55	.55			
38—Finley silt loam, 2 to 5 percent slopes														
Finley	0-12	—	—	4-10	1.15-1.35	14.00-42.00	0.13-0.15	0.0-2.9	0.7-1.0	.37	.37	3	5	56
	12-30	—	—	4-10	1.30-1.50	14.00-42.00	0.08-0.11	0.0-2.9	0.0-0.5	.10	.37			
	30-60	—	—	0-4	1.40-1.60	141.00-705.00	0.03-0.05	0.0-2.9	0.0-0.5	.05	.24			
120—Scoon silt loam, 2 to 5 percent slopes														
Scoon	0-6	—	—	5-12	1.15-1.35	4.00-14.00	0.14-0.17	0.0-2.9	0.5-1.0	.64	.64	1	4L	86
	5-16	—	—	5-12	1.30-1.50	4.00-14.00	0.13-0.17	0.0-2.9	0.0-0.5	.32	.55			
	16-60	—	—	—	—	0.01-0.42	0.00-0.00	—	—					
121—Scoon silt loam, 5 to 8 percent slopes														
Scoon	0-6	—	—	5-12	1.15-1.35	4.00-14.00	0.14-0.17	0.0-2.9	0.5-1.0	.64	.64	1	4L	86
	6-16	—	—	5-12	1.30-1.50	4.00-14.00	0.13-0.17	0.0-2.9	0.0-0.5	.32	.55			
	16-60	—	—	—	—	0.01-0.42	0.00-0.00	—	—					

Physical Soil Properties–Yakima County Area, Washington

Physical Soil Properties– Yakima County Area, Washington

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
122—Scoon silt loam, 8 to 15 percent slopes														
Scoon	0-6	—	—	5-12	1.15-1.35	4.00-14.00	0.14-0.17	0.0-2.9	0.5-1.0	.64	.64	1	4L	86
	6-16	—	—	5-12	1.30-1.50	4.00-14.00	0.13-0.17	0.0-2.9	0.0-0.5	.32	.55			
	16-60	—	—	—	—	0.01-0.42	0.00-0.00	—	—					
134—Shano silt loam, 3 to 15 percent slopes														
Shano	0-4	—	—	5-10	1.15-1.30	4.00-14.00	0.18-0.20	0.0-2.9	0.5-1.0	.55	.55	5	5	56
	4-30	—	—	5-10	1.30-1.45	4.00-14.00	0.18-0.20	0.0-2.9	0.0-0.5	.64	.64			
	30-60	—	—	5-10	1.30-1.45	4.00-14.00	0.18-0.20	0.0-2.9	0.0-0.5	.64	.64			
177—Warden silt loam, 2 to 5 percent slopes														
Warden	0-5	—	—	8-15	1.15-1.30	4.00-14.00	0.19-0.21	0.0-2.9	1.0-3.0	.55	.55	5	5	56
	5-19	—	—	8-15	1.30-1.45	4.00-14.00	0.16-0.20	0.0-2.9	0.0-0.5	.64	.64			
	19-60	—	—	8-15	1.35-1.50	4.00-14.00	0.19-0.21	0.0-2.9	0.0-0.5	.64	.64			
178—Warden silt loam, 5 to 8 percent slopes														
Warden	0-5	—	—	8-15	1.15-1.30	4.00-14.00	0.19-0.21	0.0-2.9	1.0-3.0	.55	.55	5	5	56
	5-19	—	—	8-15	1.30-1.45	4.00-14.00	0.16-0.20	0.0-2.9	0.0-0.5	.64	.64			
	19-60	—	—	8-15	1.35-1.50	4.00-14.00	0.19-0.21	0.0-2.9	0.0-0.5	.64	.64			

Physical Soil Properties– Yakima County Area, Washington

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
179—Warden silt loam, 8 to 15 percent slopes														
Warden	0-5	—	—	8-15	1.15-1.30	4.00-14.00	0.19-0.21	0.0-2.9	1.0-3.0	.55	.55	5	5	55
	5-19	—	—	8-15	1.30-1.45	4.00-14.00	0.16-0.20	0.0-2.9	0.0-0.5	.64	.64			
	19-60	—	—	8-15	1.35-1.50	4.00-14.00	0.19-0.21	0.0-2.9	0.0-0.5	.64	.64			
180—Warden silt loam, 15 to 30 percent slopes														
Warden	0-5	—	—	8-15	1.15-1.30	4.00-14.00	0.19-0.21	0.0-2.9	1.0-3.0	.55	.55	5	5	56
	5-19	—	—	8-15	1.30-1.45	4.00-14.00	0.16-0.20	0.0-2.9	0.0-0.5	.64	.64			
	19-60	—	—	8-15	1.35-1.50	4.00-14.00	0.19-0.21	0.0-2.9	0.0-0.5	.64	.64			

Data Source Information

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 9, May 27, 2008

Water Features

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Report—Water Features

Water Features– Yakima County Area, Washington

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
32—Esquatzel silt loam, 0 to 2 percent slopes										
Esquatzel	B	—	Jan-Dec	—	—	—	—	None	—	—
38—Finley silt loam, 2 to 5 percent slopes										
Finley	B	—	Jan-Dec	—	—	—	—	None	—	—
120—Scoon silt loam, 2 to 5 percent slopes										
Scoon	D	—	Jan-Dec	—	—	—	—	None	—	—
121—Scoon silt loam, 5 to 8 percent slopes										
Scoon	D	—	Jan-Dec	—	—	—	—	None	—	—
122—Scoon silt loam, 8 to 15 percent slopes										
Scoon	D	—	Jan-Dec	—	—	—	—	None	—	—
134—Shano silt loam, 8 to 15 percent slopes										
Shano	B	—	Jan-Dec	—	—	—	—	None	—	—
177—Warden silt loam, 2 to 5 percent slopes										
Warden	B	—	Jan-Dec	—	—	—	—	None	—	—
178—Warden silt loam, 5 to 8 percent slopes										
Warden	B	—	Jan-Dec	—	—	—	—	None	—	—

USDA Natural Resources Conservation Service

Water Features–Yakima County Area, Washington

Water Features– Yakima County Area, Washington

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
179—Warden silt loam, 8 to 15 percent slopes										
Warden	B	—	Jan-Dec	—	—	—	—	None	—	—
180—Warden silt loam, 15 to 30 percent slopes										
Warden	B	—	Jan-Dec	—	—	—	—	None	—	—

Data Source Information

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 9, May 27, 2008

Cow Palace

Esquatzel, Finley, Scoon, Shano, Warden

Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Droughty (Available water capacity)	(inches) > 6.0	Slight	Apply waste.	Improves available water capacity.
	3.0– 6.0	Moderate	(Low available water capacity and low retention). Reduce application rates.	Improves available water capacity. Contaminants can flow into ground water.
	< 3.0	Severe	(Very low available water capacity and very low retention). Reduce application rates and use split applications.	Improves available water capacity. Contaminants can flow into ground water and enter surface water.
Dense layer (Bulk density)	(grams/cc)			
Soil texture: Medium & fine	<1.7	Slight	Apply when soil moisture content is such that the field is in tillable condition.	Reduces bulk density and minimizes compaction.
Coarse	All			
Medium & fine	≥1.7	Moderate	(Compaction and runoff.) Apply when soil moisture content is such that the field is in tillable condition. Incorporate high solids content waste. Reduce application rate and inject liquid waste.	Reduces bulk density and minimizes compaction.
Low adsorption (Cation-exchange capacity)	(meq/100g of soil) > 15	Slight	Apply waste.	Increases cation-exchange capacity and organic matter content.
	5–15	Moderate	(Low adsorption and exchange of cations, and heavy metals.) Reduce application rates.	Contaminants can flow into ground water.
	< 5	Severe	(Very low adsorption and exchange of cations; heavy metals.) Reduce application rates.	Contaminants can flow into ground water.

Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste—Continued

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Thin layer/ cemented pan (Depth to bedrock or cemented pan)	(inches)			
	> 40	Slight	Apply waste.	None.
	20 – 40	Moderate	(Moderate soil depth and limited root zone.) Reduce application rates.	Contaminants can flow into ground water. Potential waste overloading of the soil if applied at high rates.
	< 20	Severe	(Shallow soil depth and root zone.) Reduce application rates and use split applications.	Contaminants can flow into ground water. Potential waste overloading of the soil if applied in a single application at high rates.
Wetness (Depth to high water table)	(feet)			
	> 4	Slight	Apply waste.	None.
	2 – 4	Moderate	(Moderate soil depth and limited root zone.) Reduce application rates.	Contaminants can flow into ground water.
	< 2	Severe	(Shallow soil depth and root zone.) Application of agricultural wastes not recommended.	Contaminants can flow into ground water.
Flooding (Flooding frequency)	None, rare (5 times or less in 100 years.)	Slight	Apply waste.	None.
	Occasional (5 to 50 times in 100 years.)	Moderate	(Flooding and transport of waste offsite.) Apply and incorporate waste during periods when flooding is unlikely.	Contaminants can enter surface water.
	Frequent (50 to 100 times in 100 years.)	Severe	(Flooding and transport of waste offsite.) Apply and incorporate waste during periods when flooding is unlikely.	Contaminants will most likely enter surface water.

Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste—Continued

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Too stoney or too cobbly (Fraction, > 3 inches in diameter; Rock fragments, 3 – 10 inches in diameter; Stones and boulders, >10 inches in diameter):				
	% by weight (volume)			
(Rock fragments) (Stones & boulders)	< 15 (< 10) < 5 (< 3)	Slight	Apply waste.	None.
(Rock fragments) (Stones & boulders)	15–35 (10–25) 5–15 (3–10)	Moderate	(Restricted equipment operation.) Apply waste at reduced rates.	Contaminants can enter surface water.
(Rock fragments) (Stones & boulders)	> 35 (> 25) > 15 (> 10)	Severe	(Restricted equipment trafficability and operation.) Apply waste at reduced rates.	Contaminants can enter surface water.
(Stoniness)	Stoniness class 1	Slight	Apply waste.	None.
	2	Moderate	(Restricted equipment operation.) Apply waste at reduced rates.	Contaminants can enter surface water.
	3, 4, 5	Severe	(Restricted equipment trafficability and operation.) Apply waste at reduced rates.	Contaminants can enter surface water.
Intake (hydrologic soil group) Liquid & solid wastes	B and C	Slight	Apply solid waste. Do not exceed irrigation intake rates of liquid waste.	High application rates may cause clogged surface pores and reduced infiltration.
Solid wastes	A	Moderate	(Leaching of mineralized waste.) Reduce rate of application.	Application may clog surface pores and reduce infiltration.
Liquid wastes		Severe	(Rapid infiltration and leaching vulnerability.) Split applications and reduce application rates.	Contaminants can flow into ground water.

Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste—Continued

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Intake (cont) Liquid & high solids waste	D	Moderate	(Slow infiltration and potential runoff.) Inject or incorporate agricultural wastes.	Improves infiltration and surface soil permeability. Contaminants can enter surface water.
Liquid & high solids waste	A/D, B/D, C/D	Severe	(Water table near the soil surface.) Reduce application rates.	Contaminants can flow into ground water.
Poor filter or percs slowly (Permeability)	(inches/hour)			
High solids waste	< 2.0	Slight	Apply waste.	Improves soil surface infiltration and permeability.
Liquid waste	0.6 – 2.0	Slight	Apply waste.	Improves soil surface infiltration and permeability.
Liquid waste	0.2 – 0.6	Moderate	(Slow permeability and potential runoff vulnerability.)	Contaminants can enter surface water.
Liquid & high solids waste	2.0 – 6.0	Moderate	(Leaching vulnerability.) Inject liquid waste and incorporate high solids content waste.	Contaminants can flow into ground water.
Liquid waste	< 0.2	Severe	(Slow to very slow permeability and potential runoff contamination of surface water.) Inject liquid waste and incorporate high solids content waste.	Contaminants can enter surface water.
Liquid & high solids waste	> 6.0	Severe	(Rapid permeability and leaching vulnerability.) Split applications of liquid waste and reduce application rates of liquid and high solids content waste.	Contaminants can flow intoground water. Reduced permeability from organic matter accumulation in pores.
Too acid (pH)	> 6.0	Slight	Apply waste.	Very high application rates of wastes may lower soil pH.

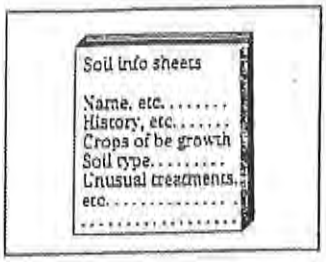
Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste—Continued

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Too acid (cont.)	4.5 – 6.0	Moderate	(Increased availability of heavy metals and reduced plant growth potential.) Reduce application rates, apply lime, and incorporate.	Heavy metal contaminants can flow into ground water.
	< 4.5	Severe	(Increased availability of heavy metals, reduced plant growth, and limited crop selection.) Reduce application rates, apply lime, and incorporate.	Heavy metals contaminants can flow into ground water.
Ponding (Ponding)	NJ ponding All	Severe	(Ponded water.) Application of agricultural wastes not recommended.	Contaminants can enter surface water.
Excess salt (Salinity)	(mmhos/cm) < 4	Slight	Apply waste.	None.
	4 – 8	Moderate	(Slight salinity—choice of crops and germination restricted.) Apply high C:N, low salt wastes. **Saline wastes:** Rotate application fields and reduce rates.	**High C:N & low salt wastes:** Improve soil infiltration, permeability, and structure; reduce plant toxicity. **Saline wastes:** May increase soil salinity applied at continuous high rates.
	> 8	Severe	(Salinity, crops limited to salt-tolerant grasses.) Apply high C:N, low salt wastes. **Saline wastes:** Rotate application fields and reduce rates.	**High C:N & low salt wastes:** Improve soil infiltration, permeability, and structure; reduce plant toxicity. **Saline wastes:** May increase soil salinity applied at continuous high rates.

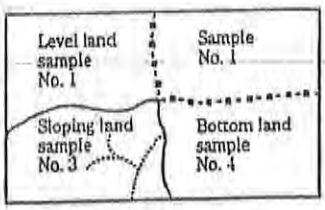
Table 5–3 Soil characteristics and recommendations and limitations for land application of agricultural waste—Continued

Restricting feature (Soil characteristics)	Site condition	Degree of limitation	(Limitation or hazard) Recommendations	Impact
Slope (Slope)	(percent) < 8	Slight	Apply waste.	None.
	8 – 15	Moderate	(Moderately steep slopes, potential water erosion.) Incorporate liquid and high solids waste and control runoff.	Contaminants can enter surface water.
	> 15	Severe	(Steep slopes, water erosion, and limited cropping potential) Incorporate liquid and high solids waste and control runoff.	Contaminants can enter surface water.
Excessive sodium (Sodium adsorption)	(SAR) < 4	Slight	Apply waste.	None.
	4 – 13	Moderate	(Slight sodicity, choice of crops and germination restricted.) Apply high C:N, low sodium wastes. Rotate application fields and reduce rates for sodic wastes.	**High C:N & low sodium wastes:** Improve soil infiltration, permeability, and structure; reduce plant toxicity. **Sodic wastes:** May increase soil sodicity if applied at continuous high rates.
	> 13	Severe	(Sodicity, limited to sodium-tolerant grasses.) Apply high C:N, low sodium wastes. Rotate applications of sodium wastes. Rotate application fields and reduce rates for sodic wastes.	**High C:N & low sodium wastes:** Improve soil infiltration, permeability, and structure; reduce plant toxicity. **Sodic wastes:** May increase soil sodicity if applied at continuous high rates.

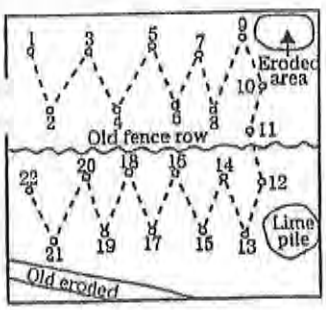
Sampling soil



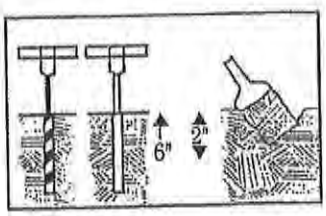
1. **Obtain soil samples information sheet and soil boxes**
A laboratory must be located that can provide appropriate soil testing. These laboratories can often be accessed through Extension Service agents and fertilizer dealers. The laboratory will provide directions to follow for soil sampling.



