Appendix I – Irrigation Water Use Needs

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1. Irrigation Water Use

Future irrigation water use is expressed as the product of a per-acre or unit water requirement and the amount of potential irrigation land that is expected to be developed in the foreseeable future. The per-acre water requirement is determined using present agricultural land cropping patterns to project the crop distribution that may occur in the future given the availability of a reliable water supply. The amount of potential irrigation land is based on U.S. Bureau of Reclamation (USBR) land classification data where available, as well as an aerial photo mapping of the basin.

1.A. Present Agricultural Land Use

Cattle and sheep enterprises are the predominant farm types in Douglas County. In more recent years, meat goats have increased in numbers within the livestock industry; especially when markets for cattle and sheep have been low. Using U.S. Census of Agriculture data, farms can be characterized as mostly livestock farms and ranches, with some fruit and nut, general crop, and vegetable farms. Approximately 80 percent of the harvested cropland is in hay which is used to support the livestock economy. Over 76 percent of the irrigated cropland is devoted to hay and pasture. Another 5.3 percent of the irrigated cropland (over 900 acres) is used for grass silage, haylage, and green chop that also support the livestock industry.

The second largest type of crop on irrigated agricultural land is in orchards. The County produces a wide range of fruit and nuts including apples, cherries, plums and prunes, pears, peaches, walnuts, and hazelnuts. In 2002, orchards occupied 1,801 acres of harvested cropland. Over half of these acres were irrigated. These irrigated orchards account for 5.8 percent of the irrigated cropland. While several fruit orchards are struggling to compete in the market, hazelnut (filbert) orchards are continuing to increase in number locally, and cherries remain successful.

Grapes grown for wine production are also a rapidly expanding crop in Douglas County. According to the 2006 Oregon Vineyard and Winery Report (USDA 2007), there are currently about 857 acres of vineyard. However according to Douglas County OSU Extension, informal surveys among winegrowers in the County in 2006 indicate there are about 1,200 acres.[1] This is an increase of about 28.5 percent over that reported to USDA. In 2002, the USDA reported acreage was 779 acres. Based on the current discrepancy in acres, the actual amount of vineyard in 2002 is assumed to be 1,001 acres, or 2.6 percent of the total harvested cropland.[2]

Although the proportion of vineyards irrigated was not reported, both Douglas County OSU Extension and the Umpqua Valley Wine Grower's Association estimate that

[1] Not all grower's respond to USDA census surveys but are more likely to respond to informal queries within the Winegrower's Association or with County Agricultural Extension, (Steve Renquist, OSU Douglas County Extension Horticulture Agent, personal communication 8/9/07).

[2] Reported acres to USDA in 2002 were 779 acres of vineyard. This number was increased by 28.5 percent to 1,001 acres based on unreported current vineyard estimates.

approximately 75 percent of the vineyards receive some irrigation during normal years depending on soils, age and planting density of vines, and grape varieties.[3] Based on that estimate, vineyards occupied about 4.4 percent (751 acres) of the irrigated cropland in the County in 2002.

Small grain acreage data are not available for many types of grain because of the small number of farms involved in production. Acres are not reported where an individual farm's production will be revealed. However, the data indicate barley and oat production are the most common small grains occupying about 0.5 percent of the harvested cropland. The irrigated acreage is not reported since only one of three farms producing barley irrigate and one of five producing oats. Wheat was only produced on one small farm in 2002 and was not irrigated. This is a dramatic reduction from the late 1980s to early 1990s when wheat production accounted for between 3.2 and 6.4 percent of the harvested cropland. Minor amounts of potatoes and corn for grain production are also occurring.

Other specialty crops grown in the valley include berries and vegetables. Most of these operations occur on both large and small, owner-operated farms with irrigation capability. Individual plantings are relatively small in comparison with plantings of forage crops. Fruit and vegetable crops such as sweet corn, snap beans, cucumbers, tomatoes, squash, carrots, melons, and onions are grown on irrigated cropland. Plantings of blueberries, strawberries, blackberries, raspberries, boysenberries, and marion berries are generally small with the exception of a large blueberry farm in Umpqua. These berry farms typically receive some irrigation during the summer. Newer plantings of prunes, plums, cherries, peaches, pears, and apples receive several irrigations. Filberts and walnuts are produced primarily on soils with high moisture-retention capability, but may receive some irrigation as well. Table 1.A-1 summarizes agricultural census data for Douglas County from 1987 through 2002 with some adjustments made based on Douglas County OSU Extension information.

