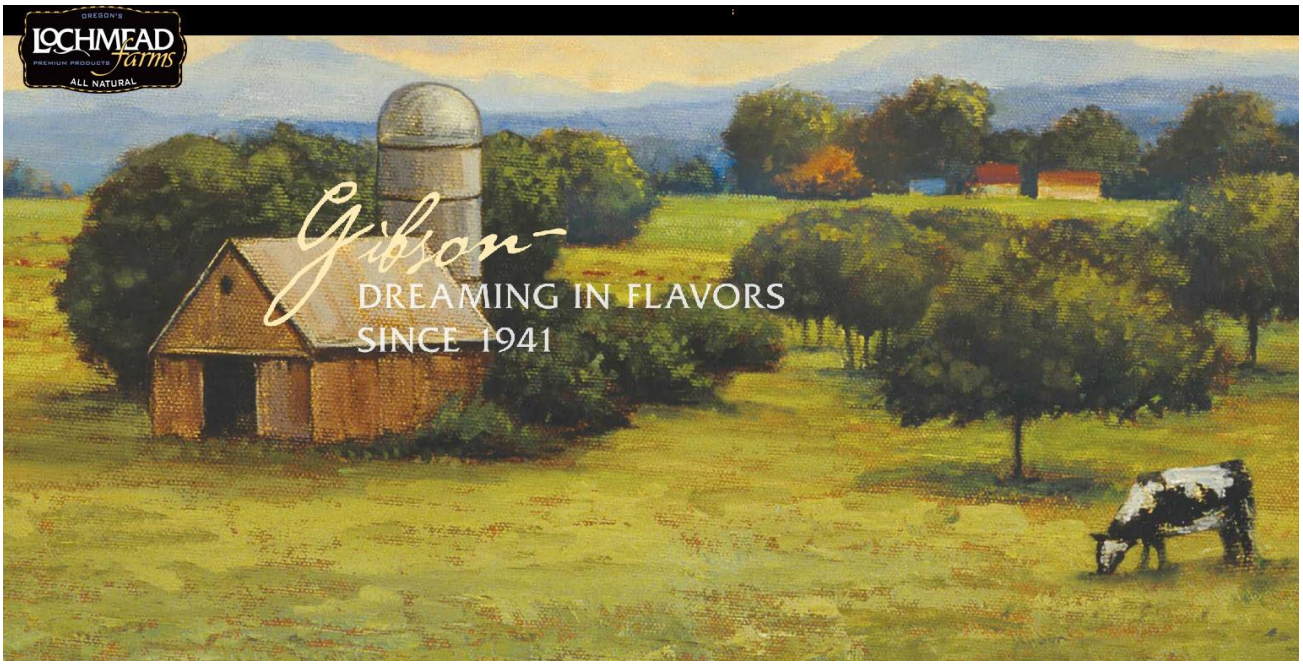
Animal Waste Management Plan
for
Lochmead Farms

c/o Chris Gibson
96428 Hwy 99 West
Junction City, OR 97448
(541) 998-2388



Prepared by:
Bruce D. Wilson
H&R Engineering LLC
Keizer, OR
(866) 493-3243

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 5 – REFERENCES

GENERAL INFORMATION

Farm contact information: Lochmead Farms
c/o Chris Gibson
96428 Hwy 99 West
Junction City, OR 97448
(541) 510-4695

Physical Location: Lochmead Farms
96428 Hwy 99 West
Junction City, OR 97448
(541) 998-2388

Animal Feeding Operation: Large Concentrated CAFO
Type & Size: Dairy – 1,800 Animals

Latitude/Longitude: N44.2811^0, W123.2434^0

AWMP Plan Approval
I certify that I have reviewed this AWMP for technical adequacy and that the elements of the documents are technically compatible, reasonable and can be implemented.

Signature: Bruce D. Wilson Date: 12/24/2013
Name: Bruce D. Wilson
Title: Individual TSP Number: TSP-05-4719

Owner/Operator
As the owner/operator of this AWMP, I, as the decision maker, have been involved in the planning process and agree that the items/practices listed in each element of the AWMP are needed. I understand that I am responsible for keeping all the necessary records associated with the implementation of this AWMP. It is my intention to implement/accomplish this AWMP in a timely manner as described in the plan.

Signature: Chris Gibson Date: 4/2/14
Name: Chris Gibson for Lochmead Farms

GENERAL INFORMATION

BACKGROUND AND SITE INFORMATION

Lochmead Farms is located approximately 5 miles north of Junction City, Oregon in Lane and Benton Counties in the Willamette Valley at an elevation of approximately 300 feet. The annual precipitation varies from 40-44 inches of which 70% falls within a 5 month period from November through March and less than 7% falls from June through August. Winds are generally moderate in the winter (15-30 mph) from the south to southwest and mild in the summer (5-15 mph) from the north to northwest. Humidity usually varies from 60 to 90 percent throughout the year except when dry east winds occur dropping the humidity to 10 to 15 percent. There is approximately 210-230 frost free days and the average annual temperature is 50 to 55 degrees Fahrenheit. Soils vary from deep to moderately deep clay, fine sandy loam and silty clay loams that are poorly to well drained.

Lochmead Farms is a Holstein dairy operation owned and operated by Gibson family who farms the irrigated and non irrigated cropland immediately adjacent to the dairy operation. The current dairy operation consists of 625 milk cows, 55 dry cows, 416 heifers and 110 calves. The maximum number of animals planned for the farm is 825 milk cows, 125 dry cows, 625 heifers and 225 calves.

All livestock are confined year round and composted manure used for bedding from the milk cow barns is scraped directly into gutters which are flushed once per day along with the alleyways in the heifer barns. The gutters and barn alleyways are flushed with recycled liquid from the waste storage ponds that is directed to a concrete reception tank. Spoiled silage and wood shavings used for bedding from the maternity barn and fresh pen containing manure are removed and hauled and spread on the crop land fields as weather conditions permit. Waste water generated from the milking parlor and wash down water from the holding pen is collected in the concrete reception tank. Runoff from the silage storage facility is collected in the underground drain lines and drains to a reception pit and is pumped directly to the wastewater storage ponds. Wastewater from the concrete reception tank is pumped to two 36’ diameter x 40” high covered anaerobic digesters for methane gas production. Each digester has a 3.5 day detention period. Outflows from the digesters drain to a 36’ diameter x 15’ high covered recovery tank. The digesters and recovery tank provide no storage benefit for short or long-term storage. During the decanting process from the covered recovery tank, wastewater is pumped to an inclined screen and screw press solid/liquid separation facility where approximately 25 percent of the solids are removed from the wastewater. Runoff and leachate from the uncovered separated solids drains to the concrete reception tank. After separation wastewater drains to the wastewater storage ponds where it is stored until it can be utilized for crop production. The combined storage of the waste storage ponds is 45.37 acre feet.

Solid manure is transferred from the solid/liquid separation facility to 3 roofed green houses for composting solid manure for bedding. The majority of the composted manure from the green houses is recycled back into the facilities to be used for bedding material and the remaining solids are exported off farm.

GENERAL INFORMATION

All but one barns are guttered and downspouts are connected to underground outlets to divert clean roof water away from the manure storage facilities. Roof water from the hay barn is collected on a sloped concrete slab and diverted away from manure contaminated areas for infiltration into the ground. Clean roof water from one of the milk cow barns is drained into a pre-dug dry well system.

Any livestock mortality that occurs during the year on the farm are picked up by Whites hauling service within 24 hours of death and disposed of at a certified landfill site.

The dairy facilities consist of 22.3 acres for the livestock barns, milking facilities and manure management system. Adjacent to the dairy facilities are 2,240 acres of diversified non irrigated and irrigated cropland where solids and wastewater containing manure from the dairy operations will be applied by employees of the dairy and members of the Gibson family. The cropland utilizes a crop rotation consisting of corn silage, corn silage-red clover double crop, peppermint, wheat for grain and straw and grass for seed production and straw. The acres in each crop will vary by year as crops are rotated through these fields. Lochmead Farms also has approximately 257.8 acres in blueberry and hazelnut production that usually does not receive applications of wastewater or solids containing manure but might in the future. It is planned to transfer all wastewater containing manure from the waste storage ponds through a buried 8 inch PVC mainline for application with 2 traveling big gun sprinklers. Solids consisting of spoiled silage and wood shavings containing manure are applied using a tractor pulled solid manure spreader. A custom applicator uses tank trucks to apply liquid manure removed from the waste storage ponds to fields that cannot be reached with the PVC mainlines and traveling big gun sprinklers

The soil concentration of phosphorus is low to excessive in the crop land fields on Lochmead Farms. The phosphorus index (PI) ratings are currently low to medium for all fields that will receive manure applications on an annual basis. Fields with a high phosphorus index (PI) rating are currently in hazelnut or blueberry production and usually do not receive applications of wastewater or solids containing manure but if they do applications will be on a phosphorus basis. Applications of wastewater and solids containing manure to fields with a low or medium phosphorus index (PI) rating will be applied on a nitrogen basis. Soil concentrations of phosphorus will be monitored with soil tests and if phosphorus concentrations increase significantly wastewater and solids containing manure will be applied on a phosphorus basis. No phosphorus applications of commercial fertilizer should be made on any field unless extension fertilizer guides for the crop recommend to do so.

GENERAL INFORMATION

MANURE STORAGE AND NUTRIENT BALANCE SUMMARY

Manure Storage-

Storage Type:	Capacity	Estimated Storage Period
Waste Storage Pond-	45.37 AF	163 Days
Dry Storage-	24,100 CF	66 Days

Nutrient Balance-

Nutrients Generated:	N Generated (lbs) after Losses	P_2O_5 Generated (lbs) after Losses
Solid Manure-	13,808 lbs	9,770 lbs
Liquid Manure-	73,371 lbs	55,939 lbs
Total-	**87,179 lbs**	**65,709 lbs**

Exported Nutrients:	N Exported (lbs) after Losses	P_2O_5 Exported (lbs) after Losses
Solid Manure-	1,381 lbs	977 lbs
Liquid Manure-	0 lbs	0 lbs
Total-	**1,381 lbs**	**977 lbs**

Crop Nutrient Removal:	N Utilized (lbs)	P_2O_5 Utilized (lbs)
Total-	**506,660 lbs**	**213,209 lbs**

Net Nutrients:	Nutrients Generated after Losses(lbs.)	Nutrients Removed by Crop and Exported after Losses (lbs)	Net Nutrient Balance after Losses (lbs)
Nitrogen (N)-	87,179 lbs	508,041 lbs	-420,862 lbs
Phosphate (P_2O_5)-	65,709 lbs	214,186 lbs	-148,477 lbs

System Losses:	Nutrients Generated (lbs)	Nutrients Remaining after Losses (lbs)	Nutrients Lost in System (lbs)
Nitrogen (N)-	221,007 lbs	87,179 lbs	133,828 lbs
Phosphate (P_2O_5)-	69,738 lbs	65,709 lbs	4,029 lbs

GENERAL INFORMATION

EMERGENCY RESPONSE PLAN

In Case of an Emergency Storage Facility Spill, Leak or Failure

Implement the following first containment steps:

a. Stop all other activities to address the spill.
b. Stop the flow. For example, use skid loader or tractor with blade to contain or divert spill or leak.
c. Call for help and excavator if needed.
d. Complete the clean-up and repair the necessary components.
e. Assess the extent of the emergency and request additional help if needed.

In Case of an Emergency Spill, Leak or Failure during Transport or Land Application

Implement the following first containment steps:

a. Stop all other activities to address the spill and stop the flow.
b. Call for help if needed.
c. If the spill posed a hazard to local traffic, call for local traffic control assistance and clear the road and roadside of spilled material.
d. Contain the spill or runoff from entering surface waters using straw bales, saw dust, soil or other appropriate materials.
e. If flow is coming from a tile, plug the tile with a tile plug immediately.
f. Assess the extent of the emergency and request additional help if needed.

Contacts to be made by the owner or operator within 24 hours

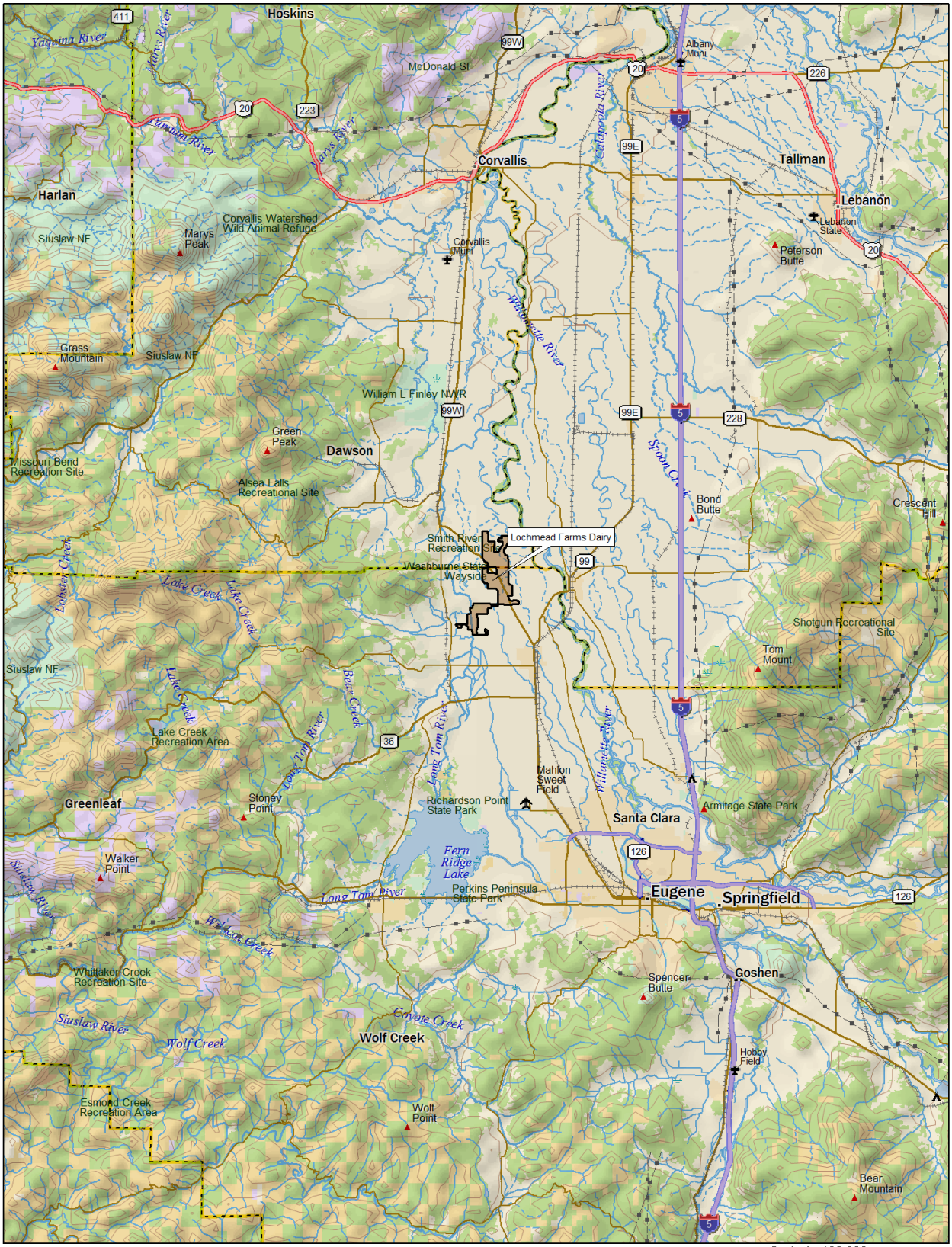
Organization	Phone Number
Oregon Dept. of Agriculture Natural Resources Division 635 Capitol St., N.E. Salem, OR 97301-2532	(503) 986-4700 TTD (503) 986-4762
Oregon Emergency Response (System OERS)	(800) 452-0311
County Environmental Health Department	
Lane County	(541) 682-4051
Benton County	(541) 766-6841
County Roads Department	
Lane County	(541) 682 6901
Benton County	(541) 766-6821

Be prepared to provide the following information:

a. Your name and contact information.
b. Farm location (driving directions) and other pertinent information.
c. Description of emergency.
d. Estimate of the amounts, area covered, and distance traveled.
e. Whether manure has reached surface waters or major field drains.
f. Whether there is any obvious damage: employee injury, fish kill, or property damage.
g. Current status of containment efforts.

GENERAL INFORMATION

LOCATION MAP FOR LOCHMEAD FARMS



Data use subject to license.

© DeLorme. Topo North America™ 9.

www.delorme.com

TN

MN (15.6°E)

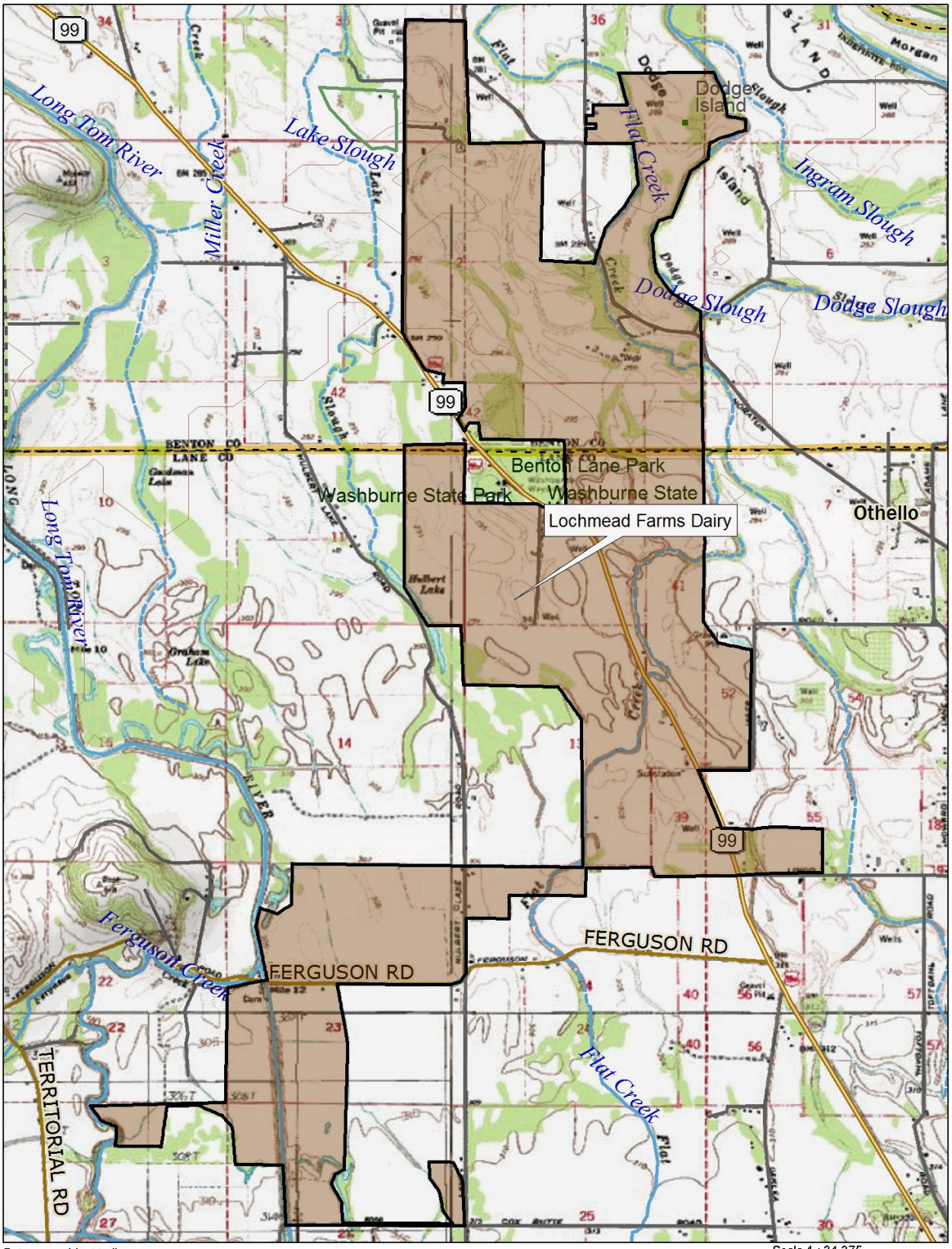
Scale 1 : 400,000

1" = 6.31 mi

Data Zoom 9-0

GENERAL INFORMATION

TOPOGRAPHY MAP FOR LOCHMEAD FARMS



PRODUCTION AREA

ANIMAL NUMBERS

Lochmead Farms is currently milking 625 cows on this dairy. The number of replacement livestock currently being cared for on Lochmead Farms consists of 55 dry cows, 416 heifers, and 110 calves. Lochmead Farms is planning for a maximum of 825 milk cows, 125 dry cows, 625 heifers and 225 calves which this plan is based on.

ANIMAL MORTALITY MANAGEMENT

Currently animal mortalities for the Lochmead Farms are being disposed of by Whites hauling services within 24 hours of death and disposed of at a certified landfill site. If conditions do not allow for pickup or it is delayed carcasses will be temporarily stored at the solid waste storage facility. Other methods of dealing with mortalities may be employed by Lochmead Farms as needed.

Having dead animals sent to an acceptable disposal site is the best method to deal with animal mortalities. A list of landfills and phone numbers can be found on the internet at http://www.deq.state.or.us/lq/sw/disposal/permittedfacilities.html. If a local landfill is not permitted to accept animal carcasses, the Oregon Department of Environmental Quality (DEQ) may grant an exception. Phone numbers to local DEQ offices can be found in most phone books or on the internet at http://www.deq.state.or.us/about/locations.html.

Under no circumstances are animal mortalities to be disposed of in any type of liquid manure storage facility.

COLLECTION OF MANURE, PROCESS WATER AND RUNOFF

Manure, bedding and wasted feed is collected in the barns. The estimated volume of Manure bedding and wasted feed that will be collected annually was generated using the ORAWM workbook located in Section 5.

Flushwater used to clean the alleyways and gutters in the barns is directed to catch basins that drain to the reception tank via underground pipelines. Flushwater is recycled from the wastewater storage ponds during the fall and winter storage period so there is no additional fresh water added.

Leachate and rainfall runoff from the silage and solids storage areas is directed to catch basins that drain to the reception tank via underground pipelines. The estimated volumes of leachate and rainfall runoff from the silage and solid storage areas that will be collected annually were generated using the ORAWM workbook located in Section 5.

Rainfall runoff from paved and unpaved areas that comes into contact with animal manure is directed to catch basins that drain to the reception tank. The estimated volume of rainfall runoff that will be collected annually was generated using the ORAWM workbook located in in Section 5. All rainfall runoff from roofs except for two barns is collected using gutters and downspouts and directed to drainage ditches using underground pipelines. Roof water from one barn is directed away from areas containing manure and the roof water from the other barn is directed to a dry well.

All process water from the dairy operation is directed to catch basins that drain to the reception tank. The estimated volume of process water that will be collected annually was generated using the ORAWM workbook located in Section 5.

PRODUCTION AREA

TREATMENT FACILITIES

The separated solids are composted and recycled for bedding.

There are two anaerobic digesters that are used to process the manure collected into methane gas which is used to power a generator that produces electrical power that is sold to the power company.

STORAGE FACILITIES

The underground reinforced concrete reception tank shown on the Production Area Map on page 2-9 is use to collect wastewater containing manure. This facility is considered a collection and temporary storage facility only and its capacity was not included in the long term storage calculations.

Capacities and estimate volumes to store for the waste storage facilities on Lochmead Farms can be found on the storage worksheet in the ORAWM workbook located in Section 5.

TRANSFER OF MANURE, PROCESS WATER AND RUNOFF

Wastewater, manure, bedding and wasted feed from the housing facilities is directed to the central reception tank where it is pumped to the anaerobic digesters for the production of methane gas. Wastewater decanted from the anaerobic digesters is pumped to the separation facility to separate solids from the wastewater stream. Wastewater from the separation facility is directed to the waste storage ponds and separated solids are transferred to three green houses for composting shown on the Production Area Map on page 2-9.

Wastewater stored in the waste storage ponds is pumped to the crop land fields using underground pipelines to be utilized as a source of nutrients. Traveling big gun irrigation systems are used to apply the wastewater to the crop land fields.

Separated solids are composted and recycled for bedding or exported off farm. Spoiled silage and wood shavings containing manure are applied using a solids spreader to be utilized as a source of nutrients.

PRODUCTION AREA

OPERATION AND MAINTENANCE CONSIDERATIONS

WASTEWATER RECEPTION TANK-

The wastewater reception tank shown on the Production Area Map on page 2-9 is used to temporarily store wastewater containing manure generated by the Lochmead Farms. Any annual buildup of solids in the wastewater reception tank must be removed to maintain design capacity and applied to land application areas in accordance with guidance given in Section 3.

Inspect the tank weekly to insure structural integrity. If the structural integrity of the tank is compromised, immediately empty the tank to determine the cause and make necessary repairs before putting the tank back into service. Do not allow equipment that exceeds the design limit of the tanks on or within 20 feet of the structure.

Keep pumps, agitators, piping, valves and all other electrical and mechanical equipment in good condition by following the manufacturer's recommendations. Maintain grounding rods and wiring for all electrical equipment in good condition. Immediately remove all foreign debris within the structure that may cause damage to pumps or agitators.

Pump the wastewater reception tank completely empty during the summer months and cleanout any debris and other solid materials that may have accumulated in the tank. Inspect the tank for structural damage and if structural damage to the tank is discovered seek the services of a qualified engineer to assess the damage and recommend necessary repairs before putting the tank back into service. Follow the guidance given in Section 3 when applying wastewater to fields.

Do not dispose of animal carcasses in the wastewater collection tank. It is against the law to do so.

Maintain all fences, railings, and/or warning signs to provide warning and/or prevent unauthorized human or livestock entry. Immediately repair vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances. Maintain lids, grates and shields on openings.

Provide proper ventilation before entering the tank, for any reason what so ever. Provide and use self - contained breathing apparatus (scuba) equipment when entering a tank. No persons should enter the tank unless safety ropes are used and someone else capable of providing rescue assistance is outside the tank.

Do not assume any tank, including open top tanks, are well ventilated.

WASTEWATER STORAGE PONDS-

The waste storage ponds shown on the Production Area Map on page 2-9 are used to store wastewater containing manure generated by the Lochmead Farms. The storage capacity and estimated storage period for the waste storage ponds are shown on the ORAWM workbook storage worksheet located in Section 5.

Emptying of the waste storage ponds should begin in the spring and continue through the spring and summer months as weather conditions permit applying wastewater in accordance with the guidance given in Section 3. To function properly and have the greatest management flexibility, the waste storage ponds must be as empty as possible

in the fall before the fall and winter rainy season begins. Any annual sludge buildup in the waste storage ponds must be removed to maintain design capacity and applied to land application areas in accordance with guidance given in Section 3.