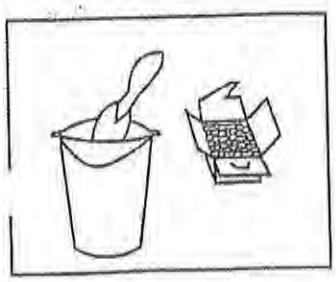
2. **Divide farm into areas or fields**
If the field is uniform, one sample will do. But most fields will have been treated differently, or the slope, drainage, or soil type will make it desirable to divide the field into small areas of 5 to 10 acres each.



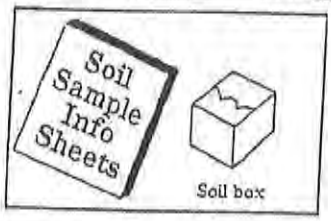
3. **Obtain a good sample of soil**
The soil test can be no better than the sample. Take the sample from 20 or more places in the field. Zig-zag across the field or area as shown in the diagram. When taking sample, avoid unusual places such as old fence row, old roadbeds, eroded spots, where lime or manure have been piled, or in the fertilizer band of row crops.



4. **Use proper sampling tools**
Sampling may be made with a soil auger, soil tube, or spade. The desired depth for cropland is plow depth (6 to 8 inches or more), and for pasture land, 2 to 4 inches. Place sample in clean container.



5. **Mix well in clean plastic pail**
From the 20 or more stops you have made, you now have 1/2 gallon or more of soil. Mix it thoroughly, then send about 1/2 pint of the mixed soil for analysis.



6. **Fill out sample information sheet for each sample**
   It is essential that your name, address, and sample number be plainly written on the sheet you send with each sample. As a guide in making recommendations for each of your numbered areas, it is important that the history of treatments and any unusual treatments be stated.

7. **Mail to soil testing and plant analysis laboratory**
   Place completed the Soil Sample Information Sheet inside the flap of the soil sample box and mail to the laboratory. Generally, the laboratory will make a routine test of seven analyses (soil pH, phosphorus, potassium, calcium, magnesium, zinc, and manganese) on all samples. Special tests on organic matter, nitrate-nitrogen, and soluble salts can be requested if needed.

	Sampling Procedures	Sampling Devices
Liquid Manure	1. Dip sampler below the basin or lagoon surface. 2. Pull cable to open top and collect sample. 3. Close container. 4. Dump sample into a 5-gallon bucket. 5. Repeat steps 1-4 until samples from *4 to 6 locations* are taken. 6. Stir the liquid in the bucket until a uniform mixture is obtained. 7. To collect laboratory sample, continue stirring the mixture. While the mixture is still in a swirling motion, dip a cup into the mixture. 8. Follow shipping procedures in Table 4 (Steps 2-4).	Wooden handle Stainless steel cable threaded through conduit Approximately 10' long, 1 ½" metal conduit
Vertical Profile	1. Insert tube vertically until the tube hits the bottom of the storage. 2. Lift the tube just enough to allow ball to seal the end of the tube after string or cable is pulled. (See opposite page for several tube variations.) 3. Pull the tube out without releasing the slurry. 4. Dump the slurry into a 5-gallon bucket. 5. Stir the slurry until a uniform mixture is obtained. 6. To collect laboratory sample, continue stirring the mixture. While the mixture is still in a swirling motion, dip a cup into the mixture. 7. Follow shipping procedures in Table 4 (Steps 2-4).	Cable Approximately 1 ½" PVC tubing, 12" longer than maximum liquid depth Approximately 2" rubber ball
Solid Manure	1. Insert tube into solid manure. NOTE: Tube may be difficult to insert into solid manure with feathers. A sharp spade can be used to obtain samples with feathers. 2. Dump manure into a 5-gallon bucket. A rod may be needed to push manure out of tube. 3. Repeat the first two steps until *10 to 15 locations* have been sampled. 4. Mix the manure until a uniform sample is obtained. 5. Follow shipping procedures in Table 5, (Steps 3-5).	3' long metal tubing

Figure 2. Using devices to obtain samples.

APRIL 1999

TEST FOR SUCCESS

Here is how to sample and test manure for nutrient content.

Liquid/Slurry Manure Sampling

For those of you who apply liquid or slurry manure with a tank applicator, Collect it at the time of application.

Before filling the manure tank or "honey wagon" remember to agitate the manure for about 5 minutes. Then, when filling the tank, use a gallon bucket to collect a sample.

Place the sample in a plastic container with a tight fitting lid and fill with about one pint of manure. Seal the container and place in a plastic bag. Keep the sample cold or freeze until you can get it to the lab.

Irrigation Applied Sampling

hen applying liquid manure directly to a growing crop, you must know the nutrient content before applying to avoid excessive nutrients.

To collect a sample, agitate the storage system. Pump to discharge about 5 to 10 gallons into a container. Use the same type of container and procedure used for the liquid/slurry sample from above.

You will want to test at the beginning of the irrigation season and throughout the season to monitor nutrient content.

Solids Manure Sampling

Whether you scrape and haul daily, or have a pile of stacked manure, the sampling procedure remains the same.

Gather a shovel full of manure from the manure spreader (during the loading process, manure gets mixed up and combined) and put it in a five- gallon bucket. Take a sample from every other load.

Stir the manure in the bucket, and then place approximately one pint of manure in a self-sealing plastic bag. Again, keep cold or freeze until you can get it to a lab.

[redacted]

Table 1. Crop Information

Year	Crop	Hybrid/ Variety	Yield Goal	Actual Yield	Planting Date	Pop. Planted	Actual Pop.	Planter Settings	Tillage Practices and Dates	Crop Residue*	Harvest Date

* Percentage of [illegible]ver left after planting.

Table 2. Soil Test Summary

Date of Soil Test Report	Name of Soil Testing Lab	Sample ID	pH	Lime Index	Soil Test Nutrient Level (lb./a.)*				Lime Recommendation			Organic Matter (%)	CEC**	Other***
					P	K	Ca	Mg	Rate (ton/a.)	Dolomitic? Yes	Dolomitic? No			

* If your soil te... tory reports soil nutrient concentrations in ppm, convert to lb./a. by multip... ...alues by 2, (ppm x 2 = lb./a.). If the test results are given in lb./a. P2O5 and K2O convert to P and K by: multiplyi... .5 by .44 = P, and multiplying K2O by .83 = K.

** Cation Exch... apacity

Table 3. Nutrient Planning

Year	Crop	Yield Goal (per acre)	Fertilizer Recommendations* (lb./a.)			Manure Nutrient Credits** (lb./a.)			Additional Fertilizer Nutrients Needed by the Crop (lb./a.)			PSNT*** N Recommendation (lb./a.)
			N	P2O5	K2O	Available N	P2O5	K2O	N	P2O5	K2O	

* Based on realistic yield goal and previous crop.

** Subtract the N, P2O5 and K2O under Manure Nutrient Credits (transferred from the Manure M... ...ent worksheet) from the Fertilizer Recommendations and record the result in the appropriate Additional Fertilizer Nutri... ...). A negative value indicates no extra fertilizer is needed.

*** Pre-Sidedres... ...Test

Table 4. Nutrient Applications

ate	Material*	Analysis			Rate/a.	lb./acre			Lime ton/a.	Other**
		N	P_2O_5	K_2O		N	P_2O_5	K_2O		

own. Manure, Starter, Sidedress N, Pre-plant N.

Table 5. Private Applicator Pesticide Use Records*

Applicator Name/ Certification No.	Date M/D/Y	Crop	Pest Controlled	Number of acres	Chemical Brand Name	Name of Manufacturer	EPA Registration Number	Chemical Formulation **	Rate/a. ***	Spray Solution/

* Chemical form required if part of brand name.
** Expressed as pounds, gallons, etc.

Livestock waste products are an excellent source of nutrients and organic material that will improve soil properties. These products can provide all or part of the nutrients required for plant production.

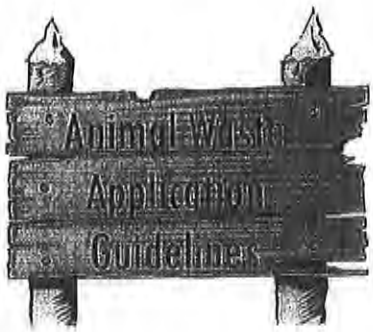
Please consult your local Conservation District or the Natural Resources Conservation Service office for planning assistance for the application of livestock waste.