[3] Personal communication with Steve Renquist, Douglas County OSU Extension Agent and Janel Wild, Umpqua Valley Winegrower's Association, August, 2007.

Douglas County Agricultural Land Use	2002 Acres	2002 Percent	1997 Acres	1997 Percent	1992 Acres	1992 Percent	1987 Acres	1987 Percent
Total cropland	**107,725**		**123,113**		**104,834**		**115,353**	
Cropland used only for pasture or grazing	**63,853**		**72,894**		**64,834**		**70,720**	
Harvested cropland	**38,775**	**100%**	**43,748**	**100%**	**36,889**	**100%**	**38,654**	**100%**
Small grains	*194*	*0.5%*	*211*	*0.5%*	*1,911*	*5.2%*	*3,205*	*8.3%*
wheat	*	*	123	0.3%	1,168	3.2%	2,485	6.4%
barley	124	0.3%	N/A	N/A	58	0.2%	195	0.5%
oats	70	0.2%	88	0.2%	685	1.9%	525	1.4%
other small grain	---	---	---	---	---	---	---	---
Hay	*31,131*	*80.3%*	*35,717*	*81.6%*	*32,036*	*86.8%*	*32,392*	*83.8%*
alfalfa hay	1,556	4.0%	1,894	4.3%	3,913	10.6%	2,804	7.3%
grain hay	1,084	2.8%	1,254	2.9%	587	1.6%	1,102	2.9%
wild hay	4,889	12.6%	4,293	9.8%	2,317	6.3%	2,547	6.6%
other hay	23,602	60.9%	28,276	64.6%	24,403	66.2%	25,203	65.2%
Field seeds (1)	*1,545*	*4.0%*	*3,953*	*9.0%*	*628*	*1.7%*	*336*	*0.9%*
Other field crops (2)	*1,559*	*4.0%*	*1,872*	*4.3%*	*816*	*2.2%*	*736*	*1.9%*
Vegetables and fruits	*	*	*706*	*1.6%*	*539*	*1.5%*	*693*	*1.8%*
snap beans	23	0.1%	21	0.05%	12	0.03%	15	0.04%
sweet corn	97	0.3%	195	0.4%	143	0.4%	253	0.7%
other (3)	*	*	490	1.1%	384	1.0%	425	1.1%
Berries	*181*	*0.5%*	*	*	*	*	*180*	*0.5%*
Grapes	*1,001*	*2.6%*	*581*	*1.3%*	*526*	*1.4%*	*444*	*1.1%*
Orchard	*1,801*	*4.6%*	*1,625*	*3.7%*	*2,013*	*5.5%*	*1,948*	*5.0%*
Other (not reported)	*1,363*	*3.5%*	---	---	---	---	---	---
Double cropped	---	---	-211	*-0.5%*	-1,041	*-2.8%*	-407	*-1.1%*
Irrigated cropland	**16,983**	**100%**	**17,450**	**100%**	**12,746**	**100%**	**13,760**	**100%**
Irrigated harvested cropland	**11,493**	**67.7%**	**10,502**	**60.2%**	**9,069**	**71.2%**	**9,326**	**67.8%**
Small grains	*	*	*	*	*	*	*	*
wheat	0	0.0%	*	*	*	*	70	0.5%
barley	*	*	---	---	---	---	---	---
oats	*	*	0	0.0%	*	*	*	*
other small grain	0	0.0%	---	---	---	---	---	---
Hay	*7,471*	*44.0%*	*8,263*	*47.4%*	*7,869*	*61.7%*	*7,352*	*53.4%*
alfalfa hay	775	4.6%	1,296	7.4%	1,694	13.3%	1,868	13.6%
grain hay	353	2.1%	114	0.7%	92	0.7%	233	1.7%
wild hay	551	3.2%	472	2.7%	472	3.7%	190	1.4%
other hay	5,792	34.1%	6,168	35.3%	5,265	41.3%	4,802	34.9%
Field seeds (1)	*78*	*0.5%*	*	*	*0*	*0.0%*	*	*
Other field crops (2)	*908*	*5.3%*	*638*	*3.7%*	*346*	*2.7%*	*259*	*1.9%*
Vegetables and fruits	*630*	*3.7%*	*684*	*3.9%*	*488*	*3.8%*	*674*	*4.9%*
snap beans	*	*	21	0.1%	12	0.1%	15	0.1%
sweet corn	*	*	195	1.1%	143	1.1%	253	1.8%
other (3)	*	*	468	2.7%	333	2.6%	406	3.0%
Grapes (vineyard)	*751*	*4.4%*						
Berries	*178*	*1.0%*	*	*	*	*	*160*	*1.2%*
Orchard	*988*	*5.8%*	*722*	*4.1%*	*711*	*5.6%*	*809*	*5.9%*
Pasture	*5,490*	*32.3%*	*6,948*	*39.8%*	*3,677*	*28.8%*	*4,434*	*32.2%*
Other (not reported)	*489*	*3%*	*879*	*5%*	---	---	*72*	*0.5%*
Double cropped	---	---	---	---	-345	-2.7%	---	---