Inspect the waste storage ponds weekly to insure structural integrity and that at least 1 foot-6 inches of freeboard is being maintained to accommodate excess rainfall such as a 25 year-24hour storm and prevent overtopping embankment. If the structural integrity of a waste storage pond embankment is found to be compromised, immediately draw the liquid level down below the damaged area to determine the cause. Seek the services of a qualified engineer to assess the damage and recommend necessary repairs before allowing wastewater levels above the damaged area.

Pump the wastewater storage pond to the lowest level possible during the summer months and inspect the embankments for structural damage. If structural damage to the embankment of a wastewater storage pond is discovered, seek the services of a qualified engineer to assess the damage and recommend necessary repairs before allowing wastewater levels above the damaged area. Follow the guidance given in Section 3 when applying wastewater to fields.

Do not permit livestock access to the pond or on pond embankments. Control undesirable vegetation growth by spraying or mowing. Control rodents as necessary. Check elevations of earthfills periodically and restored to grade and shape as necessary. Fill and reseed eroded embankment areas or repair with well graded rock riprap. Safety features such as signs and fences should be kept in good repair.

Do not dispose of animal carcasses in any wastewater storage pond. It is against the law to do so.

BUILDING ROOFS-

Inspect building roofs annually as a minimum. Repair and/or replace all rusted sections and secure loose sections as needed. Immediately replace all broken trusses, rafters, beams, poles as needed. Immediately determining the cause and necessary modification(s) to prevent reoccurring structural failure is essential.

COMPOSTING FACILITY-

The composting facility shown on the Production Area Map on page 2-9 consists of 3 greenhouses that are used to treat and store compost until it can be used for bedding in the livestock barns.

The following guidelines provide information for making good compost:

Take a representative sample of the raw compost mixture and have a laboratory determine the moisture content, pH, and the carbon and nitrogen content.

The carbon to nitrogen ratio should range between 25 and 40 to 1. Make adjustments as needed to the ingredients of the raw compost mixture as necessary to achieve a carbon to nitrogen ratio within the acceptable range.

The moisture content should be between 40 and 60 percent. Add water or drier material to adjust the moisture content. Care must be taken to see that the carbon to nitrogen ratio of the mix is still in the 25 – 40 to 1 range after adjusting the moisture content.

PRODUCTION AREA

The pH preferably should range between 6.5 and 8 however composting may be achieved between a pH of 5.5 and 9.0.

Check pile temperature using thermometer probe on a daily basis. The pile temperature should be checked at a point one-third the distance from the outside of the pile to the center of the mass. Initially it will take approximately 2 to 3 days for the compost to get above 105 degrees F. Compost temperatures should peak between 130 and 140 degrees F in 5 to 7 days. When the temperature of the compost material falls below 110 degrees F the compost needs to be aerated by turning or other means. Failure to achieve the desired temperatures may result in the incomplete destruction of pathogens and weed seeds and can cause fly and odor problems.

Odors given off by the composting operation is a good indicator of how the compost operation is proceeding. Foul odors may mean that the process has turned from aerobic to anaerobic. Anaerobic conditions are the result of insufficient oxygen in the compost. This may be caused by excessive moisture in the compost or the need for turning or aerating of the compost material.

For a well managed windrow or static pile composting operation, the composting time during the summer months should range from 14 days to a month. To ensure a finished compost, observe that the composted material has little or no trace of the original raw material and has little odor. The material should be black to brown in color. Particle size should be consistent and soil-like in texture.

All materials that are not considered feedstocks for the composting process (i.e. plastic ear tags, plastic gloves, etc…) are to be collected and transported to a permitted landfill by a garbage collection service or other means. It is anticipated that there will be no other material that will require offsite disposal.

Periodically inspect concrete and asphalt slabs, walls and curbs and repair or replace broken sections as needed. Cleanup any spillage of composted material from outside of the composting area and place them back in the composting facility.

Maintain all fences, railings, and/or warning signs to provide warning and/or prevent unauthorized human or livestock entry. Immediately repair vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.

DIKES AND BERMS-

Periodically check elevations of earthfills and restore to grade and shape, if necessary. All settlement or cracks in the dike should be investigated to determine the cause and immediately repaired.

Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization, and application of herbicides when necessary. Fertilize the established stand with at least 200 pounds of 21-0-0 per acre or equivalent annually or as needed to maintain a uniform vigorous stand. Avoid excess travel and uncontrolled grazing on any portion of the dike system that will harm or destroy vegetative cover. Periodic mowing or controlled grazing may also be needed to control height.

PRODUCTION AREA

Maintain installed fences to prevent unauthorized human access or uncontrolled grazing of dike surfaces. Livestock can be used to control vegetation height, providing grazing is controlled to short periods of time when damage to the dike surface and vegetation will not result.

Check all erosion control sections for accelerated weathering and displacement of materials. Replace to original shape and grade if necessary.

Immediately repair any vandalism, vehicular, or livestock damage to the dike or other appurtenance.

Eradicate or otherwise remove all rodents or burrowing animals and repair any damage caused by their activity.

FENCES-

Do not allow livestock access to open water courses and drainageways. Provide off stream watering facilities where possible and limit access to designated watering areas.

Inspect fences periodically and repair or replace broken or decayed posts and tighten sagging wire as needed. Broken wire can be spliced or replaced. Replace broken or missing insulators on electric fences as needed and repair or replace inoperative electric fence controllers.

Insure gates and other appurtenances are in good working order. Replace or repair components as needed.

IRRIGATION SYSTEMS-

Maintain traveling gun type sprinklers (and hose reel, if used) by oiling and greasing moving parts and the engine in accordance with the manufacturer's recommendations to help ensure trouble free operation. Prevent livestock access to equipment during operation.

Clean plugged nozzles and replace if worn or defective.

Promptly repair all leaks by replacing valves, fittings, gaskets, worn or damaged parts.

LIVESTOCK WATERING FACILITIES-

Check all above ground connections, valves, gates, rodent guards, inlets and outlets to make sure they are functioning properly. Check troughs and tanks for leaks or cracks and repair or replace immediately, if necessary.

Make certain the area adjacent to the trough is well protected with gravel, paving, or good cover. Be sure that the outlet pipe has a free outlet and is not causing any serious erosion problems. Check periodically to see if debris has fallen into the trough or tank which may restrict inflow or planned functions of the outflow system.

Clean the entire system periodically and remove moss, algae growth, and/or sludge. Chemicals such as copper sulfate and chlorine can be used to prevent moss and algae growth. Local rules and regulations are to be followed when using chemicals to make sure they are safe for animals.

Where necessary maintain coverings and insulation to prevent damage by freezing.

PRODUCTION AREA

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Immediately repair any vandalism, vehicular or livestock damage.

PIPELINES-

Flush pipelines used for liquid waste applications with clean water following waste application, or as needed, to prevent particle buildup.

Drain the pipeline and components in areas that are subject to freezing. If parts of the pipeline cannot be drained, a non-toxic antifreeze solution may be added.

Check to make sure all valves and air vents are set at the proper operating condition so they can provide protection to the pipeline.

Inspect pipelines for signs of failure. Inspect risers and valves periodically for leaks or worn gaskets. Repair or replace pipeline, risers and valves as needed.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

PUMPS-

Operate and maintain pumps in accordance with good judgment and manufacture's manuals and recommendations.

Drain liquid manure from pumps during cold weather to prevent freezing. If parts of the system cannot be drained, a non-toxic antifreeze solution may be added.

Inspect pumps periodically and remove debris wrapped around shafts and impellers. Maintain foot valves and check valves for proper operation.

For proper operation of electric motors and controls, maintain lubrication for all bearings, keep electric panel free from obstructions and debris. Maintain electrical safety devices, assure all electrical contacts are tight, and lock main electrical switch to "OFF" position during non-use season. Maintain adequate shade and ventilation for pump motors.

For proper operation of pumps, maintain lubrication for all bearings and pump shafts, assure belts are adjusted properly, maintain safety covering devices on open shafts and belt drives, check to make sure all safety valves and devices are set at proper operating conditions so they may provide protection to the pump and power unit. For centrifugal pumps, periodically measure tolerance between pump impeller and pump casing (i.e. wearing) and replace wear ring as needed to help restore new pump operating characteristics.

Use portable pressure gauge (preferably a liquid filled gauge) to monitor pump performance.

Operate and maintain agitators in accordance with the manufacture's manual and recommendations. Inspect all plumbing annually as a minimum.

Replace, tighten, or repair broken or loose connections and lines as needed.

PRODUCTION AREA

SOLID/LIQUID SEPARATION FACILITY-

Inspect the solid/liquid separation facility daily to ensure the facility is operating properly and there has been no damage to structural components. Clean screens and outlets if they have become clogged or their capacity is not adequate for proper operation of the facility.

Prevent any spillage or leakage onto roadways when transferring solids from the solid/liquid separation facility to the composting facility and other areas.

WELL(S)-

Protect the area immediately surrounding the well from being damaged by agriculture machinery, vehicles, or livestock.

All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.

Do not allow any foreign debris to accumulate and maintain soil and vegetative covering in the immediate vicinity of the well.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Check metal surfaces for rust and other damage especially sections in contact with earthfill and with other materials. Repair or replace damaged section and apply paint as a protective covering.

Keep all surface water from entering or accumulating at the immediate vicinity of the well site.

Immediately repair any vandalism, vehicular, or livestock damage.

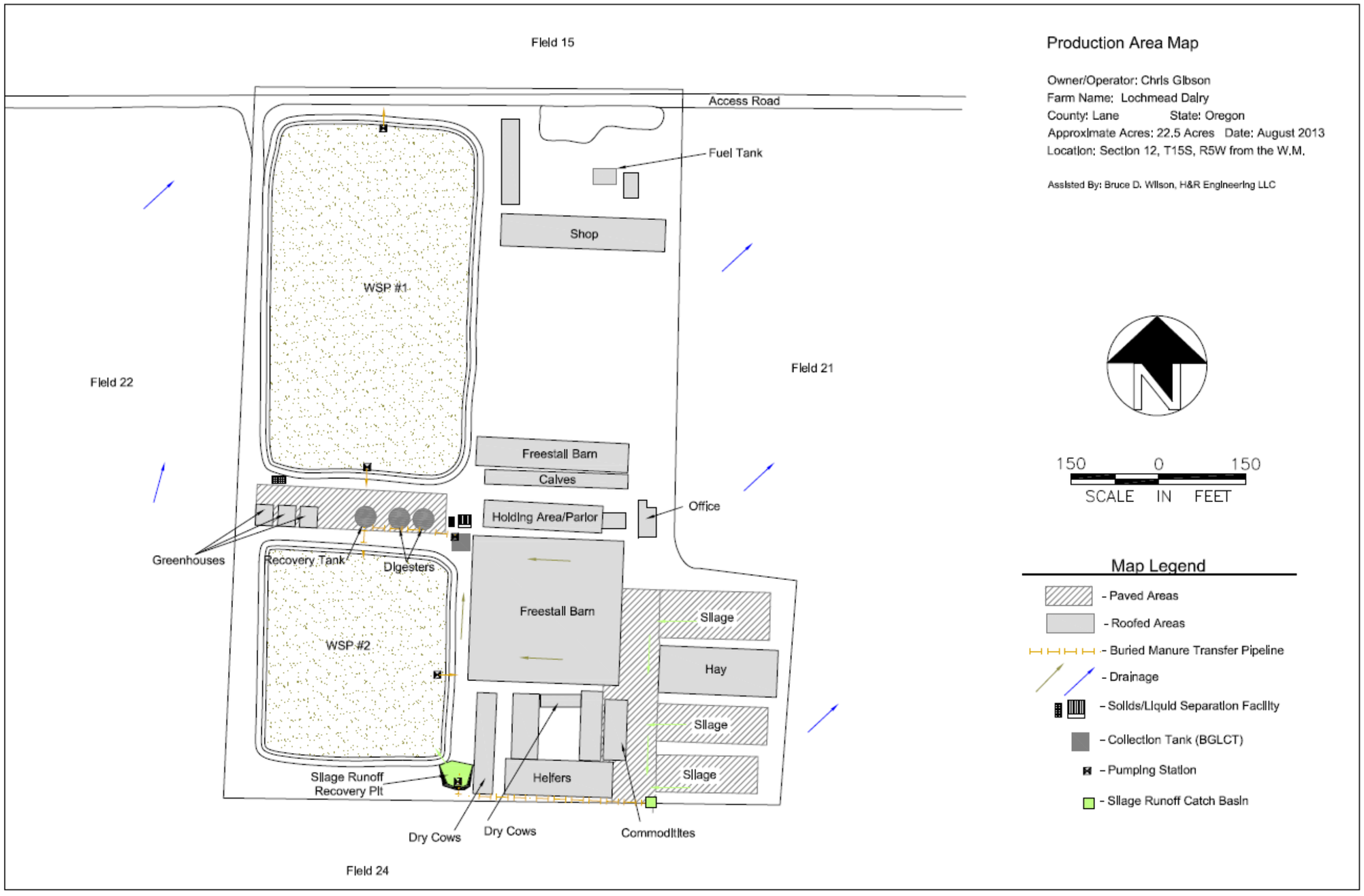
CHEMICAL HANDLING CHECKLIST-

The following measures shall be taken to prevent chemicals from contaminating process water or storm water storage and treatment systems:

1. Make sure all chemicals are stored in proper containers. Expired chemicals and empty containers are to be properly disposed of in accordance with state and federal regulations. Pesticides and associate refuse are to be disposed of in accordance with the FIFRA label.
2. Chemical storage areas are to be self-contained with no drains or other pathways that will allow spilled chemicals to exit the storage area.
3. Chemical storage areas are to be covered to prevent chemical contact with rain or snow.
4. Emergency procedures and equipment are to be in place to contain and clean up chemical spills.
5. Chemical handling and equipment wash areas are to be designed and constructed to prevent contamination of surface waters, waste water, and storm water storage and treatment systems.

PRODUCTION AREA

PRODUCTION AREA MAP FOR LOCHMEAD FARMS



UTILIZATION AREA

CROPPING SYSTEM

The acres of crop land area available for utilization of the nutrients and organics contained in the wastewater and solids produced from the Lochmead Farms is shown on the utilization worksheet in ORAWM located in Section 5. Yield data and nutrient utilization rates for the crops grown are also shown on the inventory worksheet in ORAWM located in Section 5.

Irrigated and nonirrigated crop yield data from the Lane and Benton County Soil Surveys referenced in Section 5 indicates the yield data used in developing this plan is within the range of the given crop yields for well managed fields.

Traveling big gun and center pivot sprinkler irrigation systems are used to irrigate the crop land areas for Lochmead Farms.

The traveling big gun irrigation systems are also used to apply wastewater containing manure and other organics produced from the Lochmead Farms. These systems use single large sprinkler nozzles usually mounted on a cart with wheels that is attached to a high density polyethylene pipeline that is rolled up on a large reel that provides a constant travel speed for the sprinkler. These systems apply water depending on the nozzle size, operating pressure and travel speed used and have an efficiency of 65 to 75 percent. Traveling big gun sprinkler systems must be well managed to prevent excess percolation, surface runoff, wind drift and evaporation losses.

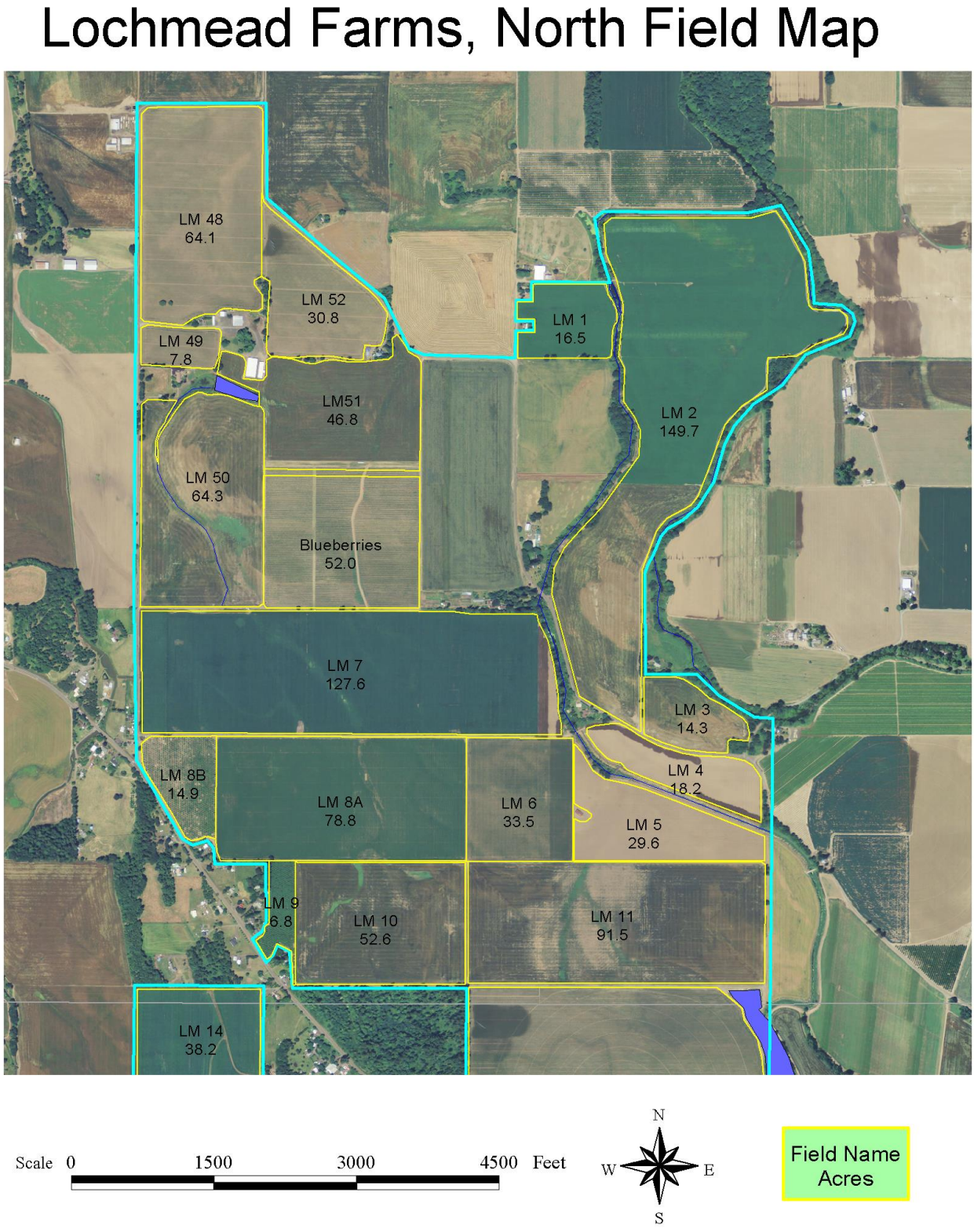
Side roll (wheeline) irrigation systems are used to irrigate the crop land fields for Lochmead Farms. These systems use single boom with sprinkler nozzles mounted above the boom and apply water depending on the nozzle size, operating pressure and set time used with an efficiency of 65 to 75 percent. Side roll sprinkler systems must be well managed to prevent excess percolation, surface runoff and erosion, wind drift and evaporation losses.

The center pivot irrigation systems are used to irrigate the crop land fields for Lochmead Farms. These systems use single boom with sprinkler nozzles mounted below the boom and apply water depending on the nozzle size, operating pressure and travel speed used with an efficiency of 80 to 90 percent. Center pivot sprinkler systems must be well managed to prevent excess percolation, surface runoff and erosion, wind drift and evaporation losses.

The amount of water to apply based on the crop can be found in the tables starting on page 3-34.

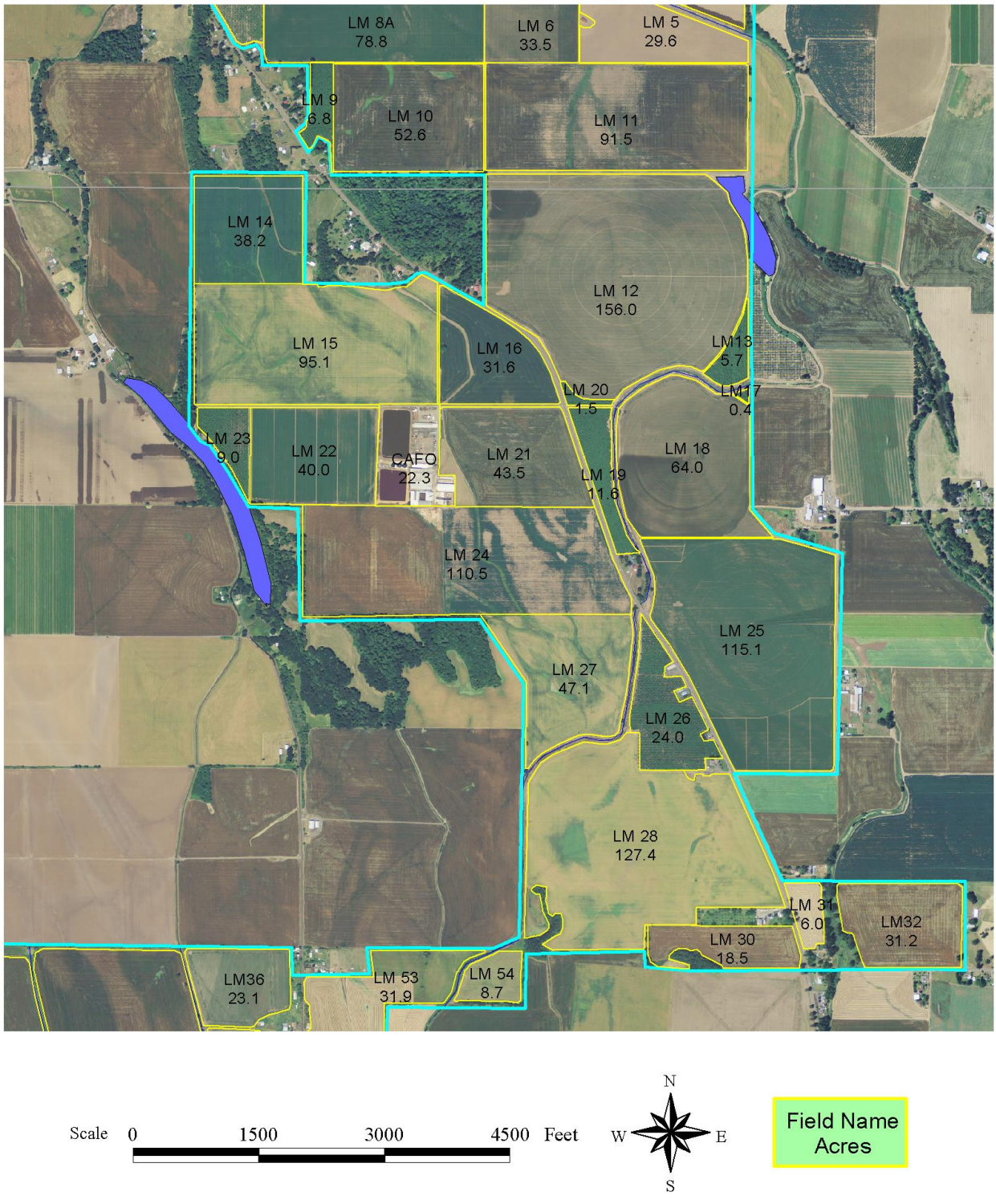
UTILIZATION AREA

FIELD MAP(S)



UTILIZATION AREA

Lochmead Farms, Middle Field Map



UTILIZATION AREA

Lochmead Farms, South Field Map

UTILIZATION AREA

APPLICATION

The manure and irrigation application systems will be calibrated in accordance with guidance starting on page 3-5 to insure the applications of manure, bedding and runoff from the waste storage facilities are in accordance with agronomic rates.

No application of wastewater or solids containing manure is to be made to the field buffer areas shown on the Setback Map on page 3-8. Applications of wastewater and solids containing manure should be made in accordance with guidance starting on page 3-5 to reduce the risk of contaminated runoff to surface water sources and leaching of contaminants to ground water sources.

The phosphorus runoff rating for each of the farm fields is based on the Western Oregon Phosphorus Index and is shown in the table on page 4-46. Wastewater, solids and commercial fertilizer for any field with a high runoff rating must be applied on a phosphorus basis. Wastewater, solids and commercial fertilizer for any field with a low or medium runoff rating can be applied on a nitrogen basis. No applications manure or commercial fertilizer containing phosphorus are to be made on a field with a very high phosphorus runoff rating.

GENERAL CONSIDERATIONS FOR MAKING MANURE APPLICATIONS

Manure applications may be made at any time of the year provided certain factors have been considered. However, the overriding factor one should use in considering whether or not to apply nutrients to a crop, irrespective of the nutrient source, is the agronomic need of the crop at the time of application. The following guidelines are to be considered once the decision has been made to make a manure application.

- **Manure applications may commence once T-Sum 200 has been reached for the calendar year** as long as you can comply with all other permit and AWMP requirements. Calculations for T-Sum 200 are outlined in OSU Extension Fertilizer Guide for Pastures (OSU FG63, 2000). T-Sum 200 is based on accumulated heat units and is an accurate guide to estimate plant activity. Research has shown that T-Sum 200 is the earliest date when plant roots begin to grow in the spring and thus are receptive to applied nutrients.

  Surface air temperature is monitored and the daily minimum and maximum air temperatures are summed and divided by two the get the average daily air temperature then converted to centigrade (F degrees minus 32 times 0.556). Manure applications may begin once 200 heat units have been accumulated. The average date of T-Sum 200 for Lochmead Farms is February 17th for the 30 year average from 1981-2010. However, one must still apply manure at agronomic rates based on the estimated growth potential of the crop and anticipated climatic events.

  Based on crop nutrient uptake patterns, manure applications should stop when the crop is done growing for the year and before the first significant rainfall event that is expected to result in saturated soils or surface runoff.

UTILIZATION AREA

- **Fields that are subsurface (TILE) drained require additional precautions** when manure is applied. Any pre-application tillage should leave as much residue as possible on the soil surface. Water control structures installed in subsurface drainage systems should be managed to prevent discharge of manure and wastewater during periods of application.
- **Be aware of the location of sensitive areas, concerns of neighbors or concerns of the public**, which require special application procedures. To reduce odor problems, apply wastewater and solids containing manure in mid-morning when temperatures are warming and air is rising rather than in the afternoon or evening when air is cooling and settling. Avoid applications during periods of fog.
- **Calibrate application equipment** to insure uniform distribution and accurate application rates in accordance with guidance given in the Considerations for Manure Applications starting on page 3-7. Refer to page 3-19 for guidance on the calibration of application equipment.
- **Maintain setbacks for manure application from any surface waters.** The following table shows minimum setback requirements for manure applications based on Oregon Department of Agriculture (ODA) regulations. The ODA minimum setbacks are 35 feet from open water based if you maintain a vegetated buffer and 100 feet for a non-vegetated buffer. Setback requirements will generally increase for manures which are applied aerially (such as a traveling big gun) versus manures applied lower to the ground (such as a splash bar) due to potential for drift from wind or splashing. The management goal is to allow no manure to enter surface waters at any time.