South Yakima Conservation District

1116 Yakima Valley Highway
Sunnyside, WA 98944

Phone: 509-837-7911
Fax: 509-837-8290

TO INSURE PROPER UTILIZATION, FOLLOW THESE GUIDELINES:



- Perform a nutrient test of animal waste in order to determine the quantity of nutrients presently in the material.
- Test soils for nutrient levels. Account for all sources of nutrients.
- Set realistic crop yield goals and apply animal waste to fit crop needs.
- Apply manure uniformly with calibrated equipment.
- Record manure and chemical fertilizer applications, crop data, soil, and manure test results.
- Animal waste should not be applied closer than 25' to any stream, ditch, waterway, or other water bodies.
- Animal waste should not be applied on saturated, frozen, or snow covered soils.
- Avoid spreading animal waste on bare soils. This may cause nitrogen to leach into the ground water. **Incorporate manure into the soil as soon as possible to prevent further losses and run-off.**
- Time the application of animal waste so that neither surface or ground water contamination will occur.
- Animal waste should not be applied to steep sloping ground or other areas where pollution from run-off is likely.
- The applicator should minimize any possible odor or pest problems that may occur with transportation, storage, or application.

APPENDIX D

NRCS Specifications (Only Needed With New Structures)

Design Plans (Only Needed With New Structures)

Correspondence

Recordkeeping Forms

Fax sent by : 5095756993 PLSA ENGINEERING 11/15/06 10:31 pg. 1/3

PLSA ENGINEERING & SURVEYING

pg 1 of 4

FACSIMILE TRANSMITTAL

To: Mark Wasemiller Fax 509-837-8290

Company: South Yakima Conservation District

From: Demian Walter Date: 11/15/06

☐ For Your Use ☐ As Requested ☐ For Your Information ☐ For Review & Comment

Number of Pages: ____ (including cover sheet) Email Address: contact@plsaofyakima.com

Re: Density tests from the Cow Palace, on 11/14/06.

Thank you
Demian Walter

1120 West Lincoln Avenue • Yakima, Washington 98902 • (509) 575-6990 • FAX (509) 575-6993

COWPAL000579
CONFIDENTIAL

P L S A ENGINEERING & SURVEYING
1120 West Lincoln Avenue
YAKIMA, WASHINGTON 98902

(509) 575-6990
FAX (509) 575-6993

TO

DATE 11/14/06	JOB NO. 06152
PROJECT Cow Palace	
LOCATION Granger	
CONTRACTOR Cow Palace	OWNER Cow Palace
WEATHER Cloudy	TEMP °at °at AM PM
PRESENT AT SITE Dirk Porter of Cow Palace	

THE FOLLOWING WAS NOTED:

I arrived on site & performed density tests on the final grade of the 4 sloped sides of the lagoon. The material I tested was native. They need 90 % for passing. They used a vibratory roller to compact the material. I performed 12 total density tests @ 8" rod depth. The moisture content was near optimum. These were re-tests from the failed density tests taken this summer. See all results on the nuclear densometer testing sheet. All tests passed above 90 % of the D1557 maximum lab density. I informed Dirk Porter of the Cow Palace of all density testing results

This field report is invalid without a date and PLSA technician's signature.

If additional test sheets are applicable they must be attached.

COPIES TO

FIELD REPORT

SIGNED

PLSA Engineering and Surveying
1210 West Lincoln Ave.
Yakima, WA 98902
(509) 575-5990

Sheet #1

Project: Cow Palace
Job #: 3d0152
Date: 11/14/06
Performed By: DW

Nuclear Relative Density Test Data
ASTM D2922

Test Number	1	2	3	4	5	6	7	8	9	10
Location	See attached drawings									
Elevation	Final Grade									
Mode / Depth	D/S"									
% Oversize	N/A									
Soil Description	Native									
Wet Density	127.7	131.1	130.5	133.7	131.1	130.6	128.1	132.7	129.8	129.5
Dry Density	112.6	114.3	114.8	116.7	113.4	113.1	112.0	115.2	112.7	111.7
% Moisture	13.0	14.7	13.7	14.6	15.6	15.4	14.4	15.2	15.1	15.9
Air Void (%)	9.8	5.3	6.7	3.5	4.4	4.9	7.7	3.6	5.8	5.3
Void Ratio	.497	.475	.468	.445	.487	.490	.505	.446	.496	.508
Max Obt. Density	115.0									
Opt. Moisture	14.7									
% Relative Comp.	97.9	99.4	99.9	101.5	98.6	98.4	97.4	100.1	98.0	97.2

Standard Count

Density:	2735
Moisture:	723

Remarks:

PLSA Engineering and Surveying
1210 West Lincoln Ave.
Yakima, WA 98902
(509) 575-6990

Sheet #2

Project: Cow Palace
Job #: J06152
Date: 11/14/06
Performed By: DW

Nuclear Relative Density Test Data
ASTM D2922

Test Number	11	12								
Location	See attached drawing									
Elevation	Final Grade	—								
Mode / Depth	D/8"	—								
% Oversize	N/A	—								
Soil Description	Native	—								
Wet Density	129.8	124.4								
Dry Density	112.0	108.5								
% Moisture	15.8	14.6								
Air Void (%)	5.1	10.2								
Void Ratio	.505	.553								
Max Obt. Density	115.0	—								
Opt. Moisture	14.7	—								
% Relative Comp.	97.4	94.4								

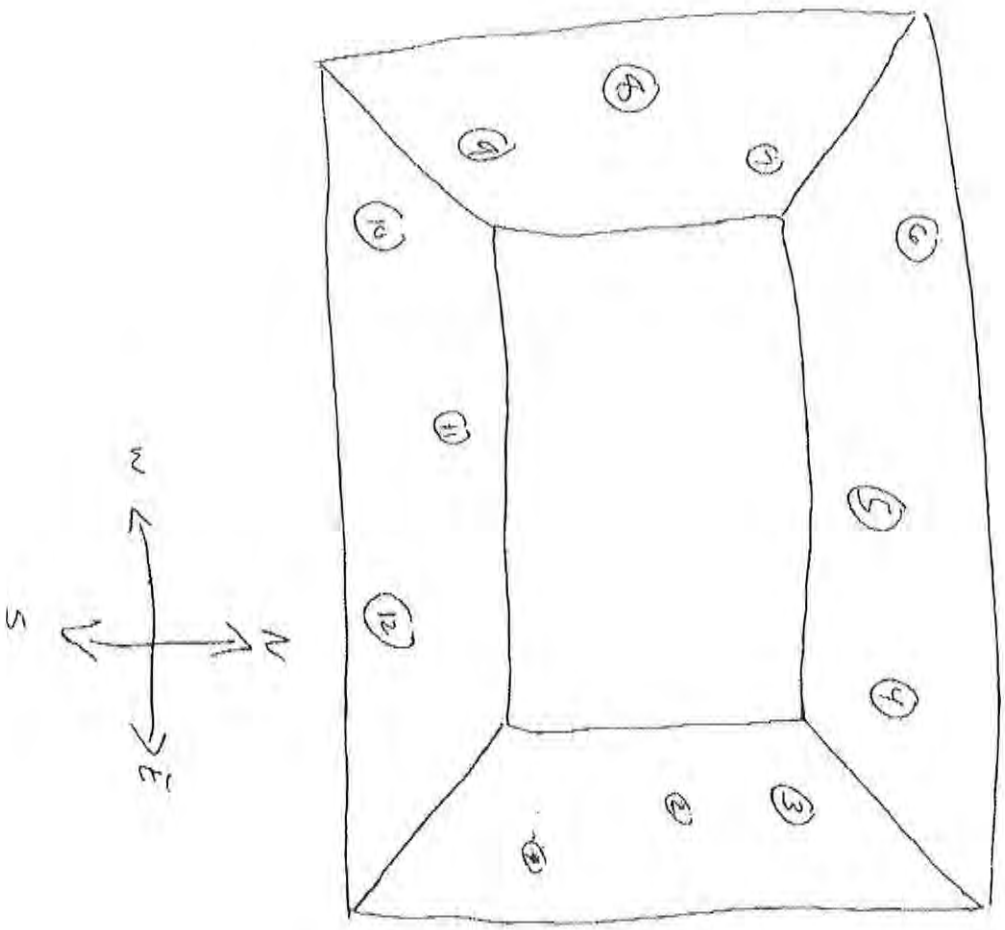
Standard Count

Density:	
Moisture:	

Remarks:

COWPAL000582
CONFIDENTIAL

Snyder Exhibit 5



11/14/09

South Yakima Conservation District

1118 Yakima Valley Hwy
Sunnyside, WA 98944
Ph# (509)-837-7911
Fax# (509)-837-5290

200 Cheyne Rd.
Ellah, WA 98953
Ph# (509)-925-3903
Fax# (509)-925-3243

June 1, 2006

pond # 4

TO: Dirk Porter
Cow Palace

FROM: Mark A. Wasemiller, PE

RE: Density Testing of Storage Pond Liner

Mr. Porter

In order to determine if the compacted soil liner will meet state requirements, it needs to be tested to determine its density. All 4 inside side slopes need to be tested for density as well as the bottom. I am aware of two soil testing firms in the Yakima area that can provide this service as well as one in the Pasco area. The Yakima firms are GN Northern INC, and PLSA Engineering and Surveying. The Pasco firm is Intermountain Materials Testing (they are owned by Budinger & Assoc. in Spokane). In the past, even though the firm in Pasco would have to travel a little farther, they have generally been a little less costly than the firms from Yakima. I would suggest that you contact all three to determine if they are available to do the testing and the fees that they would charge.