** not reported since data would reveal output for individual farms.*
(1) including rye grass seed and fescue seed;
(2) including grass silage, haylage, green chop;
(3) including beets, brocoli, cabbage, carrots, garlic, peppers, melons, and others.

Source: U.S. Department of Agriculture, National Agricultural Statisitics Service, and Douglas County OSU Extension

Table 1.A-1: Cropland and irrigated cropland use in the County from 1987-2002.

1.B. Future Cropping Distribution

For planning purposes the assumption is that cropping patterns shown in Table 1.A-1 will generally continue over the planning period with greater increases expected in grape production. The census data indicate some increase in the percentage of other field crops including grass silage, haylage, and green chop, and in orchards. These increases are expected to continue. It is also expected that portions of land irrigated with available irrigation water from existing reservoirs or potential future storage projects will be planted to high-value specialty crops. Without available irrigation water, the proportion of these specialty crops may be less. The majority of decreases is expected in hay and pasture land with some loss in vegetable crops as well.

According to Douglas County OSU Extension, vegetables and truck crops are in a decreasing trend but not expected to completely disappear. There is little growth in the berry industry, but minor growth may occur. In orchards, growth in peach production is somewhat flat, prunes and apples are decreasing, but filberts and cherries are increasing. Vineyards are currently the fastest growing crop. Umpqua Community College is currently developing a viticulture and enology program expected to be in operation by February, 2008. Conservative estimates of growth as a result of the program are for vineyards to occupy at least 6,000 acres in the next 10 years.[4] Table 1.B-1 shows a projected cropping distribution in the County assuming future irrigation water supplies will be available.

Crop	Existing distribution	Projected distribution
small grain (primarily barley and oats)	~ 1.0 %	~ 1.0 %
hay (alfalfa, grain hay, wild, and tame)	44.0 %	40.5 %
field seeds	0.5 %	0.7 %
other field crops[1]	5.3 %	7.5 %
vegetables	3.7 %	3.0 %
grapes	4.4 %	9.3 %
berries	1.0 %	3.0 %
orchard	5.8 %	6.7 %
pasture	32.3 %	28.3 %
other	~ 3.0 %	---

[1] includes grass silage, haylage and green chop

Table 1.B-1: Current and projected crop distribution on irrigated land.

1.C. Irrigation Diversion Requirement

Plants use water by means of transpiration and evaporation, referred to collectively as evapotranspiration. Water that sits on wet leaves or soil surfaces can be lost to the atmosphere through evaporation. Transpiration is the movement of water throughout the plant from the root system until it is released to the atmosphere through the leaves.

[4] Steve Renquist, OSU Extension Agent, personal communication, August, 2007.

Calculations of the evapotranspiration of particular crops for a given location or region are used to determine the water requirements of specific crops. These values are commonly referred to as the consumptive use or crop water requirements.

Precipitation is the primary source of moisture to the soil and plant surfaces. However, irrigation is used when precipitation amounts are not adequate. The publication "Oregon Crop Water Use and Irrigation Requirements" was published in 1992 by OSU Extension to update information on crop water use needs in Oregon. The publication outlines the water use needs by month for different agricultural crops grown in different regions of Oregon. The crop needs, or consumptive use needs are based on the evapotranspiration estimates of each crop by month in the growing season for the Umpqua Basin.[5]

Estimates vary by the probability of success for the crop. Estimates with a higher probability show higher evapotranspiration or consumptive use rates. Suggested ranges of probability levels for irrigation system design from the 1992 publication along with the selected level used here for planning purposes are listed by type of crop in Table 1.C-1.