  Typical Manure application setbacks:

Manure type	Application Equipment	Season	
		Late Fall, Winter	Spring, Summer, Early Fall
Liquid	Big gun	70 feet	35 feet
Solid	Spreader	70 feet	20 feet

Record applications, transfers or exports of nutrients (manure and fertilizer) and maintain them for at least 5 years. The CAFO Recordkeeping Calendar or the tools and forms referenced in Section 5 may be used to record this information.

UTILIZATION AREA

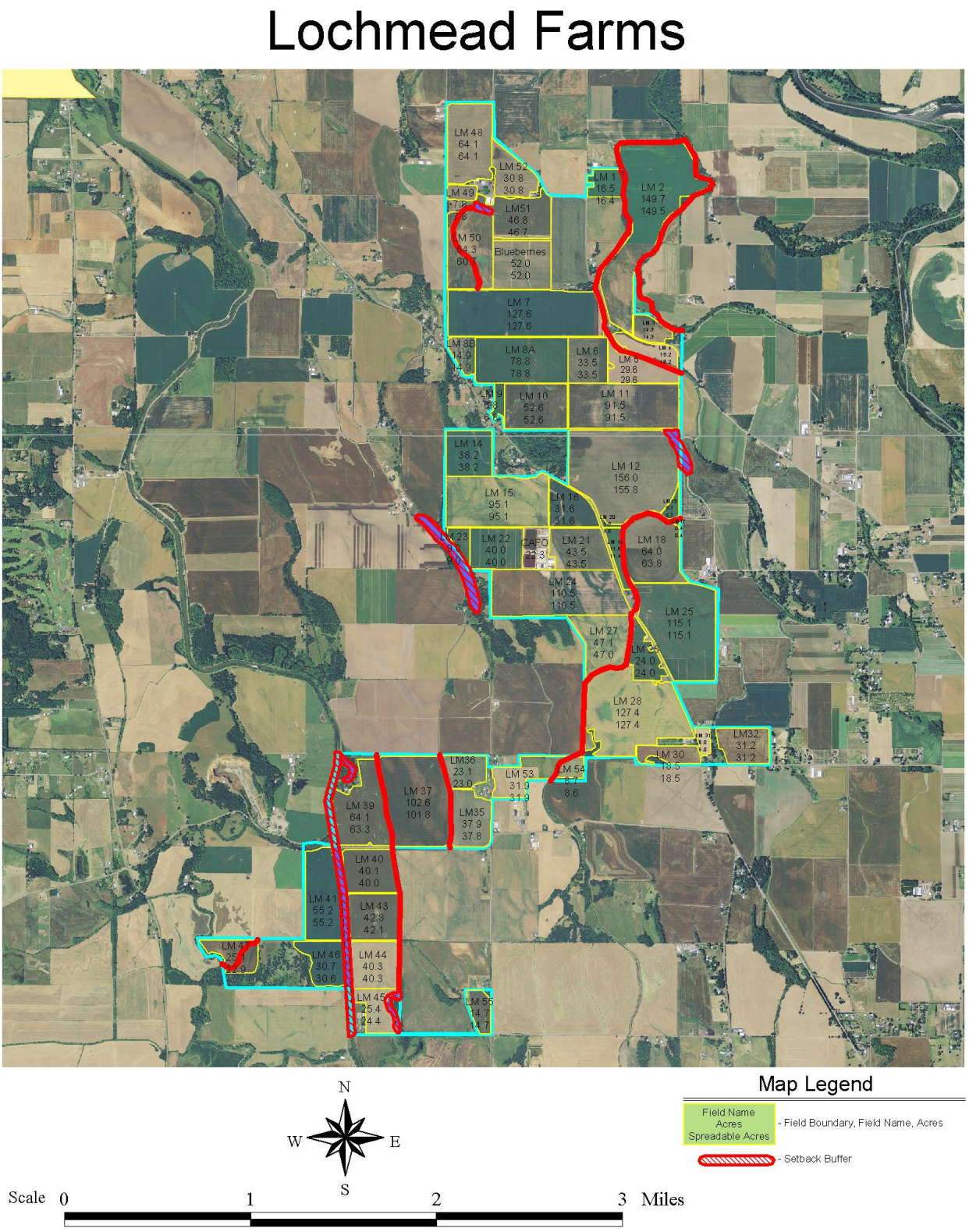
CONSIDERATIONS FOR SPRING AND SUMMER MANURE APPLICATIONS:

Apply wastewater and solids containing manure at **agronomic rates** shown on the table on page 3-23 using the following guidelines:

- Begin making manure applications once 200 heat units (T-Sum 200) have been accumulated. The average date of T-Sum 200 for Lochmead Farms is February 17th for the 30 year average from 1981-2010.
- ***Do not apply*** during rainfall events that are expected to result in saturated soils or surface runoff.
- Apply to land being prepared for crops. Till manure into soil within 3 days of application if possible or apply to actively growing crops such as grass, clover or alfalfa after cutting.
- ***Maintain the setback buffer distances*** described on page 3-6 and shown on the Setback Map on page 3-8 when making applications of liquids or solids containing manure.
- ***Record applications, transfers or exports*** of nutrients (manure and fertilizer) and maintain them for at least 5 years. The CAFO Recordkeeping Calendar or the tools and forms referenced in Section 5 may be used to record this information.

UTILIZATION AREA

SETBACK MAP(S) FOR LOCHMEAD FARMS



UTILIZATION AREA

CONSIDERATIONS FOR LATE FALL AND WINTER MANURE APPLICATIONS:

Only apply manure during this time period if the following guidelines CAN be met. Call the ODA CAFO Program at (503) 986-4700 for guidance if a manure application is needed and the following guidelines CAN NOT be met:

- Apply manure only to actively growing crops such as grass, clover or alfalfa.
- Minimize application rates by using the maximum travel rates for the application equipment.
- ***Maintain the setback buffer distances*** described in the table on page 3-6 and shown on the Setback Map on page 3-8 when making applications of liquids or solids containing manure.
- ***Do not apply*** during rainfall events that are expected to result in saturated soils or surface runoff.
- ***Do not apply*** to saturated or flooded soils. It is recommended that application(s) be limited to soils (areas) where the flooding frequency class rating is None, Very Rare or Rare.
- ***Do not apply*** to slopes greater than 5%. See the Soil Map in Section 4 for the location of soil map units with slopes greater than 5%.
- ***Applications of wastewater or solids containing manure to frozen soils should be avoided***. Do the following if an application of wastewater or solids containing manure is to be made to frozen soils:
  - Apply only enough wastewater or solids containing manure to address storage limitations until suitable soil conditions for application are available.
  - Minimize applications to 5 wet tons per acre or less of solids containing manure and 6,788 gallons (0.25 inches) per acre or less of wastewater.
  - Apply to alternating strips to reduce the risk of contaminated runoff reaching surface water sources.
  - Apply to fields of established hay, pasture or fields containing at least 90% cover and are the furthest from open water sources.
  - Do not apply wastewater or solids containing manure within 200 feet of surface water sources, drainageways, wells, or inlets to subsurface drainage systems.
  - Runoff control systems such as earthen dikes must be in place where applications will be made to fields with slopes greater than 5%.
- ***Record applications, transfers or exports*** of nutrients (manure and fertilizer) and maintain them for at least 5 years. The CAFO Recordkeeping Calendar or the tools and forms referenced in Section 5 may be used to record this information.
- ***Do not apply*** manure or commercial fertilizer to fields receiving applications unless the nutrients applied in the manure are less than the annual application of nutrients planned in the nutrient budget for the fields.

UTILIZATION AREA

HOW TO SAMPLE LIQUID MANURE

Obtain a composite following one of the procedures listed below and thoroughly mix. Using a plunger, an up-and-down action works well for mixing liquid manure in a five-gallon bucket. Fill a one-quart plastic bottle not more than three-quarters full with the composite sample. Store sample in freezer if not delivered to the lab immediately.

Procedure 1. Sampling from storage- Agitate storage facility thoroughly before sampling. Collect at least five samples from the storage facility or during loading using a five-gallon bucket. Place a sub sample of the composite sample in a one-quart plastic container. Sampling a liquid manure storage facility without proper agitation (2-4 hrs. minimum) is not recommended due to nutrient stratification, which occurs in liquid systems. If manure is sampled from a lagoon that was not properly agitated, typically the nitrogen and potassium will be more concentrated in the top liquid, while the phosphorus will be more concentrated in the bottom solids.

Procedure 2. Sampling during application- Place buckets around field to catch manure from spreader or irrigation equipment. Combine and mix samples into one composite sub sample in a one-quart plastic container.

HOW TO SAMPLE SOLID MANURE

Collect a composite sample by following one of the procedures listed below. A method for mixing a composite sample is to pile the manure and then shovel from the outside to the inside of the pile until well mixed. Fill a one-gallon plastic heavy-duty zip lock bag approximately one-half full with the composite sample, squeeze out excess air, close and seal. Store sample in freezer if not delivered to the laboratory immediately.

Procedure 1. Sampling while loading - Recommended method for sampling from a stack or bedded pack. Take at least ten samples while loading several spreader loads and combine to form one composite sample. Thoroughly mix the composite sample and take an approximately one pound sub sample using a one-gallon plastic bag. Sampling directly from a stack or bedded pack is not recommended.

Procedure 2. Sampling during spreading - Spread a tarp in field and catch the manure from one pass. Sample from several locations and create a composite sample. Thoroughly mix the composite sample together and take a one-pound sub sample using a one-gallon plastic bag.

Procedure 3. Sampling daily haul - Place a five-gallon bucket under the barn cleaner 4-5 times while loading a spreader. Thoroughly mix the composite sample together and take a one-pound sub sample using a one-gallon plastic bag. Repeat sampling 2-3 times over a period of time and test separately to determine variability.

Procedure 4. Sampling poultry in-house - Collect 8-10 samples from throughout the house to the depth the litter will be removed. Samples near feeders and waterers may not be indicative of the entire house and sub samples taken near here should be proportionate to their space occupied in the whole house. Mix the samples well in a five-gallon pail and take a one-pound sub sample, place it in a one-gallon zip lock bag.

Procedure 5. Sampling stockpiled litter - Take ten sub samples from different locations around the pile at least 18 inches below the surface. Mix in a five-gallon pail and place a one-pound composite sample in a gallon zip lock bag.

UTILIZATION AREA

Sample Identification and Delivery

Identify the sample container with information regarding the farm, animal species and date. This information should also be included on the sample information sheet along with application method, which is important in determining first year availability of nitrogen.

Keep all manure samples frozen until shipped or delivered to a laboratory. Ship early in the week (Mon.-Wed.) and avoid holidays and weekends.

UTILIZATION AREA

MANURE TESTS

Manure Nutrient Analyses

Manure Source	Dry Matter (%)	Total N	NH_4-N	Total P_2O_5	Total K_2O	Avail. P_2O_5	Avail. K_2O	Units	Analysis Source and Date
WSP #1 & WSP #2	2.3	9.4	5.4	4.3	17.9	4.3	17.9	Lb/1000Gal	Agri-Check; 2009 & 2010
Solids	24.7	5.3	0.6	2.1	3.3	2.1	3.3	Lb/Ton	Agri-Check; 2010

Manure analyses should be performed by a laboratory that meets the requirements and performance standards of the Manure Testing Laboratory Certification Program (MTLCP), http://www.mda.state.mn.us/licensing/pestfert/manurelabs.htm.

To develop a cumulative manure analysis history as a basis for nutrient allocation to the fields, manure should be analyzed annually for a minimum of three (3) consecutive years.

UTILIZATION AREA

HOW TO SAMPLE SOILS

Current soil tests must be used in the development and editing of nutrient management plans. A current soil test is one that is no older than 5 years that is used to represent the nutrient status of the entire field. Soil analysis must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP). Results of these analysis will be used to determine application rates for manure, litter, and process wastewater. Guidance for soil sampling can be found in the Pacific Northwest (PNW) Extension publication 570-E, "Monitoring Soil Nutrients Using a Management Unit Approach". Oregon State university Extension publication EC1478, "Soil Test interpretation Guide" provides guidance on how to determine soil nutrient concentrations and how to adjust soil pH to improve nutrient availability.

Field Area. A composite soil sample should represent a uniform field area. Each area should have similar crop and fertility history. Soil characteristics (color, slope, texture, drainage) should be similar. Exclude small areas within a field that are obviously different. The field area represented by a single composite sample should represent no more than 40 irrigated acres or 100 dry land acres.

Sampling Depth. Laboratory tests are calibrated to specific depths. It is vital to collect samples from appropriate depths. Sampling depth for most soils is the rooting depth in 6-inch intervals. In Oregon, as a minimum, soil samples should be collected from the 0-12" depth and from the 12-24" depth. The 0-6" surface soil samples are normally used for conventional tests of organic matter, nitrogen, phosphorus, potassium, pH and salt levels. Additionally, subsurface samples from the 6-24" depth are needed to estimate nitrogen availability for crops.

UTILIZATION AREA

SOIL TESTS

Field	Test Year	OM (%)	P Test Used	P	K	Mg	Ca	Na	Units	Soil pH	Buffer pH	CEC (meq/ 100g)	NO_3-N (ppm)	EC (mmhos/ cm)
LM 1	2013	4.5	Bray P1	59	183	506	2,563	46	ppm	5.6	6.1	23.0	8.0	
LM 2	2013	4.0	Bray P1	35	114	553	2,289	55	ppm	5.3	6.1	23.9	10.0	
LM 3	2013	3.6	Bray P1	63	142	398	1,802	42	ppm	5.3	6.1	18.6	4.0	
LM 4	2008	2.5	Bray P1	120	203	338	2,084	26	ppm	5.5	7.0	15.9	18.0	
LM 5	2008	4.3	Bray P1	159	278	325	2,415	14	ppm	5.6	6.9	18.0	5.0	
LM 6	2013	4.3	Bray P1	89	429	423	2,511	35	ppm	5.1	6.0	27.8	25.0	
LM 7	2013	3.7	Bray P1	74	218	395	2,401	45	ppm	5.4	6.1	22.4	13.0	
LM 8A	2013	4.0	Bray P1	89	355	379	2,187	34	ppm	4.9	6.0	26.9	34.0	
LM 8B	2013	4.0	Bray P1	89	355	379	2,187	34	ppm	4.9	6.0	26.9	34.0	
LM 9	2008	3.9	Bray P1	235	322	330	2,867	14	ppm	5.8	7.0	20.0	10.0	
LM 10	2013	5.0	Bray P1	135	405	402	2,031	65	ppm	5.3	6.1	21.4	26.0	
LM 11	2013	4.3	Bray P1	97	473	515	2,305	125	ppm	5.7	6.3	22.1	43.0	
LM 12	2013	4.5	Bray P1	126	642	529	2,635	37	ppm	5.5	6.3	26.1	34.0	
LM 13	2008	3.9	Bray P1	235	322	330	2,867	14	ppm	5.8	7.0	20.0	10.0	
LM 14	2013	5.9	Bray P1	26	192	508	2,835	38	ppm	5.5	6.3	26.1	5.0	
LM 15	2013	5.0	Bray P1	150	834	590	2,536	34	ppm	5.4	6.1	27.7	20.0	
LM 16	2013	3.4	Bray P1	114	561	500	2,343	30	ppm	5.0	5.9	29.4	21.0	
LM 17	2008	2.8	Bray P1	146	316	369	3,594	19	ppm	6.5	7.0	23.9	5.0	
LM 18	2013	4.9	Bray P1	116	364	435	2,469	31	ppm	4.8	5.9	32.0	39.0	
LM 19	2008	2.8	Bray P1	146	316	369	3,594	19	ppm	6.5	7.0	23.9	5.0	
LM 20	2008	2.8	Bray P1	146	316	369	3,594	19	ppm	6.5	7.0	23.9	5.0	
LM 21	2013	4.0	Bray P1	123	751	493	2,258	36	ppm	5.4	5.9	24.3	5.0	
LM 22	2008	3.9	Bray P1	235	322	330	2,867	14	ppm	5.8	7.0	20.0	10.0	
LM 23	2008	2.5	Bray P1	120	203	338	2,084	26	ppm	5.5	7.0	15.9	18.0	
LM 24	2013	5.2	Bray P1	108	621	537	2,480	43	ppm	5.1	5.9	30.0	24.0	
LM 25	2013	4.4	Bray P1	94	301	506	2,206	33	ppm	5.6	6.2	21.0	16.0	
LM 26	2008	2.5	Bray P1	120	203	338	2,084	26	ppm	5.5	7.0	15.9	18.0	
LM 27	2013	5.1	Bray P1	74	467	583	2,097	268	ppm	5.1	5.8	26.8	31.0	

UTILIZATION AREA

Field	Test Year	OM (%)	P Test Used	P	K	Mg	Ca	Na	Units	Soil pH	Buffer pH	CEC (meq/ 100g)	NO_3-N (ppm)	EC (mmhos/ cm)
LM 28	2013	5.2	Bray P1	47	247	441	2,901	24	ppm	6.0	6.3	22.2	4.0	
LM 30	2013	4.7	Bray P1	97	352	476	1,822	36	ppm	5.0	5.8	23.8	13.0	
LM 31	2013	4.8	Bray P1	122	322	293	1,350	25	ppm	4.5	5.4	24.0	11.0	
LM 32	2013	5.0	Bray P1	74	214	522	2,132	56	ppm	5.5	6.1	21.3	8.0	
LM 35	2013	3.5	Bray P1	28	111	456	2,370	40	ppm	5.0	5.7	27.2	5.0	
LM 36	2013	3.5	Bray P1	28	111	456	2,370	40	ppm	5.0	5.7	27.2	5.0	
LM 37	2013	4.9	Bray P1	18	120	454	2,570	38	ppm	5.3	6.1	24.7	3.0	
LM 39	2013	2.8	Bray P1	31	132	418	2,360	40	ppm	5.0	5.8	26.7	8.0	
LM 40	2013	6.0	Bray P1	22	157	535	2,801	47	ppm	4.9	5.8	33.9	19.0	
LM 41	2013	4.9	Bray P1	35	136	354	2,327	36	ppm	4.6	5.6	32.7	10.0	
LM 43	2013	5.4	Bray P1	23	137	500	2,675	50	ppm	4.9	5.7	32.2	8.0	
LM 44	2013	4.9	Bray P1	19	92	407	2,591	25	ppm	4.8	5.6	31.4	5.0	
LM 45	2013	5.3	Bray P1	14	140	277	1,995	25	ppm	4.4	5.6	33.4	16.0	
LM 46	2013	4.8	Bray P1	21	117	393	2,633	36	ppm	5.0	5.8	28.5	5.0	
LM 47	2013	4.5	Bray P1	25	149	312	2,407	28	ppm	5.4	6.0	21.1	4.0	
LM 48	2013	3.6	Bray P1	64	185	429	2,491	37	ppm	5.6	6.1	21.7	15.0	
LM 49	2013	4.8	Bray P1	61	287	489	3,037	43	ppm	5.2	5.9	30.7	34.0	
LM 50	2013	4.4	Bray P1	40	163	489	2,274	46	ppm	5.4	5.8	22.4	5.0	
LM 51	2013	3.9	Bray P1	51	244	526	2,678	46	ppm	6.4	6.6	20.3	4.0	
LM 52	2013	3.8	Bray P1	72	240	455	2,267	42	ppm	5.7	6.3	20.1	19.0	
LM 53	2013	4.8	Bray P1	15	99	440	2,165	37	ppm	4.7	5.7	30.0	16.0	
LM 54	2013	4.5	Bray P1	25	149	312	2,407	28	ppm	5.4	6.0	21.1	4.0	
LM 55	2013	4.5	Bray P1	25	149	312	2,407	28	ppm	5.4	6.0	21.1	4.0	
Blueberries	2013	3.9	Bray P1	51	244	526	2,678	46	ppm	6.4	6.6	20.3	4.0	

Soil test analyses should be performed by laboratories that meet the requirements and performance standards of the North American Proficiency Testing Program (NAPT) Proficiency Assessment Program (PAP); http://www.naptprogram.org/pap/.

UTILIZATION AREA

HOW TO CALIBRATE APPLICATION EQUIPMENT

Calibration of application equipment is a critical part of nutrient management. Calibration should be completed at least annually to insure manure and fertilizer will be uniformly applied. There are two basic approaches for calibrating a manure spreader – the load area and the weight area methods. The load area method is more accurate and can be used for both liquid and solid manure. The weight area method works only with solid or semi-solid manure.

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 travel 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 of liquid applied:

Inches Liquid Manure Applied via Irrigation:	Gallons per Acre:
0.20	5,431
0.30	8,146
0.40	10,862
0.50	13,577
0.75	20,366
1.00	27,154
1.25	33,943
1.50	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 1,000 gallons over a distance of 600 feet and 10 feet wide.

Formula:

Application Rate (7,260 gallons/acre) = (Gallons Applied (1,000 gal) X 43,560 sq. ft/acre) divided by (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).

UTILIZATION AREA

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.

For example:
Step 1) Collect 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.

Manure Spreader/Tanker 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 weight-area 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 middle than at the edge of the spread pattern. Overlapping can make the overall application more uniform. Calibrating application rates when overlapping is involved 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.

UTILIZATION AREA

Load-Area Method:
The load-area method is the most accurate and can be used for both liquid and soild manure. The load area method is a 3-step process:

Step 1) Determine the amount of manure in the spreader. The most accurate way to determine the amount of manure in a spreader is weighting the spreader when it is empty and again when it is full. For a reliable estimate of spreader capacity, weigh several representative loads (at least five) to determine the average gross weight. Subtract the empty spreader weight. Then, calculate the average net loaded weight.

Step 2) Determine the area of spread using the method at the right. Width measurements near the beginning and end of the spread pattern should be avoided because the spreader may not be operating at full capacity.

Step 3) Calculate the application rate. The application rate is calculated using the formula for either liquid or solid manure.

> **Formula for Solid Manure Equals Tons/Acre**
> (Average Loaded Weight (lbs) x 21.81) divided by (Distance Traveled (ft) x Width of Spread (ft))
>
> **Formula for Liquid Manure Equals Gal/Acre**
> (Tank Volume (gal) x 43,560) divided by (Distance Traveled (ft) x Width of Spread (ft))

Weight-Area Method:
The weight-area method can only be used with solid or semi-solid manure. When a scale is not available, the application rate of a box spreader can be determined by collecting manure on a tarp or piece of heavy material. The weight area method is less accurate than the load area method.

This method consists of eight steps:
Step 1) Prepare/cut three 56-inch square tarps or pieces of heavy material (this size equals 1/2,000 of an acre). The pounds of manure collected on 56 inches square equals tons applied per acre.

Step 2) Weigh one of the clean tarps and a large bucket on a platform scale. Record the weight.

Step 3) Anchor the three tarps in the field ahead of the spreader near the beginning, middle, and end of the area that will be spread with one load.

Step 4) Drive over the three tarps at a normal speed to collect a representative manure sample.

Step 5) Fold and place the first tarp into the empty bucket without spilling the manure. Weigh the bucket, tarp, and manure. Subtract the weight of the clean tarp and bucket recorded in step 2.

UTILIZATION AREA

Step 6) Repeat the process for each of the two remaining tarps.
Calculate the average weight (pounds) of the manure collected. This value equals tons of manure applied per acre.

Factor for converting pounds to tons and square feet to acres (21.8 = 43,560 sq ft per acre divided by 2,000 lbs/ton).

The factor for converting square feet to acres = 43,560 sq ft per acre.

Step 7) Determining Area of Spread.
The "area of spread" is the length and width of the ground covered with one load of manure. The area of spread is affected by speed and equipment settings. Spreaders discharge manure at varying rates depending on travel and PTO speed, gear box settings, and discharge openings. It is important to adjust the spreader so the pattern is as uniform as possible. Accurately measuring the length and width of this area is essential. To determine width, measure two adjacent spreads and divide by two to find the "effective" spread width. This accounts for overlap, which is often needed for a more uniform application. The length of spread is determined using the following three values:

1. Desired manure application rate based on soil and manure tests,
2. Width of the manure spread, and
3. Manure spreader holding capacity (weight and/or volume).

From these values, calculate the distance or lengths of spread using these formulas:

Formula: Solid Manure Equals Feet/Load
(Average Load Weight (lbs) x 21.81) divided by (Spread Width (ft) x App. Rate (tons/ac))

Formula: Liquid Manure Equals Feet/Load
(Tank Volume (gal) x 43,560) divided by (Spread Width (ft) x Desired App. Rate (gal/ac))

Step 8) Spread a load. If the distance traveled does not equal the calculated distance, adjust the speed or equipment settings.

UTILIZATION AREA

AMOUNT OF MANURE TO APPLY FOR CROPS GROWN

The timing and frequency of applications of wastewater and solids containing manure for utilization by crops shown in the table below are based on information provided in Oregon State University Extension publications listed in Section 5.