The testing that needs to be done is a Nuclear Densiometer (ASTM D 5195). The test parameters that need to be determined are max density and moisture content. I am unsure as to how the recent rains might or might not impact the ability for the test to be conducted. You will need to ask the testing firm that you select if there is any impact due to the recent rain.

The testing firm will need to know the following information:

Maximum Density: 115 lbs/cuft
Optimum Moisture: 14.7%

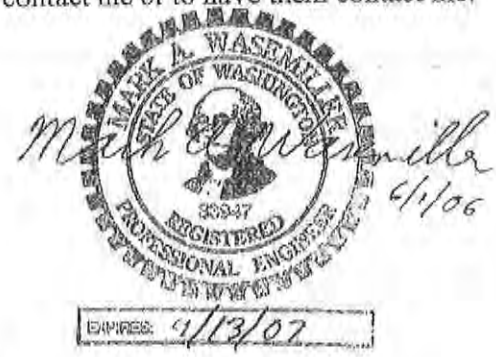
The *average density* that we are looking to see from all of the tests that they conduct is 90% of the maximum density (or 103.5 lbs/cuft or better).

There will need to be a minimum of 3 tests conducted on each inside slope; 1 test in the upper third of each slope, 1 in the middle third of each slope, and 1 in the bottom third of each slope. In the bottom of the basin, there will need to be 2 tests conducted in each quadrant of the pond bottom for a minimum total of 8 tests done in the bottom. Generally these testing firms will charge a flat hourly rate and they should be able to do more than the minimum required number of tests in one hour. If after taking the minimum number of tests (3 on each side slope for a total of 12 on the slopes, 8 in the bottom for a minimum total of 20 sites), the average density of these tests meets or exceeds the minimum that we are looking for (103.5 lbs/cuft) there is no need to

continue testing. If the average density is relatively close, it might be advantageous to conduct additional tests to be considered into the average density of the pond liner. In the event that the density does not meet the 103.5 lbs/cuft, we can look at weighting the test results (separating out the side slope results from the bottom results) to determine if the weighted average will meet the state minimum requirement.

I will need to have a copy of the test results and a map of the pond (drawn by the technician conducting the test) showing the location of each test site. Once I have this and have reviewed the data, I will be able to determine if the pond liner meets the minimum requirements and send you a letter concerning the results of my review.

If you have any questions, or if the testing firm that you select has any questions, please feel free to contact me or to have them contact me.



MARK A. WASEMILLER, PE
South Yakima Conservation District

Cc: file

Budinger & Associates

3820 E. Broadway Ave.
Spokane, WA 99202
Tel: 509.535.8841
Fax: 509.535.9589

Cow Palace
1631 Liberty Road
Granger, WA

August 26, 2004

Project Number L04276

PROJECT: Cow Palace
Granger, WA

SUBJECT: Results of Laboratory Testing
Report # 1

At your request, we provided laboratory testing services for the subject project. Our services are limited to the performance of specific laboratory tests, selected at your discretion.

For this period our involvement consisted of testing for maximum density, optimum moisture, and permeability in general accordance with the methods listed on the attached *Laboratory Summary*.

Results are presented on the attached *Laboratory Summary, Permeability (Flexible Wall) Test Results, and Permeability (Flexible Wall) Test Saturation Phase Data.*

If you have any questions regarding this report, please call.

Respectfully Submitted:
BUDINGER & ASSOCIATES, INC.

Terri J. Perry
Engineering Technician

Reviewed by:

John E. Finnegan, PE
Geotechnical Engineer

JEF/gc
Addressee – 2
South Yakima Conservation District, Mark Wasemiller - 1
Attachments
- Laboratory Summary (1 page)
- Moisture Density Relationship (1 page)
- Permeability Test Results (1 page)
- Permeability Test Saturation Phase Data (1 page)

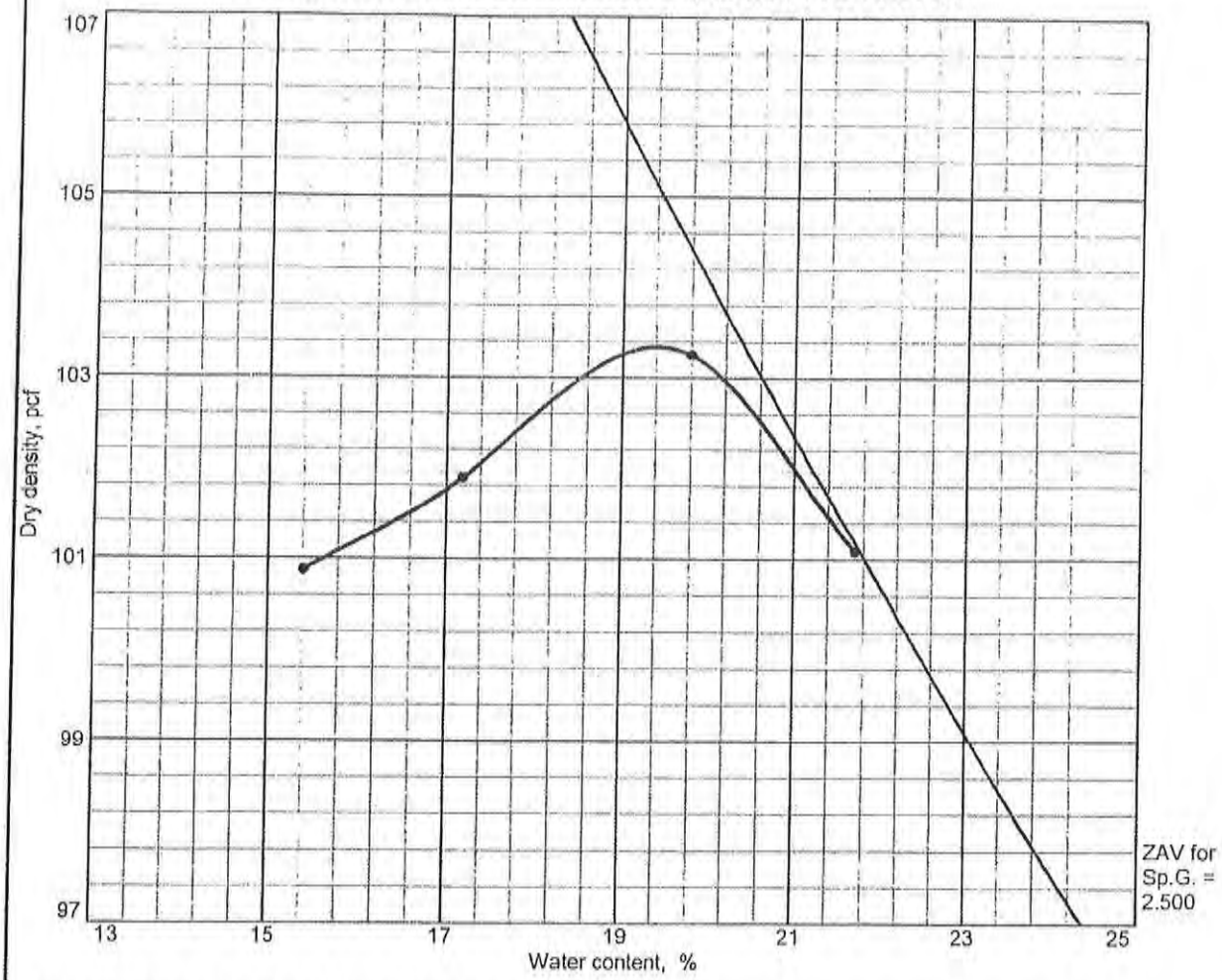
Geotechnical & Environmental Engineers
Construction Materials Testing & Inspection