Crop type	Probability level (percent)		
	Minimum	Maximum	Selected
Field crops	50	70	60
orchards – new planting	70	80	70
orchards – mature	50	60	
Specialty crops	80	90	80
Source: "Oregon Crop Water Use and Irrigation Requirements," (OSU et al. 1992)			

Table 1.C-1: Suggested range of probability levels for irrigation system design.

Monthly consumptive water use at the selected probability level for crops anticipated in Douglas County, with the exception of grapes, are shown in Table 1.C-2. Consumptive water uses by berries or grapes are not projected for the Umpqua Valley in the 1992 OSU Extension publication. The water need for berries is assumed similar to orchard crops. Grapes are discussed in the irrigation need section that follows. Consumptive use for field seeds in September through November and for orchards in October and November listed in the 1992 publication were eliminated based on local information from Douglas County OSU Extension.

The consumptive water use values in Table 1.C-2 reflect average or typical planting times for each crop in the Umpqua Basin. If planting or harvest times occur outside of these common periods, then consumptive use values would change. Precipitation supplies adequate water during November through February, therefore consumption is not shown for those periods.

[5] Evapotranspiration data from the 1992 publication are given by region in Oregon. Most of Douglas County is within the Umpqua Basin region with the exception of the coastal area and Camas Valley that are within different regions. However, since there is minimal crop use and irrigation in those areas, no adjustments were made to the Umpqua Basin data.

Crop	Consumptive water use need (inches)							
	Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
small grain[1]	0.98	2.28	4.45	5.71	5.31	---	---	---
hay[2]	0.91	2.80	3.90	4.61	5.94	4.92	3.70	---
field seeds[3]	0.71	1.73	2.64	4.06	6.46	5.94	---	---
field crops[4]	---	---	1.18	3.98	7.28	5.94	1.14	---
vegetables[5]	0.67	3.07	4.92	5.75	7.68	6.18	2.24	---
berries[6]	1.54	2.95	4.69	6.06	7.99	6.61	4.84	---
orchard[7]	1.54	2.95	4.69	6.06	7.99	6.61	4.84	---
pasture	1.77	2.99	4.17	4.96	6.42	5.28	4.09	2.56

[1] based on winter grain
[2] based on alfalfa
[3] based on grass seed
[4] based on corn silage
[5] based on highest need of tomatoes, peas, sweet corn, and beans
[6] no values available- assumed the same as orchards during common growing season
[7] based on apples, cherries, and filberts
Source: "Oregon Crop Water Use and Irrigation Requirements," (OSU et al. 1992).

Table 1.C-2: Average monthly consumptive water use by crop.

To estimate irrigation requirements, the expected effective precipitation levels are subtracted from the consumptive use requirements.[6] The "Oregon Crop Water Use and Irrigation Requirements" publication summarizes the average effective precipitation by month for each region. From this information, the anticipated irrigation need for different crops by month is determined. This net irrigation requirement is determined for each of the anticipated crops to be grown in Douglas County. The values are listed in Table 1.C-3.

As previously mentioned, water needs for berries and grape production are not included in the 1992 publication. The water requirement for berries is assumed to be similar to orchard production for the common growing season period. Grape irrigation needs vary greatly by soil type, grape variety, planting density, and preferred growing methods. An estimate of 0.5 acre-feet per acre per year is based on discussions with wine growers in the Umpqua Valley and literature on irrigation practices in similar climates. The irrigation season is generally between mid-May and mid-October for all varieties. Distribution of the annual water need was estimated based on needs of other crops with similar growing seasons.

For planning purposes, a weighted average irrigation need by month is determined based on the crop distribution list in Table 1.B-1. The average irrigation requirements by month for all irrigated crops are shown in Table 1.C-3.

[6] The effective precipitation measurement is the amount plants can use to meet the evapotranspiration of the crop during the period of interest. The amount of precipitation that goes to runoff or deep percolation below the root zone is not effective in reducing the irrigation requirement.