The formulas for determining the total nutrient application rate per unit yield for each crop shown in the table below are as follows:

Total N to apply in pounds = N in pounds per yield unit from the table for the crop grown X percent (%) dry matter (DM) of harvested crop/100 X planned or measured yield per yield unit

Total P_2O_5 to apply in pounds = P in pounds per yield unit from the table for the crop grown X 2.291 P_2O_5/P X percent (%) dry matter (DM) of harvested crop/100 X planned or measured yield per yield unit

Total K_2O to apply in pounds = K in pounds per yield unit from the table for the crop grown X 1.205 K_2O/K X percent (%) dry matter (DM) of harvested crop/100 X planned or measured yield per yield unit

The following table shows the crops that may be grown on this farm:

				Nutrient Removal (lb/yield unit)		
FRUIT OR VEGETABLES	**Yield Unit**	**lb/Unit**	**% DM**	**N**	**P**	**K**
Beans, dry edible	cwt	100	100	3.13	0.45	0.85
Caneberries	ton	2000	100	11.43	7.42	11.43
Corn, Sweet	ton	2000	100	17.80	4.8	11.6
Mixed Vegetables & Fruit	ton	2000	100	8.33	2.08	10.20
Onions	cwt	100	100	0.30	0.06	0..22
Orchard, Fruit	ton	2000	100	13.00	2.00	16.00
Pea, edible	ton	2000	100	73.60	8.00	18.00
Potatoes	ton	2000	100	6.60	1.20	10.33

UTILIZATION AREA

				Nutrient Removal (lb/yield unit)		
GRAIN, SEED OR OIL CROPS	**Yield Unit**	**lb/Unit**	**% DM**	**N**	**P**	**K**
Barley	bushels	48	100	0.87	0.16	0.21
Beets, sugar	ton	2000	100	4.00	0.60	2.78
Canola	ton	2000	100	70.00	12.00	18.00
Corn, grain shelled	bushels	56	100	0.90	0.16	0.22
Crimson Clover seed	lb	1	100	0.05	0.01	0.02
Fescue Seed, Straw Removed	cwt	100	100	10.03	1.08	8.33
Fescue, seed (Fine or Tall)	lb	1	100	0.02	0.00	0.00
Grass Seed	cwt	100	100	1.60	0.20	0.40
Grass Seed, Straw Removed	ton	2000	100	33.90	5.50	34.40
Oats, grain	bushels	32	100	0.62	0.11	0.16
Orchardgrass seed	lb	1	100	0.016	0.002	0.004
Pumpkins	ton	2000	100	4.00	1.40	6.60
Red Clover seed	lb	1	100	0.05	0.01	0.02
Ryegrass Seed	cwt	100	100	1.60	0.20	0.40
Ryegrass, Perennial Seed	lb	1	100	0.02	0.002	0.004
Wheat, Soft White for grain	bushels	60	100	1.00	0.24	0.21
Wheat, Soft White Straw Removed	ton	2000	100	43.40	8.90	20.90
Wheat, Hard Red for grain	bushels	60	100	1.60	0.37	0.31
Wheat, Soft White Straw Removed	ton	2000	100	83.40	17.10	37.10

UTILIZATION AREA

HAY AND PASTURE CROPS	Yield Unit	lb/Unit	% DM	Nutrient Removal (lb/yield unit) N	P	K
Alfalfa, Hay	ton	2000	100	64.00	8.00	42.00
Alta Fescue Hay/Pasture	ton	2000	100	33.00	6.90	37.60
Grass Legume Hay/Pasture	ton	2000	100	33.90	5.50	34.40
Meadow Fescue Hay/Pasture	ton	2000	100	41.60	8.80	47.40
Oats Hay/Pasture	ton	2000	100	60.00	10.20	14.80
Orchardgrass Hay/Pasture	ton	2000	100	53.20	8.60	18.60
Perennial Hay/Pasture (Low Intensity)	ton	2000	100	32.00	6.00	38.00
Perennial Hay/Pasture (Low-Med Intensity)	ton	2000	100	38.00	6.00	38.00
Perennial Hay/Pasture (Medium Intensity)	ton	2000	100	48.00	7.00	38.00
Perennial Hay/Pasture (Med- High Intensity)	ton	2000	100	58.00	8.00	40.00
Perennial Hay/Pasture (High Intensity)	ton	2000	100	64.00	8.00	40.00
Ryegrass Hay	ton	2000	100	33.40	5.40	28.40
Ryegrass, Perennial Pasture	ton	2000	100	58.00	8.00	48.00
Tall Fescue Hay/Pasture	ton	2000	100	39.40	4.00	40.00

SILAGE AND HAYLAGE CROPS	Yield Unit	lb/Unit	% DM	Nutrient Removal (lb/yield unit) N	P	K
Corn for Silage	ton	2000	100	25.00	4.00	20.00
Crimson Clover forage	ton	2000	100	40.00	4.41	32.98
Field Pea, Forage	ton	2000	100	73.60	8.00	18.00
Oat haylage	ton	2000	100	60.00	10.20	14.80
Oats & Peas/ Green Beans	ton	2000	100	32.03	5.58	18.65
Red Clover forage	ton	2000	100	40.00	4.41	32.98
Ryegrass Haylage	ton	2000	100	50.00	8.00	42.67
Sorghum-Sudan Haylage	ton	2000	100	54.33	6.33	58.00
Triticale Haylage	ton	2000	100	49.00	6.80	11.40
Wheatgrass Hay/Pasture	ton	2000	100	28.40	5.40	53.60

UTILIZATION AREA

				Nutrient Removal (lb/yield unit)		
OTHER CROPS	**Yield Unit**	**lb/Unit**	**% DM**	**N**	**P**	**K**
Hops, Cones	bale	200	100	9.00	0.96	5.00
Natural Area (Trees and Grass)	ton	2000	100	10.52	1.56	9.20
Nursery Stock	ton	2000	100	8.33	2.08	10.20

UTILIZATION AREA

SOLID MANURE APPLICATION CHART

MANURE ANALYSIS
(As received lb/ton)

Total N	P_2O_5	K_2O
5.30	2.10	3.30

Test Date: 04/25/11
Source: Solids

Manure Nutrient Content

Manure Applied	Thickness to apply	Total N	P_2O_5	K_2O
(Tons/Ac)	(inches/Ac)	(lb/A)	(lb/A)	(lb/A)
1.00	0.013	5	2	3
1.50	0.020	8	3	5
2.00	0.026	11	4	7
2.50	0.033	13	5	8
3.00	0.039	16	6	10
3.50	0.046	19	7	12
4.00	0.052	21	8	13
4.50	0.059	24	9	15
5.00	0.066	27	11	17
5.50	0.072	29	12	18
6.00	0.079	32	13	20
6.50	0.085	34	14	21
7.00	0.092	37	15	23
7.50	0.098	40	16	25
8.00	0.105	42	17	26
8.50	0.111	45	18	28
9.00	0.118	48	19	30
9.50	0.124	50	20	31
10.00	0.131	53	21	33
10.50	0.138	56	22	35

LIQUID MANURE APPLICATION CHART

MANURE ANALYSIS
(As received lb/1000 gal)

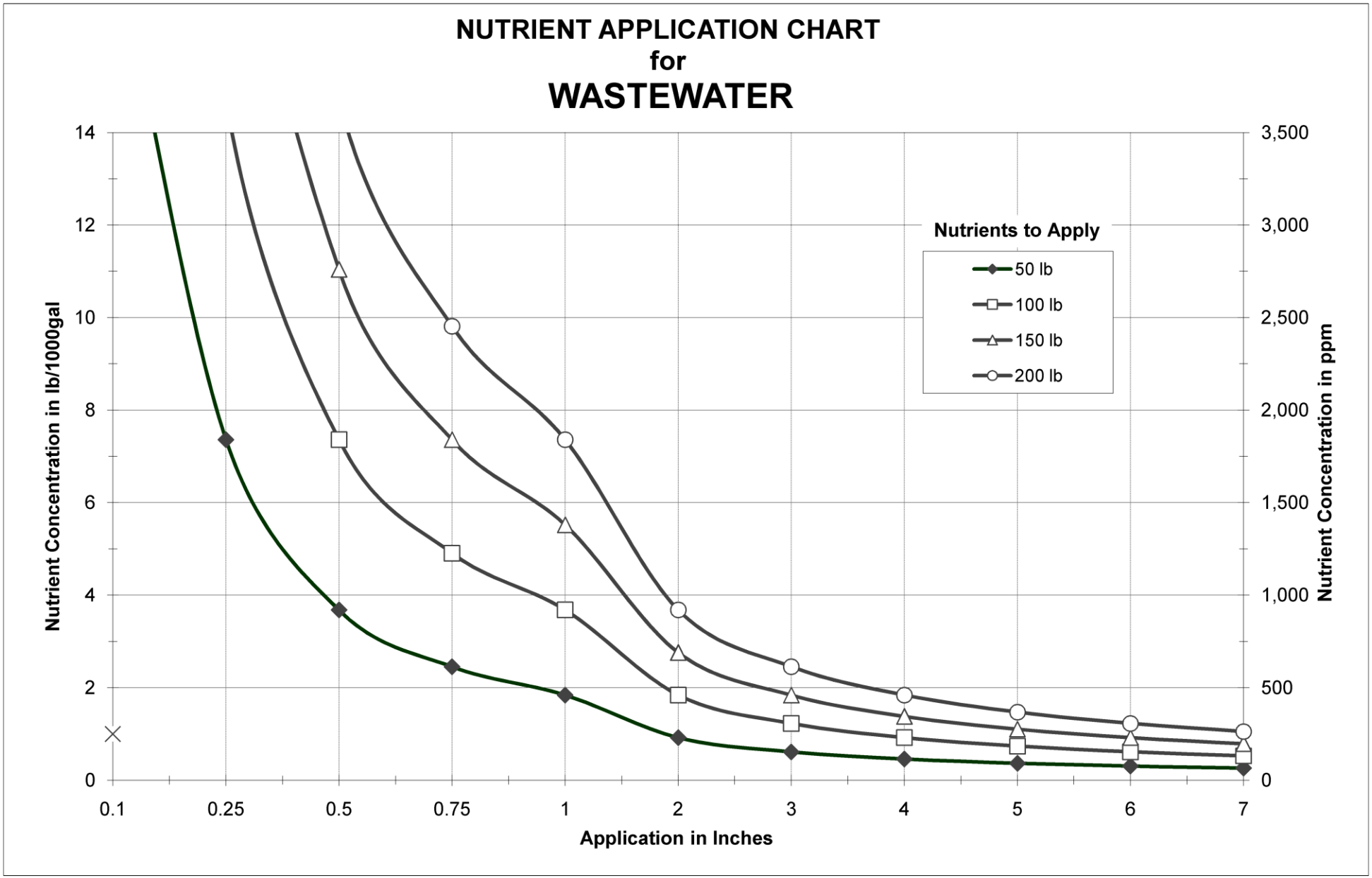
Total N	P_2O_5	K_2O
9.40	4.30	17.90

Test Date: 04/25/11
Source: WSP1 & WSP2

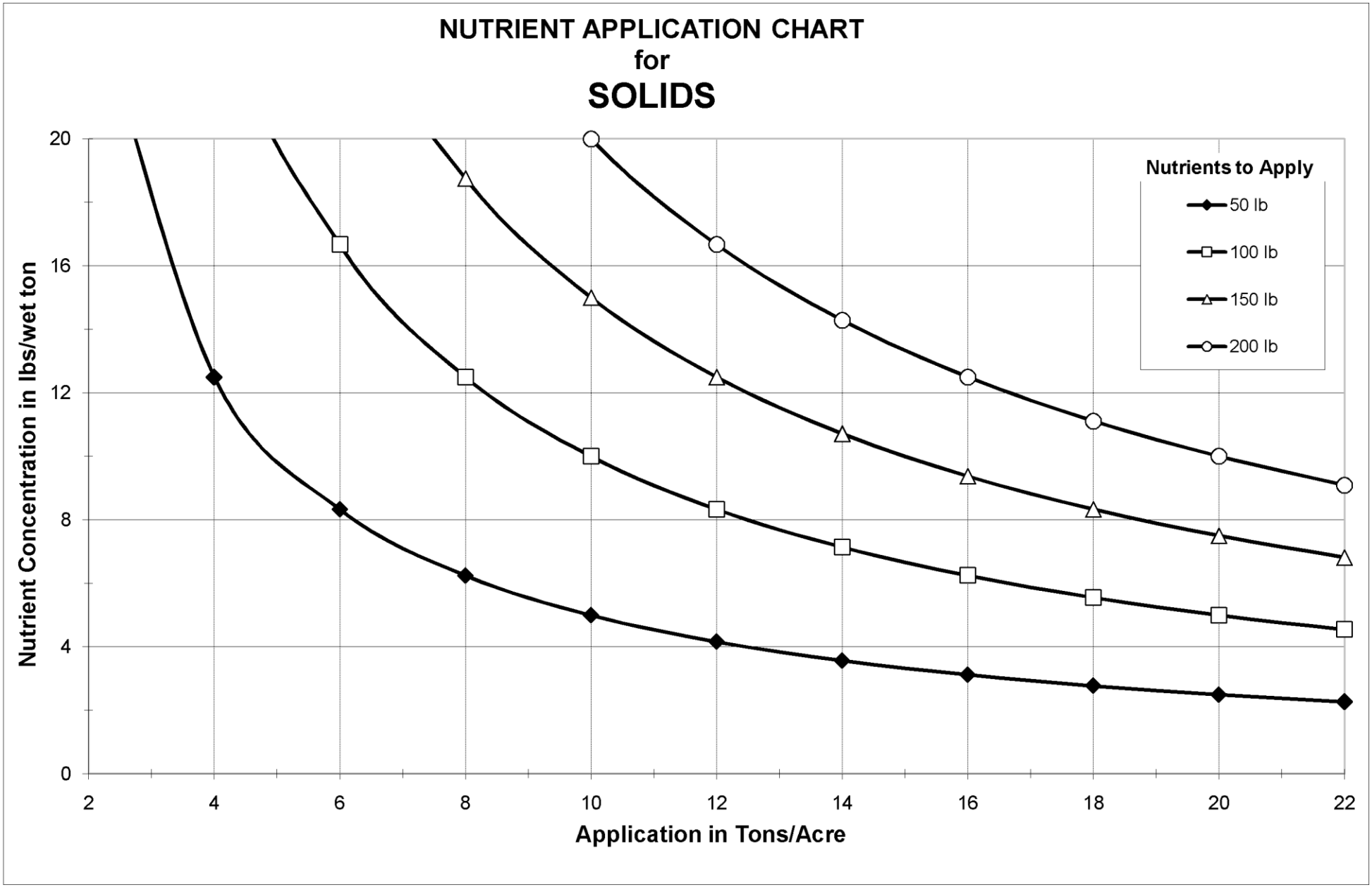
Manure Nutrient Content

Manure Applied	Thickness to apply	Total N	P_2O_5	K_2O
(Gallons/Ac)	(inches/Ac)	(lb/A)	(lb/A)	(lb/A)
2,715	0.10	26	12	49
5,431	0.20	51	23	97
8,146	0.30	77	35	146
10,862	0.40	102	47	194
13,577	0.50	128	58	243
16,292	0.60	153	70	292
19,008	0.70	179	82	340
21,723	0.80	204	93	389
24,439	0.90	230	105	437
27,154	**1.00**	**255**	**117**	**486**
29,869	1.10	281	128	535
32,585	1.20	306	140	583
35,300	1.30	332	152	632
38,016	1.40	357	163	680
40,731	1.50	383	175	729
43,446	1.60	408	187	778
46,162	1.70	434	198	826
48,877	1.80	459	210	875
51,593	1.90	485	222	924
54,308	2.00	510	234	972

UTILIZATION AREA



UTILIZATION AREA



UTILIZATION AREA

IRRIGATION WATER MANAGEMENT

The application of Irrigation Water Management to the irrigated fields as shown on the Field Map will manage soil moisture to promote the desired crop response, optimize the available water supplies, minimize irrigation induced erosion, decrease non-point source pollution of surface and groundwater sources, manage salts in the crop root zone and manage the crop micro climate. Irrigation water is supplied by wells and surface water sources using pumps through an underground pvc pipelines to sprinkler irrigation systems. The average amount of irrigation water to be applied per application and total annual amount needed for irrigated crops with guidance on when and how much irrigation water to apply can be found starting on page 3-34.

Permits: Under Oregon law all water is publicly owned and anyone planning to store or divert surface or groundwater for the purpose of irrigation must obtain a permit or water right from the Oregon Water Resources Department. These permits or water rights must be obtained prior to the use of the water. It is the responsibility of the Farmer to file for the necessary permits or water rights.

Irrigation Water Flows, Volumes, and Relationships

Equation 1-

$$Q \times T = D \times A$$

where:

Q = flow rate (acre-in/hr or cfs)
T = time (hr)
D = gross depth applied (in)
A = area (acres)

Equation 2-

$$Q = \frac{453 \times A \times D}{F \times H}$$

where:

Q = flow rate (gpm)
A = area (acres)
D = gross application depth (in)
F = irrigation period (days)
H = hours of operation per day

Water Flow Rates:

1 cubic foot per second (cfs)
= 448.8 gallons per minute
1 cfs for 1 hour = 0.99 acre-inch
1 cfs for 24 hr = 1.98 acre-ft
1,000 gpm = 2.23 cfs
1,000 gpm for 24 hr = 4.42 ac-ft
1 gpm/acre = 0.053 ac-in/ac/day
1 cfs = 40 miner's inches in OR, No CA
1 cfs = 50 miner's inches in ID, WA
1 miner's inch = 11.22 gpm in OR
1 miner's inch = 9 gpm in ID, WA
1 cfs = 28.32 liters/sec
1 cubic meter/sec = 35.3 cfs
1 liter/sec = 15.85 gpm

Q x **T = D** x **A** *where:*

Q = cfs, T = hr; D = inches depth; A = acres

Gpm for 5 ft/s velocity in PVC pipe:

6"	8"	10"	12"	14"
480	800	1250	1750	2150

NRCS *Natural Resources Conservation Service*

Water Volumes & Weights:

1 cubic foot = 7.48 gallons
= 62.4 lb = 28.3 liters
1 acre-foot = 43,560 cubic feet
(1 acre covered 1 ft deep)
12 acre-in = 1 acre-ft = 325,829 gal
1 million gallons = 3.07 acre-ft
1 acre-ft = 1,234 cubic meters
1 cu meter = 1,000 liters = 35.3 cu ft

Pressure and Pressure Head:

1 psi = 2.31 ft of pressure head
1 atmosphere (sea level)
= 14.7 psi = 33.9 ft of head

Lengths and Areas:

1 mile = 5,280 ft = 1.61 km
1 meter = 3.28 ft = 39.37 inches
1 acre = 43,560 square ft
1 hectare = 2.47 acres

Pump Power Requirement

$$Horsepower = \frac{Pump\ Head\ in\ ft \times gpm}{39.6 \times \%\ Pump\ Efficiency}$$

UTILIZATION AREA

SOILS-

Based on the Natural Resources Conservation Service National Engineering Handbook, Part 652, National Irrigation Guide, the irrigated soils on this farm have an average water holding capacity of 0.20 inches per inch of soil depth and a soil intake rate of 0.30 inches per hour.

CROPS-

CROP	MATURE ROOT DEPTH (INCHES)	MAXIMUM ALLOWED DEPLETION	CRITICAL PERIOD
Blueberries	18	50%	July
Corn Silage	48	50%	July
Grass Seed	36	50%	July
Peppermint	24	35%	July
Small Grains	48	50%	July

Above data are from EM8713, *Western Oregon Irrigation Guides*, June 1998, OSU: Corvallis, OR and NRCS *Irrigation Guide (National Engineering Handbook, Part 652)*.

IRRIGATION WATER SUPPLY-

Description of Oregon Water Right:	Certificates 19444, 19465, 37988, 38127, 38128, 38129, 38130, 38133, 38134, 38135, 46119, 49568, 49572, 53634, 53635, 53636, 61764, 61765, 83385, 83386, 83387, 83388, 83389
Description of Irrigation Water Supply (Well, Stream, Irrigation District, etc.):	Wells and Surface Water Sources
Supply Flowrate (gpm or cfs):	122 cfs
Annual Volume Available (Acre-ft.):	1,954 AF
Water Delivery Schedule:	On Demand
Method(s) of Water Measurement:	Unknown

IRRIGATION SYSTEM-

System	System Capacity (gpm)	Nozzle Size (in)	Pressure (psi)	Spacing (ft)	Application Rate (in/hr)	System Efficiency (%)
Side Roll (Wheel Line) Sprinkler	231	11/64 and 3/16	50 to 60	60	0.26 to 0.3	75
Traveling Big Gun Sprinkler	300	1.1	80 to 90	180 to 240	0.4 to 0.5	65
Center Pivot Sprinkler	800	1/4	50 to 60	NA	0.7 to 0.8	80

UTILIZATION AREA

Irrigation Water Management Worksheet						
Crop Name:	**Blueberries**					
Managed Rooting Depth (inches)**:**	**18**					
Management Allowed Depletion, MAD:	**50%**					
Irrigated Acres:	**101.9**					
Soil Name:	**Malabon**					
Soil Depth (inches)**:**	**60**					
Available Water Capacity (in/in)**:**	**0.20**					
Soil Intake Rate (in/hr) **:**	**0.30**					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	**Month**					
	April	**May**	**June**	**July**	**August**	**Sept**
Total Plant Available Water Capacity (in)**:** Soil or Root Depth * Available Water Capacity	3.6	3.6	3.6	3.6	3.6	3.6
Net Irrigation Application (in)**:** Total Plant Available Water Capacity * MAD	1.8	1.8	1.8	1.8	1.8	1.8
Irrigation System Application Rate (in/hr)**:** Determined based on the type of Irrigation System	0.30	0.30	0.30	0.30	0.30	0.30
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in)**:** (From OSU Extension Miscellaneous Pub 8530, 1992)	2.70	4.34	6.60	7.75	7.13	5.40
Average Daily Crop Water Use (in/day)**:**	0.09	0.14	0.22	0.25	0.23	0.18
Irrigation Frequency (days)**:** Net Irrigation Application / Daily Crop Water Use	20	13	8	7	8	10
Irrigation System Set Time (hours)**:**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Actual Net Irrigation Application (in)**:** Gross Application * System Application Efficiency	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**
Actual Irrigation Frequency (days)**:** Actual Net Irrigation Application / Daily Crop Water Use	**18**	**11**	**7**	**6**	**7**	**9**
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%)**:** Water Required / Water Applied	70%	70%	70%	70%	70%	70%
Gross Irrigation Application (in)**:** System Application Rate * System Set Time	2.25	2.25	2.25	2.25	2.25	2.25
Volume of Water per Irrigation (acre-in)**:** Gross Irrigation Application * Irrigated Acres	229	229	229	229	229	229
Irrigation System Operation (hours/day)**:**	18	18	18	18	18	18
Required System Flow Rate (gpm)**:** (Equation 2)	**330**	**513**	**806**	**916**	**843**	**659**
Compare **Required** system flow rate with **Measured** flow noted on **Irrigation Application Record**						

UTILIZATION AREA

Irrigation Water Management Worksheet						
Crop Name:	**Corn Silage**					
Managed Rooting Depth (inches):	**48**					
Management Allowed Depletion, MAD:	**50%**					
Irrigated Acres:	**610.3**					
Soil Name:	**Conser, Malabon**					
Soil Depth (inches):	**60**					
Available Water Capacity (in/in):	**0.20**					
Soil Intake Rate (in/hr) :	**0.30**					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	**Month**					
	April	**May**	**June**	**July**	**August**	**Sept**
Total Plant Available Water Capacity (in): Soil or Root Depth * Available Water Capacity	9.6	9.6	9.6	9.6	9.6	9.6
Net Irrigation Application (in): Total Plant Available Water Capacity * MAD	4.8	4.8	4.8	4.8	4.8	4.8
Irrigation System Application Rate (in/hr): Determined based on the type of Irrigation System	0.30	0.30	0.30	0.30	0.30	0.30
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in): (From OSU Extension Miscellaneous Pub 8530, 1992)	0.00	0.47	3.62	7.13	5.83	1.06
Average Daily Crop Water Use (in/day):	0.00	0.02	0.12	0.23	0.19	0.04
Irrigation Frequency (days): Net Irrigation Application / Daily Crop Water Use	30	31	30	21	26	30
Irrigation System Set Time (hours):	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Actual Net Irrigation Application (in): Gross Application * System Application Efficiency	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**
Actual Irrigation Frequency (days): Actual Net Irrigation Application / Daily Crop Water Use	**30**	**31**	**13**	**7**	**8**	**30**
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%): Water Required / Water Applied	70%	70%	70%	70%	70%	70%
Gross Irrigation Application (in): System Application Rate * System Set Time	2.25	2.25	2.25	2.25	2.25	2.25
Volume of Water per Irrigation (acre-in): Gross Irrigation Application * Irrigated Acres	1373	1373	1373	1373	1373	1373
Irrigation System Operation (hours/day):	16	16	16	16	16	16
Required System Flow Rate (gpm): (Equation 2)	**1,296**	**1,254**	**2,979**	**5,677**	**4,642**	**1,296**
Compare **Required** system flow rate with **Measured** flow noted on **Irrigation Application Record**						

UTILIZATION AREA

Irrigation Water Management Worksheet						
Crop Name:	**Grass Seed**					
Managed Rooting Depth (inches)**:**	**30**					
Management Allowed Depletion, MAD:	**50%**					
Irrigated Acres:	**840.1**					
Soil Name:	**Camas, Chehalis, Malabon**					
Soil Depth (inches)**:**	**60**					
Available Water Capacity (in/in)**:**	**0.20**					
Soil Intake Rate (in/hr) **:**	**0.30**					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	**Month**					
	April	**May**	**June**	**July**	**August**	**Sept**
Total Plant Available Water Capacity (in)**:** Soil or Root Depth * Available Water Capacity	6.0	6.0	6.0	6.0	6.0	6.0
Net Irrigation Application (in)**:** Total Plant Available Water Capacity * MAD	3.0	3.0	3.0	3.0	3.0	3.0
Irrigation System Application Rate (in/hr)**:** Determined based on the type of Irrigation System	0.30	0.30	0.30	0.30	0.30	0.30
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in)**:** (From OSU Extension Miscellaneous Pub 8530, 1992)	1.73	3.62	5.24	0.09	5.31	2.09
Average Daily Crop Water Use (in/day)**:**	0.06	0.12	0.17	0.00	0.17	0.07
Irrigation Frequency (days)**:** Net Irrigation Application / Daily Crop Water Use	30	26	17	31	18	30
Irrigation System Set Time (hours)**:**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Actual Net Irrigation Application (in)**:** Gross Application * System Application Efficiency	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**
Actual Irrigation Frequency (days)**:** Actual Net Irrigation Application / Daily Crop Water Use	**27**	**13**	**9**	**31**	**9**	**23**
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%)**:** Water Required / Water Applied	70%	70%	70%	70%	70%	70%
Gross Irrigation Application (in)**:** System Application Rate * System Set Time	2.25	2.25	2.25	2.25	2.25	2.25
Volume of Water per Irrigation (acre-in)**:** Gross Irrigation Application * Irrigated Acres	1890	1890	1890	1890	1890	1890
Irrigation System Operation (hours/day)**:**	16	16	16	16	16	16
Required System Flow Rate (gpm)**:** (Equation 2)	**1,959**	**3,968**	**5,935**	**1,726**	**5,820**	**2,367**
Compare **Required** system flow rate with **Measured** flow noted on **Irrigation Application Record**						

UTILIZATION AREA

Irrigation Water Management Worksheet						
Crop Name:	**Peppermint**					
Managed Rooting Depth (inches)**:**	**24**					
Management Allowed Depletion, MAD:	**50%**					
Irrigated Acres:	**292.3**					
Soil Name:	**Coberg, Conser, Malabon**					
Soil Depth (inches)**:**	**60**					
Available Water Capacity (in/in)**:**	**0.20**					
Soil Intake Rate (in/hr) **:**	**0.30**					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	**Month**					
	April	**May**	**June**	**July**	**August**	**Sept**
Total Plant Available Water Capacity (in)**:** Soil or Root Depth * Available Water Capacity	4.8	4.8	4.8	4.8	4.8	4.8
Net Irrigation Application (in)**:** Total Plant Available Water Capacity * MAD	2.4	2.4	2.4	2.4	2.4	2.4
Irrigation System Application Rate (in/hr)**:** Determined based on the type of Irrigation System	0.30	0.30	0.30	0.30	0.30	0.30
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in)**:** (From OSU Extension Miscellaneous Pub 8530, 1992)	0.67	3.50	5.31	4.96	0.00	0.00
Average Daily Crop Water Use (in/day)**:**	0.02	0.11	0.18	0.16	0.00	0.00
Irrigation Frequency (days)**:** Net Irrigation Application / Daily Crop Water Use	30	21	14	15	31	30
Irrigation System Set Time (hours)**:**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Actual Net Irrigation Application (in)**:** Gross Application * System Application Efficiency	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**
Actual Irrigation Frequency (days)**:** Actual Net Irrigation Application / Daily Crop Water Use	**30**	**14**	**9**	**10**	**31**	**30**
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%)**:** Water Required / Water Applied	70%	70%	70%	70%	70%	70%
Gross Irrigation Application (in)**:** System Application Rate * System Set Time	2.25	2.25	2.25	2.25	2.25	2.25
Volume of Water per Irrigation (acre-in)**:** Gross Irrigation Application * Irrigated Acres	658	658	658	658	658	658
Irrigation System Operation (hours/day)**:**	16	16	16	16	16	16
Required System Flow Rate (gpm)**:** (Equation 2)	**621**	**1,335**	**2,093**	**1,892**	**601**	**621**
Compare **Required** system flow rate with **Measured** flow noted on **Irrigation Application Record**						

