THOMPSON PUMP & Irrigation Inc.

Aaron Lafky
99997 Starvation Lane
Morro, Oregon

11-9-15

541-480-3166: aaronlafky@gmail.com

Pivot A:

604' Valley 8000 pivot including:

(3) 6" x 180' spans, 64' overhang, 11.2 x 24 tires with tubes, pivot flex, run light, Select control panel, hose drops – rotators – regulators, end of field auto reverse with barricades, no end gun, pad, freight, installation

Total $53,074.00

Ancillary:

800'	5" 125# pvc	2.47	1976.00
850'	wire and conduit	2.31	1963.50
800'	pipe and wire installation	2.00	1600.00
1	5" gooseneck at pivot		375.00
1	4" Nelson control valve		813.00
1	4" x 6" flanged barrel		125.00
1	thrust blocks		200.00
		Total	**$ 7,052.50**

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2425 SW Highway 97 ▪ Madras, Oregon 97741 ▪ Phone (541) 475-1215 ▪ Fax 475-7515
CCB # 56341 ▪ www.thompsonpump.us

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Pivot B:

747' Valley 8000 pivot including:

(4) 180' spans, 27' overhang, all other options same as Pivot A.

Total		**$64061.00**

Ancillary pivot B:

900'	5" 125# pvc	2.47	2223.00
950'	wire and conduit	2.31	2194.50
900'	pipe and wire installation	2.00	1800.00
1	5" gooseneck at pivot		375.00
1	4" Nelson control valve		813.00
1	4" x 6" flanged barrel		125.00
1	thrust blocks		100.00
		Total	**$ 7630.50**

NW Corner CREP tie in:

1130'	4" 125# pvc	1.67	1887.10
1130'	pipe installation	1.50	1695.00
1	5 x 4 tie in		53.26
8	4 x 4 x 30" galvanized risers	182.00	1456.00
1	4" end piece with vent and drain		175.00
1	thrust blocks		100.00
		Total	**$ 5366.36**

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Tie into existing CREP area:

680'	4" 125# pvc (pump to tie in point)	1.67	1135.60
680'	pipe installation	1.50	1020.00
1	Nelson wireless controller		1448.00
3	single twigg wireless	594.00	1782.00
3	2" Nelson valves	871.00	2613.00
1	misc. tie in fittings		300.00
1	thrust blocks		100.00
		Total	**$ 8,398.60**

Pivot Pump: 220 gpm @ 55 psi

1	15 hp close set turbine		10,460.00
1	15 hp VFD 3R drive (outdoor enclosure)		6,957.00
1	6" check valve		282.00
1	6" flow meter (seametrics)		2,027.00
1	6" flanged barrel		65.00
1	6" gooseneck		475.00
1	6 x 5 x 5 tee		93.00
1	flange gaskets and bolts		75.00
1	pump installation		500.00
		Total	**$ 20,934.00**

Top system to CREP area and NW corner pump: 80 gpm @ 80 psi

1	7 ½ hp close set turbine pump		12,066.00
1	7 ½ hp VFD 3R drive		6,168.00
1	4" check valve		232.00
1	4" flow meter (seametrics)		1,909.00
1	4" flanged barrel		55.00
1	4" gooseneck		325.00
1	flange gaskets and bolts		50.00
1	pump installation		500.00
		Total	**$ 21,305.00**

(a submersible turbine could be used instead for $7440.00)

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New River Intake:

River Screen Sump:

1	5' x 20' culvert		1789.50
1	fabricated screened lid		187.50
1	CW600 Clemons fish screen		1711.00
1	8" x 90 sweep		150.00
1	fabricated ladder		90.00
2	8" flange adpt.	115.45	230.90
2	8" worm gear butterfly valve 8' extension	914.00	1828.00
2	bolt sets	20.00	40.00
2	8" pvc flanges	49.60	99.20
1	shop welding		600.00
	Total		**$ 6,726.10**

Pump Sump:

1	4' x 20' culvert	1095.00
1	fabricated pump platform (2 pumps)	289.00
1	center baffle	150.00
1	8" stub out	115.45
1	8" dresser coupler	116.00
1	shop welding	500.00
1	culvert and pipe installation in customer ditch	2000.00
	Total	**$ 4,265.45**

1	Estimate to transport pivot down the grade	**$ 3,000.00**

1	Valley Base Station including: Radio link at each pivot, Base control at house, installed	**$ 12,010.00**

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Total:

Pivot A	$53,074.00
Ancillary	7,052.50
Pivot B	$64,061.00
Ancillary	7,630.50
NW Corner CREP tie in	5,366.36
Tie into existing CREP area	$ 8,398.60
Pivot pump	$20,934.00
Top system to CREP area & NW corner pump	$21,305.00
River Screen Sump	$ 6,726.10
Pump sump	$ 4,265.45
Transport estimate	$ 3000.00
Valley Base Station	$12,010.00
Total	$ 213,823.51

Steve Frazier 408-5572

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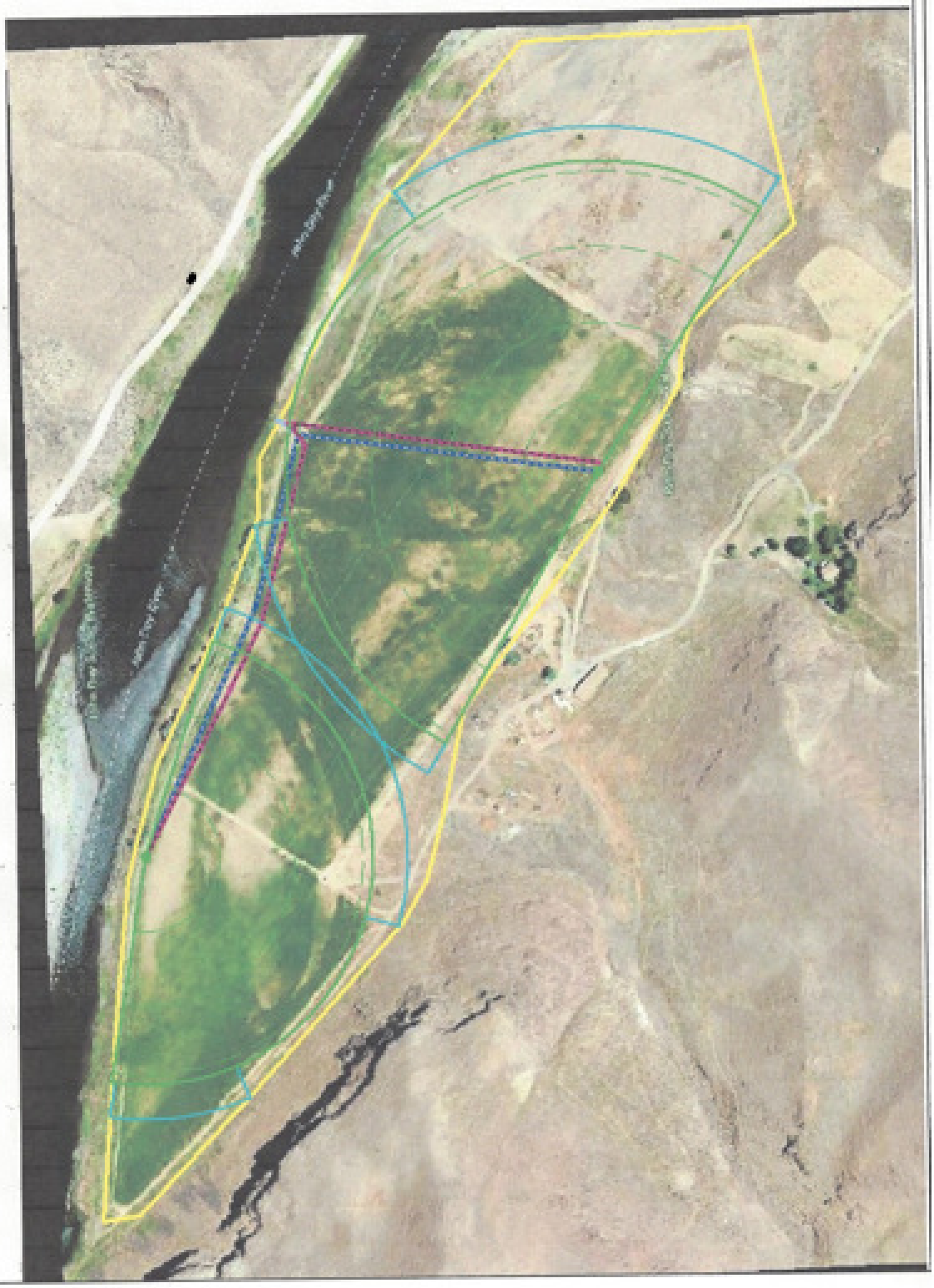
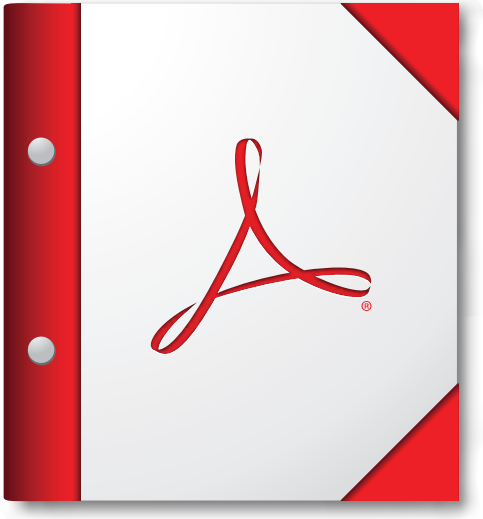
John Day River Ranch
Irrigation Efficacy Project