Crop	Irrigation water requirement (inches)								
	Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Total**
small grain[1]	0.08	0.47	3.11	4.88	5.20	---	---	---	13.74
hay[2]	0.08	0.94	2.52	3.90	5.87	4.72	2.95	---	20.98
field seeds[3]	0.04	0.16	1.42	3.39	6.34	5.71	---	---	16.96
field crops[4]	---	---	0.24	3.35	7.24	5.75	1.02	---	17.60
vegetables[5]	0.08	1.77	3.90	5.16	7.64	6.14	2.01	---	26.70
grapes[6]	---	---	0.07	0.64	2.17	1.90	1.17	0.05	6.00
berries[7]	0.12	1.38	3.54	5.47	7.83	6.54	4.09	---	28.97
orchard[8]	0.12	1.38	3.54	5.47	7.83	6.54	4.09	---	28.97
pasture	0.16	1.14	2.76	4.21	6.30	5.08	3.19	0.59	23.43
weighted average	0.09	0.90	2.33	3.84	5.99	4.82	2.74	0.17	20.88

[1] based on winter grain
[2] based on alfalfa
[3] based on grass seed
[4] based on corn silage
[5] based on highest need of tomatoes, peas, sweet corn, and beans
[6] based on 0.5 acre-feet per acre per year from mid-May through mid-October
[7] no values available- assumed the same as orchards during common growing season
[8] based on apples, cherries, and filberts
Source: "Oregon Crop Water Use and Irrigation Requirements" (OSU et al. 1992).

Table 1.C-3: Net irrigation requirements by month for various crops in the County and a weighted average for all crops each month.

The State of Oregon establishes the irrigation season and maximum annual diversion (duty) for irrigation water rights. The season for most of the Umpqua Basin runs from March 1 through October 31. However, the season on Roberts Creek is May 15 to September 15 and on Cow Creek is April 1 through October 1. The duty is 2.5 acre-feet per acre per season for most of the basin, although the Cow Creek Decree allows 3.5 acre-feet per acre per season.

Various irrigation methods are used to apply water to fields in order to meet crop needs. Such methods include flood, furrow and row, and pump/sprinkler irrigation. Sprinkler irrigation is the most common method used in Douglas County. Regardless of the irrigation system, losses occur in the conveyance and application of water to meet crop needs. Losses are related to many factors including, soil type, plant spacing, the interval and duration of water application, and the condition of irrigation delivery systems. Water must be delivered to a farm in amounts sufficient to account for these types of losses.

Net irrigation requirements are a measure of how much additional water crops will need. However, they do not account for losses due to irrigation system inefficiencies. Although it is difficult to calculate these losses, coefficients have been developed based on the type of irrigation system. It is common practice to determine farm delivery requirements by adjusting for system losses. The "Oregon Crop Water Use and Irrigation Requirements"

report suggests low and high efficiency values for several types of sprinkler irrigation systems ranging from 60 to 85 percent. For planning purposes, an efficiency of 73 percent will be used.

Using the weighted average irrigation requirement and an average system efficiency of 73 percent, farm delivery requirements are shown in Table 1.C-4. The result is an average delivery requirement of 2.22 acre-feet per acre per season. Since future irrigation supplies are likely to come from storage, it is necessary to apply a conveyance loss for the downstream delivery of stored water. Applying a 10 percent conveyance loss results in a storage release of 2.44 acre-feet in order to supply 2.22 acre-feet per acre at the irrigators point of diversion. Monthly irrigation release requirements are calculated in Table 1.C-5.

Month	Irrigation requirement	Efficiency	Farm delivery		Percent of annual
			Inches	Acre-feet	
March	0.09	73	0.11	0.01	0.41
April	0.90	73	1.14	0.10	4.30
May	2.33	73	2.96	0.25	11.16
June	3.84	73	4.88	0.41	18.40
July	5.99	73	7.61	0.63	28.70
August	4.82	73	6.12	0.51	23.08
Sept	2.74	73	3.48	0.29	13.12
October	0.17	73	0.22	0.02	0.83
Total	20.88		26.52	2.22	100

Table 1.C-4: Average farm delivery requirements per acre.

Month	Percent of annual	Acre-feet per acre demand
March	0.45	0.01
April	4.44	0.11
May	11.46	0.28
June	18.58	0.45
July	28.50	0.69
August	22.88	0.56
September	12.59	0.32
October	1.10	0.02
Total	100	2.44

Table 1.C-5: Monthly irrigation estimated demand schedule.