SOILS
LABORATORY SUMMARY

	UNITS		
LABORATORY NUMBER			04-0820
SAMPLE NUMBER			1
SAMPLED BY			Client
SAMPLE TYPE			Bulk
DATE RECEIVED			7/20/04
SAMPLE LOCATION			silt with trace sand
		Test Method	
PROCTOR		ASTM D-698	
Maximum Density	pcf		103½
Optimum Moisture	%		19.5
Sample Moisture	%		14.0
PERMEABILITY (flexible wall)	cm/sec	ASTM D-5084	5.7×10^{-7}

Budinger & Associates, Inc.
Geotechnical & Environmental Engineers
Construction Materials Testing & Inspection

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 698-91 Procedure A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
			14.0				0.5	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.5 pcf Optimum moisture = 19.5 %	Silt with trace sand

Project No. L04276 **Client:** Cow Palace
Project: Cow Palace Soils
Date: 8/2/04
• **Source:** on site **Sample No.:** 1 (04-0820)

Remarks:
Sampled by Client

MOISTURE-DENSITY RELATIONSHIP

BUDINGER & ASSOCIATES, INC.

Reviewed By:

L04276 Cow Palace - permeability (flex wall) #1

Table 1:Permeability (Fexible Wall) Test Saturation Phase Data

Sample ID: 1
Tested by: TP
Sampled by: Client

Project Location: Cow Palace
Sample Description: #1 silt with trace sand
Initial Dry Density: 103½ pcf
Final Moisture Content: 23.5%
Date Tested: 8/13/04

X Remolded
Undisturbed

Date	Time	Temp. °F	Cell			Register 2 Bottom, Color: RED		Register 3 Top, Color: BLACK		Pore Pressure				B-Value	
			Pressure (psi)	Chg in Pr. (psi)	Burette Volume (cc)	Pressure (psi)	Burette Volume (cc)	Pressure (psi)	Burette Volume (cc)	Bottom (Red)	Change in bottom pp	Top (Black)	Change in top pp	Bottom (Red)	Top (Black)
8/13/04	14:54	72	5.0		3.0	4.0	1.4	4.0	1.6						
	15:12	72	5.0		3.7	4.0	1.3	4.0	1.5	4.9		4.9			
	15:15	72	10.0	5.0		closed	closed	closed	closed	8.0		8.1			
	15:17	72	10.0		7.0	9.0	1.5	9.0	1.6						
	17:38	72	10.0		10.3	9.0	2.2	9.0	2.4	9.9		9.9			
	17:41	72	20.0	10.0		closed	closed	closed	closed	16.2	6.3	16.4	6.5	63	65
	17:43	72	20.0		14.1	19.0	3.1	19.0	3.2						
8/14/04	9:42	72	20.0		16.3	19.0	4.2	19.0	4.3	20.0		20.0			
	9:45	72	30.0	10.0		closed	closed	closed	closed	27.9	7.9	28.3	8.3	79	83
	9:47	72	30.0		18.0	29.0	4.4	29.0	4.5						
	20:56	72	30.0		17.1	29.0	4.8	29.0	5.0	29.9		29.9			
	20:59	72	40.0	10.0		closed	closed	closed	closed	38.8	8.9	39.0	9.1	89	91
	21:02	72	40.0		18.5	39.0	5.0	39.0	5.1						
8/16/04	7:16	72	40.0		19.2	39.0	5.5	39.0	5.6	39.9		39.9			
	7:19	72	50.0	10.0		closed	closed	closed	closed	49.5	9.6	49.7	9.8	96	98

budinger and associates, inc.
geotechnical and material engineers

L04-176 Cow Palace - permeability (flex wall) #1

Table 2 Permeability (Flexible Wall) Test Data Results

Project No. L04-275
Tested By: TP
Sampled By: Client

Project Location: Cow Palace
Sample Description: #1 silt with trace sand
Initial Dry Density: 103.4 pcf
Final Moisture Content: 23.5%
Date Tested: 8/17/04

X Remolded
Undisturbed

System Constant, C: 0.906 (cm²)

Run 1

Effluent burette: 0.9 cm³
Final Length, L: 10.2 cm
Final Area, A_f: 18.7 cm²

Chamber	
Upper	49.0
Lower	50.0
Test gradient	6.9

Date	Time (s)	Temp °C	R_T	Burette Readings Upper V_U (t) (cc)	Burette Readings Lower V_L (t) (cc)	Incremental Flow Inflow (lower) (cc)	Incremental Flow Outflow (upper) (cc)	Incremental Flow Ratio In/Out	Head Difference h (t) (cm)	Gradient i	Preliminary² kA/L (cm³/sec)	ASTM Falling Head Final³ k_{20} (x10⁻⁷) (cm/sec)	ASTM Constant Head k (cm/sec)
8/17/04	0	21	0.980	24.0	1.4				93.0	9.1			
	2160	21	0.980	23.8	1.6	0.2	0.2	1.0	92.6	9.1	9.0E-07	4.8E-07	5.5E-07
	10800	21	0.980	22.9	2.5	0.9	0.9	1.0	90.8	8.9	1.1E-06	5.9E-07	6.7E-07
	12820	21	0.980	22.6	2.8	0.3	0.3	1.0	90.2	8.8	1.1E-06	5.1E-07	6.9E-07
	16860	21	0.980	22.2	3.2	0.4	0.4	1.0	89.4	8.8	1.0E-06	5.3E-07	5.1E-07
	20980	21	0.980	21.8	3.6	0.4	0.4	1.0	88.6	8.7	1.0E-06	5.4E-07	5.1E-07
	23600	21	0.980	21.5	3.9	0.3	0.3	1.0	88.0	8.6	1.1E-06	6.1E-07	6.9E-07
	25440	21	0.980	21.3	4.1	0.2	0.2	1.0	87.6	8.6	1.1E-06	6.0E-07	5.6E-07
											k_{ave} last 4	5.7E-07 cm/s	cm/s

Permeant liquid: standard water

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Appendix 1

WSP Practice Standard Criteria Reference Documents

Table outline for – NRCS Practice Standard Criteria Revisions and WA State Supplements

Waste Storage Pond, PS-425, Dated: 1979 -1994

Waste Storage Facility, PS-313, Dated 2000 - Current

Washington State NRCS REVISION and Supplement Dates:

- April 1979 - #1
- February 1987 – State Supplement
- January 1994 – State Supplement #2, 3
- February 2000
- June 2001
- December 2004 #4

Earth pond construction dimension criteria for all WSP practices and all revisions: April 1979 to December 2004

Practice Standard Code/Name	PS 425 Waste Storage pond			PS 313 Waste Storage Facility		
Release Date	#1 1979, April			2000, February	2001, June	2004, #4 December
Supplement Release Date		1987, February #2	1994, #3 January			
1. Embankment Height.	35 feet or Less	35 feet or Less	35 feet or Less	35 feet or Less	35 feet or Less	35 feet or Less
2. Failure of WSP would result in damages limited to farm buildings, Ag-Land, or country roads.	N/A	N/A	N/A	Yes	Yes	Yes
3. WSP Embankment Elevation above Floodplain?	25 Yr	25 Yr	25 Yr	25 Yr	25 Yr	25 Yr
4. Inlet permanent and resists; corrosion, plugging, freeze damage and is UV protected?	Yes	Yes	Yes	Yes	Yes	Yes
5. Emptying features are provided and are protected against erosion and accidental release?	Yes	Yes	Yes	Yes	Yes	Yes
6. Liquid Storage Ramp slope.	4:1	4:1	4:1	4:1	4:1	4:1
7. If the WSP creates a safety hazard fencing is necessary for protection of Humans and livestock.	Yes	Yes	Yes	Yes	Yes	Yes
8. WSP Embankment protected against erosion.	Yes	Yes	Yes	Yes	Yes	Yes
9. Separation distance from WSP Bottom and SHGWT	0 inches	6 inches	6 inches	24 inches	24 inches	24 inches
10. Liner	Only if Self Sealing is not anticipated	Required for all foundation material, except glacial till, when closer than 300 feet to a domestic well.	Required for all WSP's	Required for all WSP's	Required for all WSP's if wetted surface permeability rate is less than $1x10^{-6}$ cm/s	Required for all WSP's if wetted surface permeability rate is less than $1x10^{-6}$ cm/s

(Seasonal High Ground Water Table)

United State Department of Agriculture
Soil Conservation Service

Washington State Supplement

Waste Storage Pond, PS-425

Design Criteria

Washington State dam safety regulations. All waste storage ponds impounding a volume of 10 ac-ft, or more above ground level, as defined in Chapter 173-175 WAC, Dam Safety Regulations, require emergency spillways and embankments meeting state dam safety criteria.