Pivot A	53,074
Ancillary A	7,631
Pivot B	64,061
Ancillary B	7,053
Northwest Corner Pick Up	5,366
Tie Into Existing Crep	8,399
Valley Base Station	12,010
Transport	3,000
Total Pivot Cost	160,593
Pump Station	
Pivot	20,934
Tie In	21,305
Total Pump Station Cost	42,239
Intake System	
Screen Sump	6,726
Pump Sump	4,265
Total Intake System Cost	10,992
Excavation	
Ditch and Backfill	22,815
Pivot Base	2,400
Intake Dig Out	22,500
Total Excavation Cost	47,715
Electrical	
Wire VFD & Pivot Make Up	1,500
2 Fused Disconnects	2,555
480 Transformer	5,500
Total Electrical Cost	9,555
Sub-Total	271,094
Contingency	29,163
Total Project Costs	300,258


Malheur River
Malheur Creek



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Agricultural Energy Management Plan - Landscape

Aaron Lafky

JDR Ranch LLC, Bend, Oregon

Fred Vosper

Dec 17, 2013

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

An Agriculture Energy Management Plan (AgEMP) estimates current baseline energy usage and the energy savings by change in practices. The baseline is determined by a site visit and information provided by the producer. Energy use calculations are based on the USDA NRCS Cropland Energy Estimation Tool calculator. Acreage values contained within the plan are approximation and may not represent actual values. Northwest Energy Engineering LLC considers this plan a reasonable representation of the energy use and savings based on the information provided and the proposed changes. Actual energy use and savings may vary based on multiple factors including weather and practices that may not be addressed in this plan.

Information contained within this plan is confidential and the plan is not for public release or distribution.

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Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

Overview

An Agricultural Energy Management Plan (AgEMP) contains the strategy by which producers can voluntarily address on-farm energy savings opportunities. Aaron Lafky is engaged in irrigated farming within Morrow County, Oregon. The AgEMP is for 36 acres of irrigated land located east of Moro, Oregon.

Irrigated water is provided from the John Day River. There are two centrifugal pumps that move the water to the fields. The irrigation water is delivered by a combination of two wheel lines, two traveling big guns and hand lines.

The primary crop planned is alfalfa hay with a rotation crop of oats or barley hay. The irrigated land will employ a mulch-till practice which involves primary tillage by chisel plot or other non-inversion implement followed by one or more tillage practices. The planting and tillage operations leave previous crop residue on the surface. All of the soil is disturbed. The practice also includes harvest, fertilizer applications, and pesticide applications when appropriate.

The Washington state NRCS Crop land energy estimation tool was used to calculate the energy use of the farm. Irrigation energy use was based on a combination of tools including an energy assessment using guidelines from Irrigation Sixth Edition (2011 – Irrigation Association) and the BPA Variable Frequency Drive – Energy Savings Estimator.

Aaron has a goal of being as energy efficient as possible while lowering expenses. Soil sampling is planned to determine nutrient content. He plans to improve the pumping plant(s) and irrigation systems. It is recommended that he install center pivots to replace the current irrigation systems. A pumping plant should be replaced/upgraded to match the requirements of the center pivots.

All land in the plan is EQIP (Environmental Quality Incentives Program) eligible. No resource issues for soil erosion, water quantity, or local concerns were identified by the producer.

Recommendations

Practices

- Upgrade the irrigation systems in the fields to center pivots. Estimated energy savings of 17,472 kWh based on reduced water pressure requirements and improved watering efficiency. Irrigation System – Sprinkler (442).
- Replace/upgrade a pump to match the irrigation requirements of the center pivot systems. Energy saving of 2,378 kWh based on improved pump efficiency. Pumping Plant (533).
- Implement scientific irrigation scheduling to reduce watering and energy requirements. Scientific Irrigation Scheduling (SIS) calculations indicate an annual savings of 1.924 kWh when practiced. It is recommended that a flow meter be installed/maintained at the pump. Irrigation Water Management (449).
- It is recommended that automation be installed/utilized at the pumping plants. Automation that allows pump and pivot monitoring and/or control by computer or smart phone can identify irrigation issues and improve irrigation management. Automation improvements that result in a 3% reduction in electrical consumption will save 400 kWh. Irrigation System, Sprinkler (442).
- Replace sprinkler hardware on a routine basis to optimize system performance. Annual estimated energy savings is 1,500 kWh. Irrigation System, Sprinkler (442).
- Measure soil nutrient content to determine fertilizer application rates. Nutrient Management (590).

A summary of new practices are shown in Table 1.

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

Recommended Measure	Estimated Reduction in Energy Use and Cost Savings						
	Electrical Savings (kWh)	Agrichemical (lb)	Diesel Savings (Gal)	Energy Savings (MMbtu)	Estimated CO^2 (lbs) Reduction	Energy Cost Savings	Additional Cost Savings
Upgrade to Center Pivot Systems - Irrigation System - Sprinkler (442)	17,472			59.6	15,005	$874	
Replace/Upgrade Pump to Match Center Pivot Requirements - Pumping Plant (533)	2,378			8.1	2,042	$119	
Implement high level Scientific Irrigation Scheduling - Irrigation Water Management (449)	1,924			6.6	1,652	$96	
Install Automation - Irrigation System - Sprinkler (442)	400			1.4	344	$20	
Total	22,174	0	0	75.7	19,043	$1,109	

Table 1. Summary of new recommended practice

Tractor and Field Operations

- The most efficient energy operation will have the best matched tractor to the implement. The principle of gearing up and throttling down should be used to maintain proper ground speed while optimizing fuel consumption. A tractor will get better fuel economy when it's operating at a medium gear and medium RPM rather than a low gear and high RPM. The engine speed should be reduced as far as possible while staying in the engine power range for the tractor.
- Upgrade to a more efficient tractor when replacing an older model. The Nebraska Tractor Test Lab reports the efficiency of tractors in horsepower hours per gallon. The common efficiency rating for a field tractor is between 17 to 19 horsepower hours per gallon. The higher the number the more energy efficient the tractor.
- Properly inflated radial tires can significantly reduce slippage in comparison to bias ply tires. High wheel slippage (> 15% for two-wheel drive and >10% for four-wheel drive) will result in lower fuel economy. Additional information can be found from references that are listed at the end of the plan.

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

Owner(s) Name(s):	Aaron Lafky		
Owner(s) Mailing Address(es):	P.O. Box 5908 Bend, Oregon 97708		
Owner(s) Phone Number(s):	541-480-3166		
Owner(s) Email(s):	aaronlafky@gmail.com		
	Owner(s) Signature(s)		
Plan Developed by:	Fred Vosper, Northwest Energy Engineering - LLC		
Planner's Mailing Address:	3305 Columbia View Dr. The Dalles, OR 97058		
Planner's Phone Number:	503-949-0225		
Planner's Email:	Fred.Vosper@gmail.com		
	Planner's Signature		
Plan Date:	Dec 17, 2013		
Total Acres in Plan:	36		
Producer's Objectives or Goals	Improve irrigation systems efficiency		
Attachments:	Conservation Plan Map Soils Map Soils Descriptions Energy Printouts Showing Before and After Energy Use (Savings) (list) Other (list):		

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

Resource Concern Assessment				
Resource Concern	**Minimum Treatment Level**	**Does this meet the minimum treatment Before Plan? Describe or attach evaluation**	**Does this meet the minimum treatment After Plan Implementation? Describe or attach evaluation**	**Comments**
SOIL EROSION - Sheet, rill,	Soil loss per RUSLE2 is ≤ T + 1 ton	Attach RUSLE2 Printout for each field	Attach RUSLE2 Printout for each field	No resource concerns identified by producer
SOIL EROSION - Wind erosion	Soil Loss per WEPS is ≤ T + 1 ton	Attach WEPS Printout for each field	Attach WEPS Printout for each field	No resource concerns identified by producer
SOIL EROSION – Concentrated flow erosion	Concentrated flow erosion is stabilized.	Describe fields with the problem:	Describe fields with the problem:	No resource concerns identified by producer
INSUFFICIENT WATER –Inefficient moisture management	Runoff and evapotranspiration are minimized to meet Client objectives, consistent with land capability.	Describe:	Describe:	No resource concerns identified by producer
INEFFICIENT ENERGY USE – Farming/ranching practices and field operations	Field operations and practices meet energy efficiency objectives and are addressed by planner using an energy assessment - e.g. On-Line Energy Self Assessment tool, RUSLE2, or WEPS as appropriate	Describe and attach Energy assessments	Describe and attach Energy assessments	NRCS Washington State Cropland Energy Tool Used
Other resource concerns (Describe):		Describe:	Describe:	

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

For Energy Saving due to nitrogen credits from grass/legumes:				
Planned Crop	**Acres**	**Grass/Legume Nitrogen Source**	**Nitrogen Credit N Lbs/AC**	**Total Energy Saving in BTU's 20,000 BTU's/Lb N**

Agricultural Energy Management Plan, Landscape Conservation Activity Plan (124)