1.D. Supplemental Irrigation Requirements

Lands irrigated under water rights established prior to1958 generally have adequate supplies of water except in very dry years and on certain smaller tributary streams. Minimum instream flow requirements were first established in the Umpqua Basin by the State of Oregon in 1958. Lands irrigated under water rights younger than 1958 are

subject to curtailment as flows decrease below the instream minimums, usually in late summer.

In 1974, 1983, and 1991 new instream water rights went into effect on many streams in the Umpqua Basin. Water rights junior to these dates are not likely to have water available for the full irrigation season. Due to the result of the lack of water to meet existing instream and consumptive rights, the State no longer issues new full season irrigation rights for the use of natural flow on most streams in the basin. Water users with access to Galesville Reservoir or Ben Irving Reservoir stored water may contract for the purchase of storage and obtain new rights to supplement their existing natural flow right. Users can also purchase storage from these two sources and obtain a primary water right for the use of the stored water. In both cases, irrigators would be able to use water for the full irrigation season provided reservoir storage was adequate.

1.E. Irrigation Lands

Not all lands suitable for agriculture may be successfully irrigated. Factors including slope, depth to impermeable layers, stoniness, parcel size and shape, and several other characteristics play a part in identification of irrigation lands.

1.E.1. Potential Irrigation Land

The U.S. Bureau of Reclamation (USBR) is the lead federal agency in development of large-scale irrigation projects in the West. The agency has developed specific criteria used for identifying land suitable for irrigation. Although not all of Douglas County has been classified, four investigations have been made in the County by the USBR and studies related to the formulation of the Galesville Project and the Milltown Hill Analysis also included assessment of irrigation lands based on USBR criteria. These combined classifications cover the majority of potential irrigated land in Douglas County. The four USBR investigations are listed in Table 1.E-1 with the year of classification and the areas mapped.

Investigation	Date	Coverage
Rosealea	1971	Cow Creek below river mile 60.
Days Creek	1971	South Umpqua below river mile 60 North Umpqua below river mile11 Umpqua River downstream to Elkton Calapooya Creek from Oakland to the mouth
Olalla	1962	Champagne Creek, Flournoy Valley Lookingglass Creek, Happy Valley Tenmile Creek and Winston area.
Elk Creek	1987	Elk Creek, Scotts Valley and Yoncalla Valley

Table 1.E-1: U.S. Bureau of Reclamation irrigation land classification completed in Douglas County.

The irrigation land classification includes three primary arable land classes used to differentiate the suitability of the land for sustained agricultural production under irrigation. Characteristics of these three arable classes are described below and detailed specifications of the classes related to sprinkler irrigation are listed in Table 1.E-2.[7]

Class 1

These lands have well-drained soils with good moisture retention capability. There is little or no limitation to cultural operations, with tillage possible over a wide moisture range. Inherently productive, with high cation exchange capacity, soils are deep and permit full root development for all climatically adapted crops.

Class 2

Class 2 lands are of good quality but are not capable of providing a net return to the irrigator as high as Class 1 lands. They have moderate physical limitations that cause either reduced yield or increased production costs. In some cases these limitations affect both yields and costs. Class 2 lands with solid deficiencies are often droughty, requiring a higher management level to achieve high yields. If the soil texture is clayey, they commonly have minor internal drainage problems that affect yields, at least for the higher value deep-rooted crops.

Class 3

Class 3 lands are the lowest classification mapped that can be considered feasible for irrigation. These lands have multiple deficiencies, generally of the soil and drainage, or the soil and topography. The effect is that yields of higher value crops such as orchard or truck crops would be reduced severely, perhaps to the point of being infeasible. Therefore these lands are generally relegated to the production of lower value, more tolerant forage-type crops such as hay, pasture or small grains.

Classes 4 and 5

In earlier land-classification studies, Classes 4 and 5 were included to identify lands with further limitations. This was the case for some lands, particularly in the Olalla Project area. Current USBR classification criteria no longer include these classes and the criteria direct that lands be included in Class 3.

Class 6

These lands are unsuitable for sustained irrigation because of excessive deficiencies in soils, topography, drainage, or a combination of these factors.