Foundation and subsurface investigations. Minimum criteria for the subsurface investigation of waste storage ponds in Washington State is as listed below.

(1) The Unified Soil Classification System (USCS), shall be used for subsurface investigations on waste storage pond sites and identified borrow sites. Soil profiles and their locations shall be shown on construction plans.

(2) All embankment foundations shall be investigated, as a minimum, to a depth that is equal to the height of the embankment unless unweathered bedrock is encountered at a more shallow depth. If bedrock, groundwater, or evidence of seasonal high water are encountered, they will be identified on the soil profiles.

(3) On excavated pond sites, subsurface investigations will extend to at least 2 ft below the planned depth of excavation. If bedrock, groundwater, or evidence of seasonal high water are encountered, they will be identified on the soil profiles.

Groundwater protection and liners. Waste storage ponds shall not be excavated below the seasonal high water table and shall have a properly designed and installed liner. Liners may be constructed of on-site natural soil materials, off-site natural soil materials, natural soil materials modified with amendments such as bentonite, or may consist of synthetic materials.

All natural and amended soils liners shall have a minimum compacted thickness of 1 ft measured perpendicular to the soil surface. Compaction shall be in accordance with Washington SCS Construction Specifications CS-14, Earth Fill, Class A or

CS-15, Earth Fill, Class S. The acceptability of natural soil materials is based on the Unified Soil Classification System (USCS), ASTM D-2487 or ASTM D-2488.

The following natural materials are acceptable for liners:

(1) CH, CL, MH, ML soils

(2) SM, SC, GM, and GC soils, if they contain more than 20% fines (passing #200 sieve), by weight.

(3) SM, SC, GM, and GC soils must be amended for use as a liner material if they contain less than 20% fines (passing #200 sieve), by weight.

Soil amendments and synthetic liners shall be designed, installed and maintained as specified in SCS practice standard 521, Pond Sealing or Lining.

Access facilities. If required for emptying, platforms, docks, retaining walls, or access ramps shall be designed and shown on the construction drawings. Minimum ramp slopes shall not be steeper than 4:1 for pump and agitation access and 7:1 for hauling equipment access.

Inlet and outlet. Construction plans shall include drawings of any inlet and outlet facilities adequate for construction purposes.

Safety. The construction plans shall specify appropriate fencing and warning signs.

Erosion control. If needed to control erosion on the site, the construction plans and specifications shall specify that the embankment and surrounding areas be vegetated or otherwise protected.

Health. Existing wells shall be inventoried during waste storage pond planning/design. A separation distance of 300 ft with the pond shall be maintained unless an evaluation of the aquifer will justify a reduced distance.

Permits. The waste storage pond shall be planned, design and operated within the applicable federal, state, and local permits, ordnances, and/or regulations that are applicable for the specific site.

Operation and Maintenance. A site specific operation and maintenance plan will be developed and provided to the cooperator. The SCS PS-425 Operation and Maintenance Plan for waste storage ponds may be utilized in the standard form or modified to meet specific site requirements.

United States Department of Agriculture
Soil Conservation Service

Washington State Supplement

Waste Storage Pond, PS-425

I. Planning Considerations:

Permits: The pond shall be in compliance with all requirements of State and local permits, ordinances and/or regulations that are applicable for the installation of the planned site.

Location: The minimum distances to the pond from existing improvements shall be as specified in the permit(s), or this section, whichever is more restrictive. All distances are measured from the outside toe of embankments or the top edge of an excavated pond.

Owner occupied dwellings	100 ft.
All other dwellings	300 ft.
Domestic wells	
unconfined aquifers	200 ft.
confined aquifers	100 ft.
Water Courses	25 ft.

II. Design Criteria:

Soils: All GP, GW, SP or SW soils encountered in excavation or used as embankment material shall be lined if the nearest domestic water source is located closer than 300 feet to the site. Embankment heights of MH and CH soils shall not exceed four feet. The OL and OH soils shall not be used for construction of embankments. The PT soils are not recommended for installation of waste storage ponds. Excavated ponds in dense glacial till do not require a lining or need to be mechanically compacted. All soils with the exceptions listed may be used in the design and installation of waste storage ponds using standard construction methods.

SCS-WA-FEB. 1987

Waste Storage Pond 425-4

Lining: Livestock waste storage ponds may be lined by the methods described in the Practice Standards for pond sealing or by earthen materials. The following earth materials may be used for liners with livestock manure sealing:

Soil Liners	Minimum Compacted Thickness
GM with well-graded gravels	12 inches
GC	9 inches
SM with well-graded sands	12 inches
SC	9 inches
ML	12 inches
CL	6 inches
CH	6 inches

Water Tables: The operation and maintenance plan shall specify that the liquid level in the pond be maintained at least six inches above the ground water. This also includes installations in sites where the ground water has seasonal fluctuations.

Livestock Manure Sealing: The initial loading of ponds designed for livestock manure sealing shall specify the first 12 inches of the pond depth to be either non-diluted manure slurry or solids. The remainder of the pond may be filled with either non-diluted or diluted manure slurry. The operation and maintenance plan shall specify that the landowner notify the local SCS office of any sudden decrease in the liquid level other than during periods of emptying.

O&M Plans: An operation and maintenance plan shall be prepared and reviewed with the landowner/operator of each installation.

SCS-WA-FEB. 1987

Waste Storage Pond (425-4)

Lining: Livestock waste storage ponds may be lined by the methods described in the Practice Standards for pond sealing or by earthen materials. The following earth materials may be used for liners with livestock manure sealing:

Soil Liners	Minimum Compacted Thickness
GM with well-graded gravels	12 inches
GC	9 inches
SM with well-graded sands	12 inches
SC	9 inches
ML	12 inches
CL	6 inches
CH	6 inches

Water Tables: The operation and maintenance plan shall specify that the liquid level in the pond be maintained at least six inches above the ground water. This also includes installations in sites where the ground water has seasonal fluctuations.

Livestock Manure Sealing: The initial loading of ponds designed for livestock manure sealing shall specify the first 12 inches of the pond depth to be either non-diluted manure slurry or solids. The remainder of the pond may be filled with either non-diluted or diluted manure slurry. The operation and maintenance plan shall specify that the landowner notify the local SCS office of any sudden decrease in the liquid level other than during periods of emptying.

O&M Plans: An operation and maintenance plan shall be prepared and reviewed with the landowner/operator of each installation.

SCS-WA-FEB. 1987

Waste Storage Pond (No.)

Definition

An impoundment made by excavation or earthfill for temporary storage of animal or other agricultural waste.

Scope

This standard establishes the minimum acceptable requirements for design, construction, and operation of waste storage ponds. Embankments are limited to an effective height of 35 ft or less and to hazard class (a). This standard does not apply to waste treatment lagoons or to waste storage structures.

Purpose

To store liquid and solid waste, waste water, and polluted runoff to reduce pollution and to protect the environment.

Conditions where practice applies

This practice applies where: (1) an overall waste management system has been planned; (2) waste is generated by agricultural production or processing; (3) storage is necessary to properly manage the waste, and (4) soils and topography are suitable for construction.

Planning considerations

Location. Waste storage ponds should be as close to the source of waste and polluted runoff as practicable. Due consideration should be given to economics, the overall waste management plan, and health and safety factors. The ponds should be located where prevailing winds, vegetative screening, and building arrangement minimize odor and visual resource problems. Nonpolluted runoff should be excluded to the fullest extent possible.

Waste storage ponds shall not be located on flood plains unless they are protected from inundation or damage from a 25-year flood event.