Planned Conservation Practices			
Fields(s)	**Planned Application Year**	**Planned Practice(s) – Prepare Narratives for all practices. When planned, prepare Jobsheets or Implementation Requirements for:** 328 - Conservation Crop Rotation, 330 - Contour Farming, 340 - Cover Crop, 345 - Residue and Tillage Management, Mulch Till, 329 - Residue and Tillage Management, No Till/Strip Till/Direct Seed, 346 - Residue and Tillage Management, Ridge Till, 380 - Windbreak/Shelterbelt Establishment, 528 - Prescribed Grazing.	**Energy Jobsheet or Practice Specifications Attached (Yes or NO)**
All Irrigated cropland	2014	442 – Irrigation System – Sprinkler – Install Center Pivot(s)	No
River – T7682 F10	2014	533 – Pumping Plant – Replace/Upgrade pump to match requirements of center pivot(s)	Yes
All Irrigated cropland	2015	449 – Irrigation Water Management – Practice SIS	Yes
All Irrigated cropland	2014	442 – Irrigation System – Sprinkler – Install Automation	No
All Irrigated cropland	Ongoing	442 – Irrigation System, Sprinkler –Replace sprinkler packages on routine basis	No
All crop land	Ongoing	590 – Nutrient Management - Soil Sampling	No
		(Practice Code:) – Narrative	
		(Practice Code:) – Narrative	
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Irrigation Energy Use

Irrigation water is delivered from the river by two pumps (Table 2). The pumps are relatively old and in poor condition. Water is supplied to the fields by wheel lines, traveling big guns, and hand lines. The pumps have had electrical consumption of 4,204 kWh in July 2013. Historic electrical use includes 16,000 kWh in 2010 and 37,800 kWh in 2007.

Location	Pumping Plant
River	Centrifugal – 30 HP
River	Centrifugal - 25 HP

Table 2. Pumping plants

Irrigation System

Recommendation

- Upgrade the wheel lines and traveling big guns to center pivots. Energy savings of 17,472 kWh from reduced water pressure requirements and improved watering efficiency. Savings determined from NRCS cropland energy tool.

Irrigation Pumps

Recommendation

- Replace/Upgrade the centrifugal pump to match the requirements of the two center pivot systems. Estimated energy savings of 2,378 kWh from improved pump efficiency. Savings determined from NRCS cropland energy tool.

Scientific Irrigation Scheduling

It is recommended to practice irrigation water management with Scientific Irrigation Scheduling (SIS) when water is available. Actual savings of 1,924 kWh per year based on the BPA SIS calculator (Fig. 1). SIS provides information on when to irrigate, how much water to apply, and how to apply water to satisfy crop water requirements and avoid plant moisture stress. When used appropriately, irrigation scheduling saves water, energy, labor, and fertilizer (www.bpa.gov/energy/n/agriculture.cfm).

SIS Calculator Release 3.0

Standard Tool for Calculation of Water and Electricity Savings from Scientific Irrigation Scheduling

Bonneville Power Administration

Report Generated by Aaron Lasky for Columbia Basin Electric Coop
12/16/13 2:35 PM

Clear Crop Information

Enter Grower and Field Information	
User Name	Aaron Lasky
Utility Name	Columbia Basin Electric Coop
Project Name	AFD
Project Identifier	AgEMP
State	Oregon
County	Sherman
Average Electricity Rate ($/kWh)	$0.05

Pump Station Information	
Water Source	Other
Pump Type	Centrifugal
Pumping Plant Size (Effective HP)	50
Suction Type	Pumping Lift
Pumping Lift (+) feet	20
Suggested Pump Station Efficiency	Turbine / N/A hp / >100 ft / 66.3%
Tested Pump Station Efficiency (%)*	66.3%
Discharge Pressure (psi)	40

Crop Information	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5
Weather Station ID*	Echo (ECHO)				
ET Data Source (Agrimet, PAWS, Oregon)*	Model Data				
Crop Name*	Alfalfa (Mean)				
Total SIS Treated Acres	36.0				
Soil Type*	Sandy Loam				
Water Level in Soil Profile (%)	100%				
Effective Precipitation Adjustment Factor (%)	71%				
Irrigation System Type*	Center Pivot				
Suggested Application Efficiency % Range	75% - 85%				
Attainable Application Efficiency (%)*	90%				
Delivery Pressure (psi)	40				
Seasonal Crop ET (inches)*	45.35				
Total Seasonal Precipitation (inches)*	3.42				
Effective Seasonal Precipitation (inches)*	2.42				
Soil Water Holding Capacity (inches per foot)*	1.45				
Effective Root Depth (Feet)*	5.00				
Management Allowable Depletion (%)*	50%				
Antecedent Available Soil Moisture (inches)*	3.6				
Net Seasonal Water Requirement (inches)*	39.30				
Total Seasonal Water Use (acre-ft)*	131.00				
Actual Water Applied (in. of water hitting crop)	30.0				
Water Measurement Type*	Neutron Probe				
Actual Water Delivered (adjusted gross inches)*	33.3				
Verified Water Savings (acre-ft)*	11.1				
Verified Energy Savings (kWh/season)*	1,924				

Results for AFD	Potential	Actual
Total SIS Treated Acres	**36**	**36**
Water Savings (acre-ft)	**13**	**11**
Energy Savings (kWh/season)	**2,269**	**1,924**
Value of Energy Savings ($)	**$113**	**$96**

Fig. 1 Irrigation water management calculations

NRCS - CROPLAND ENERGY TOOL

ENERGY SUMMARY FOR ALTERNATIVE FIELD ROTATIONS

Landowner: Aaron Lafky
Field Location: Sherman Co., OR

Field Area: 36 ac
Field ID: See Plan Map

Date: 11/21/2013
Latitude:
Longitude:

	ALTERNATIVES	
Alternative Description	BENCHMARK	PLANNED
Crop Rotation	Alfalfa-Alfalfa-Barl	Alfalfa-Alfalfa-Barl
Length of Rotation	5.00 yrs	5.00 yrs
Irrigation Method	Wheel Lines to Pivots	Wheel Lines to Pivots
Energy Input (added) to Field [MMBTU/Ac/Yr]	**4.5**	**2.3**
	Savings 48.5%	**2.2 MMBTU/ac/yr**
Energy Harvest [MMBTU/Ac/Yr]	**51.7**	**51.7**
	Gain 0%	**0 MMBTU/ac/yr**
Energy Remaining [MMBTU/Ac/Yr]	**70.7**	**70.7**
	Gain 0%	**0 MMBTU/ac/yr**
Total Energy Yield [MMBTU/Ac/Yr]	**117.8**	**120.0**
	Gain 1.9%	**2.2 MMBTU/ac/yr**
Energy Gain Index	**27.15**	**52.66**
Output Index	**0.42**	**0.42**
Energy Harvest Index	**11.47**	**22.24**

NRCS - CROPLAND ENERGY TOOL

DETAILED ENERGY SUMMARY FOR ALTERNATIVE FIELD ROTATIONS

Landowner: Aaron Lafky Field Area: 36 ac Date: 11/21/2013
Field Location: Sherman Co., OR Field ID: See Plan Map Latitude:
Longitude:

Alternatives	Alternative Description	BENCHMARK		PLANNED	
	Crop Rotation	Alfalfa-Alfalfa-Barl		Alfalfa-Alfalfa-Barl	
	Length of Rotation	5.00 yrs		5.00 yrs	
	Irrigation Method	Wheel Lines to Pivots		Wheel Lines to Pivots	
Units	(MMBTU = Million British Thermal Units)	[MMBTU/ac/yr]	Percent	[MMBTU/ac/yr]	Percent
Energy Input (added) to Field	Harvest Operations Energy Input	0.8	16.8%	0.8	32.6%
	Field Operations Energy Input	0.3	6.2%	0.3	11.9%
	Irrigation and Delivery Energy	3.2	70.8%	1.1	48.5%
	Other Delivery Energy	0.0	0.0%	0.0	0.0%
	Agrichemicals/Fertilizers	0.3	6.2%	0.2	7.0%
	Soil Amendments	0.0	0.0%	0.0	0.0%
	Labor	0.000	0.0%	0.000	0.0%
Savings 48.5%	Total	**4.5**		**2.3**	
Energy Harvest	Crop Harvest Removed	51.7	100.0%	51.7	100.0%
	Post Harvest Grazing Yield	0.0	0.0%	0.0	0.0%
	Post Harvest Crop Residue Removed	0.0	0.0%	0.0	0.0%
Gain 0%	Total	**51.7**		**51.7**	
Energy Remaining	Rootmass	18.9	26.7%	18.9	26.7%
	Surface Residue	51.8	73.3%	51.8	73.3%
Gain 0%	Total	**70.7**		**70.7**	
Total Energy Yield	Total	**117.8**		**120.0**	
	Gain/Loss	**Gain 1.9%**	**2.2 MMBTU/ac/yr**		
Energy Index Values	**Energy Gain Index**	**27.15**		**52.66**	
	Output Index	**0.42**		**0.42**	
	Energy Harvest Index	**11.47**		**22.24**	