[7] Descriptions of the three arable classes and the detailed specifications in Table 1.E-2 were used to classify land in the investigations made in Douglas County. The USBR has updated these characteristics for current classification projects, and in some instances, lowered the standards for arable land (personal communication, Ruth Page, USBR Water Rights Specialist, 7/10/07).

Land Characteristic	Class 1	Class 2	Class 3
Texture (surface to 18” depth)	Fine sandy loam to friable clay loam.	Sandy loam, firm clay loam, or well aggregated clay. May be loamy sand if underlain by finer subsoil.	Loamy sand or clay. Clay should permit root development, water movement, and cultivation.
Depth to clean sand, gravel, cobble	30" plus good free working soil of fine sandy loam or finer.	20" plus good free working soil of fine sandy loam or finer; or 30" of sandy loam.	15" plus good free working soil of fine sandy loam or finer; or 24" of coarser textured soil.
Zone which slightly impedes drainage	24”	15”	12”
Creviced rock or slowly permeable clay substratum	48”	36”	18”
Dense sedimentary substratum	60”	48”	30”
Cobble or gravel in plow layer.	Slight restriction (less than 15% gravel or 5% cobble)	Moderate cultivation restriction (less than 40% gravel or 25% cobble).	Serious cultivation restriction (less than 70% gravel or 50% cobble).
Slope	8 percent	14 percent	20 percent
Size-shape[1]	8 acres	5 acres	2 acres
Surface rock or large cobble[2]	Removal cost not over $50/acre. (17 yds^3)	Not over $100/acre. (33 yds^3)	Not over $150/acre. (50 yds^3)
Surface and subsurface drainage, drainage outlet requirements	No specific farm drainage anticipated over $50/acre; or 165ft of 4” tile at 6ft depth.	Not over $100/acre; or 330 ft. of 4” tile at 6 ft. depth; or 165 ft of open ditch 5 ft. deep.	Not over $150/acre; or 500 ft. of 4” tile at 6 ft. depth; or 250 ft of open ditch 5 ft. deep.
Drainage deficiency (water table)	No evidence of development of growing season water table within 5 ft of surface.	No evidence of development of permanent water table within 3 ft. of surface.	No evidence of development of permanent water table within 2 ft. of surface.

[1] Larger where shape materially increases labor requirement in irrigation and cultivation. Size limitation does not apply in cases where field constitutes an entire ownership.
[2] Land development costs shown constitute the maximum total permissible cost. Where more than one type of land development cost is involved, the total per acre cost should not exceed $50 for class 1, $100 for class 2, or $150 for class 3.
Source: 1989 Water Resources Management Program, Appendix I.

Table 1.E-2: U.S. Bureau of Reclamation land classification specifications for sprinkler irrigation. (Revised 1981)

USBR irrigable land classification maps and acreages were reviewed and allocated to sub-basins in the 1989 Water Resources Management Program report (Tucson Myers et al. 1989). The acres by class are listed in Table 1.E-3 for each sub-basin and stream reach. No additional land classification has been done by the USBR since that time, therefore the acres of irrigation land by class remains the same for each sub-basin.

Sub-basin	Reach	Class 1	Class 2	Class 3	Total
Coastal / Umpqua River	Coastal[1]	---	---	---	---
	Smith River[1]	---	---	---	---
	Umpqua River below Scottsburg[1]	---	---	---	---
	subtotal	---	---	---	---
Umpqua River	USGS 3210 to Scottsburg	1,613	967	814	3,394
	Confluence to USGS 3210	3,786	2,166	1,439	7,391
	subtotal	**5,399**	**3,133**	**2,253**	**10,785**
North Umpqua River	Glide to the mouth	349	176	432	957
	Sutherlin Creek	12	93	244	349
	subtotal	**361**	**269**	**676**	**1,306**
Elk Creek	Upper Elk Creek[2]	230	347	308	885
	Scotts Valley[2]	125	429	906	1,460
	Yoncalla Valley[2]	69	529	2,703	3,024
	Lower Elk Creek[2]	422	303	1,006	1,731
	subtotal	**846**	**1,608**	**4,923**	**7,377**
Calapooya Creek	Oakland to USGS 3207	456	69	102	627
	USGS 3207 to mouth	734	1,560	498	2,792
	subtotal	**1,190**	**1,629**	**600**	**3,419**
South Umpqua River	Tiller to Cow Creek	1,978	715	602	3,295
	Cow Creek to USGS 31203	2,323	1,235	1,057	4,615
	USGS 31203 to mouth	2,531	1,172	3,553	7,256
	subtotal	**6,832**	**3,122**	**5,212**	**15,166**
Cow Creek	above West Fork Cow Creek[3]	1,483	1,805	918	4,206
	West Fork Cow Cr to mouth[3]	1,492	700	460	2,652
	Windy Creek	0	229	104	333
	subtotal	**2,975**	**2,734**	**1,482**	**7,191**
South Umpqua Tributaries	Deer Creek[1]	---	---	---	---
	Lookingglass Creek	1,109	3,259	6,197	10,565
	North Myrtle Creek	80	133	60	273
	South Myrtle Creek	258	15	52	325
	Days Creek	134	213	203	550
	subtotal	**1,581**	**3,620**	**6,152**	**11,713**
Total Basin Irrigable Land					**56,957**

