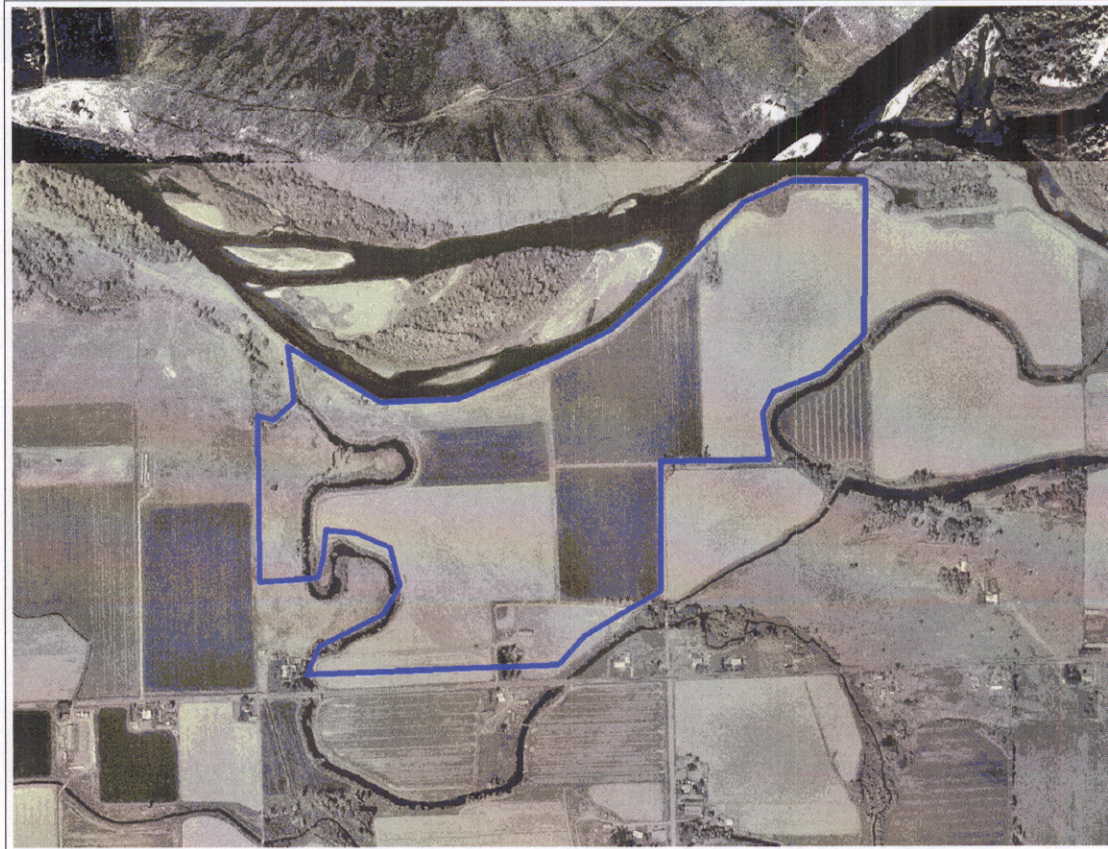


IRRIGATION REQUIREMENT ANALYSIS

25-277, 25-278, 25-13989

Claimants: Sheppard, Riggs, and Clark



Scott King

Idaho Department of Water Resources

Adjudication Bureau

September 17, 2003

INTRODUCTION

This report presents a determination of Field Irrigation Requirements (FIR) for a farm located south of the Menan Buttes in Basin 25. Identified SRBA water right claims include 25-277, 25-278, and 25-13989. These claims identify diversion from the Hyrum Poole Slough for irrigation of 144.5 acres in Sections 22 and 23 of T5N R38E. Based on the Hubble analysis, this farm has field irrigation requirements of 0.023 cfs per acre.

ANALYSIS

FIELDS

Fourteen individual fields were identified based interpretation of 1987 and 1992 aerial photography (see Figures 1 & 2). Furrow direction was determined from photo inspection, and furrow length ranged from 500 to 1400 feet (see Figure 3). Slope was estimated at 0.005 based on topographic maps, and this value was used for analysis of all fields.