NRCS - CROPLAND ENERGY TOOL

COST ANALYSIS SUMMARY FOR ALTERNATIVE FIELD ROTATIONS

Landowner: Aaron Lafky
Field Location: Sherman Co., OR

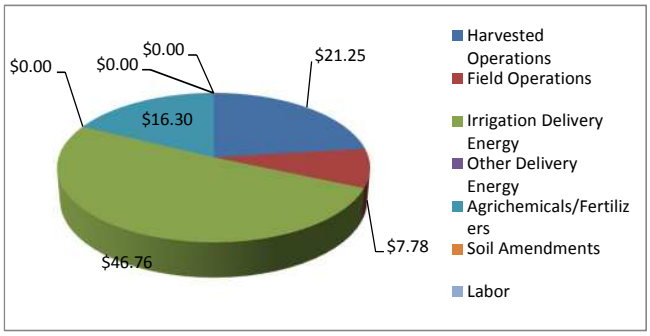
Field Area: 36 ac
Field ID: See Plan Map

Date: 11/21/2013
Latitude:
Longitude:

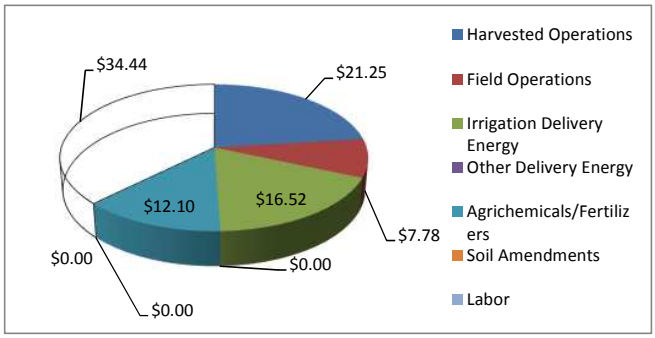
Energy Input - Fuel Types and Unit Costs

Fuel Type	Units	Unit Price	BTU/Unit	Unit Conversion to MMBTU	Cost per MMBTU
Diesel	Gal	$3.90	139,000	7.19	$28.06
Gasoline (E10)	Gal	$3.70	120,000	8.33	$30.83
BioDiesel B2	Gal	$4.00	138,600	7.22	$28.86
BioDiesel B5	Gal	$4.00	138,000	7.25	$28.99
BioDiesel B10	Gal	$4.00	136,900	7.30	$29.22
BioDiesel B20	Gal	$4.00	134,900	7.41	$29.65
BioDiesel B100	Gal	$4.00	118,300	8.45	$33.81
SVO	Gal	$4.00	123,140	8.12	$32.48
Heating Oil	Gal	$4.00	140,000	7.14	$28.57
Propane	Gal	$4.00	91,600	10.92	$43.67
Natural Gas	CCF	$0.86	103,000	9.71	$8.35
CNG	CCF	$4.00	100,000	10.00	$40.00
Ethanol	Gal	$3.00	84,400	11.85	$35.55
Electricity	KWH	$0.05	3,412	293.08	$14.65
Hydro Elec.	KWH	$0.00	3,412	293.08	$0.00
Solar	KWH	$0.00	3,412	293.08	$0.00
Wind	KWH	$0.00	3,412	293.08	$0.00
Soil Amend	ton	$25.00	11,250,000	0.09	$2.22
Labor	day	$30.00	11,900	84.03	$2,521.01
Nitrogen	lb	$0.70	20,000	50.00	$35.00
Phosphorus	lb	$0.65	7,000	142.86	$92.86
Potassium	lb	$0.55	5,500	181.82	$100.00
Sulfur	lb	$0.21	2,000	500.00	$105.00
Herbicide	oz	$0.35	6,250	160.00	$56.00
Pesticide	oz	$3.50	6,250	160.00	$560.00
Agrichemicals	lb	Varies	Varies	Varies	Varies

BENCHMARK COSTS PER ACRE



PLANNED COSTS PER ACRE



Per Acre Costs

Energy Inputs (Added) to the Field	BENCHMARK Alfalfa-Alfalfa-Barley-Al 5.00 yr				PLANNED Alfalfa-Alfalfa-Barley-Al 5.00 yr				Difference
	Amount MMBTU/ac/yr	Energy Type	Amount Used [Unit/ac]	Cost [$/ac/yr]	Amount MMBTU/ac/yr	Energy Type	Amount Used [Unit/ac]	Cost [$/ac/yr]	Cost Change [$/ac/yr]
Harvested Operations	0.76	Diesel	5.45 Gal	$21.25	0.76	Diesel	5.45 Gal	$21.25	$0.00
Field Operations	0.28	Diesel	1.99 Gal	$7.78	0.28	Diesel	1.99 Gal	$7.78	$0.00
Irrigation Delivery Energy	3.19	Electricity	935 KWH	$46.76	1.13	Electricity	330 KWH	$16.52	$30.24
Other Delivery Energy	0.00	Electricity	0 KWH	$0.00	0.00	Electricity	0 KWH	$0.00	$0.00
Agrichemicals/Fertilizers	0.28	Agrichemicals	36.4 lb	$16.30	0.16	Agrichemicals	30.4 lb	$12.10	$4.20
Soil Amendments	0.00	Soil Amend	0 ton	$0.00	0.00	Soil Amend	0 ton	$0.00	$0.00
Labor	0.00	Labor	0 day	$0.00	0.00	Labor	0 day	$0.00	$0.00
Total:	**4.51**			**$92.08**	**2.32**			**$57.64**	**$34.44**

Total Field Costs

Energy Inputs (Added) to the Field	BENCHMARK Alfalfa-Alfalfa-Barley-Al 5.00 yr				PLANNED Alfalfa-Alfalfa-Barley-Al 5.00 yr				Difference
	Amount MMBTU/yr	Energy Type	Amount Used [Unit]	Cost [$/yr]	Amount MMBTU/yr	Energy Type	Amount Used [Unit]	Cost [$/yr]	Cost Change [$/yr]
Harvested Operations	27.26	Diesel	196 Gal	$764.90	27.26	Diesel	196 Gal	$764.90	$0.00
Field Operations	9.98	Diesel	72 Gal	$279.96	9.98	Diesel	72 Gal	$279.96	$0.00
Irrigation Delivery Energy	114.87	Electricity	33665 KWH	$1,683.27	40.57	Electricity	11891 KWH	$594.56	$1,088.71
Other Delivery Energy	0.00	Electricity	0 KWH	$0.00	0.00	Electricity	0 KWH	$0.00	$0.00
Agrichemicals/Fertilizers	10.13	Agrichemicals	1309.5 lb	$587	5.81	Agrichemicals	1093.5 lb	$436	$151
Soil Amendments	0.00	Soil Amend	0 ton	$0	0.00	Soil Amend	0 ton	$0	$0
Labor	0.00	Labor	0 day	$0.00	0.00	Labor	0 day	$0.00	$0.00
Total:	**162.24**			**$3,315**	**83.63**			**$2,075**	**$1,240**

NRCS - CROPLAND ENERGY TOOL

INPUT SUMMARY WORKSHEET

Date: 11/21/2013

Landowner: Aaron Lafky | Field Area: 36 ac | Latitude:

Field Location: Sherman Co., OR | Field ID: See Plan Map | Longitude:

BENCHMARK

Crop Yields

Crop Name	Year [yr]	Labor [hr/ac]	Crop Harvest Moisture [%]	Crop Yield [yld/ac]	Yield Unit	Post Harvest Forage Removed [DM lb/ac]	Post Harvest Grazing AUD [DM lb/ac]
Alfalfa	2009	0.0	12	5.0	tons/acre		
Alfalfa	2010	0.0	12	5.0	tons/acre		
Barley	2011	0.0	12	3.0	bu/acre		
Alfalfa	2012	0.0	12	4.5	tons/acre		
Alfalfa	2013	0.0	12	5.0	tons/acre		

Soil Amendments

Crop Name	Applied Stored Manure [DM lb/ac]	Compost [DM lb/ac]	Seed, transplnt, sprig, etc. [DM lb/ac]	Animal Feed O. M. [DM lb/ac]	Other Applied O. M. [DM lb/ac]
Alfalfa	0	0	0	0	0
Alfalfa	0	0	0	0	0
Barley	0	0	0	0	0
Alfalfa	0	0	0	0	0
Alfalfa	0	0	0	0	0

Agrichemicals/Fertilizers

Crop Name	N Nitrogen [lbs/acre]	P Phosphorus [lbs/acre]	K Potassium [lbs/acre]	S Sulfur [lbs/acre]	H_{rb} Herbicide [oz/acre]	P_{st} Pesticide [oz/acre]
Alfalfa	0	0	10	20	6	0
Alfalfa	0	0	10	20	6	0
Barley	40	0	0	20	6	0
Alfalfa	0	0	10	20	6	0
Alfalfa	0	0	10	20	6	0

PLANNED

Crop Yields

Crop Name	Year [yr]	Labor [hr/ac]	Crop Harvest Moisture [%]	Crop Yield [yld/ac]	Yield Unit	Post Harvest Forage Removed [DM lb/ac]	Post Harvest Grazing AUD [DM lb/ac]
Alfalfa	2014	0.0	12	5.0	tons/acre		
Alfalfa	2015	0.0	12	5.0	tons/acre		
Barley	2016	0.0	12	3.0	bu/acre		
Alfalfa	2017	0.0	12	4.5	tons/acre		
Alfalfa	2018	0.0	12	5.0	tons/acre		

Soil Amendments

Crop Name	Applied Stored Manure [DM lb/ac]	Compost [DM lb/ac]	Seed, transplnt, sprig, etc. [DM lb/ac]	Animal Feed O. M. [DM lb/ac]	Other Applied O. M. [DM lb/ac]
Alfalfa	0	0	0	0	0
Alfalfa	0	0	0	0	0
Barley	0	0	0	0	0
Alfalfa	0	0	0	0	0
Alfalfa	0	0	0	0	0