Solids separation. To minimize frequency of solids removal from runoff storage ponds, direct polluted runoff through vegetative filter strips, low-gradient channels, or debris basins to remove readily settleable solids. Settling facilities should have adequate capacity to store settled solids for a reasonable period, based on climate, equipment, and method of disposal. If animal manure, such as from dairy cows, is flushed into a storage pond, a solids separator may be provided for removing fibrous solids to facilitate pumping and irrigation.

Design criteria

Soil and foundation. Locate pond on soils of slow to moderate permeability or on soils that can seal through sedimentation and biological action. Avoid gravelly soils and shallow soils over fractured or cavernous rock. If self-sealing is not probable, the storage pond shall be sealed by mechanical treatment or by the use of an impermeable membrane. Do not construct to an elevation below the seasonal high water table unless considered as a special design.

Storage period. The storage period is the maximum anticipated length of time between emptying, based on climate, crops, equipment, and labor.

Design volume. Waste storage ponds shall store the design volume. Design volume is the minimum volume required to store waste for the storage period. It is the total of the following:

With drainage area—	Without drainage area—
1. Manure, waste water, and normal runoff[1]	1. Manure and waste water[1]
2. Normal precipitation less evaporation on pond surface[1]	2. Normal precipitation less evaporation on pond surface[1]
3. 25-year, 24-hour runoff	3. 25-year, 24-hour precipitation on pond surface
4. Solids accumulation[2]	4. Solids accumulation[2]

[1]Accumulated during the storage period.

[2]For the period between solids removal. This applies mainly to ponds used to store waste water and polluted runoff and refers to the residual solids after the liquids have been removed.

Additional storage can be provided to meet management goals or regulations.

SCS, April 1979

Inlet and outlet. Inlets to storage ponds can be of any permanent type designed to resist erosion, plugging, and, if freezing may be a problem, damage by ice. If slurry and solid waste is stored, the inlet should be designed so that waste will be deposited near the center of the pond.

There shall be no outlet that can automatically release storage from the design volume. An emergency spillway, combination of spillways, or additional storage shall be provided to protect the facility from overtopping during a 25-year, 24-hour storm occurring when the design volume is filled. Spillway requirements, however, do not apply to waste storage ponds without drainage areas.

Earth embankment. The design height of the embankment shall be increased by the amount needed to insure that the design top elevation will be maintained after settlement. This increase shall not be less than 5 percent. The minimum top width shall be 8 ft. The combined side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical.

For ponds with a drainage area, the minimum elevation of the top of the settled embankment shall be 1 ft above the elevation of the water surface during the 25-year, 24-hour emergency spillway storm occurring when the design volume is filled. For ponds without a drainage area, the minimum elevation of the settled top shall be 1 ft above the design volume.

Disposal facilities. Waste shall be removed from storage and used or disposed of at locations, times, rates, and volumes shown in the overall waste management plan without polluting the surface or ground water. Waste may be liquid, slurry, or solid, and proper equipment must be available to remove and apply it to the land.

If polluted runoff is stored, liquids shall be removed promptly to insure that sufficient capacity is available to store runoff from subsequent storms. The maximum allowable emptying time shall be based on the chance of overflow from subsequent storms and on the capacity of the disposal area.

Provisions shall be made for removing solids from storage ponds to preserve the storage capacity. The method or removal must be considered in planning, particularly in determining the size and shape of the pond. For ponds built to store runoff and waste water, an entrance ramp having a slope of 4:1 or flatter may be used. For those built to store slurry and solid waste, some type of emptying facility must be provided. It may be a dock, a pumping platform, a retaining wall, or a ramp having a slope of 7:1 or flatter.

Protection. If the waste storage pond creates a safety hazard, it shall be fenced and warning signs posted to prevent children and others from using it for other than the intended purpose. The embankment and surrounding areas shall be vegetated to control erosion. Vegetative screens or other methods should be used to shield the pond from public view and to improve visual conditions.

Plans and specifications

Plans and specifications for waste storage ponds shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Zillah Field Office (509)829-3003

Assistance Notes for Date Range
07/31/97 - 06/23/98

Client Name: Dolsen, Robert R.
Business Name: Robert R Dolsen
Business ID: dolsra

#2

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 12/09/97

Note:
Construction Check. Foundation cleared, core trench started. Job appears to be going smoothly.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 12/03/97 #2

Note:
I met with Dirk Porter, Bill and Bob Dolsen, and their lawyer to review the updated waste management plan.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 12/01/97 #1

Note:
I met with Dirk Porter and the contractor at a potential pond site. This is just south and across East Zillah Drive Road from the existing storage pond. I reviewed the standards and specifications with the contractor. No water table apparent. Soils mapped as Scoon silt loam. Design size is 300 x 200 x 15.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 11/21/97

Note:
Talked with Dirk Porter and Bob Dolsen regarding the catch basin and dam site. I explained to them that the catch basin was at it's maximum elevation to stay under the 10 acre foot above ground rule. They can still construct, but will need a dam safety permit. Also, the dam site will also require a permit because it would be considered "a dam in series" and the lower catch basin is at the maximum elevation.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Zillah Field Office (509)829 3003

Assistance Notes for Date Range
07/31/97 - 06/23/98

Client Name: Dolsen, Robert R.
Business Name: Robert R Dolsen
Business ID: dolsra

#3

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 04/02/98

Note:
Rod Lobos and I met the contractor at the potential pond site. The contractor had already steaked the site on a 50' grid. Rod and I surveyed the site using the contractors grid. We also discussed the specifications and that the pond cound not be 10 acre feet above ground. The proposed pond size is 200 x 225. This will keep it below the 10 acre feet.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 02/20/98

Note:
I met with Dirk Porter, Bill and Bob Dolsen, and the dairy's irrigator to review the latest update on the waste management plan. Many questions were asked regarding winter application. I told them that if they did't have to apply, don't. The storage capacities are such that they should not have to apply during the winter months unless conditions permit.

Dirk also mentioned that they would like to build another storage pond just east of the newest one. The same contractor will be doing the work. He will call when he is ready to start.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 02/18/98 #2

Note:
Construction check. Pond is complete. Concrete apron in place for erosion control. Excellent job. Job appears to meet NRCS standards and specifications.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 12/16/97 #1

Note:
Construction check. Pond taking shape. Compaction good. Job looks good. Contractor said that construction may have to stop depending on the weather.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Zillah Field Office (509)829-3003

Assistance Notes for Date Range
07/31/97 - 06/23/98

#3

Client Name: Dolsen, Robert R.
Business Name: Robert R Dolsen
Business ID: dolsra

Client Address	Business Address
7006 Scenic Dirve Yakima, WA 98908-	

Client Phone	Ext	Description	Business Phone	Ext	Description
(509) 829-5777		HOME			

NOTES

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 04/16/98

Note:
Construction check. Job near complete. Needs to have concrete placed at inlet for erosion control.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 04/13/98

Note:
Construction check. Job looks good. Compaction is good. Contractor hit a vein of sand. This material was excavated and not used in the construction of the pond. Job nearing completion.

Assistance Type: Technical Assistance — Assisted By: LAC
Fund ID: CTA — Date: 04/08/98

Note:
Construction check. Construction started. Foundation cleared, core trench in, pond taking shape.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Zillah Field Office (509)829-3003

Sep 20, 1999

Technical Assistance Notes for Date Range
04/17/98 - 09/20/99

Client Name: Dolsen, Robert R.
Business Name: Cow Palace Dairy
Business ID: dolsro

Assistance Type: Technical Assistance
Fund ID: CTA
Assisted By: LAC
Date: 12/01/98

Note:
Met with Dirk Porter. They are cleaning out the main storage pond and he wanted me to measure the pond for volume. The diamentions are approximately 430' X 280' X 30' deep. This is approximately 18.2 million gallons of storage.

Assistance Type: Technical Assistance
Fund ID: CTA
Assisted By: LAC
Date: 11/10/98

Note:
Dirk Porter called to let us know to add an addtional 100 acres to the management plan. They purchased the orchard behind them. The two new pond volumes are 8 million and 5 million gallons. They are also planning on cleaning out the main storage pond before winter.

Assistance Type: Technical Assistance
Fund ID: CTA
Assisted By: LAC
Date: 05/01/98
#3

Note:
Final Construction check. All componets in place. Job meets NRCS Standards and Specifications.