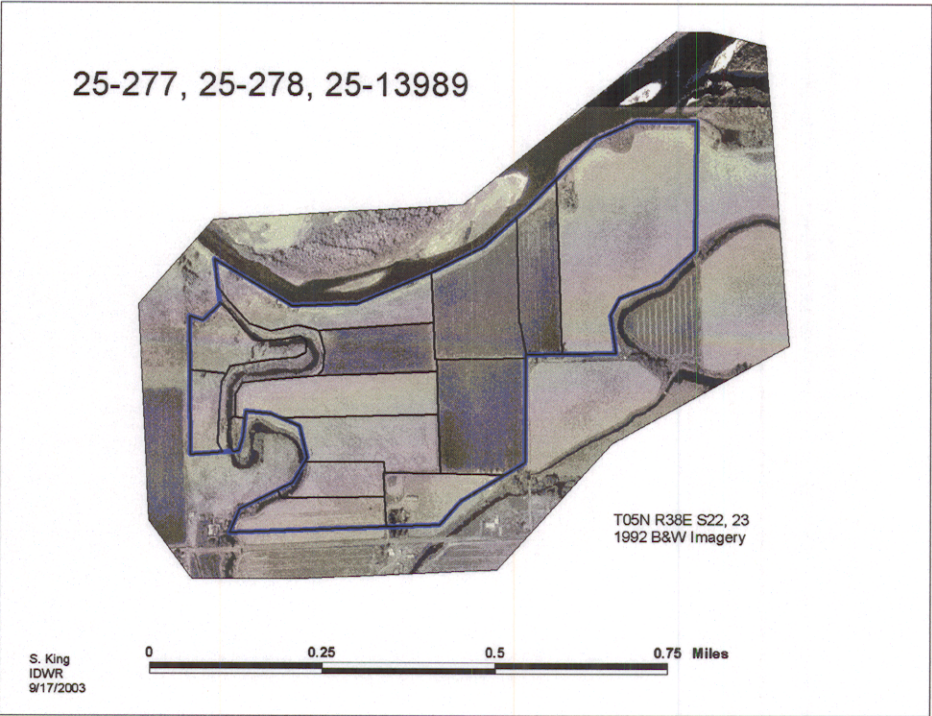


Figure 1. Field boundaries and 1992 image.

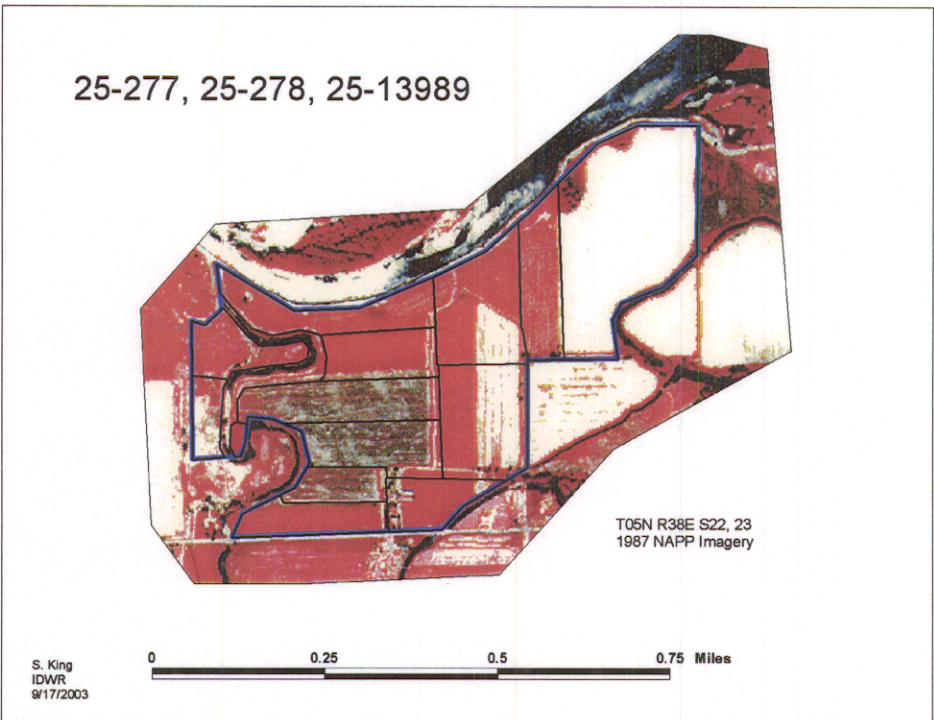


Figure 2. Fields boundaries and 1987 NAPP image.