Agrichemicals/Fertilizers

Crop Name	N Nitrogen [lbs/acre]	P Phosphorus [lbs/acre]	K Potassium [lbs/acre]	S Sulfur [lbs/acre]	H_{rb} Herbicide [oz/acre]	P_{st} Pesticide [oz/acre]
Alfalfa	0	0	10	20	6	0
Alfalfa	0	0	10	20	6	0
Barley	10	0	0	20	6	0
Alfalfa	0	0	10	20	6	0
Alfalfa	0	0	10	20	6	0

NRCS - CROPLAND ENERGY TOOL

INPUT SUMMARY WORKSHEET

Date: 11/21/2013

Landowner: Aaron Lafky | Field Area: 36 ac | Latitude:

Field Location: Sherman Co., OR | Field ID: See Plan Map | Longitude:

BENCHMARK

Diesel Use

Crop Name	Operation Description	No. Times	Diesel Use [gal/ac]
Alfalfa	Harrow, spike tooth	1	0.34
	Mower, swather, windrower	3	1.05
	Rake or windrower	3	0.75
	Harvest, hay, legume	3	5.76
	Remove Straw Bale	3	0.00
	Sprayer, post emergence	1	0.13
Alfalfa	Harrow, spike tooth	1	0.34
	Mower, swather, windrower	3	1.05
	Rake or windrower	3	0.75
	Harvest, hay, legume	3	5.76
	Remove Straw Bale	3	0.00
	Sprayer, post emergence	1	0.13
Barley	Disk, offset, heavy	1	0.90
	Cultivator, field with spike points	2	1.48
	Disk, tandem light finishing	1	0.40
	Drill or airseeder, double disk	1	
	Mower, swather, windrower	1	0.35
	Rake or windrower	1	0.25
		Total:	19.44

Irrigation

Method	Op. Pressure [psi]	Pump plant Efficiency [%]	Operating Hours [hr]	Power Req [BTU/gal]	Ave. Amt Applied [in]	Ave. Amt Pumped [Mgal]
Irrigation Delivery	75	60%	24	3.1	38	37.1
Other Delivery 1						
Other Delivery 2						
Other Delivery 3						

PLANNED

Diesel Use

Crop Name	Operation Description	No. Times	Diesel Use [gal/ac]
Alfalfa	Harrow, spike tooth	1	0.34
	Mower, swather, windrower	3	1.05
	Rake or windrower	3	0.75
	Harvest, hay, legume	3	5.76
	Remove Straw Bale	3	0.00
	Sprayer, post emergence	1	0.13
Alfalfa	Harrow, spike tooth	1	0.34
	Mower, swather, windrower	3	1.05
	Rake or windrower	3	0.75
	Harvest, hay, legume	3	5.76
	Remove Straw Bale	3	0.00
	Sprayer, post emergence	1	0.13
Barley	Disk, offset, heavy	1	0.90
	Cultivator, field with spike points	2	1.48
	Disk, tandem light finishing	1	0.40
	Drill or airseeder, double disk	1	
	Mower, swather, windrower	1	0.35
	Rake or windrower	1	0.25
		Total:	19.44

Irrigation

Method	Op. Pressure [psi]	Pump plant Efficiency [%]	Operating Hours [hr]	Power Req [BTU/gal]	Ave. Amt Applied [in]	Ave. Amt Pumped [Mgal]
Irrigation Delivery	40	72%	24	1.4	30.2	29.5
Other Delivery 1						
Other Delivery 2						
Other Delivery 3						

NRCS - CROPLAND ENERGY TOOL

INPUTS FOR COMPUTING GREENHOUSE GAS EMISSIONS

Landowner: Aaron Lafky
Field Location: Sherman Co., OR

Field Area: 36 ac
Field ID: See Plan Map

Date: ########
Latitude:
Longitude:

	Per Acre Inputs		
Annual Energy Input (Fuel)	BENCHMARK	PLANNED	DIFFERENCE
Liquid			
Diesel	7.44 Gal	7.44 Gal	0 Gal
Gasoline (E10)	0 Gal	0 Gal	0 Gal
BioDiesel B2	0 Gal	0 Gal	0 Gal
BioDiesel B5	0 Gal	0 Gal	0 Gal
BioDiesel B10	0 Gal	0 Gal	0 Gal
BioDiesel B20	0 Gal	0 Gal	0 Gal
BioDiesel B100	0 Gal	0 Gal	0 Gal
SVO	0 Gal	0 Gal	0 Gal
Gas			
Propane	0 Gal	0 Gal	0 Gal
Natural Gas	0 CCF	0 CCF	0 CCF
CNG	0 CCF	0 CCF	0 CCF
Electricity			
Electricity	935.15 KWH	330.31 KWH	604.84 KWH
Other Energy Input			
Soil Amendments	0 ton	0 ton	0 ton
Agrichemicals & Fertilizers	36.38 lb	30.38 lb	6 lb
Labor	0 day	0 day	0 day

NRCS - CROPLAND ENERGY TOOL

BENCHMARK GREENHOUSE GAS EMISSIONS FROM FIELD INPUTS

Landowner: Aaron Lafky | Field Area: 36 ac | Date: 11/21/2013
Field Location: Sherman Co., OR | Field ID: See Plan Map | Latitude:
Longitude:

Total Field Inputs

Energy Input	Units	Value	CO_2 [lb]	N_2O [lb]	CH_4 [lb]	Total CO_2 [lb]	SO_2 [lb]	NO_x [lb]
Liquid								
Diesel	Gal	268.0	5,997.0	0.13	0.74	6,052.9	0.08	4.82
Gasoline (E10)	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B2	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B5	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B10	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B20	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B100	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
SVO	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Gas								
Propane	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Natural Gas	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
CNG	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Electricity								
Electricity	KWH	33,665	8,725.6	0.14	0.33	8,726.1	4.20	10.24
Other Energy Input								
Soil Amendments	Ton	0	0.0	0.00	0.00	0.0	0.00	0.00
Agrichemicals/Fert.	lb	0	0.0	0.00	0.00	0.0	0.00	0.00
Labor	Day	0.00	0.0	0.00	0.00	0.0	0.00	0.00
TOTAL	**162 [MMBTU]**		**14,722.6**	**0.3**	**1.1**	**14,779.0**	**4.3**	**15.1**

NRCS - CROPLAND ENERGY TOOL

PLANNED GREENHOUSE GAS EMISSIONS FROM FIELD INPUTS

Landowner: Aaron Lafky
Field Location: Sherman Co., OR

Field Area: 36 ac
Field ID: See Plan Map

Date: 11/21/2013
Latitude:
Longitude:

Total Field Inputs

Energy Input	Units	Value	CO_2 [lb]	N_2O [lb]	CH_4 [lb]	Total CO_2 [lb]	SO_2 [lb]	NO_x [lb]
Liquid								
Diesel	Gal	268.0	5,997.0	0.13	0.74	6,052.9	0.08	4.82
Gasoline (E10)	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B2	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B5	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B10	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B20	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B100	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
SVO	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Gas								
Propane	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Natural Gas	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
CNG	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Electricity								
Electricity	KWH	11,891	3,082.0	0.05	0.12	3,100.5	1.48	3.62
Other Energy Input								
Soil Amendments	Ton	0	0.0	0.00	0.00	0.0	0.00	0.00
Agrichemicals/Fert.	lb	0	0.0	0.00	0.00	0.0	0.00	0.00
Labor	Day	0.00	0.0	0.00	0.00	0.0	0.00	0.00
TOTAL	**84 [MMBTU]**		**9,079.0**	**0.18**	**0.86**	**9,153.4**	**1.56**	**8.44**

NRCS - CROPLAND ENERGY TOOL

GREENHOUSE GAS EMISSION CHANGES FROM FIELD INPUTS

Landowner: Aaron Lafky | Field Area: 36 ac | Date: 11/21/2013
Field Location: Sherman Co., OR | Field ID: See Plan Map | Latitude:
Longitude:

Total Field Inputs

Energy Input	Units	Value	CO_2 [lb]	N_2O [lb]	CH_4 [lb]	Total CO_2 [lb]	SO_2 [lb]	NO_x [lb]
Liquid								
Diesel	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Gasoline (E10)	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B2	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B5	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B10	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B20	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
BioDiesel B100	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
SVO	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Gas								
Propane	Gal	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Natural Gas	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
CNG	CCF	0.0	0.0	0.00	0.00	0.0	0.00	0.00
Electricity								
Electricity	KWH	21,774	5,643.6	0.09	0.22	5,677.4	2.72	6.62
Other Energy Input								
Soil Amendments	Ton	0	0.0	0.00	0.00	0.0	0.00	0.00
Agrichemicals/Fert.	lb	0	0.0	0.00	0.00	0.0	0.00	0.00
Labor	Day	0.00	0.0	0.00	0.00	0.0	0.00	0.00
TOTAL	**79 [MMBTU]**		**5,643.6**	**0.09**	**0.22**	**5,677.4**	**2.72**	**6.62**

NRCS - CROPLAND ENERGY TOOL

ENERGY SUMMARY BY PRACTICE STANDARD

Date: 11/21/2013

Landowner: Aaron Lafky | Field Area: 36 ac | Latitude:

Field Location: Sherman Co., OR | Field ID: See Plan Map | Longitude:

Energy Change Distribution by Practice

Benchmark Energy [MMBTU]	Energy Input to the Field			Energy Harvest			Energy Remaining			Energy Gain (Loss)		
	4.51			51.67			70.67			117.83		
Practice Standard	Number	Percent		Number	Percent		Number	Percent		Number	Percent	
	[MMBTU]	Change	Total	[MMBTU]	Change	Total	[MMBTU]	Change	Total	[MMBTU]	Change	Total
533 Pumping Plant	(2.18)	100.0%	(48.5%)	0.00		0.0%	0.00		0.0%	2.18	100.0%	1.9%
449 Irrigation Water Management	(0.60)	27.4%	(13.3%)	0.00		0.0%	0.00		0.0%	0.60	27.4%	0.5%
442 Irrigation System, Sprinkler	0.60	(27.4%)	13.3%	0.00		0.0%	0.00		0.0%	(0.60)	(27.4%)	(0.5%)
Energy not accounted for in a practice standard	0.00	0.0%	0.0%	0.00		0.0%	0.00		0.0%	0.00	0.0%	0.0%
Energy Change [MMBTU]	(2.18)	100.0%	(48.5%)	0.00		0.0%	0.00		0.0%	2.18	100.0%	1.9%
Planned Energy [MMBTU]	2.32			51.67			70.67			120.01		

NRCS - CROPLAND ENERGY TOOL

GREENHOUSE GAS CHANGE BY PRACTICE STANDARD

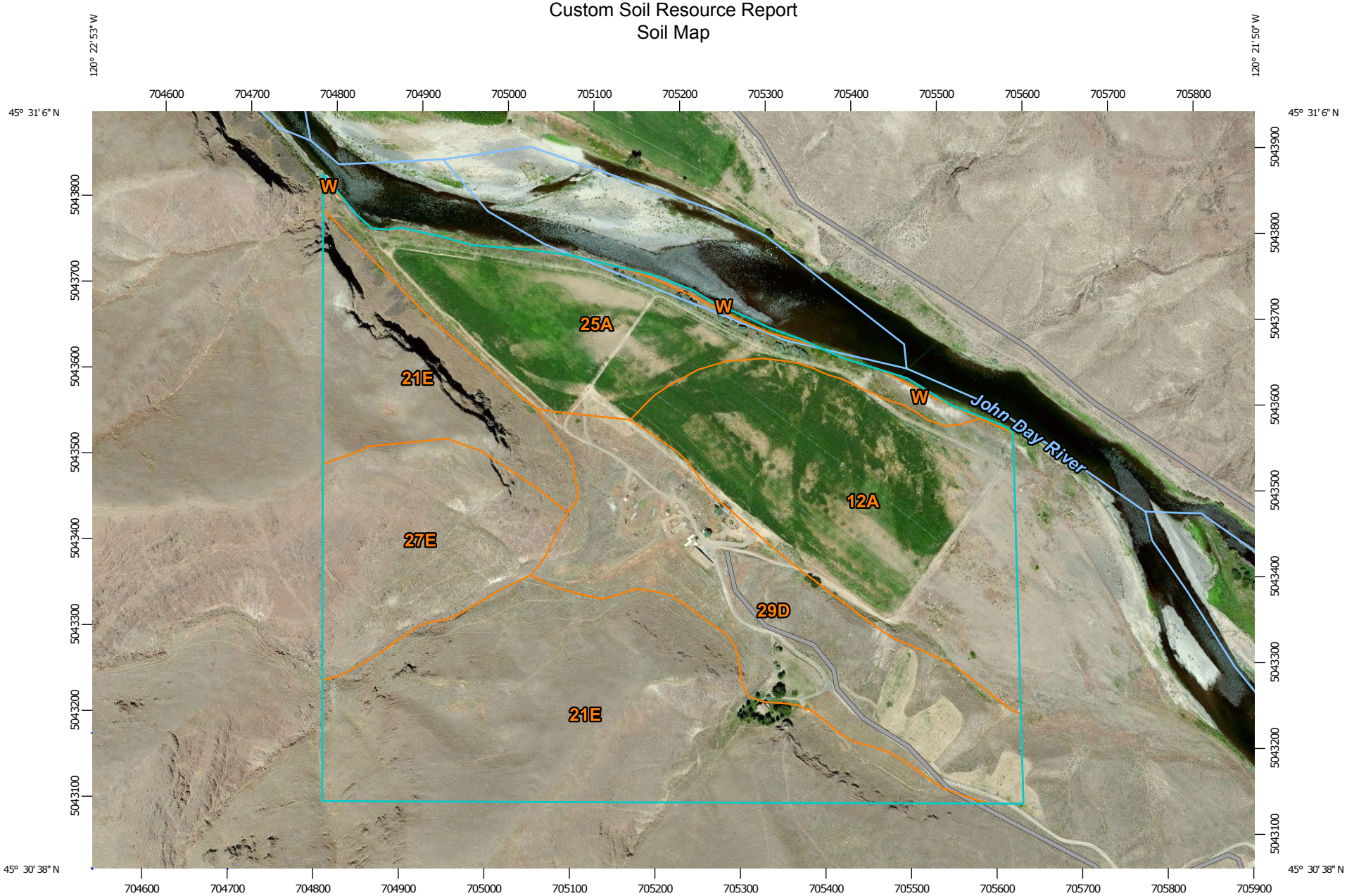
Date: 11/21/2013

Landowner: Aaron Lafky | Field Area: 36 ac | Latitude:

Field Location: Sherman Co., OR | Field ID: Oregon | Longitude:

Total Field	Energy	Reduced Greenhouse Gas Emissions				
Practice Standard	Savings	CO_2	N_2O	CH_4	SO_2	NO_x
	[MMBTU]	[lb]	[lb]	[lb]	[lb]	[lb]
533 Pumping Plant	78.61	11,960.2	0.259	1.485	0.152	9.621
449 Irrigation Water Management	21.53	3,466.1	0.075	0.430	0.044	2.788
442 Irrigation System, Sprinkler	(21.53)	0.0	0.000	0.000	0.000	0.000
Energy percentage not accounted for in a practice standard	0.00	0.0	0.000	0.000	0.000	0.000

Practice Standard (Summary)	Energy	Reduced Greenhouse Gas Emissions				
	Savings	CO_2	N_2O	CH_4	SO_2	NO_x
	[MMBTU]	[lb]	[lb]	[lb]	[lb]	[lb]
Energy Practice Standards	100.14	15,426.2	0.334	1.915	0.196	12.409
Non-Energy Practice Standards	(21.53)	0.0	0.000	0.000	0.000	0.000
Energy percentage not accounted for in a practice standard	0.00	0.0	0.000	0.000	0.000	0.000
Total	78.61	15,426.2	0.334	1.915	0.196	12.409



Map Scale: 1:6,210 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Sherman County, Oregon
Survey Area Data: Version 7, Aug 20, 2012

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

Date(s) aerial images were photographed: Jul 11, 2010—Jul 7, 2011

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

Map Unit Legend

Sherman County, Oregon (OR055)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
12A	Endersby-Hermiston complex, 0 to 3 percent slopes	24.4	20.6%
21E	Nansene-Rock outcrop complex, 35 to 70 percent north slopes	42.3	35.8%
25A	Riverwash	16.0	13.6%
27E	Rock outcrop-Rubble land-Lickskillet complex, 50 to 80 percent south slopes	13.0	11.0%
29D	Sagemoor silt loam, 20 to 40 percent north slopes	21.9	18.6%
W	Water	0.4	0.3%
Totals for Area of Interest		**118.0**	**100.0%**

Sherman County, Oregon

12A—Endersby-Hermiston complex, 0 to 3 percent slopes

Map Unit Setting

Elevation: 200 to 2,000 feet
Mean annual precipitation: 11 to 16 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Endersby and similar soils: 50 percent
Hermiston and similar soils: 40 percent
Minor components: 3 percent

Description of Endersby

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 1
Land capability (nonirrigated): 2c
Hydrologic Soil Group: A
Ecological site: LOAMY BOTTOM (R011XY001OR)

Typical profile

0 to 16 inches: Fine sandy loam
16 to 31 inches: Fine sandy loam
31 to 40 inches: Very gravelly sand
40 to 60 inches: Stratified loamy sand to silt loam

Description of Hermiston

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 11.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 1
Land capability (nonirrigated): 2c
Hydrologic Soil Group: B
Ecological site: LOAMY BOTTOM (R011XY001OR)

Typical profile

0 to 21 inches: Silt loam
21 to 37 inches: Very fine sandy loam
37 to 60 inches: Silt loam

Minor Components

Riverwash

Percent of map unit: 3 percent
Landform: Flood plains

21E—Nansene-Rock outcrop complex, 35 to 70 percent north slopes

Map Unit Setting

Elevation: 200 to 2,600 feet
Mean annual precipitation: 12 to 13 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 110 to 150 days

Map Unit Composition

Nansene, north, and similar soils: 50 percent
Rock outcrop: 40 percent

Description of Nansene, North

Setting

Landform: Canyons
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loess over fractured basalt

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: NORTH 10-14 PZ (R008XY220OR)

Typical profile

0 to 20 inches: Silt loam
20 to 37 inches: Silt loam
37 to 54 inches: Silt loam
54 to 64 inches: Unweathered bedrock