UTILIZATION AREA

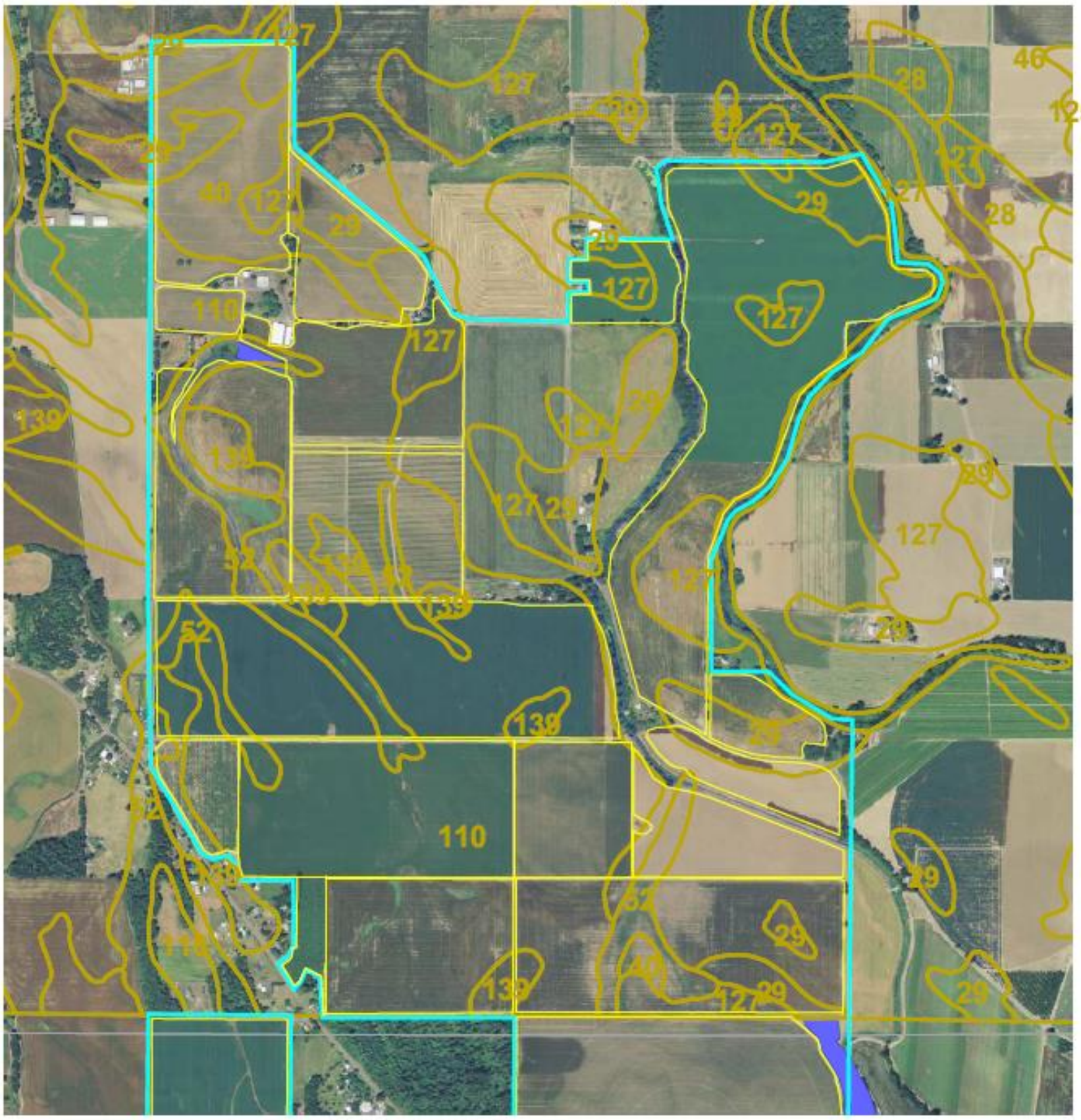
Irrigation Water Management Worksheet						
Crop Name:	**Small Grains**					
Managed Rooting Depth (inches)**:**	**48**					
Management Allowed Depletion, MAD:	**50%**					
Irrigated Acres:	**174.3**					
Soil Name:	**Conser, Malabon**					
Soil Depth (inches)**:**	**60**					
Available Water Capacity (in/in)**:**	**0.20**					
Soil Intake Rate (in/hr) **:**	**0.30**					
IRRIGATION REQUIREMENT HOW MUCH water to apply?	**Month**					
	April	**May**	**June**	**July**	**August**	**Sept**
Total Plant Available Water Capacity (in)**:** Soil or Root Depth * Available Water Capacity	9.6	9.6	9.6	9.6	9.6	9.6
Net Irrigation Application (in)**:** Total Plant Available Water Capacity * MAD	4.8	4.8	4.8	4.8	4.8	4.8
Irrigation System Application Rate (in/hr)**:** Determined based on the type of Irrigation System	0.30	0.30	0.30	0.30	0.30	0.30
IRRIGATION TIMING WHEN to apply water?						
Net Irrigation Water Requirement (in)**:** (From OSU Extension Miscellaneous Pub 8530, 1992)	0.79	2.99	5.24	6.22	0.63	0.00
Average Daily Crop Water Use (in/day)**:**	0.03	0.10	0.17	0.20	0.02	0.00
Irrigation Frequency (days)**:** Net Irrigation Application / Daily Crop Water Use	30	31	27	24	31	30
Irrigation System Set Time (hours)**:**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Actual Net Irrigation Application (in)**:** Gross Application * System Application Efficiency	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**	**1.58**
Actual Irrigation Frequency (days)**:** Actual Net Irrigation Application / Daily Crop Water Use	**30**	**16**	**9**	**8**	**31**	**30**
IRRIGATION SYSTEM CAPACITY						
System Application Efficiency (%)**:** Water Required / Water Applied	70%	70%	70%	70%	70%	70%
Gross Irrigation Application (in)**:** System Application Rate * System Set Time	2.25	2.25	2.25	2.25	2.25	2.25
Volume of Water per Irrigation (acre-in)**:** Gross Irrigation Application * Irrigated Acres	392	392	392	392	392	392
Irrigation System Operation (hours/day)**:**	16	16	16	16	16	16
Required System Flow Rate (gpm)**:** (Equation 2)	**370**	**680**	**1,231**	**1,415**	**358**	**370**
Compare **Required** system flow rate with **Measured** flow noted on **Irrigation Application Record**						

SOIL AND RISK ASSESSMENT

SOIL MAP(S)

Lochmead Farms

North Soil Map



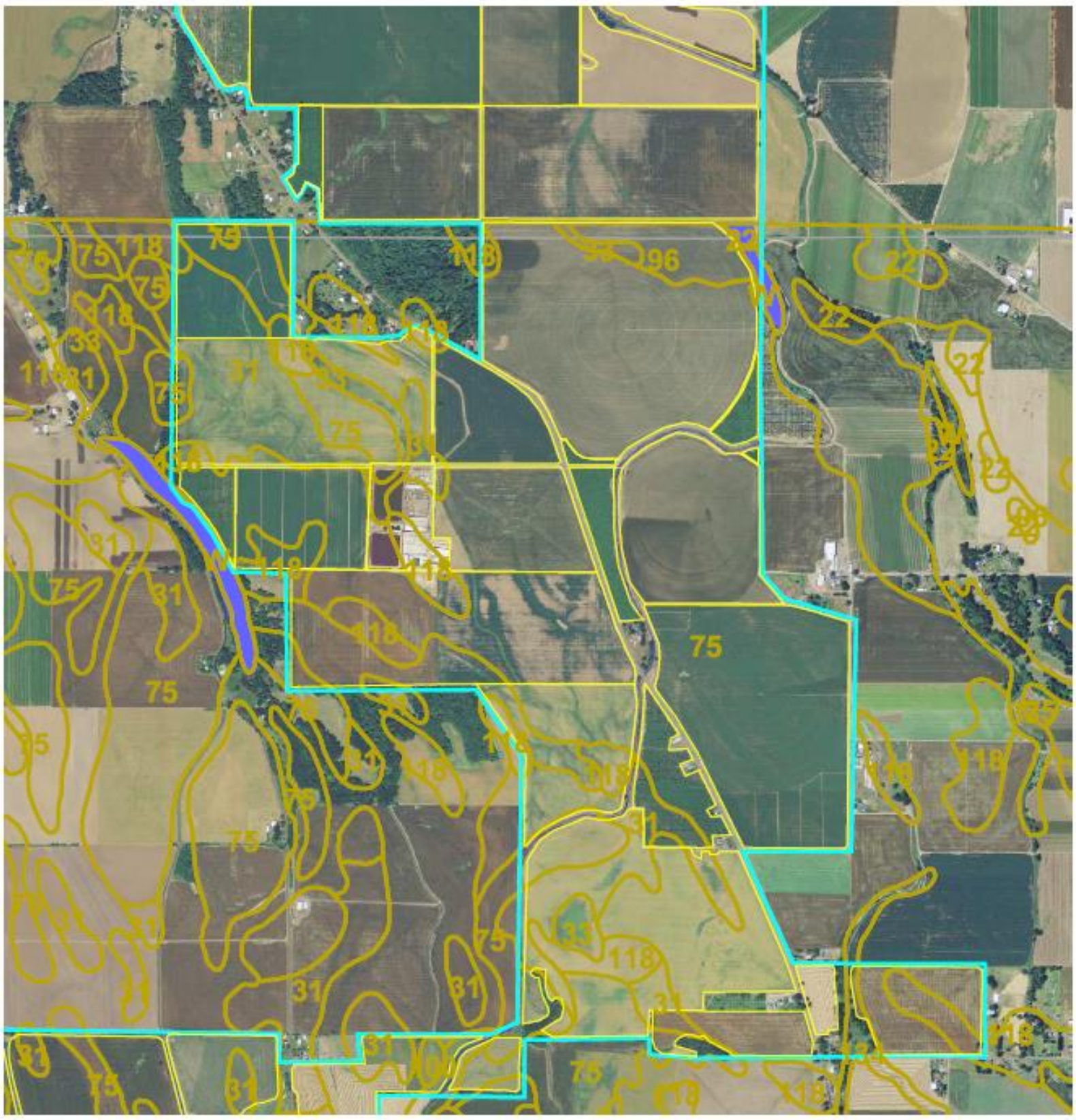
Soil Map Units

20- Camas gravelly sandy loam, relict bar, 0 to 3 percent slopes
40- Chehalis silty clay loam, 0 to 3 percent slopes
52- Conser silty clay loam, 0 to 3 percent slopes
66- Fluvents-Fluvaquents complex, 0 to 2 percent slopes
110- Malabon silty clay loam, 0 to 3 percent slopes
127- Newberg loam, 0 to 3 percent slopes
139- Salem gravelly silt loam, 0 to 3 percent slopes

SOIL AND RISK ASSESSMENT

Lochmead Farms

Middle Soil Map



Soil Map Units

22- Camas gravelly sandy loam, occasionally flooded
31- Coburg silty clay loam
33- Conser silty clay loam
75- Malabon silt clay loam
96- Newberg loam
118- Salem gravelly loam
134- Wapato silty clay loam

SOIL AND RISK ASSESSMENT

Lochmead Farms

South Field Soils Map

Soil Map Units

8- Bashaw clay
22- Camas gravelly sandy loam,occasionally flooded
26- Chehalis silty clay loam, occasionally flooded
29- Cloquato silt loam
31- Coburg silty clay loam
33- Conser silty clay loam
75- Malabon silty clay loam
78- McAlpin silty clay loam
79- McBee silty clay loam
96- Newberg loam
100- Oxley gravelly silt loam
118- Salem gravelly silt loam
130- Waldo silty clay loam
134- Wapato silty clay loam
W- Water

N
W E
S

Scale 0 1500 3000 4500 Feet

SOIL AND RISK ASSESSMENT

SOIL REPORTS

Map Unit Description (Brief, Generated)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Benton County, Oregon

Map Unit: 29—Camas gravelly sandy loam, relict bar, 0 to 3 percent slopes

Component: Camas, rarely flooded (90%)

The Camas, rare flooding component makes up 80 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of sandy and gravelly alluvium derived from igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Pilchuck (4%)

Generated brief soil descriptions are created for major components. The Pilchuck soil is a minor component.

Component: Newberg (4%)

Generated brief soil descriptions are created for major components. The Newberg soil is a minor component.

Component: Wapato (2%)

Generated brief soil descriptions are created for major components. The Wapato soil is a minor component.

Map Unit: 40—Chehalis silty clay loam, 0 to 3 percent slopes

Component: Chehalis (91%)

The Chehalis component makes up 86 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of silty and loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is moderate. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: McBee (3%)

Generated brief soil descriptions are created for major components. The McBee soil is a minor component.

Component: Camas (2%)

Generated brief soil descriptions are created for major components. The Camas soil is a minor component.

Component: Wapato (2%)

Generated brief soil descriptions are created for major components. The Wapato soil is a minor component.

Component: Newberg (2%)

Generated brief soil descriptions are created for major components. The Newberg soil is a minor component.

SOIL AND RISK ASSESSMENT

Map Unit: 52—Conser silty clay loam, 0 to 3 percent slopes

Component: Conser (86%)

The Conser component makes up 86 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces, valleys. The parent material consists of silty and clayey alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is frequently ponded. A seasonal zone of water saturation is at
0 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Component: Coburg (5%)

Generated brief soil descriptions are created for major components. The Coburg soil is a minor component.

Component: Awbrig (4%)

Generated brief soil descriptions are created for major components. The Awbrig soil is a minor component.

Component: Courtney (3%)

Generated brief soil descriptions are created for major components. The Courtney soil is a minor component.

Component: Clackamas (2%)

Generated brief soil descriptions are created for major components. The
Clackamas soil is a minor component.

Map Unit: 66—Fluvents-Fluvaquents complex, 0 to 2 percent slopes

Component: Fluvents (53%)

The Fluvents component makes up 45 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains. The parent material consists of Recent loamy alluvium over stratified extremely gravelly loamy and sandy alluvium derived from igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Component: Fluvaquents (37%)

The Fluvaquents component makes up 33 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains. The parent material consists of recent loamy alluvium over stratified very gravelly and loamy alluvium derived from igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Component: Chehalis (5%)

Generated brief soil descriptions are created for major components. The Chehalis soil is a minor component.

Component: Riverwash (5%)

Generated brief soil descriptions are created for major components. The Riverwash soil is a minor component.

Map Unit: 110—Malabon silty clay loam, 0 to 3 percent slopes

Component: Malabon (89%)

The Malabon component makes up 86 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. The parent material consists of loamy and clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 1. Irrigated land capability classification is 1 This soil does not meet hydric criteria.

Component: Coburg (5%)

Generated brief soil descriptions are created for major components. The Coburg soil is a minor component.

Component: Salem (3%)

Generated brief soil descriptions are created for major components. The Salem soil is a minor component.

Component: Conser (2%)

Generated brief soil descriptions are created for major components. The Conser soil is a minor component.

Component: Clackamas (1%)

Generated brief soil descriptions are created for major components. The Clackamas soil is a minor component.

Map Unit: 127—Newberg loam, 0 to 3 percent slopes

Component: Newberg (92%)

The Newberg component makes up 84 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of loamy and stratified sandy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Camas (3%)

Generated brief soil descriptions are created for major components. The Camas soil is a minor component.

Component: McBee (2%)

Generated brief soil descriptions are created for major components. The McBee soil is a minor component.

Component: Chehalis (2%)

Generated brief soil descriptions are created for major components. The Chehalis soil is a minor component.

Component: Wapato (1%)

Generated brief soil descriptions are created for major components. The Wapato soil is a minor component.

Map Unit: 139—Salem gravelly silt loam, 0 to 3 percent slopes

Component: Salem (91%)

The Salem component makes up 91 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces, valleys. The parent material consists of loamy alluvium over stratified sandy and gravelly alluvium. Depth to a root restrictive layer, strongly contrasting textural stratification, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2s. Irrigated land

capability classification is 2s. This soil does not meet hydric criteria.

Component: Clackamas (5%)

Generated brief soil descriptions are created for major components. The Clackamas soil is a minor component.

Component: Malabon (2%)

Generated brief soil descriptions are created for major components. The Malabon soil is a minor component.

Component: Conser (2%)

Generated brief soil descriptions are created for major components. The Conser soil is a minor component.

Lane County Area, Oregon

Map Unit: 8—Bashaw clay

Component: Bashaw (85%)

The Bashaw component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains, terraces, alluvial fans. The parent material consists of clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is occasionally flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil meets hydric criteria.

Component: Natroy (3%)

Generated brief soil descriptions are created for major components. The Natroy soil is a minor component.

Component: Courtney (3%)

Generated brief soil descriptions are created for major components. The Courtney soil is a minor component.

Component: Conser (3%)

Generated brief soil descriptions are created for major components. The Conser soil is a minor component.

Component: Awbrig (3%)

Generated brief soil descriptions are created for major components. The Awbrig soil is a minor component.

Map Unit: 22—Camas gravelly sandy loam, occasionally flooded

Component: Camas, occasionally flooded (85%)

The Camas, occasionally flooded component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of sandy and gravelly alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. Irrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Fluvents (4%)

Generated brief soil descriptions are created for major components. The Fluvents soil is a minor component.

Component: Riverwash (3%)

Generated brief soil descriptions are created for major components. The Riverwash soil is a minor component.

Map Unit: 26—Chehalis silty clay loam, occasionally flooded

Component: Chehalis, occasionally flooded (85%)

The Chehalis, occasionally flooded component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of alluvium from mixed sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: 29—Cloquato silt loam

Component: Cloquato (85%)

The Cloquato component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of alluvium from mixed sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation

within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: 31—Coburg silty clay loam

Component: Coburg (85%)

The Coburg component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on stream terraces. The parent material consists of loamy alluvium over clayey alluvium. Depth to a root restrictive layer is greater than
60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Conser (4%)

Generated brief soil descriptions are created for major components. The Conser soil is a minor component.

Map Unit: 33—Conser silty clay loam

Component: Conser (85%)

The Conser component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions on stream terraces, drainageways on stream terraces. The parent material consists of silty and clayey alluvium from mixed sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Component: Bashaw (5%)

Generated brief soil descriptions are created for major components. The Bashaw soil is a minor component.

Component: Awbrig (5%)

Generated brief soil descriptions are created for major components. The Awbrig soil is a minor component.

Map Unit: 75—Malabon silty clay loam

Component: Malabon (90%)

The Malabon component makes up 90 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. The parent material consists of silty and clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 1. Irrigated land capability classification is 1 This soil does not meet hydric criteria.

Map Unit: 78—McAlpin silty clay loam

Component: McAlpin (85%)

The McAlpin component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, alluvial fans. The parent material consists of fine-textured mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Riverwash (4%)

Generated brief soil descriptions are created for major components. The Riverwash soil is a minor component.

Component: Waldo (4%)

Generated brief soil descriptions are created for major components. The Waldo soil is a minor component.

Component: Fluvents (3%)

Generated brief soil descriptions are created for major components. The Fluvents soil is a minor component.

Map Unit: 79—McBee silty clay loam

Component: McBee (85%)

The McBee component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of recent mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3w. Irrigated land

capability classification is 3w. This soil does not meet hydric criteria.

Component: Wapato (3%)

Generated brief soil descriptions are created for major components. The Wapato soil is a minor component.

Map Unit: 96—Newberg loam

Component: Newberg (85%)

The Newberg component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of recent silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about
3 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: 100—Oxley gravelly silt loam

Component: Oxley (85%)

The Oxley component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. The parent material consists of mixed gravelly alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Courtney (4%)

Generated brief soil descriptions are created for major components. The Courtney soil is a minor component.

Map Unit: 118—Salem gravelly silt loam

Component: Salem (85%)

The Salem component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on stream terraces. The parent material consists of gravelly mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2s. Irrigated land capability classification is 2s. This soil does not meet hydric criteria.

Map Unit: 130—Waldo silty clay loam

Component: Waldo (85%)

The Waldo component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, terraces. The parent material consists of mixed silty and clayey alluvium. Depth to a root restrictive layer is greater than
60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is high. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 3 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Component: Wapato (5%)

Generated brief soil descriptions are created for major components. The Wapato soil is a minor component.

Component: Bashaw (5%)

Generated brief soil descriptions are created for major components. The Bashaw soil is a minor component.

Map Unit: 134—Wapato silty clay loam

Component: Wapato (85%)

The Wapato component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 75 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil meets hydric criteria.

Component: Conser (4%)

Generated brief soil descriptions are created for major components. The Conser soil is a minor component.

Component: Waldo (3%)

Generated brief soil descriptions are created for major components. The Waldo soil is a minor component.

Map Unit: W—Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

SOIL AND RISK ASSESSMENT

Data Source Information

Soil Survey Area:	Benton County, Oregon
Survey Area Data:	Version 10, Aug 21, 2012
Soil Survey Area:	Lane County Area, Oregon
Survey Area Data:	Version 9, Aug 20, 2012

SOIL AND RISK ASSESSMENT

PREDICTED SOIL EROSION

USDA NRCS Natural Resources Conservation Service

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 1, 2**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	40 Chehalis silty clay loam, 0 to 3 percent slopes\Chehalis silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass for Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	1.2	0.9	52.2	0	24	3400000	73

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 3**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	29 Camas gravelly sandy loam, relict bar, 0 to 3 percent slopes\Camas gravelly sandy loam rare flooding 80%	2.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Hazelnut Orchard	a.Single Year/Single Crop Templates\A_Orchard, hazelnut, established; CMZ53	a. rows up-and-down hill	(none)	(none)	3.1	-0.01	0.900	0	3.6	500000	11

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 4, 5**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	40 Chehalis silty clay loam, 0 to 3 percent slopes\Chehalis silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Hazelnut Orchard	a.Single Year/Single Crop Templates\A_Orchard, hazelnut, established; CMZ53	a. rows up-and-down hill	(none)	(none)	4.9	-0.1	0.900	0			

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

USDA NRCS Natural Resources Conservation Service

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 6**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	1.1	0.9	52.2	0	24	3400000	73

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 7, 8A**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Peppermint	a.Single Year/Single Crop Templates\Peppermint; fall seed, 5 yr, CT, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.49	1	25.5	0	28	3900000	85

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 8B, Blueberries**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Blueberries	a.Single Year/Single Crop Templates\A_Blueberry, established; clean till rows, CMZ53	a. rows up-and-down hill	(none)	(none)	2.5	0.4	26.3	0	8.3	1200000	25

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 9**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Hazelnut Orchard	a.Single Year/Single Crop Templates\A_Orchard, hazelnut, established; CMZ53	a. rows up-and-down hill	(none)	(none)	4.5	-0.1	0.900	0	5.0	690000	15

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 10, 49**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Corn Silage with Cover Crop	c.Other Local Mgt Records\Corn silage, with Cover Crop; CMZ53	a. rows up-and-down hill	(none)	(none)	1.9	-0.6	283	0	17	2300000	50

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 11, 48**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	40 Chehalis silty clay loam, 0 to 3 percent slopes\Chehalis silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Corn Silage with Cover Crop	c.Other Local Mgt Records\Corn silage, with Cover Crop; CMZ53	a. rows up-and-down hill	(none)	(none)	2.0	-0.6	283	0	17	2300000	50

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 13, 17, 19, 20, 22, 23, 26**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	75 MALABON SILTY CLAY LOAM\MALABON silty clay loam 90%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Hazelnut Orchard	a.Single Year/Single Crop Templates\A_Orchard, hazelnut, established; CMZ53	a. rows up-and-down hill	(none)	(none)	4.3	-0.10	0.900	0	4.8	670000	14

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

USDA NRCS Natural Resources Conservation Service

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 14**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Corn Silage with Cover Crop	c.Other Local Mgt Records\Corn silage, with Cover Crop; CMZ53	a. rows up-and-down hill	(none)	(none)	1.3	-0.6	283	0	16	2200000	48

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 15**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	31 COBURG SILTY CLAY LOAM\COBURG silty clay loam 85%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Corn Silage with Cover Crop	c.Other Local Mgt Records\Corn silage, with Cover Crop; CMZ53	a. rows up-and-down hill	(none)	(none)	2.1	-0.6	283	0	16	2200000	48

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 16, 21, 25**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	75 MALABON SILTY CLAY LOAM\MALABON silty clay loam 90%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Corn Silage with Cover Crop	c.Other Local Mgt Records\Corn silage, with Cover Crop; CMZ53	a. rows up-and-down hill	(none)	(none)	1.8	-0.6	283	0	16	2200000	48

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 12, 18, 24, 28, 30, 31, 32**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	75 MALABON SILTY CLAY LOAM\MALABON silty clay loam 90%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	1.1	0.9	52.2	0	23	3300000	70

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 27**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	75 MALABON SILTY CLAY LOAM\MALABON silty clay loam 90%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Winter Wheat	a.Single Year/Single Crop Templates\Wheat, winter; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	1.4	0.7	154	0	7.5	1000000	23

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 35, 36**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\Grass, seed; clean till, rem. straw, Z53	a. rows up-and-down hill	(none)	(none)	3.9	-0.6	208	0	11	1500000	32

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 37**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Red Clover Seed	a.Single Year/Single Crop Templates\Clover, red seed; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	2.7	0.2	70.0	0	12	1700000	36

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 39, 40, 43, 47**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.74	1.0	52.2	0	23	3300000	70

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 41**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Peppermint	a.Single Year/Single Crop Templates\A_Peppermint; fall seed, 5 yr, CT, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.34	1.0	25.5	0	27	3800000	81

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

USDA NRCS Natural Resources Conservation Service

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 44**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Winter Wheat	a.Single Year/Single Crop Templates\Wheat, winter; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	1.1	0.7	154	0	7.5	1000000	23

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 45**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	31 COBURG SILTY CLAY LOAM\COBURG silty clay loam 85%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Winter Wheat	a.Single Year/Single Crop Templates\Wheat, winter; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	1.7	0.7	154	0	7.5	1000000	23

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 46**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	31 COBURG SILTY CLAY LOAM\COBURG silty clay loam 85%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Peppermint	a.Single Year/Single Crop Templates\A_Peppermint; fall seed, 5 yr, CT, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.51	1.0	25.5	0	27	3800000	81

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 47**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.74	1.0	52.2	0	23	3300000	70

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 50**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	1.1	0.9	52.2	0	24	3400000	73

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 51**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	110 Malabon silty clay loam, 0 to 3 percent slopes\Malabon silty clay loam 86%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Red Clover Seed	a.Single Year/Single Crop Templates\Clover, red seed; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	4.6	0.02	70.0	0	12	1700000	37