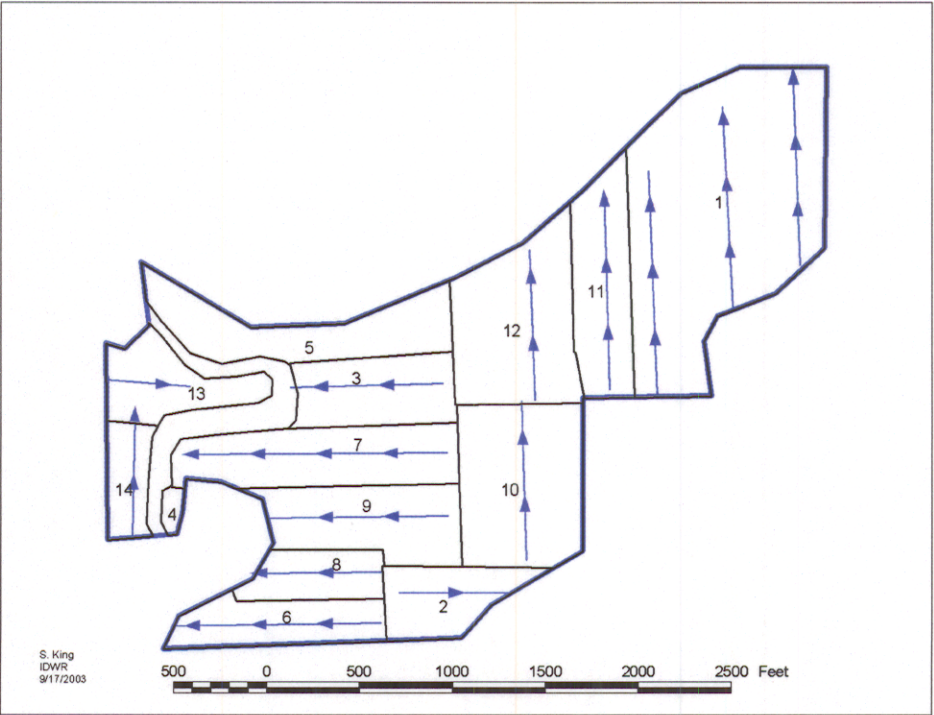


Figure 3. Field ID number and furrow direction.

SOILS

Soil information is provided by the Natural Resource Conservation Service digital SSURGO database. Figure 4 identifies the soil types with Blackfoot Silt Loam clearly dominating. An analysis of Blackfoot Silt Loam is shown in Figure 5, and is also included in the appendix. The loamy soils identified have a furrow intake family value in the 0.5 to 0.56 range, which is considered moderate. Water infiltrates slowly into low intake family soils, and quickly when the intake family is high (heavy clay = 0.3; sand = 0.8). The soil is deep and has a good water holding capacity (AWC).