Description of Rock Outcrop

Setting

Landform: Canyons
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, free face
Down-slope shape: Convex
Across-slope shape: Convex

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Unweathered bedrock

25A—Riverwash

Map Unit Setting

Elevation: 200 to 2,500 feet

Mean annual precipitation: 11 to 13 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 150 days

Map Unit Composition
Riverwash: 85 percent

Description of Riverwash

Setting
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities
Slope: 0 to 4 percent
Drainage class: Poorly drained
Depth to water table: About 0 to 24 inches
Frequency of flooding: Frequent

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile
0 to 60 inches: Stratified sand to gravel

27E—Rock outcrop-Rubble land-Lickskillet complex, 50 to 80 percent south slopes

Map Unit Setting
Elevation: 200 to 2,800 feet
Mean annual precipitation: 11 to 13 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 150 days

Map Unit Composition
Rock outcrop: 35 percent
Rubble land: 30 percent
Lickskillet, south, and similar soils: 25 percent

Description of Rock Outcrop

Setting
Landform: Canyons
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, free face
Down-slope shape: Convex
Across-slope shape: Convex

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Unweathered bedrock

Description of Rubble Land

Setting

Landform: Canyons
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Fragmental material

Description of Lickskillet, South

Setting

Landform: Canyons
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loess mixed with colluvium from basalt

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: SHALLOW SOUTH 10-14 PZ (R008XY210OR)

Typical profile

0 to 9 inches: Very stony loam

9 to 13 inches: Very gravelly loam
13 to 19 inches: Very gravelly clay loam
19 to 29 inches: Unweathered bedrock

29D—Sagemoor silt loam, 20 to 40 percent north slopes

Map Unit Setting

Elevation: 300 to 1,500 feet
Mean annual precipitation: 12 to 13 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 110 to 150 days

Map Unit Composition

Sagemoor, north, and similar soils: 85 percent

Description of Sagemoor, North

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Lacustrine deposits

Properties and qualities

Slope: 20 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 11.7 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: LOAMY 10-12 PZ (R008XY110OR)

Typical profile

0 to 4 inches: Silt loam
4 to 24 inches: Silt loam
24 to 84 inches: Stratified very fine sandy loam to silt loam

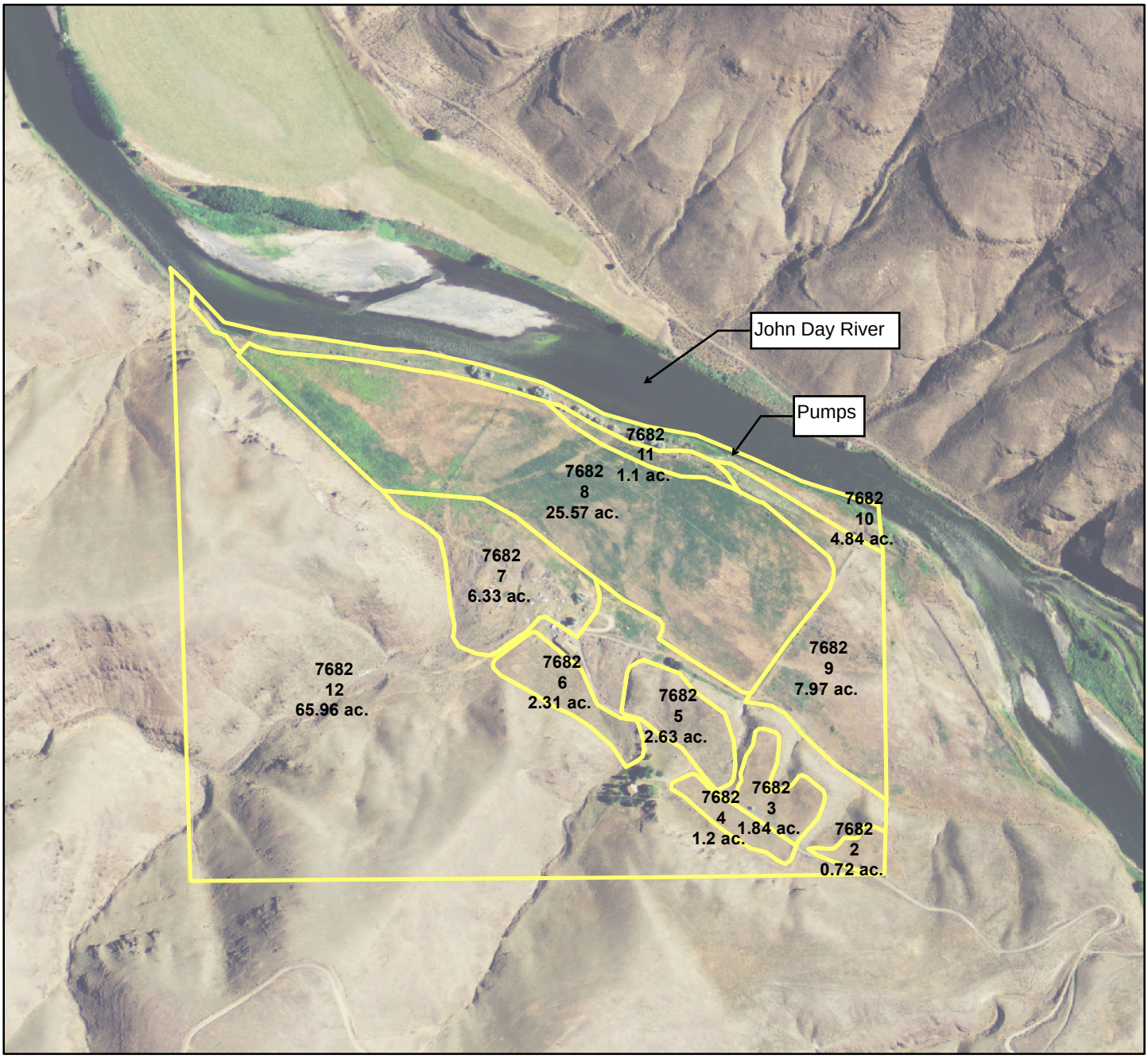
Aaron Lafky Plan Map

Date: 12/16/2013

Tract 7682

Legal Description: T1S, R19E, Section 1; T1S, R20E, Section 6

State and County: OR, SHERMAN



Legend

Tract 7682

350 0 350 700 1,050 1,400 Feet

N

Confidential

Definitions (Source USDA-NRCS)

Conventional Tillage

These systems involve primary tillage utilizing moldboard plows or heavy disks followed by one or more secondary tillage, planting and row cultivation operations that bury nearly all previous crop residue. All of the soil is disturbed. These systems also include harvest and fertilizer and pesticide applications.

Mulch-Till

These systems involve primary tillage of chisel plows or other non-inversion implements followed by one or more secondary tillage, planting and row cultivation operations that leave some previous crop residue on the surface. All of the soil is disturbed. These systems also include harvest and fertilizer and pesticide applications.

Ridge-Till

These systems involve planting row crops on ridges created by ridging cultivators during the previous year's crop. The top of the ridge is skimmed off during planting and the ridge rebuilt during one or two row crop cultivations during the first month or two of crop growth. These systems also include harvest and fertilizer and pesticide applications.

Strip-Till

These systems consist of fertilizer and planting operations in strips that involve disturbance of approximately half of the inter row area. The remaining soil and residue is undisturbed. These systems also include harvest and fertilizer and pesticide applications.

No-Till

These systems consist of fertilizer and planting operations in narrow strips or slots that involve disturbance of less than one third of the inter row area. The remaining soil and residue is undisturbed. These systems also include harvest and fertilizer and pesticide applications.

Tools Used for Energy Evaluation

- NRCS – Cropland Energy Tool developed by Washington state NRCS. Database tables created from RUSLE2. CEET_052013
- BPA – VFD Calculator – USDA.
- BPA – Pump Testing and System Analysis Tools
- BPA – Savings Calculation Tool for Scientific Irrigation Scheduling
- BPA – Estimated Energy Savings per Unit – Sprinkler
- BPA – Irrigation (Pump Test) Screening Tool
- Irrigation Self-Assessment – Equations and table from Irrigation Sixth Edition. Irrigation Association.

References

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Conservation Tillage Seeding Equipment. AE-1351. North Dakota State University Extension Service. www.ndsu.edu/energy

Conserving Fuel on the Farm. Cathy Svejkovsky. National Sustainable Agriculture Information Service. www.attr.ncat.org

Farmstead Energy Audit. AE-1366 Tractor and Field Operations Pages 2-3. North Dakota State University Extension Service. www.ndsu.edu/energy

Fuel Efficiency Factors for Tractor Selection. PM20890. Mark Hanna and Dana Petersen. Iowa State University Extension. www.extension.iastate.edu

Introduction to Energy-Efficient Tractor and Field Operations. Oregon State University Extension. Mar, 2012. www.oregonstate.edu

Irrigation in the Pacific Northwest http://irrigation.wsu.edu/

Irrigation Sixth Edition. Stetson and Mecham. Irrigation Association 2011. www.irrigation.org

Residue and Tillage Management No Till/Strip Till/Direct Seed. USDA-NRCS Conservation Practice Standard Code 329. May 2006 www.nrcs.usda.gov

Selecting Energy-Efficient Tractors H.W. Downs and R. W. Hansen. No.5.007 Colorado State University Extension. www.colostate.edu.