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

USDA NRCS Natural Resources Conservation Service

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 52**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Benton County\OR_Benton_R40-44	29 Camas gravelly sandy loam, relict bar, 0 to 3 percent slopes\Camas gravelly sandy loam rare flooding 80%	2.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Hazelnut Orchard	a.Single Year/Single Crop Templates\A_Orchard, hazelnut, established; CMZ53	a. rows up-and-down hill	(none)	(none)	3.1	-0.01	0.900	0	3.6	500000	11

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 53**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Winter Wheat	a.Single Year/Single Crop Templates\Wheat, winter; clean till, mb plow, Z53	a. rows up-and-down hill	(none)	(none)	1.1	0.7	154	0	7.5	1000000	23

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 54**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	33 CONSER SILTY CLAY LOAM\CONSER silty clay loam 85%	5.0	900	2.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	0.74	1.0	52.2	0	23	3300000	70

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

RUSLE2 Worksheet Erosion Calculation Record

Info:

Owner name	*Tract #*	*Field name*
Lochmead Dairy	**NA**	**LM 55**

Location	*Soil*	*T value, t/ac/yr*	*Slope length (horiz), ft*	*Avg. slope steepness, %*
Oregon\Lane County\OR_Lane_R40-44	31 COBURG SILTY CLAY LOAM\COBURG silty clay loam 85%	5.0	900	3.0

Alternatives:

Description	*Management*	*Contouring*	*Strips / barriers*	*Diversion/terrace, sediment basin*	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*	*Equiv. diesel use, gal/ac*	*Energy use, BTU/ac*	*Fuel cost, US$/ac*
Erosion on Grass Seed	a.Single Year/Single Crop Templates\A_Grass, seed, perennial; fall planted, CT, remove straw, 4 yr rotation, CMZ 53	a. rows up-and-down hill	(none)	(none)	1.1	0.9	52.2	0	23	3300000	70

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

SOIL AND RISK ASSESSMENT

OREGON PHOSPHORUS INDEX (WEST)

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower:	Lochmead Farms
Application Plan by:	Bruce D. Wilson, H&R Engineering
Date:	November 25, 2013

Field	LM1	LM2	LM3	LM4	LM5	LM6	LM7	LM8A
Acres	16.5	149.7	14.3	18.2	29.6	33.5	127.6	78.8
Soil	40, Chehalis	40, Chehalis	29, Camas	40, Chehalis	40, Chehalis	110, Malabon	110, Malabon	110, Malabon
Soil test date	November 15, 2013	November 15, 2013	November 15, 2013	May 12, 2008	May 12, 2008	November 15, 2013	November 15, 2013	November 15, 2013
Bray 1 P (ppm)	59	35	63	120	159	89	74	89
Acetate K (ppm)	183	114	142	203	278	429	218	355
pH	5.6	5.3	5.3	5.5	5.6	5.1	5.4	4.9
SMP	6.1	6.1	6.1	7	6.9	6	6.1	6
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	1-3	1-3	1-3	<1	1-3	<1	<1
Irrigation erosion (tons/ac-yr)	not irrigated	not irrigated	not irrigated	not irrigated	not irrigated	not irrigated	no irrig. runoff	no irrig. runoff
Runoff Class	low	low	negligble	low	low	medium	medium	medium
Flooding Frequency	occasional	occasional	rare	occasional	occasional	none	none	none
Distance to stream (ft)	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	300-500 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	49	49	25	25	25	70	211	211
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	14.9	13.0	13.1	20.5	22.9	17.8	18.4	19.9
P RUNOFF RISK RATING	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower:	Lochmead Farms
Application Plan by:	Bruce D. Wilson, H&R Engineering
Date:	November 25, 2013

Field	LM8B	LM9	LM10	LM11	LM12	LM13	LM14	LM15
Acres	14.9	6.8	52.6	91.5	156.0	5.7	38.2	95.1
Soil	110, Malabon	110, Malabon	110, Malabon	40, Chehalis	75, MALABON	75, MALABON	33, CONSER	31, COBURG
Soil test date	November 15, 2013	May 12, 2008	November 19, 2013	November 19, 2013	November 15, 2013	May 12, 2008	November 15, 2013	November 15, 2013
Bray 1 P (ppm)	89	235	135	97	126	235	26	150
Acetate K (ppm)	355	322	405	473	642	322	192	834
pH	4.9	5.8	5.3	5.7	5.5	5.8	5.8	5.4
SMP	6	7	6.1	6.3	6.3	7	6.1	6.1
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	1-3	1-3	1-3	<1	1-3	1-3	1-3
Irrigation erosion (tons/ac-yr)	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff
Runoff Class	medium	medium	medium	low	medium	medium	medium	medium
Flooding Frequency	none	none	none	occasional	none	none	rare	none
Distance to stream (ft)	100-199 ft	100-199 ft	200-299 ft	<100 ft	<100 ft	300-500 ft	<100 ft	<100 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	4	25	154	154	70	25	49	77
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	17.2	32.3	24.8	21.5	20.8	32.3	14.0	24.8
P RUNOFF RISK RATING	Medium	High	Medium	Medium	Medium	High	Medium	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower:	Lochmead Farms
Application Plan by:	Bruce D. Wilson, H&R Engineering
Date:	November 25, 2013

Field	LM16	LM17	LM18	LM19	LM20	LM21	LM22	LM23
Acres	31.6	0.4	64.0	11.6	1.5	43.5	40.0	9.0
Soil	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON
Soil test date	November 15, 2013	May 12, 2008	November 15, 2013	May12, 2008	May 12, 2008	November 15, 2013	May 12, 2013	May12, 2013
Bray 1 P (ppm)	114	146	116	146	146	123	235	120
Acetate K (ppm)	561	316	364	316	316	751	322	203
pH	5	6.5	4.8	6.5	6.5	5.4	5.8	5.5
SMP	5.9	7	5.9	7	7	5.9	7	7
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3
Irrigation erosion (tons/ac-yr)	no irrig. runoff	no irrig. runoff	not irrigated	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff	no irrig. runoff
Runoff Class	medium	medium	medium	medium	medium	medium	medium	medium
Flooding Frequency	none	none	none	none	none	none	none	none
Distance to stream (ft)	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	300-500 ft	100-199 ft	100-199 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	154	25	49	25	25	154	25	25
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	22.7	23.4	20.1	23.4	23.4	23.6	32.3	20.8
P RUNOFF RISK RATING	Medium	Medium	Medium	Medium	Medium	Medium	High	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower:	Lochmead Farms
Application Plan by:	Bruce D. Wilson, H&R Engineering
Date:	November 25, 2013

Field	LM24	LM25	LM26	LM27	LM28	LM30	LM31	LM32
Acres	110.5	115.1	24.0	47.1	127.4	18.5	6.0	31.2
Soil	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON	75, MALABON
Soil test date	November 15, 2013	November 19, 2013	May 12, 2008	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013
Bray 1 P (ppm)	108	94	120	74	47	97	122	74
Acetate K (ppm)	537	301	203	467	247	352	322	214
pH	5.1	5.6	5.5	5.1	6	5	4.5	5.5
SMP	5.9	6.2	7	5.8	6.3	5.8	5.4	6.1
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3
Irrigation erosion (tons/ac-yr)	not irrigated	no irrig. runoff	not irrigated	not irrigated	not irrigated	not irrigated	not irrigated	not irrigated
Runoff Class	medium	medium	medium	medium	medium	medium	medium	medium
Flooding Frequency	none	none	none	none	none	none	none	none
Distance to stream (ft)	300-500 ft	<100 ft	<100 ft	<100 ft	300-500 ft	300-500 ft	<100 ft	100-199 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	49	154	25	71	49	49	49	49
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	19.3	20.7	20.0	16.3	13.2	18.2	20.7	15.9
P RUNOFF RISK RATING	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Grower: Lochmead Farms
Application Plan by: Bruce D. Wilson, H&R Engineering
Date: November 25, 2013

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Field	LM35	LM36	LM37	LM39	LM40	LM41	LM43	LM44
Acres	37.9	23.1	102.6	64.1	40.1	55.2	42.8	40.3
Soil	33, CONSER	33, CONSER	33, CONSER	33, CONSER	33, CONSER	33, CONSER	33, CONSER	33, CONSER
Soil test date	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013
Bray 1 P (ppm)	28	28	18	31	22	35	23	19
Acetate K (ppm)	111	111	120	132	157	136	137	92
pH	5	5	5.3	5	4.9	4.8	4.9	4.8
SMP	5.7	5.7	6.1	5.8	5.8	5.6	5.7	5.6
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	4-6	4-6	1-3	<1	<1	<1	<1	1-3
Irrigation erosion (tons/ac-yr)	not irrigated	not irrigated	not irrigated	not irrigated	not irrigated	no irrig. runoff	not irrigated	not irrigated
Runoff Class	medium	medium	medium	medium	medium	medium	medium	medium
Flooding Frequency	rare	rare	rare	rare	rare	rare	rare	rare
Distance to stream (ft)	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft	<100 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	2	2	3	49	49	211	49	71
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	13.8	13.8	12.3	11.7	11.7	15.7	11.7	13.7
P RUNOFF RISK RATING	Medium	Medium	Low	Low	Low	Medium	Low	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower:	Lochmead Farms
Application Plan by:	Bruce D. Wilson, H&R Engineering
Date:	November 25, 2013

Field	LM45	LM46	LM47	LM48	LM49	LM50	LM51	LM52
Acres	25.4	30.7	25.1	64.1	7.8	64.3	46.8	30.8
Soil	31, COBURG	31, COBURG	33, CONSER	40, Chehalis	110, Malabon	110, Malabon	110, Malabon	28, Camas
Soil test date	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013
Bray 1 P (ppm)	14	21	25	64	61	40	51	72
Acetate K (ppm)	140	117	149	185	287	163	244	240
pH	4.4	5	5.4	5.6	5.2	5.4	6.4	5.7
SMP	5.6	5.8	6	6.1	5.9	5.8	6.6	6.3
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	<1	<1	1-3	1-3	1-3	4-6	1-3
Irrigation erosion (tons/ac-yr)	not irrigated	no irrig. runoff	not irrigated	no irrig. runoff	no irrig. runoff	not irrigated	not irrigated	no irrig. runoff
Runoff Class	medium	medium	medium	low	medium	medium	medium	negligble
Flooding Frequency	none	none	rare	occasional	none	none	none	occasional
Distance to stream (ft)	<100 ft	<100 ft	<100 ft	>500 ft	>500 ft	<100 ft	<100 ft	300-500 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	71	211	49	154	154	49	2	25
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible	All months possible
SCORE	12.9	15.0	11.7	18.2	17.4	12.5	14.1	15.5
P RUNOFF RISK RATING	Low	Medium	Low	Medium	Medium	Low	Medium	Medium

COMMENTS

SOIL AND RISK ASSESSMENT

FIELD SUMMARY & WESTERN OREGON P INDEX

Enter data in gray cells and select best choice from drop down menus.
Cells with blue font are completed automatically.

Grower: Lochmead Farms
Application Plan by: Bruce D. Wilson, H&R Engineering
Date: November 25, 2013

Field	LM53	LM54	LM55	Blueberries				
Acres	31.9	8.7	14.7	52.0				
Soil	33, CONSER	33, CONSER	31, COBURG	110, Malabon				
Soil test date	November 15, 2013	November 15, 2013	November 15, 2013	November 15, 2013				
Bray 1 P (ppm)	15	25	22	51				
Acetate K (ppm)	99	149	211	244				
pH	4.7	5.4	4.4	6.4				
SMP	5.7	6	5.4	6.6				
TRANSPORT FACTORS								
Sheet & rill erosion (tons/ac-yr)	1-3	<1	1-3	1-3	<1	<1	<1	<1
Irrigation erosion (tons/ac-yr)	not irrigated	not irrigated	not irrigated	no irrig. runoff	not irrigated	not irrigated	not irrigated	not irrigated
Runoff Class	medium	medium	medium	medium	none	none	none	none
Flooding Frequency	rare	rare	none	none	none	none	none	none
Distance to stream (ft)	<100 ft	<100 ft	<100 ft	300-500 ft	>500 ft	>500 ft	>500 ft	>500 ft
Buffers	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.	> 30 ft or NRCS spec.
Drainage	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles	no tiles
SOURCE FACTORS								
Commercial P2O5 rate (lbs/ac)	0	0	0	0	0	0	0	0
Commercial P2O5 method	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Commercial P2O5 timing	None applied	None applied	None applied	None applied	None applied	None applied	None applied	None applied
Organic P2O5 rate (lbs/ac)	71	49	49	2	0	0	0	0
Organic P2O5 method	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	Not incorp. in 5 days	None applied	None applied	None applied	None applied
Organic P2O5 timing	All months possible	All months possible	All months possible	All months possible	None applied	None applied	None applied	None applied
SCORE	13.7	11.7	12.5	13.4	0.0	0.0	0.0	0.0
P RUNOFF RISK RATING	Medium	Low	Low	Medium	Low	Low	Low	Low

COMMENTS

SOIL AND RISK ASSESSMENT

Oregon Phosphorus Index Risk Interpretation

P Index rating	Interpretation	Recommended Nutrient Limitation
West PI Score<13 East PI Score<30	Low potential for P movement from this site given current management practices and site characteristics. There is a low probability of an adverse impact to surface waters from P losses on this site. Soil test P and P losses are likely to increase in future due to N-based nutrient management from animal manure.	Nitrogen
West PI Score 13-25 East PI Score 30-100	Medium potential for P movement from this site given current management practices and site characteristics. Practices should be introduced to reduce P losses by surface runoff, subsurface flow, and erosion. Soil test P and P losses are likely to increase in future due to N-based nutrient management from animal manure.	Nitrogen
West PI Score >25-50 East PI Score >100-400	High potential for P movement from this site given current management practices and site characteristics. All practicable management practices to reduce P losses through surface runoff, subsurface flow, or erosion should be implemented.	Phosphorus
West PI Score >50 East PI Score >400	Very high potential for P movement from this site given current management practices and site characteristics. Active remediation techniques should be implemented in an effort to reduce the P loss potential from this site.	No manure

REFERENCES

PUBLICATIONS AND SOFTWARE

Crop Fertilizer Recommendations

Nutrient Requirements for Dairy Cattle 7th Ed, 2001 Natl. Research Council
http://www.nap.edu/openbook.php?isbn=0309069971

OSU EM8978-E, June 2009 (w. of Cascades); PNW615, 2010 (e. of Cascades)
http://extension.oregonstate.edu/catalog/details.php?sortnum=0134&name=Fertilizer+Guides

Extension Service Publications

Field Corn, Eastern Oregon-East of the Cascades, FG 71, January 2000
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20643/fg71-e.pdf

Manure Application Rates for Forage Production, OSU EM 8585-E, July 2007
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20536/em8585-e.pdf

Monitoring Soil Nutrients Using a Management Unit Approach, PNW 570-E, October 2003, *http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20762/pnw570-e.pdf*

Post-Harvest Soil Nitrate Testing for Manured Croppings Systems, EM 8832-E, May 2003
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20221/em8832-e.pdf

Silage Corn, Western Oregon, EM 8978-E, June 2009
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20610/em8978-e.pdf

Soil Test Interpretation Guide, OSU EC 1478, August 1999
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/22023/ec1478.pdf

Feed Management

Feed Management, A tool for balancing nutrients on dairies and other livestock operations, EM 8913-E, July 2006
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20501/em8913-e.pdf

Manure Application Setback Features/Distances

CAFO General Permit #1
http://oregon.gov/ODA/NRD/docs/pdf/cafo_gnlpmt.pdf

Manure Nutrient Availability

Waste Utilization Jobsheet 633 OR-JS, Oregon USDA-NRCS, May 2003
http://efotg.sc.egov.usda.gov/references/public/OR/633js042707.pdf

REFERENCES

Phosphorus Assessment

Agronomy Technical Note No. 26: The Phosphorus Index, Oregon NRCS, June 2008
ftp://ftp-fc.sc.egov.usda.gov/OR/Technical_Notes/Agronomy/Agronomy26.pdf

Agricultural Phosphorus Management Using the Oregon/Washington Phosphorus Indexes, *http://eesc.orst.edu/agcomwebfile/edmat/em8848-e.pdf*

Practice Standards

Oregon NRCS Nutrient Management Standard (590), May 2008
http://efotg.nrcs.usda.gov/references/public/OR/590std.doc

Record Keeping

Oregon ODA CAFO Recordkeeping Calendar, May 2013
http://www.oregon.gov/ODA/NRD/pages/cafoprogdocs.aspx

Oregon ODA Recordkeeping Workbook, ODARKversion4.0, March 2013
http://www.oregon.gov/ODA/NRD/pages/cafoprogdocs.aspx

Water Quality/Quantity

Oregon NRCS Water Quality Technical Note No. 1: Water Quality Indicator Tools, October 2000
ftp://ftp-fc.sc.egov.usda.gov/OR/Technical_Notes/Water%20Quality/WaterQual01.pdf

Software

Revised Universal Soil Loss Equation, RUSLE2 version 1.26.6.4, October 2006
http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm

Oregon Animal Waste Management Planning Tool, ORAWMv4.5, May 2013
http://www.oregon.gov/ODA/NRD/pages/cafoprogdocs.aspx

Oregon ODA Recordkeeping Workbook, ODARKv4.0, March 2013
http://www.oregon.gov/ODA/NRD/pages/cafoprogdocs.aspx

REFERENCES

ORAWM WORKBOOK

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: Lochmead Farms Dairy

ASSISTED BY: Bruce D. Wilson, H&R Engineering LLC

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Milk Production in Pounds/Cow/Day= 70 — Nutrient Production (lbs./day/1000 lb. Animal Unit) N	P	K	(lbs./day) N	P	K	Manure CF/D/AU	Annual Days Confined	Days Grazed	Days Off Farm
MILKER (Holstein)	825	1,300	1,072.5	0.70	0.12	0.32	750.75	128.91	345.13	1.70	365	0	0
MILKER (DRY)	125	1,400	175.0	0.30	0.04	0.10	52.50	7.35	17.50	0.92	365	0	0
HEIFERS (12-24 Months)	625	970	606.3	0.27	0.05	0.12	161.26	27.58	72.75	0.90	365	0	0
CALVES (1-12 Months)	225	150	33.8	0.42	0.05	0.11	14.18	1.82	3.71	1.34	365	0	0
Totals/Averages-	1,800	955	1,887.5	0.52	0.09	0.23	978.7	165.7	439.1	1.4			

GRAZING PERIOD

Type of Animal	Percent of Month and Number of Animals Grazing OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AU-YR.
MILKER (Holstein)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	825	825	825	825	825	825	825	825	825	825	825	825	0
MILKER (DRY)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	125	125	125	125	125	125	125	125	125	125	125	125	0
HEIFERS (12-24 Months)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	625	625	625	625	625	625	625	625	625	625	625	625	0
CALVES (1-12 Months)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	225	225	225	225	225	225	225	225	225	225	225	225	0
													0
													0
													0
													0
													0
													0
Total AUM's Available>	0	0	0	0	0	0	0	0	0	0	0	0	0
Total AUM's Needed>>>	0	0	0	0	0	0	0	0	0	0	0	0	0
Total AUM's>>>>>>>>>>	0	0	0	0	0	0	0	0	0	0	0	0	0

Page 1 of 3

LochmeadORAWMv4.7.xls

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: Lochmead Farms Dairy

ASSISTED BY: Bruce D. Wilson, H&R Engineering LLC

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION: EUGENE WSO AIRPORT

Month	25Yr-24Hr	5.00	Lot Runoff Factors as a Percent of Monthly Precipitation	
	RCN=	95.00		
	Average Monthly Inches			
	Precipitation	Evaporation	Paved	Unpaved
October	3.35	1.66	100%	20%
November	8.43	0.50	100%	25%
December	8.29	0.26	100%	20%
January	7.65	0.30	100%	25%
February	6.35	0.59	100%	20%
March	5.80	1.47	100%	15%
April	3.66	2.38	100%	10%
May	2.66	3.77	100%	10%
June	1.53	4.66	100%	10%
July	0.64	6.09	100%	0%
August	0.99	5.32	100%	10%
September	1.54	3.57	100%	15%
Annual	50.89	30.57		

AREAS CONTRIBUTING RUNOFF TO LIQUID STORAGE FACILITY

Description of Runoff Area	Area in SF
Paved Lot Area >> Is paved lot scraped daily? (Y/N) YES	38,940
Unpaved Lot Area >>>	0
Roof Area >>	15,680
Surface Area of Silage Storage Facility>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Does Silage Seepage Drain to Storage Facility? (Y/N) YES	41,380
Total Runoff Area Contributing to Liquid Storage Facility>>>>>>>>>>>>>>>>>	96,000

WATER USE THAT ENTERS LIQUID STORAGE FACILITY

Type of Water Use	Number of Animals	Number of Washes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	825.0	0	0.00	0	0.0
Equipment Wash		2	360.00	720	96.3
Flushwater		0	0.00	0	0.0
Miscellaneous		1	25.00	25	3.3
Total>>				745	99.6

CROP DATA

Field Number	Acres	Crop	Percent Dry Matter (DM)	Yield Units	Target Yield	Nutrients Removed in Pounds per Acre		
						Nitrogen N	Phosphorous P_2O_5	Potassium K_2O
LM 1...55	1075.4	Ryegrass Seed	90%	cwt	22.50	164	49	48
LM 10...49	539.5	Corn, Silage(AH)/Cover Crop	30%	Ton	43.00	419	154	404
LM 3...52	190.9	Filberts	100%	Ton	1.50	63	25	71
LM 27,44,45,53	144.7	Wheat, Winter Soft White Straw Removed	80%	Ton	3.50	152	71	88
LM 7,8A,41,46	292.3	Peppermint, Oil Stems & Leaves Removed	100%	Ton	2.50	218	211	174
LM 8B, Blueberries	66.9	Blueberries	15%	Ton	8.00	17	4	17
LM 35,36	61.0	Fescue Seed	90%	cwt	16.00	20	0	0
LM 37,51	149.4	Red Clover Seed	88%	cwt	6.00	27	6	0
Off Farm								
Total Acres-	2,520.1							

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: **Lochmead Farms Dairy**

ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

Type of Animal	Type of Bedding Facility	Bedding Material	Unit Weight Lbs/CF	Amount Needed Lbs/Day/AU	Volume CF/Day/AU	Total Volume CF/Day	Total Weight Lbs/Day
MILKER (Holstein)	Free Stall	Composted Manure	36.00	0.00	0.00	0	0
MILKER (DRY)	Loose Housing	Wood Shavings	9.00	4.70	0.52	91	823
HEIFERS (12-24 Months)	Loose Housing	Chopped Straw	7.00	0.30	0.04	26	182
CALVES (1-12 Months)	Confined	Composted Manure	36.00	0.00	0.00	0	0

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	Separation Factor %	Volume of Solids Separated CF/Day	Volume of Solids in Liquids CF/Day	Volume of Manure in Liquids CF/Day	Volume of Manure in Solids CF/Day	Accumulated Sludge in Storage CF/Day	Density of Separated Solids Lbs/CF	Weight of Separated Solids Lbs/Day
MILKER (Holstein)	Static Inclined Screen with Screw Press	25%	457	1,371	1,371	457	789	36	16,448
MILKER (DRY)	Static Inclined Screen with Screw Press	25%	63	189	121	40	31	36	2,272
HEIFERS (12-24 Months)	Static Inclined Screen with Screw Press	25%	143	429	409	136	179	36	5,144
CALVES (1-12 Months)	Dry Scrape System	100%	45	0	0	45	0	36	1,628
Total Solids>>			708	1,989	1,901	679	999		25,492

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

Month	Runoff in Cubic Feet: Roof Area Square Feet 15,680	Runoff in Cubic Feet: Paved Slab Area Square Feet 38,940	Runoff in Cubic Feet: Unpaved Lot Area Square Feet 0	Runoff in Cubic Feet: Silage Pit Surface Area, SF 41,380	Facility Water Use Cubic Feet	Manure: Solids Cubic Feet	Manure: Liquids Cubic Feet	Bedding: Cubic Feet	Bedding: Pounds	Solids Separated: Cubic Feet	Solids Separated: Pounds	Solids in Liquids: Cubic Feet	Solids in Liquids: Pounds	Total Solids Cubic Feet	Total Liquids Cubic Feet
October	4,377	10,871	0	5,135	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	85,119
November	11,015	27,355	0	9,954	2,988	10,172	67,209	3,521	30,131	21,243	764,758	59,660	2,147,744	21,243	110,972
December	10,832	26,901	0	8,542	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	111,011
January	9,996	24,824	0	9,420	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	108,976
February	8,297	20,606	0	6,928	2,789	9,494	62,729	3,286	28,123	19,827	713,774	55,682	2,004,561	19,827	94,303
March	7,579	18,821	0	5,825	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	96,960
April	4,782	11,877	0	3,949	2,988	10,172	67,209	3,521	30,131	21,243	764,758	59,660	2,147,744	21,243	83,256
May	3,476	8,632	0	917	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	77,760
June	1,999	4,965	0	528	2,988	10,172	67,209	3,521	30,131	21,243	764,758	59,660	2,147,744	21,243	70,139
July	836	2,077	0	0	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	67,649
August	1,294	3,213	0	341	3,088	10,511	69,450	3,639	31,136	21,951	790,250	61,648	2,219,336	21,951	69,583
September	2,012	4,997	0	3,483	2,988	10,172	67,209	3,521	30,131	21,243	764,758	59,660	2,147,744	21,243	73,141
Annual	66,496	165,138	0	55,023	36,354	123,764	817,713	42,840	366,597	258,460	9,304,552	725,858	26,130,888	258,460	1,048,868
Annual Gallons	497,392	1,235,233	0	411,569	271,925	925,754	6,116,497	320,446		1,933,279		5,429,418		1,933,279	7,845,536

DAILY NUTRIENT PRODUCTION

Type of Animal	Pounds/Day of Nutrients from LIQUIDS: N	LIQUIDS: P_2O_5	LIQUIDS: K_2O	Pounds/Day of Nutrients from SOLIDS: N	SOLIDS: P_2O_5	SOLIDS: K_2O	Pounds/Day of Nutrients from GRAZING: N	GRAZING: P_2O_5	GRAZING: K_2O	Grazing Manure Gallons/Yr	Confined Manure Cubic Feet/Yr
MILKER (Holstein)	401.19	126.93	532.35	66.22	22.40	35.83	0.00	0.00	0.00	0	667,052
MILKER (DRY)	28.06	7.24	26.99	4.63	1.28	1.82	0.00	0.00	0.00	0	58,765
HEIFERS (12-24 Months)	86.18	27.16	112.21	14.22	4.79	7.55	0.00	0.00	0.00	0	199,153
CALVES (1-12 Months)	0.00	0.00	0.00	5.00	1.27	1.54	0.00	0.00	0.00	0	16,507
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
									Total-	0	941,477