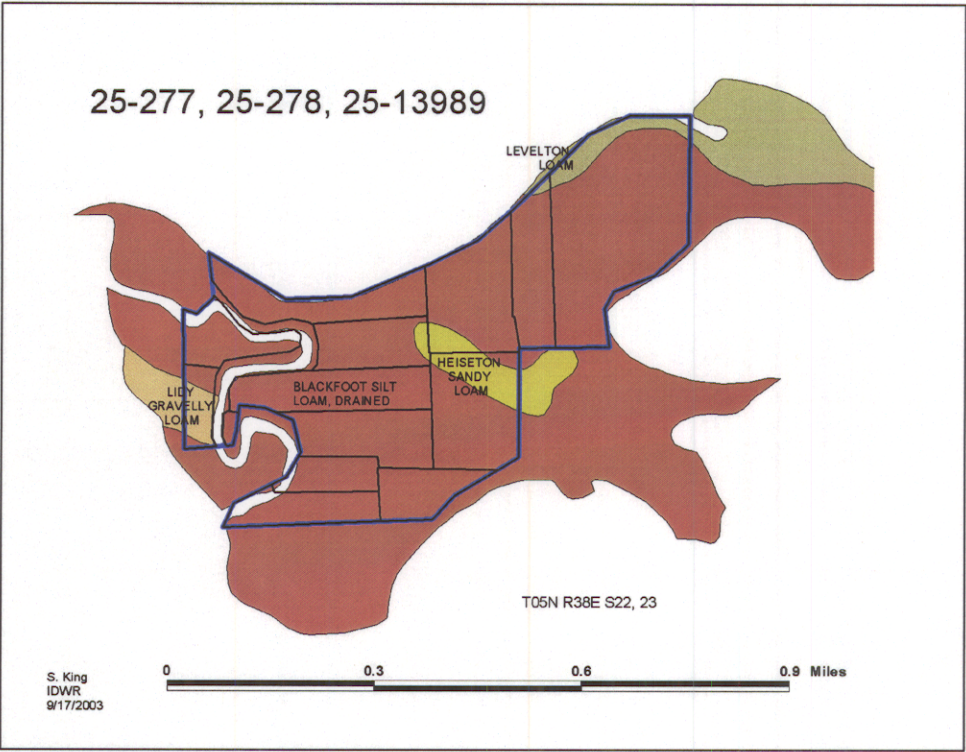


Figure 4. Soil types identified by NRCS.

SOIL CHARACTERISTICS

initials: sk

date: Sept 16, 2003

Soil Name = Blackfoot Silt Loam, Drained

Soil Type = 0-10" = Silt loam; 10-16" = Loam, silt loam; 16-22" = Silty clay loam, 22-60" = Stratified fine sandy loam / silty clay loam

Source of Soils Data = SSURGO Digital Soils Database, ToClip

soil depth (inches)		AWC (in/in)		PH		organic (%)		soil depth (ft)	AWC (inches)	intake family	
lower	upper	lower	upper	lower	upper	lower	upper			flood	furrow
0	10	0.19	0.21	7.4	8.4	1	3	1	2.34	1.5	0.5
10	16	0.16	0.18					2	4.56		
16	22	0.19	0.21					3	6.60		
22	60	0.13	0.21					4	8.64	alternate	
								5	10.68	method	
										2	0.56

Management Allowed Deficit (MAD)

crop	root depth (ft)	stress point	MAD (inches)
alfalfa (hay or seed)	5	0.5	5.34
corn (field or silage)	4	0.5	4.32
grain (winter or spring)	4	0.5	4.32
pasture (or grass hay)	3	0.5	3.30
other (enter below)			

Figure 5. Blackfoot silt loam soil characteristics.

CROPS

Grain is the primary crop identified and was used for the farm except for 19 acres of pasture for fields 4, 5, 13 and 14. This cropping pattern was provided as being representative of historic growing practices. Other cropping patterns may result in higher or lower irrigation requirements.

CLIMATE

The Idaho Falls FAA weather station was used as the basis for crop evapotranspiration (ET) requirements for this farm. 80th percentile values of monthly ET for this station are included in the Appendix.

IRRIGATION EFFICIENCY

The FURROW program written by the NRCS is used to estimate irrigation efficiency based on the following input parameters:

- irrigation application depth (inches of water, equivalent to MAD in Figure 5)
- irrigation type (corrugate or furrow)
- furrow length (ft)
- furrow spacing (ft)
- furrow slope (ft/ft)
- soil intake family (dimensionless)
- furrow inflow rate (gpm)
- application time (hours)

Inflow rate is adjusted for application times in 12 hour increments in order to determine the optimum efficiency. For the Blackfoot silt loam, soil intake family values of 0.50 and 0.56 were both used, and the lower resulting efficiency used for final analysis. Irrigation efficiency is determined for every field.

FIELD IRRIGATION REQUIREMENT

Table 1 provides a summary of conditions for each field including furrow length, representative soil type, field size, crop type, and irrigation efficiency (or field application efficiency, FAE). FAE values are the result of Furrow program runs; results of these runs are included in the appendix.