Sprinkler Irrigation Systems. MWPS-30. Mid-West Plan Service, Ames, IA. www.mwps.org

Whole-farm Benefits of GPS-enabled Navigation Technologies. Terry Griffin. ASABE Paper # 095983. 2009 ASABE Annual Intl. Meeting. Reno, Nevada, June, 2009. www.asabe.org

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Pumping Plant

WA-533

Washington Conservation Practice – Energy CAP Job Sheet **July 2013**

Definition

A facility that delivers water at a designed pressure and flow rate. Includes the required pump(s), associated power unit(s), plumbing, appurtenances, and may include on-site fuel or energy source(s), and protective structures.

Purpose

This practice may be applied as a part of a resource management system to achieve one or more of the following:

- Delivery of water for irrigation, watering facilities, wetlands, or fire protection
- Removal of excessive subsurface or surface water
- Provide efficient use of water on irrigated land
- Transfer of animal waste as part of a manure transfer system
- Improvement of energy use efficiency
- Improvement of air quality

Where used

This practice applies where conservation objectives require the addition of energy to pressurize and transfer water to maintain critical water levels in soils, wetlands, or reservoirs; transfer wastewater; or remove surface runoff or groundwater.

Resource Management Systems (RMS)

A RMS is a combination of structural, vegetative and management practices that meet a set of objectives and solve resource problems. On irrigated land, the pumping plant is one of several components of a RMS used to supply water to a crop through an irrigation system. The RMS for pumping plant includes the supply system to the field, the method used to apply the water, how to schedule and manage irrigations, plus how to manage nutrient and pesticide applications.

Plans and Specifications

Plans and specifications for constructing pumping plants shall be in accordance with the standard and describe the requirements for properly installing the practice to achieve its intended purpose. As a minimum, the plans and specifications shall include the following:

- A plan view showing the location of the pumping plant in relationship to other structures or natural features.
- Detail drawings of the pumping plant and appurtenances, such as piping, inlet and outlet connections, mounting, foundations, and other structural components.

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Pumping Plant

WA-533

Washington Conservation Practice – Energy CAP Job Sheet **July 2013**

- Written specifications that describe the site specific details of installation.

Pump Criteria

Pump requirements Design flow rate, range of operating heads, and pump type shall meet the requirements of the application.

Selection of pump materials shall be based on the physical and chemical qualities of the material being pumped and manufacturer's recommendations.

Variable Frequency Drives The owner shall inform the electric power provider that a Variable Frequency Drive will be installed prior to installation, and be responsible for following requirements of the electric power provider.

The Variable Frequency Drive shall be protected against overheating.

The Variable Frequency Drive control panel shall provide the read out display of flow rate or pressure.

Flow and Pressure Provisions for the connection of flow and pressure measurement devices shall be included in power plant system design.

Operation and Maintenance

An Operation and Maintenance plan specific to the pumping plant being installed shall be prepared for use by the owner and responsible operator. The plan shall provide specific instructions for operating and maintaining facilities to ensure the pumping plant functions properly as designed. As a minimum, the plan shall address the following:

- Inspection or testing of all pumping plant components and appurtenances.
- Proper start-up and shut-down procedures for the operation of the pumping plant.
- Routine maintenance of all mechanical components (power unit, pump, drive train, etc.) in accordance with the manufacturer's recommendations.
- Procedures to protect the system from damage due to freezing temperatures.
- When applicable, procedures to frequently check the power unit, fuel storage facilities, and fuel lines, for leaks and repair as needed.
- Periodic checks and removal of debris as necessary from trash racks and structures, to assure adequate flow capacity reaching the pumping plant intake.
- Periodic removal of sediment in suction bays, to maintain design capacity and efficiency.
- Inspection and maintenance of anti-siphon devices, if applicable.
- Routine test and inspection of all automated components of the pumping plant, to assure the proper functioning as designed.

CLIENTS ACKNOWLEDGEMENT

By signing below, I acknowledge that I:

- ☐ have reviewed and understand the above information on pumping plant;
- ☐ will work with NRCS on flow rate and pressures required for my irrigation system;
- ☐ will work with NRCS on the design of the pumping plant in order to get the most efficient system available;
- ☐ will monitor and maintain my pumping plant according to the O and M plan.

Client's signature: _____ Date: _____

Contract No._____ CIN_____

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Irrigation Water Management

WA-449

Washington Conservation Practice - Producer Acknowledgment Form **June 2013**

Definition

Irrigation water management (IWM) is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner.

Purpose

IWM is applied as part of a conservation management system to support one or more of the following:

- Manage soil moisture to promote desired crop response.
- Optimize use of available water supplies.
- Minimize irrigation induced soil erosion.
- Decrease non-point source pollution of surface and groundwater resources.
- Manage salts in the crop root zone.
- Manage air, soil, or plant micro-climate.
- Proper and safe chemigation or fertigation.
- Improve air quality by managing soil moisture to reduce particulate matter movement.

Where used

This practice is applicable to all irrigated lands. An irrigation system adapted for site conditions (soil, slope, crop grown, climate, water quantity and quality, etc.) must be available and capable of applying irrigation water to meet the intended purpose(s).

Resource Management Systems (RMS)

A RMS is a combination of structural, vegetative and management practices that meet a set of objectives and solve resource problems. On irrigated land, IWM is one of several components of a RMS used to manage water supplied to a crop through an irrigation system. The RMS for IWM includes the supply system to the field, the method used to apply the water, how to schedule and manage irrigations, plus how to manage nutrient and pesticide applications.

Plans and Specifications

IWM requires knowledge, skills, and desire to determine when irrigation water should be applied. The main variables influencing IWM are:

- *irrigation interval* (time between irrigations).
- *irrigation set time* (time water is applied)
- *application rate* (rate at which water is applied).

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Irrigation Water Management

WA-449

Washington Conservation Practice - Producer Acknowledgment Form **June 2013**

Four main factors influence when to irrigate, how long to irrigate, and the rate of water application:

- Capability and limitations of the irrigation system.
- How crop water use varies throughout the season.
- Amount of water in the soil profile and the ability of the soil to hold water
- Upcoming weather conditions.

IWM is most effective when used in conjunction with other conservation practices such as irrigation system design, cover crop, residue management, conservation buffers, nutrient management, pest management, and conservation crop rotation. System design and maintenance are also important factors influencing IWM.

Site-specific requirements for IWM should be included in an IWM plan. Specifications are prepared in accordance with the NRCS Field Office Technical Guide. See NRCS practice standard, Irrigation Water Management, Code 449. Use a *Soil Survey* and NRCS National Engineering Handbook, Part 652 – WA *Irrigation Guide* or locally accepted references for procedures to calculate values such as application rates for various irrigation systems, and to estimate water holding capacities of soils.

Monitoring

Decisions of where and how many soil moisture monitoring sites used in a field can be based on a number of different conditions, including but not limited to:

- Soils
- Field size and shape
- Crop
- Slope

A minimum of one moisture monitoring station (2 depths monitored min.) located in each field may be adequate where soils are uniform and all irrigation decisions are on a field wide basis. Where other factors affect the need for more stations, locate them in areas where the monitoring stations will best measure the factors controlling irrigation timing.

Depth of soil moisture devices will be dependent on the factors above but generally a shallow probe (8”-12”) will be installed for irrigation scheduling decisions and a deeper probe (24”-36”) for deep percolation monitoring.

Approved Methods of Irrigation Water Management

Advanced Methods will include one or more:

- **Telemetry type system**– for access from a remote site, continuous data monitoring. Minimum of 1 station installed for the season per field, data recorded minimum of once per day.

- **Data Logger** – automated moisture sensor probes. Minimum of 2 probe installed for the season per field, data recorded minimum of once per day.

- **Irrigation Service** – using a neutron probe in each field, readings will be taken a minimum of once per week.

- **On Line** – Daily Advisory Management Program that is web based such as IWMO (Irrigation Water Management ~OnLine) developed by NRCS and Oregon State University.

Timing

- All methods and probes will be started by the first irrigation and continue through the last irrigation of that field’s crop.

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Irrigation Water Management

WA-449

Washington Conservation Practice - Producer Acknowledgment Form **June 2013**

Records

- All records will be maintained for the season and submitted to NRCS after the crop growing season.

IWM is a required practice in your EQIP contract. NRCS is responsible for ensuring that adequate documentation has been completed to validate monitoring of your irrigation system and certify completion for payment

IWM may be done by you or a vendor and contractors with rented or purchased equipment. If you decide to monitor your system, NRCS can help you set up this process.

Regardless of the method you choose, we will inventory your system and discuss appropriate options with you. NRCS hopes to provide information that will save water, decrease potential soil erosion, save pumping costs and increase yield.

Please contact your local NRCS office with questions or request assistance before, after and during the irrigation season.

Operation and Maintenance

There are no operation and maintenance (O&M) aspects applicable to this standard. Necessary O&M items are addressed in the physical component standards considered as companions to this standard.

CLIENTS ACKNOWLEDGEMENT

By signing below, I acknowledge that I:

- ☐ have reviewed and understand the above information on IWM;
- ☐ will work with NRCS on how many and where to located moisture monitoring sites for the contracted area;
- ☐ will work with NRCS on development of an IWM plan for the planned acres;
- ☐ at the end of the each growing season supply NRCS with IWM records from each sensor installed showing twice weekly readings; and
- ☐ will continue sensor readings for contract period that IWM is scheduled.

Client's signature: _____ Date: _____

Contract No._____ CIN_____