Page 1 of 2

LochmeadORAWMv4.7.xls

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Total Pounds of Nutrients from ALL SOURCES		
Month	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O
October	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
November	15,463	4,840	20,147	2,702	892	1,402	0	0	0	18,165	5,732	21,549
December	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
January	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
February	14,432	4,517	18,804	2,522	833	1,309	0	0	0	16,954	5,350	20,112
March	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
April	15,463	4,840	20,147	2,702	892	1,402	0	0	0	18,165	5,732	21,549
May	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
June	15,463	4,840	20,147	2,702	892	1,402	0	0	0	18,165	5,732	21,549
July	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
August	15,978	5,001	20,818	2,792	922	1,449	0	0	0	18,770	5,923	22,267
September	15,463	4,840	20,147	2,702	892	1,402	0	0	0	18,165	5,732	21,549
Annual	**188,131**	**58,883**	**245,118**	**32,876**	**10,855**	**17,058**	**0**	**0**	**0**	**221,007**	**69,738**	**262,176**

REFERENCES

12/10/2013

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

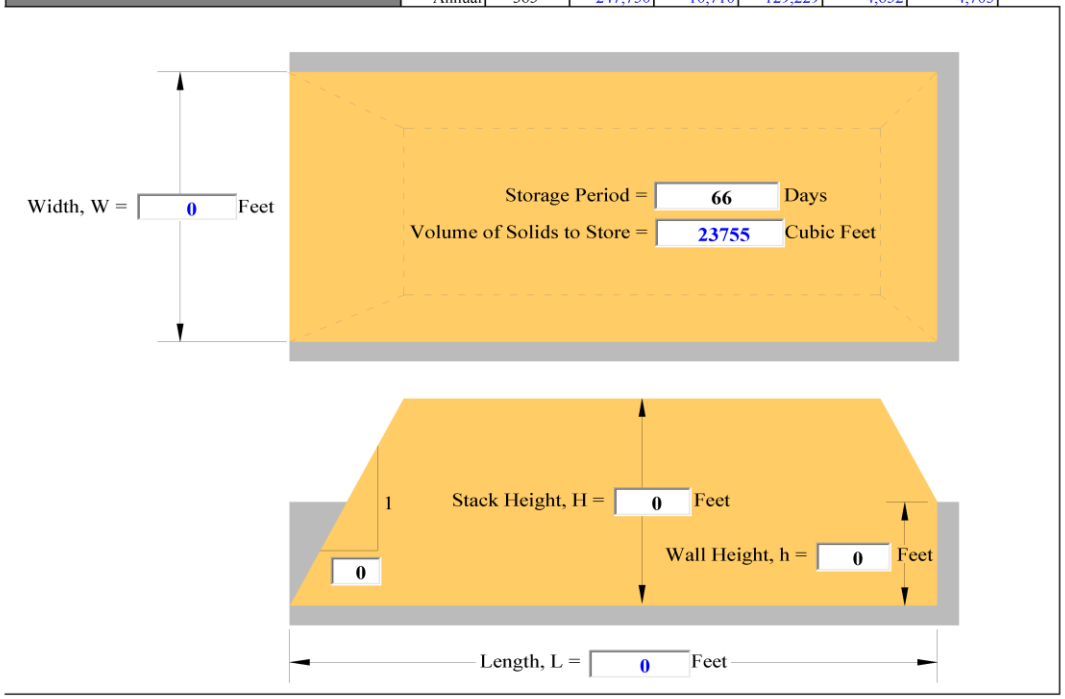
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY

Solids Storage Facility Parameters	Value
Storage Period, Days=	66
Stacking Width, W in Feet=	0
Stacking Height, H in Feet=	0.00
Wall Height, h in Feet=	0.00
Stack Side Slope (X:1)=	0.00
Existing Storage, Cubic Feet=	24,100
Surface Area of Existing Storage, SF=	5,880
25 Year-24 Hour Storm Runoff, CF=	2,166
Volume Needed, Cubic Feet=	23,755
Design Volume, Cubic Feet=	0
Is Facility Covered?	NO

MONTHLY SOLIDS VOLUME STACKED IN FACILITY

Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Solids to Store Tons	Normal Runoff CF
October	31	21042	910	10,976	395	328
November	30	20363	880	10,622	382	1,033
December	31	21042	910	10,976	395	812
January	31	21042	910	10,976	395	937
February	28	19005	822	9,914	357	622
March	31	21042	910	10,976	395	426
April	30	20363	880	10,622	382	179
May	31	21042	910	10,976	395	130
June	30	20363	880	10,622	382	75
July	31	21042	910	10,976	395	0
August	31	21042	910	10,976	395	49
September	30	20363	880	10,622	382	113
Annual	365	247,750	10,710	129,229	4,652	4,705



LochmeadORAWMv4.7.xls

REFERENCES

12/10/2013

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

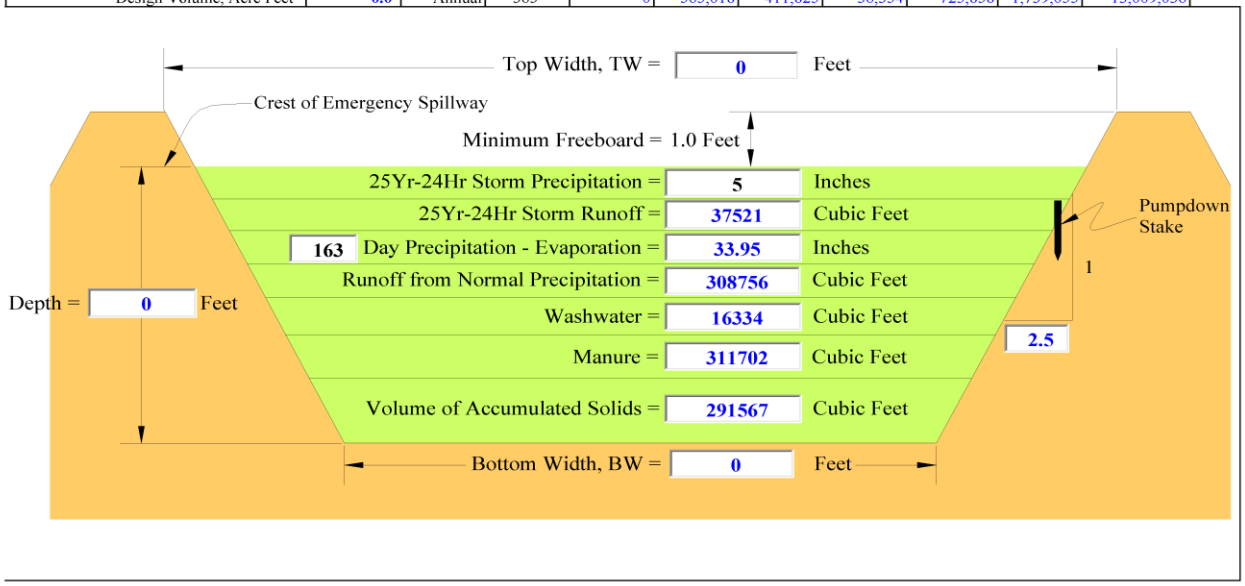
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

WASTE STORAGE POND

Pond Parameters	Value
Storage Period, Days=	163
Side Slope (X:1)=	2.50
Bottom Width, BW, Feet=	0
Bottom Length, BL, Feet=	0
Accumulated Solids Duration, Years=	1
Existing Storage, Acre Feet=	45.37
Surface Area of Existing Storage, SF=	333,672
Minimum Soil Liner Depth, Feet=	1.00
25 Year-24 Hour Storm Runoff, CF=	37,521
Top Width, TW, Feet=	0
Top Length, TL, Feet=	0
Volume Needed, Acre Feet=	45.3
Design Volume, Acre Feet=	0.0

MONTHLY INFLOWS INTO WASTE STORAGE POND

Month	Number of Days	Rain-Evap on Pond CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Solids CF	Waste to Store CF	Waste to Store Gallons
October	31	0	46,992	27,128	3,088	61,648	138,856	1,038,717
November	30	0	220,502	68,473	2,988	59,660	351,622	2,630,314
December	31	0	223,282	67,132	3,088	61,648	355,150	2,656,710
January	31	0	204,374	62,137	3,088	61,648	331,247	2,477,900
February	28	0	160,163	51,422	2,789	55,682	270,056	2,020,158
March	31	0	120,400	46,826	3,088	61,648	231,962	1,735,197
April	30	0	35,592	29,459	2,988	59,660	127,699	955,252
May	31	0	-30,865	21,410	3,088	61,648	55,281	413,534
June	30	0	-87,033	12,315	2,988	59,660	-12,070	-90,292
July	31	0	-151,543	5,120	3,088	61,648	-81,687	-611,061
August	31	0	-120,400	7,969	3,088	61,648	-47,696	-356,789
September	30	0	-56,446	12,433	2,988	59,660	18,635	139,396
Annual	365	0	565,018	411,825	36,354	725,858	1,739,055	13,009,036



LochmeadORAWMv4.7.xls

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation / Type of Storage Facility	Pounds of Nutrients Available N	Pounds of Nutrients Available P2O5	Pounds of Nutrients Available K2O	Percent Nutrients Retained After Storage N	Percent Nutrients Retained After Storage P2O5	Percent Nutrients Retained After Storage K2O	Pounds of Nutrients Retained After Storage N	Pounds of Nutrients Retained After Storage P2O5	Pounds of Nutrients Retained After Storage K2O
	Dairy									
Liquids	Storage Pond Manure Analysis	188,131	58,883	245,118	65%	95%	95%	122,285	55,939	232,862
Solids	Solids Storage Manure Analysis	32,876	10,855	17,058	75%	90%	90%	24,657	9,770	15,352
Grazing	NONE	0	0	0	100%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER APPLICATION

Nutrient Source	Type of Application System	Pounds of Nutrients Available N	Pounds of Nutrients Available P2O5	Pounds of Nutrients Available K2O	Percent Nutrients Retained After Application N	Percent Nutrients Retained After Application P2O5	Percent Nutrients Retained After Application K2O	Pounds of Nutrients Retained After Application N	Pounds of Nutrients Retained After Application P2O5	Pounds of Nutrients Retained After Application K2O
Liquids	Sprinkling	122,285	55,939	232,862	75%	100%	100%	91,714	55,939	232,862
Solids	Broadcast (Incorporated 7 or more days after application)	24,657	9,770	15,352	70%	100%	100%	17,260	9,770	15,352
Grazing	Grazing	0	0	0	85%	100%	100%	0	0	0

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location / Soil Drainage Class	Pounds of Nutrients Available N	Pounds of Nutrients Available P2O5	Pounds of Nutrients Available K2O	Percent Nutrients Retained After Denitrification N	Percent Nutrients Retained After Denitrification P2O5	Percent Nutrients Retained After Denitrification K2O	Pounds of Nutrients Retained After Denitrification N	Pounds of Nutrients Retained After Denitrification P2O5	Pounds of Nutrients Retained After Denitrification K2O
	Between Coastal and Cascade Mountains									
Liquids	Somewhat Poorly Drained	91,714	55,939	232,862	80%	100%	100%	73,371	55,939	232,862
Solids	Somewhat Poorly Drained	17,260	9,770	15,352	80%	100%	100%	13,808	9,770	15,352
Grazing	Somewhat Poorly Drained	0	0	0	80%	100%	100%	0	0	0
							TOTAL-	***87,179***	***65,709***	***248,214***

REFERENCES

OREGON ANIMAL WASTE MANAGEMENT DESIGN AID (ORAWM)

Version 4.7

12/10/2013

CLIENT: **Lochmead Farms Dairy**
ASSISTED BY: **Bruce D. Wilson, H&R Engineering LLC**

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON NITROGEN, N

Field Number	Acres	Crop	LIQUIDS			SOLIDS			GRAZING		
			Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients	Percent to be Applied	Pounds of Nutrients to be Applied	Acres Needed for Utilization of Nutrients
LM 1...55	1075.4	Ryegrass Seed	35%	25,544	156	8%	1,105	7	0%	0	0
LM 10...49	539.5	Corn, Silage(AH)/Cover Crop	45%	32,755	78	8%	1,105	3	0%	0	0
LM 3...52	190.9	Filberts	2%	1,729	28	0%	0	0	0%	0	0
LM 27,44,45,53	144.7	Wheat, Winter Soft White Straw Removed	4%	3,186	21	0%	0	0	0%	0	0
LM 7,8A,41,46	292.3	Peppermint, Oil Stems & Leaves Removed	13%	9,228	42	0%	0	0	0%	0	0
LM 8B, Blueberrie	66.9	Blueberries	0%	166	10	0%	0	0	0%	0	0
LM 35,36	61.0	Fescue Seed	0%	173	9	0%	0	0	0%	0	0
LM 37,51	149.4	Red Clover Seed	1%	591	22	0%	0	0	0%	0	0
Off Farm			0%	0		84%	11,599		100%	0	
TOTALS-	2520.1		100%	73,371	365	100%	13,808	9	100%	0	0

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED			- NUTRIENTS REMOVED			= NUTRIENT BALANCE		
			Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre	Nitrogen, N Lbs/Acre	Phosphorous, P_2O_5 Lbs/Acre	Potassium, K_2O Lbs/Acre
LM 1...55	1075.4	Ryegrass Seed	25	19	77	164	49	48	-139	-30	28
LM 10...49	539.5	Corn, Silage(AH)/Cover Crop	63	48	195	419	154	404	-356	-106	-209
LM 3...52	190.9	Filberts	9	7	29	63	25	71	-53	-18	-42
LM 27,44,45,53	144.7	Wheat, Winter Soft White Straw Removed	22	17	70	152	71	88	-130	-54	-18
LM 7,8A,41,46	292.3	Peppermint, Oil Stems & Leaves Removed	32	24	100	218	211	174	-186	-187	-74
LM 8B, Blueberrie	66.9	Blueberries	2	2	8	17	4	17	-15	-2	-9
LM 35,36	61.0	Fescue Seed	3	2	9	20	0	0	-17	2	9
LM 37,51	149.4	Red Clover Seed	4	3	13	27	6	0	-23	-3	13
Off Farm											

Oregon
John A. Kitzhaber, MD, Governor

Department of Agriculture
635 Capitol St NE
Salem, OR 97301-2532

June 27, 2014

Warren Gibson
Lochmead Farms, Inc.
125 E 6th AVE
Junction City, Oregon 97448

RE: Construction request review; Lochmead Farms, Inc./MA#62977

Dear ~~Mr. Gibson~~: 3622

On April 25, 2014, the Oregon Department of Agriculture (department) received a construction approval request for modification of the anaerobic digester project at your dairy located at 96428 Hwy 99W in Junction City, Oregon. On June 24, 2014, the department received an Oregon-stamped design package and specifications for the materials We have completed our review of the designs and construction request materials, and our conclusions follow.

Construction Status: Approved.
Modification of the anaerobic digester facility according to the plans and designs submitted June 24, 2014, is hereby approved.

Animal Waste Management Plan Status: Update required within 90 days of construction completion
All modifications to the waste storage or treatment system must be incorporated into your Animal Waste Management Plan (AWMP).

Permit Status: No Change; Remains a Large Federal CAFO.
Your dairy facility remains permitted for 1,800 animals.

If you have any questions, please contact Wym Matthews, the CAFO Program Manager, at (503) 986-4792.

Sincerely,

FOR Ray Jaindl, Administrator
Natural Resources Division
PH: (503) 986-4700
FX: (503) 986-4730

Enclosure: Review Memo

cc: Chris Anderson, AREA IV LWQS
Alan Tank, Revolution Energy Solutions
Tim O'Connell, CST

RJ/wm/js

From: **Tim O'Connell** toconnell@cst-storage.com
Subject: RES projects in Oregon
Date: June 24, 2014 at 3:24 PM
To: wmatthew@oda.state.or.us
Cc: ATank@revolutionenergysolutions.com, steve@cnw.com, Pat Howell phowell@cstindustries.com

Good Afternoon Wym,

I have attached the info for the Bio Dome Gas Storage structures and the Bio Dome Membrane specs. I would like to set up a call with you to review. Please let me know when you have a few moments.

Regards,

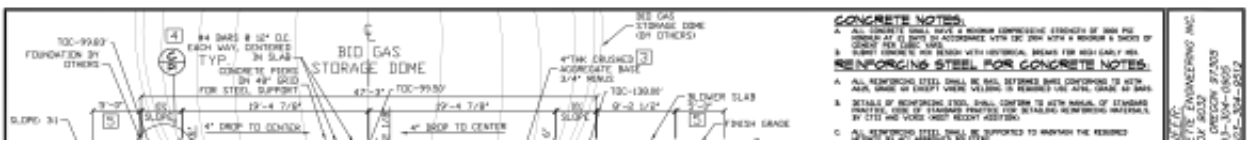
Tim

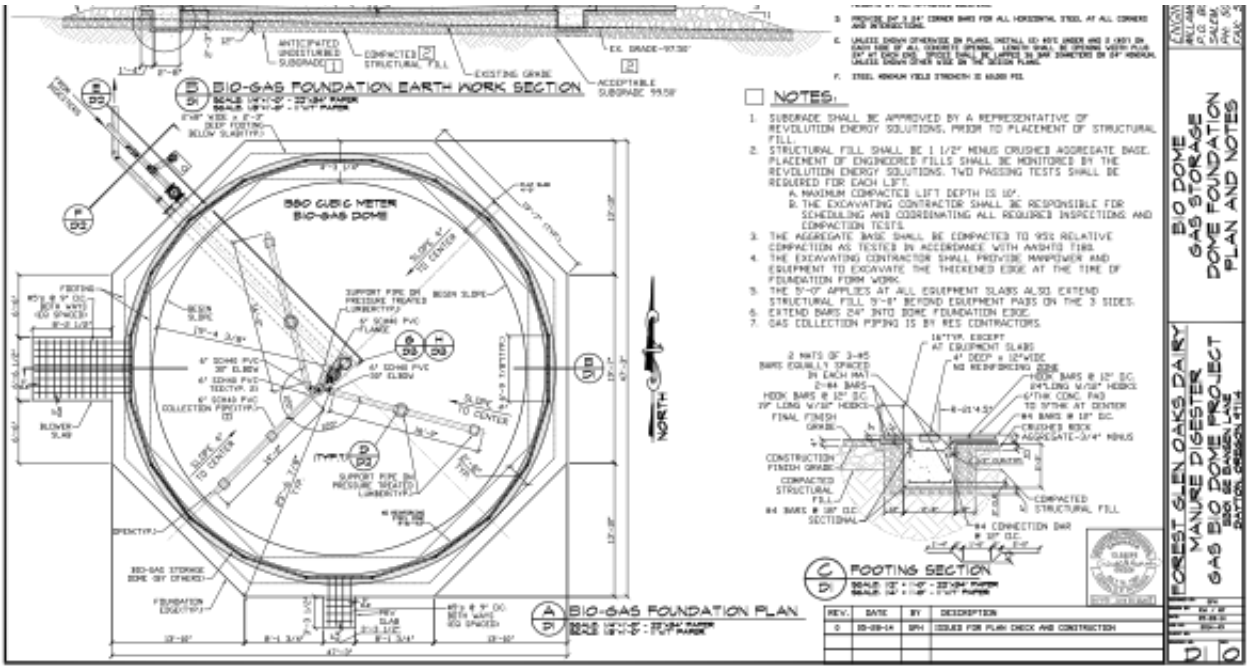
Tim O'Connell

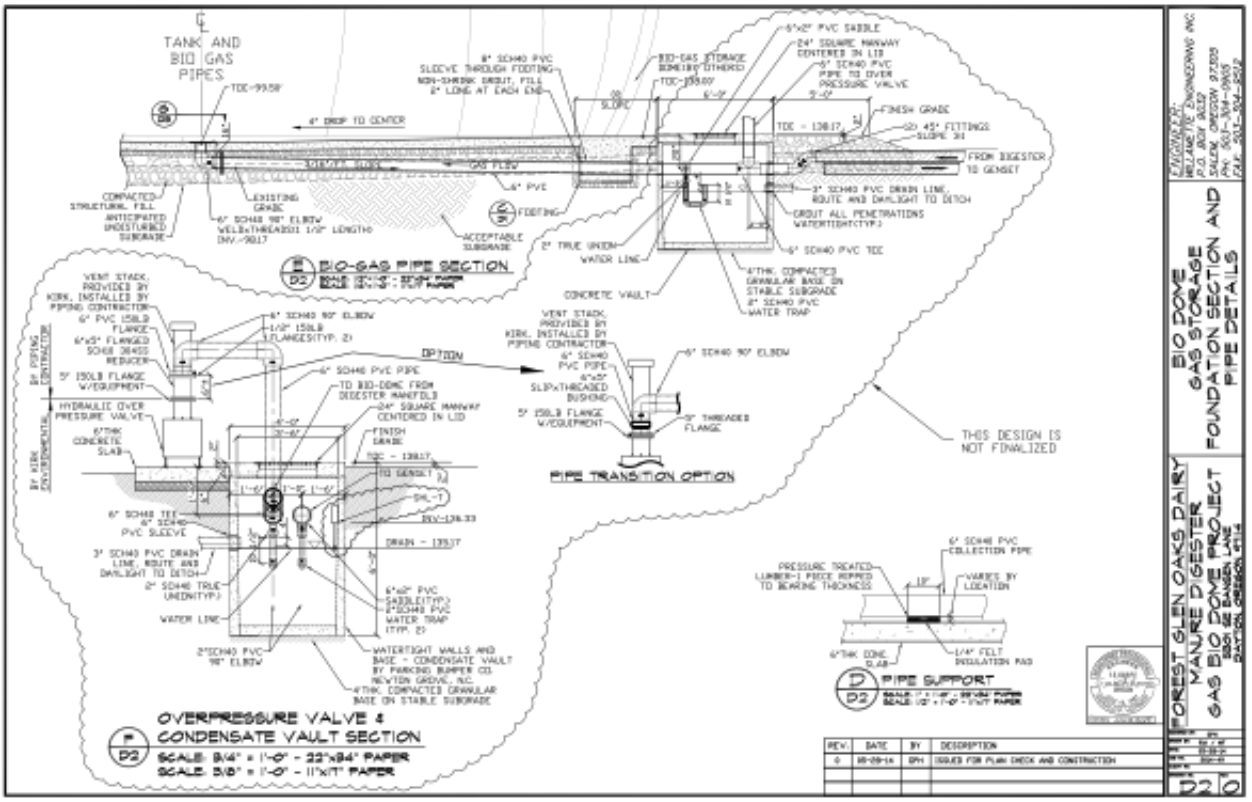
Western Area Ag Manager
CST Storage
A Division of CST Industries, Inc.
345 Harvestore Dr
DeKalb, IL 60115
Direct: (815) 261-0988
Mobile: (405) 380-5410

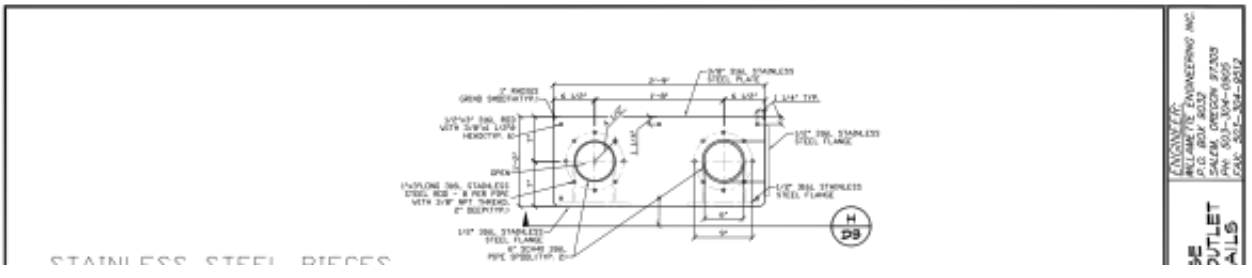
Email: toconnell@cst-storage.com

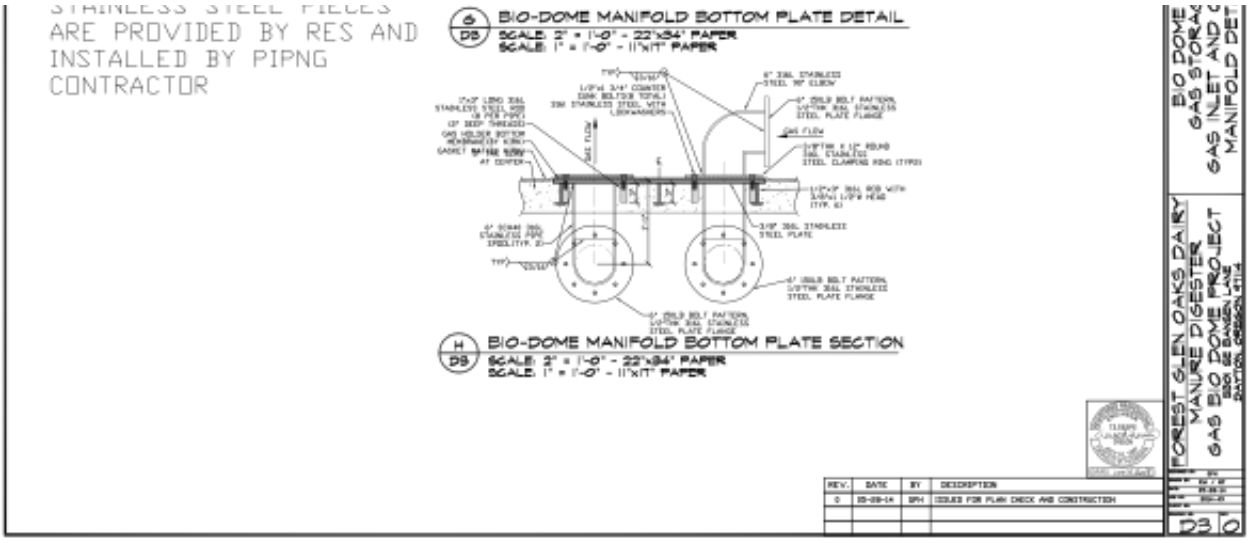
PDF
BIS-K012(A) Biodome Specificatio…anding.pdf