FIELD ID	FURROW	REPRESENTATIVE	ACRES	CROP	FAE (%)
	LENGTH (ft)	SOIL			
1	1100	Blackfoot Silt Loam	32.0	Grain	55
2	600	Blackfoot Silt Loam	5.7	Grain	64
3	800	Blackfoot Silt Loam	7.2	Grain	67
4	500	Blackfoot Silt Loam	0.6	Pasture	70
5	500	Blackfoot Silt Loam	9.3	Pasture	70
6	1100	Blackfoot Silt Loam	6.3	Grain	55
7	1400	Blackfoot Silt Loam	10.6	Grain	52
8	650	Blackfoot Silt Loam	4.4	Grain	65
9	950	Blackfoot Silt Loam	9.2	Grain	68
10	850	Blackfoot Silt Loam	13.2	Grain	67
11	1050	Blackfoot Silt Loam	8.4	Grain	56
12	800	Blackfoot Silt Loam	12.7	Grain	67
13	500	Blackfoot Silt Loam	5.8	Pasture	70
14	650	Lidy Gravelly Loam	3.3	Pasture	38
			128.9		

Table 1. Summary of furrow length, soil, area, and FAE for each field.

Figures 6 and 7 present spreadsheets used to determine the irrigation requirements based on crop ET requirements, net irrigation application (equivalent to MAD values from the soil analysis spreadsheet, Figure 5), and FAE. Figure 6 includes grain crops at various furrow lengths for the Blackfoot silt loam soil. Figure 7 shows pasture crops with 500 ft furrows in Blackfoot silt loam, and 650 ft furrows in Lidy gravelly loam. Total on-farm irrigation requirement from both Figures 6 and 7 is $2.60 + 0.35 = 2.95$ cfs; a total acreage of $109.7 + 19 = 128.7$ acres; and resulting in an on-farm average of $2.95 \div 128.7 = 0.023$ cfs per acre.

FIELD IRRIGATION REQUIREMENT															
initials:		SNK		Claimant = 25-277, 25-278, 25-13989 (Sheppard, Riggs, & Clark)											
date:		09/16/03		Weather Station = Idaho Falls FAA											
crop	acres	irrig. system	eff. (%)	mar	Monthly ET (mm/day)							AVE IR season (mm/yr)	net irrig. app. (in)	ET ratio	irrig. freq. (days)
					apr	may	jun	jul	aug	sep	oct				
grain 600'	5.7	cor	64		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 650'	4.4	cor	65		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 800'	19.9	cor	67		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 850'	13.2	cor	67		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 950'	9.2	cor	68		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 1050'	8.4	cor	56		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 1100'	38.3	cor	55		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
grain 1400'	10.6	cor	56		1.44	3.09	7.53	8.13	2.97			739	4.32	1.06	12.7
Summary		109.7													
Peak Gross Irrigation Application (mm/day) =							14.31								
On-Farm Irrigation Requirement (cfs/acre) =							0.024								
Total On-Farm Irrigation Requirement (cfs) =							2.60								
Irrigation Diversion Volume (ft/yr) =							4.03								
Total Irrigation Diversion Volume (ac-ft/yr) =							441.69								

Figure 6. Field irrigation requirement spreadsheet for grain fields.

FIELD IRRIGATION REQUIREMENT															
initials:		SNK		Claimant = 25-277, 25-278, 25-13989 (Sheppard, Riggs, & Clark)											
date:		09/16/03		Weather Station = Idaho Falls FAA											
crop	acres	irrig. system	eff. (%)	mar	apr	may	Monthly ET (mm/day)				oct	AVE IR season (mm/yr)	net irrig. app. (in)	ET ratio	irrig. freq. (days)
							jun	jul	aug	sep					
past 500'	15.7	cor	70		2.52	5.01	6.03	6.33	5.06	3.91	2.56	801	3.30	1.08	12.3
past 650'	3.3	cor	38		2.52	5.01	6.03	6.33	5.06	3.91	2.56	801	1.88	1.11	6.8
Summary		19													
Peak Gross Irrigation Application (mm/day) =							11.28								
On-Farm Irrigation Requirement (cfs/acre) =							0.019								
Total On-Farm Irrigation Requirement (cfs) =							0.35								
Irrigation Diversion Volume (ft/yr) =							4.30								
Total Irrigation Diversion Volume (ac-ft/yr) =							81.763								

Figure 7. Field irrigation requirement spreadsheet for pasture fields.

RESULTS & CONCLUSIONS

The above analysis indicates an average field irrigation requirement of 0.023 cfs per acre, slightly above the standard of 0.02 cfs per acre. The silt loam soils present on this farm appear to be well suited for surface irrigation. System efficiency could be increased somewhat by splitting fields longer than 1000 feet.