BIO-GAS FOUNDATION EARTH WORK SECTION
880 CUBIC METER BIO-GAS DOME
BIO-GAS FOUNDATION PLAN
FOOTING SECTION
NOTES:
1. SUBGRADE SHALL BE APPROVED BY A REPRESENTATIVE OF REVOLUTION ENERGY SOLUTIONS, PRIOR TO PLACEMENT OF STRUCTURAL FILL.
2. STRUCTURAL FILL SHALL BE 1 1/2" MINUS CRUSHED AGGREGATE BASE. PLACEMENT OF ENGINEERED FILLS SHALL BE MONITORED BY THE REVOLUTION ENERGY SOLUTIONS. TWO PASSING TESTS SHALL BE REQUIRED FOR EACH LIFT.
A. MAXIMUM COMPACTED LIFT DEPTH IS 10".
B. THE EXCAVATING CONTRACTOR SHALL BE RESPONSIBLE FOR SCHEDULING AND COORDINATING ALL REQUIRED INSPECTIONS AND COMPACTION TESTS.
3. THE AGGREGATE BASE SHALL BE COMPACTED TO 95% RELATIVE COMPACTION AS TESTED IN ACCORDANCE WITH AASHTO T180.
4. THE EXCAVATING CONTRACTOR SHALL PROVIDE MANPOWER AND EQUIPMENT TO EXCAVATE THE THICKENED EDGE AT THE TIME OF FOUNDATION FORM WORK.
5. THE 5'-0" APPLIES AT ALL EQUIPMENT SLABS ALSO EXTEND STRUCTURAL FILL 5'-0" BEYOND EQUIPMENT PADS ON THE 3 SIDES.
6. EXTEND BARS 24" INTO DOME FOUNDATION EDGE.
7. GAS COLLECTION PIPING IS BY RES CONTRACTORS.
NORTH
REV. DATE BY DESCRIPTION
0 05-09-14 BPH ISSUED FOR PLAN CHECK AND CONSTRUCTION
BIO DOME GAS STORAGE DOME FOUNDATION PLAN AND NOTES
FOREST GLEN OAKS DAIRY MANURE DIGESTER
GAS BIO DOME PROJECT
D1 0

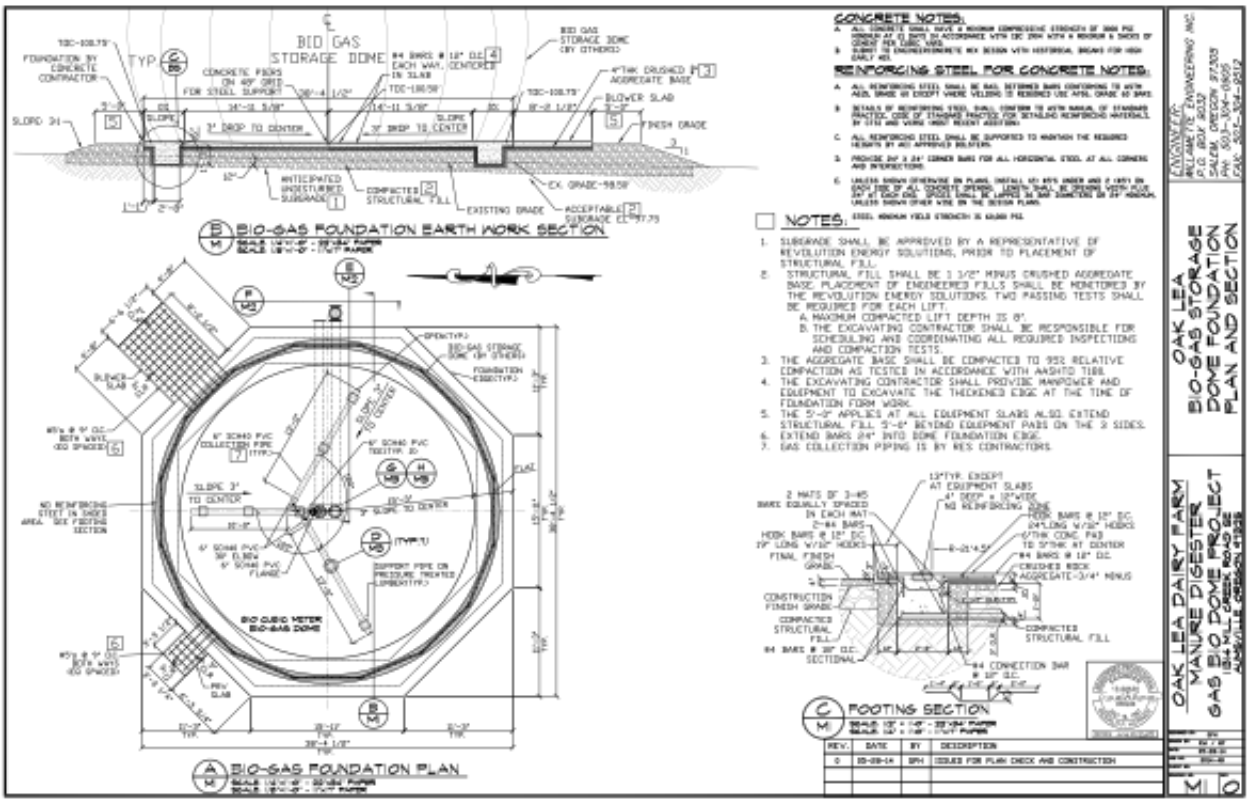

TANK AND BIO GAS PIPES
BIO-GAS PIPE SECTION
OVERPRESSURE VALVE & CONDENSATE VAULT SECTION
SCALE: 3/4" = 1'-0" - 22"x34" PAPER
SCALE: 3/8" = 1'-0" - 11"X17" PAPER
PIPE TRANSITION OPTION
PIPE SUPPORT
THIS DESIGN IS NOT FINALIZED
REV. DATE BY DESCRIPTION
0 05-09-14 BPH ISSUED FOR PLAN CHECK AND CONSTRUCTION
BIO DOME GAS STORAGE FOUNDATION SECTION AND PIPE DETAILS
FOREST GLEN OAKS DAIRY MANURE DIGESTER
GAS BIO DOME PROJECT
D2 0

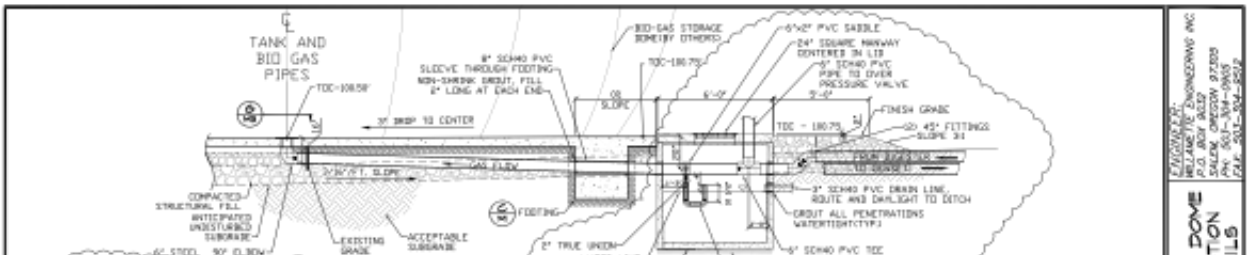

STAINLESS STEEL PIECES

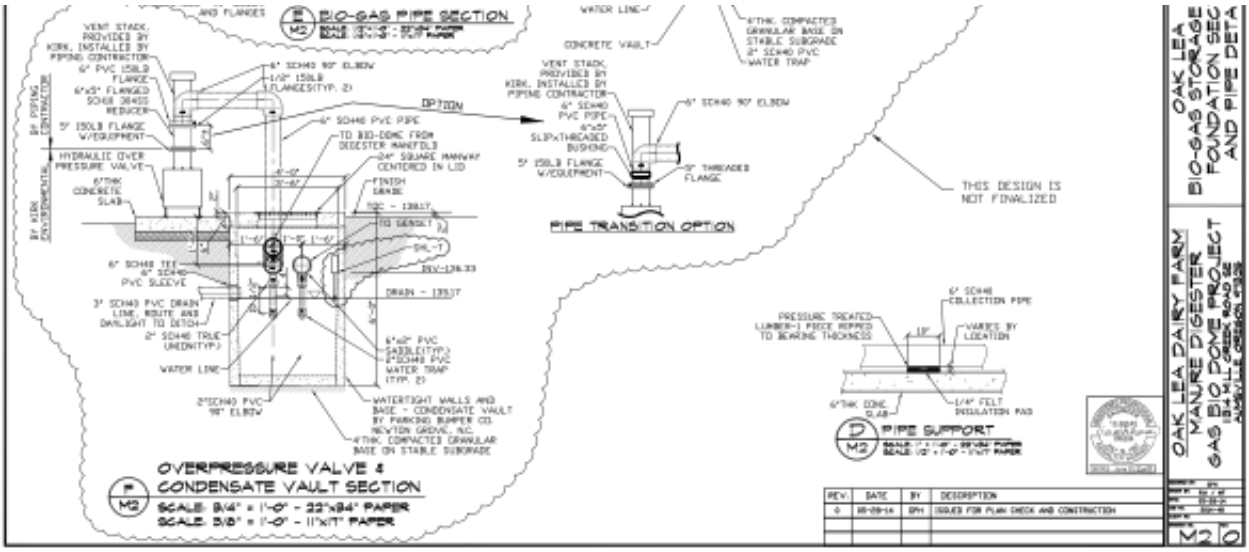


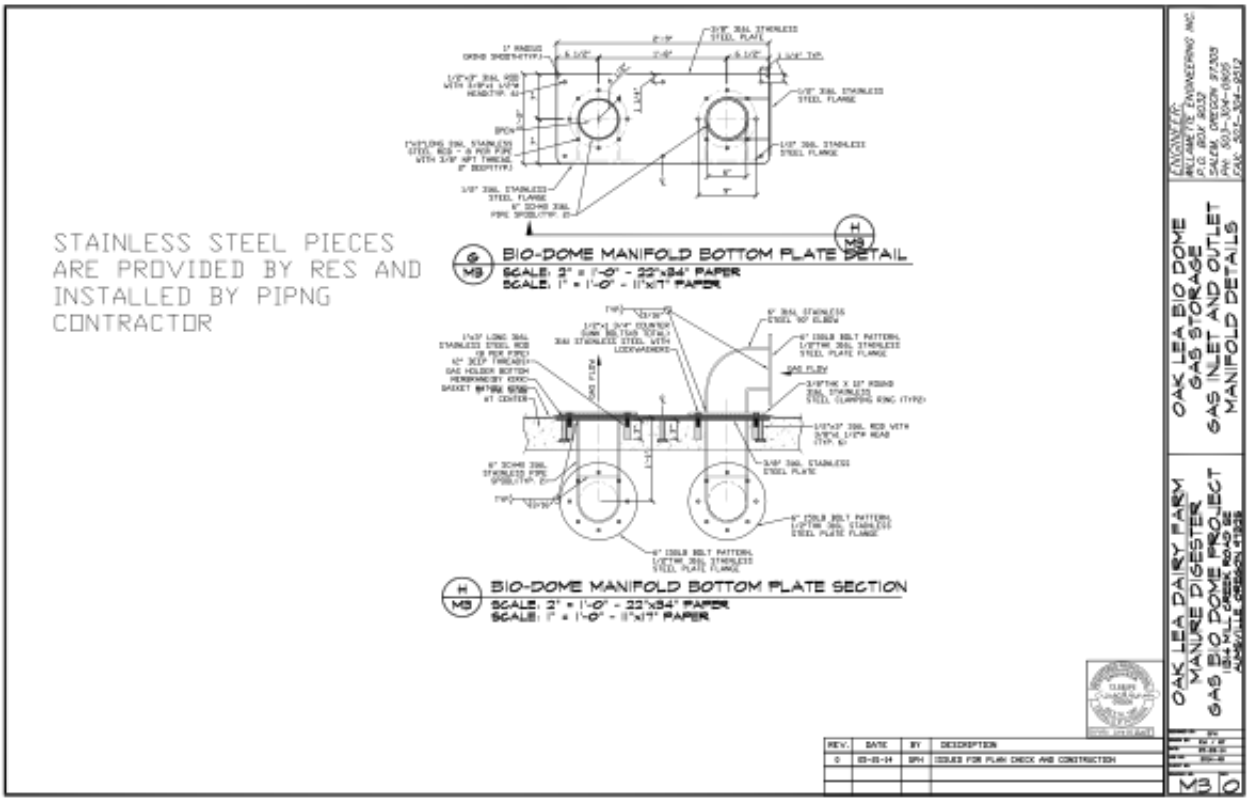
PDF

Forest Glen Oaks Bio Dome Foun…lations.pdf









PDF

Oak Lea Bio Dome Foundation…ulations.pdf

BIODOME® INTERNATIONAL

Valley Forge Business Park,
Reedyford Road, Nelson,
Lancashire, BB9 8TU, UK

T: +44 (0)1282 677968
F: +44 (0)1282 696731

www.biodome-international.com

TECHNICAL SPECIFICATIONS OUTER MEMBRANE – TYPE 3

Quality Typ III – Polyester 1670 dtex weaving, both sides PVC-coated and lacquered, increased UV – resistance, fungicide treatment, flame retardant according to DIN 4102 B I, high gloss, cadmium free.

Base Material:

- High tenacity polyester 1670 dtex
- Weave Panama 2:2
- Thread density: warp: approx. 10.5 thr/cm
- Weft: approx. 10.5 thr/cm
- Weight: approx. 350g/m²

Carrying-out of welding seams:

60mm HF

Finished Material:

- Total weight: approx. 1100 g/m² - Total thickness: approx. 1mm
- Tensile strength: (DIN 53 354) Warp: approx. 5700N/5cm Weft: approx. 5100 N/5 cm
- Tear strength: (DIN 53 363) Warp: approx. 950N/5cm Weft: approx. 800N/5cm
- Coating Adhesion: (DIN53 352) 150 N/5cm
- Cold Resistance: Rating 0* (DIN 53 361) 1 h at -30°C (* rating 0-4, 0 = Very good)
- Heat Resistance: No sticking after 24h at +70°C

TECHNICAL SPECIFICATIONS INTERNAL AND BOTTOM MEMBRANE - TYPE 3

Quality Typ III – Polyester 1670 dtex weaving, both sides PVC-coated and lacquered, increased UV – resistance, fungicide treatment, flame retardant according to DIN 4102 B I, high gloss, with special plasticizer.

Base Material:

- High tenacity polyester 1670 dtex
- Weave Panama 2:2
- Thread density: warp: approx. 10.5 thr/cm
- Weft: approx. 10.5 thr/cm
- Weight: approx. 350g/m²

Carrying-out of welding seams:

60mm HF

Finished Material:

- Total weight: approx. 1100 g/m² - Total thickness: approx. 1mm
- Tensile strength: (DIN 53 354) Warp: approx. 5700N/5cm Weft: approx. 5100 N/5 cm
- Tear strength: (DIN 53 363) Warp: approx. 950N/5cm Weft: approx. 800N/5cm
- Coating Adhesion: (DIN53 352) 150 N/5cm
- Cold Resistance: Rating 0* (DIN 53 361) 1 h at -30°C (* rating 0-4, 0 = Very good)
- Heat Resistance: No sticking after 24h at +70°C

Valley Forge Business Park, Reedyford Road, Nelson, Lancashire. BB9 8TU. UK
t: +44(0)1282 677966 e: enquiries@biodome-international.com f: +44(0)1282 696731
w: www.biodome-international.com

Specification for Biodome® Double Membrane Free-standing Gas Holder Installations

1. SYSTEM DESCRIPTION

1.1. General

1.1.1. The gas containment structure shall comprise 3-off coated fabric membranes forming a truncated spherical assembly onto a concrete base slab. The gas containment volume shall be formed between a flat 'bottom' membrane laid onto the base slab and a spherically shaped internal membrane. A spherically shaped external membrane will form the outside of the structure, providing the air support compartment.

1.1.2. A standard range of Biodome® double membrane gas holders provides for a wide variation of standard geometry and storage volumes.

1.1.3. The Biodome® double membrane gas holder shall be designed to suit the project specific working gas pressure and gas production/usage rates. .

1.2. Standard Installations

1.2.1. The following items are included within the civils element of the package:

1.2.1.1. A concrete base slab designed to accommodate the bearing pressure from the stored gas as well as the anchoring forces from the Biodome® structure.

1.2.1.2. Project specific gas feed and draw-off pipework .

1.2.2. The following items shall be included within the gas holder supply package:

1.2.2.1. 1-off external membrane.

1.2.2.2. 1-off internal membrane.

1.2.2.3. 1-off bottom membrane.

1.2.2.4. 2-off electric powered air-support blowers (Duty and Stand-by).

BIODOME LTD
Registered in England and Wales No. 07347949 – Registered Office as above
VAT No: 114 2370 57

1.2.2.5. 1-off pressure regulating valve.
1.2.2.6. 1-off hydraulic over-pressure relief valve.
1.2.2.7. 1-set anchoring rails and anchoring bolts.
1.2.2.8. 1-off acrylic viewing window in outer membrane.
1.2.2.9. 1-off electrical contents fill/level sensor.
1.2.2.10. 1-off gas detection system for outer membrane volume.
1.2.2.11. All necessary air hoses for connections between blowers, valves and membranes.

1.2.3. The electrical connections to the gas holder ancillary equipment shall generally fall within the scope of the project main electrical installation contractor, but may be included as an option from the gas holder supplier.

2. DESIGN, CONSTRUCTION AND SPECIFICATIONS

2.1. Design Loads

2.1.1. The membrane structures shall each be designed to resist the internal forces due to the gas and air pressures. The internal membrane shall be designed to accommodate the full forces due to internal pressure in the absence of air pressure within the external membrane in case of total air blower failure. In addition, the external membrane shall be designed to accommodate forces due to wind and snow loading. In lieu of any global standard for air-supported membrane-type Gas Holder structures, the structural design shall be compliant with the relevant parts of the German standard for air-supported structures DIN 4134 (1983).

2.1.2. Design wind loads shall be determined according to BS.6399: Part 2. 2.1.3 Design snow loads shall be determined according to BS.6399: Part 3, applied in accordance with the DIN standard.

2.2. Base

2.2.1. The base shall be constructed from reinforced concrete, designed to accommodate the maximum anchoring forces due to the combination internal pressure and external imposed load cases.

2.2.2. The base shall be circular or any flat sided polygon that suits the dimensions of the gas containment membranes.

2.2.3. Gas charge and discharge pipes as specified against the requirements of individual projects shall be provided underneath the concrete terminating at the centre of the base slab.

2.2.4. The base pipework shall be terminated in the centre of the base with a connection manifold to suit the gas holder standard 'bottom' membrane sealing detail. Captive nuts under the manifold for the clamping-flange fasteners shall be capped and gas-tight.

2.2.5. Gas charge and discharge pipework shall be fabricated from stainless steel (grade 316). The pipework shall terminate at the condensate chamber pit with flanges to BS.4304 PN16.

2.2.6. The under-base pipework shall be designed to eliminate the build-up of condensate water either by pipework design or by the provision of fail-safe drainage.

2.2.7. The periphery of the base shall provide a flat level area for the membrane anchorage, and shall slope downwards towards the gas pipes to provide for condensate drainage. Base slope shall be a minimum of 1° and a maximum of 5°.

2.2.8. The reinforced concrete shall be designed with a reinforcement-steel exclusion zone around the anchorage positions to allow for unrestricted site drilling of the anchoring bolts during installation.

2.2.9. The concrete surface shall be finished to 'steel trowel finish' in accordance with Civil Engineering Specification for the Water Industry (CESWI).

2.3. Membranes

2.3.1. The three membranes shall be manufactured from PVC-coated polyester fabrics. The membranes shall be manufactured to form the correct truncated spherical shape. All joints shall be welded and additional material thickness shall be provided as

reinforcement at key structural locations.

2.3.2. The external membrane material shall be coated both sides with finisher and softener. The membrane shall be protected against Ultra Violet light, treated with fungicide, and flame retardant according to DIN 4102 B1. The minimum material strength shall be 5000N/5cm or greater according to the static design calculations for the inflated structure.

2.3.3. The internal and bottom membranes shall be coated both sides with finisher and softener. The membrane shall be protected against Ultra Violet light, treated with fungicide, and flame retardant according to DIN 4102 B1. The minimum material strength shall be 5000N/5cm or greater according to the static design calculations for the inflated structure. The material shall also be protected against the project specific requirements of the composition of the gas to be stored. Methane permeability shall be less than 250ml/m².day.bar. The internal membrane shall be designed to resist the maximum operating pressure of the system to ensure its integrity in the event of a total failure of both air blowers.

2.3.4. All edges of each stressed membrane shall be reinforced by encapsulated polyester rope. This shall include the peripheral edges around the anchor channels and edges around all penetrations (viewing windows, instrumentation etc). Reinforcement is not required around the edges of the pipe penetrations through the non-stressed 'bottom' membrane.

2.3.5. Facility must be provided to enable access for inspection/repair in the event of gas leakage from the inner membrane.

2.4. Air Support Blowers

2.4.1. Air support blowers shall be specified according to individual project requirements. Operating pressure, maximum and average gas production volumes, and maximum and average gas consumption volumes shall all be considered when specifying the blower power and air-flow rates.

2.4.2. Blower units shall be powered by 415v, 3-phase, 50Hz electricity. To ensure continuous operation of the gas holder and plant reliant upon it, it is recommended that an uninterruptable power supply is provided by means of an automatically operated back-up generator.

2.4.3. Blower units shall be specified for operation in hazardous areas and be protected to ATEX 94/9/EC for Zone 2, CAT 3G. The motor shall be specified to IE2 efficiency, ATEX Zone 2, IP55 ingress protection.

2.4.4. Each air blower unit shall be provided with a non-return valve in the air hose between the blower and the 'Y'-piece connecting the blowers to a common supply hose to the outer membrane.

2.4.5. The non-return valves shall be designed to be non-sparking.

2.5. Pressure Regulating Valve

2.5.1. A pressure regulating valve shall be provided to maintain the air pressure in the outer membrane air containment compartment. The valve shall be connected to the outer membrane by a flexible air hose.

2.5.2. The valve shall be designed to be non-sparking.

2.5.3. The valve plate shall be fitted with balancing weights that can be adjusted to determine the operating pressure of the structure.

2.6. Hydraulic Over-Pressure Valve

2.6.1. A hydraulic over-pressure valve shall be provided for connection into the gas holder gas supply pipework.

2.6.2. The valve shall be manufactured from grade 316 stainless steel.

2.6.3. The valve size shall be determined according to individual project specifications, ensuring a blow-off capacity in excess of the specified maximum gas production rate.

2.6.4. The valve shall provide a surge pressure relief of 5mbarg above the gas holder operating pressure.

2.6.5. The valve shall be filled with a glycol anti-freeze mixture to protect against freezing to -40°C.

2.6.6. The valve shall be provided with a contents level viewing window, a fill-level tapping fitted with valve, and a drain tapping fitted with a screwed plug.

2.6.7. The valve shall be supplied with a vent stack of sufficient height that gas is vented above personnel head height.

2.6.8. The vent stack cowl shall be screened against the ingress of birds.

2.7. Anchor Rails and Anchor Bolts

2.7.1. The membranes shall be clamped to the concrete base structure by the use of anchor rails.

2.7.2. The anchor rails shall be provided in channel section stainless steel grade 304.

2.7.3. The anchor rails shall be fitted with protective strips along the channel legs to prevent chaffing of the membrane.

2.7.4. Anchor rails shall be secured to the base using spun galvanised or stainless steel expanding anchor bolts. Isolation washers shall be provided between the galvanised washer and the stainless steel rails. Plastic nut-caps shall be fitted to the anchor bolts. (Resin/Chemical anchor bolts are not suitable for this purpose due to the requirement to compress the sealing gaskets AND ensure that the bolt is contained within the sides of the channel).

2.8. Contents / Fill Level Measurement

2.8.1. Contents measurement shall be determined by the measurement of the height of the internal membrane above the base level.

2.8.2. An ultrasonic transducer shall be provided in the crown of the outer membrane. This unit shall be Eex rated for use in hazardous environments.

2.8.3. A report unit with an output signal of 4-20 mA shall be provided for inclusion within the gas holder or overall system control panel. Power supply requirements shall be 110v or 240v, 50Hz as specified by the panel builder.

2.9. Gas Detection System

2.9.1. A gas detection sensor shall be provided to detect leakage of gas into the outer membrane air containment. The sensor shall be Eex rated for use in hazardous environments and shall be factory calibrated for the detection of methane gas.

2.9.2. The sensor shall be located at the outer membrane pressure regulator valve.

2.9.3. A report unit for inclusion within the gas holder control system shall be provided. This will provide output for the alarm/control system. Power supply requirements shall be 110v or 240v, 50Hz as specified by the panel builder.

2.10. Hazardous Zone Categories

2.10.1. Inner membrane containment: Zone 0

2.10.2. Outer membrane containment: Zone 1

2.10.3. Area around outer membrane extending 6m in all directions: Zone 2

2.11. Lightning Protection (where necessary)

2.11.1. Where required, the gas holder installation shall be provided with a lightning protection system in accordance with the requirements of BS.6651.

2.11.2. A 'Faraday cage' type system is the standard provision, with down-conductors affixed to the outer membrane. The number of down-conductors will increase according to the project specific size of the Biodome®.

2.11.3. When the 'Faraday cage' type protection is specified, earth pots must be included within the scope of the civils package for the termination of the down-conductors.

2.11.4. Alternative arrangements of lightning poles and air-conductors may be specified if required on a per-project basis. These arrangements require sufficient space around the Biodome® for the erection of the vertical poles.

3. SYSTEM SPECIFICATION

3.1. Design Input Requirements.

3.1.1. Project site location.
3.1.2. Storage system operating pressure (mbarg).
3.1.3. Maximum gas production rate (m^3/hour).
3.1.4. Average gas production rate (m^3/hour).
3.1.5. Maximum gas storage capacity (hours production retention or volume in m^3).
3.1.6. Maximum gas withdrawal rate (m^3/hour).
3.1.7. Composition of gas to be stored.
3.1.8. Sizes of all gas charge and discharge pipework.
3.1.9. Colour of outer membrane.

3.2. Dimensions.

3.2.1. Gas Holder dimensions shall be determined according to the standardised range based on the maximum storage capacity specified by the purchaser.
3.2.2. General Arrangement drawings will be issued that clearly show the system dimensions.

4. INSTALLATION AND TESTING

4.1. Installation

4.1.1. The installation programme shall be specified by the Purchaser to enable the Supplier to install the membranes and associated equipment and for immediate connection to the permanent electrical control circuits.
4.1.2. Once installed, the outer membrane shall be fully inflated

4.2. Testing

4.2.1. The seal between the bottom membrane and the inner membrane (the seal that forms the gas containment) shall be tested by a 'soapy water' bubble test. No leakage shall be permissible at this joint.
4.2.2. The gas containment seals shall be tested by partial inflation with air prior to commissioning.
4.2.3. The seal between the outer membrane and the inner membrane (the seal that forms the air containment) is not required to be 100% air-tight and is not tested. Some air leakage at this seal assists to dissipate condensation build-up between these two membranes.
4.2.4. The gas containment volume must be full purged of the test air by venting the containment against full inflation of the outer membrane prior to commissioning the structure for service.

4.3. Certification

4.3.1. Certification shall be provided for:
4.3.1.1. Completion of satisfactory testing of the gas containment membrane seal.
4.3.1.2. Certificate of Conformity for level sensor transducer.
4.3.1.3. Certificate of calibration for gas detection sensor.

5. ADDITIONAL NOTES

5.1. Access Provisions

5.1.1. Further to the access provisions of clause 2.3.5, there are no operational reasons for access into the void between the two membranes. Access to this void would only be required in the event of a suspected leakage from the inner membrane. Membrane repairs should only be carried out by specialised personnel. A permanent 'access' opening through the outer membrane is not required when access can be gained through the opening of the viewing window.