[1] USBR land class photos not prepared for this reach.
[2] Class distributions from Milltown Hill Project Final EIS, 1992.
[3] Acreage used as basis for Galesville Project service area.

Table 1.E-3: U.S. Bureau of Reclamation irrigation land classification (acres by sub-basin and reach).

The amount of land that would actually be included in a specific irrigation project service area may vary from the acres listed in Table 1.E-3. Factors including the cost of providing water to the land, changes in land use since the classification was completed, the acreage irrigated under water rights at the time of development, and other factors can all influence the actual acres that may be irrigated. However, the acres mapped represent potential resources that should be considered in preparation of this water resources program.

For an alternative comparison of potential irrigation land, the County asked local residents familiar with agriculture to examine unmarked aerial photos of land in each sub-basin during preparation of the original Water Management Program in 1979. Residents mapped areas that, in their experience and judgment, could reasonably be considered irrigable at some time in the future. Table 1.E-4 lists the acres mapped by sub-basin, along with the names of those individuals who participated in this effort.

The results of this aerial photo mapping resulted in a similar total potential irrigation land for the basin; 62,420 acres compared to 56,957 acres from the USBR mapping. Unlike the USBR mapping, the aerial photo survey included the coastal, lower Umpqua River, Smith River, and Deer Creek sub-basins. The areas where the aerial mapping revealed more potential irrigation land were primarily the North Umpqua River, Sutherlin Creek, Deer Creek (not mapped in USBR), and South Myrtle Creek. The aerial photo mapping showed over 600 fewer acres capable of irrigation in the Lookingglass Creek sub-basin than the USBR mapping.

Sub-basin	Participants	Reach	Acres
Coastal / Umpqua River	Lester Wade Ken Karlinger Berl Oar Norm Compton George Fen	Coastal	0
		Smith River	460
		Umpqua River to Scottsburg	0
		subtotal	**460**
Umpqua River	Donald Davis John Youngquist	Umpqua River above Scottsburg	11,430
		subtotal	**11,430**
North Umpqua River	Donald Davis John Youngquist	Glide to the mouth	2,890
		Sutherlin Creek	3,240
		subtotal	**6,130**
Elk Creek	Roger Johnston Bruce Cunningham John Youngquist	Upper Elk Creek	5,700
		Lower Elk Creek	1,280
		subtotal	**6,980**
Calapooya Creek	Creighton Baxter George Wilcox	Upper Calapooya Creek	1,060
		Middle Calapooya Creek	300
		Lower Calapooya Creek	2,100
		subtotal	**3,460**
South Umpqua River	Don Kruse Ken Bare Webb Briggs	Tiller to Cow Creek	4,770
		Cow Creek to USGS 3120	4.920
		USGS 3120 to the mouth	6,240
		subtotal	**15,930**
Cow Creek	Louis Brady Webb Briggs	Upper Cow Creek	1,570
		Lower Cow Creek	1,600
		subtotal	**3,170**
South Umpqua Tributaries	John Youngquist Ken Bare Joe Brumback	Deer Creek	2,790
		Lookingglass Creek	9,960
		North Myrtle Creek	320
		South Myrtle Creek	1,040
		Days Creek	750
		subtotal	**14,860**
County Total			**62,420**
Source: 1989 Douglas County Water Resources Management Program, Appendix I.			

Table 1.E-4: Potential irrigation land mapping by residents with local knowledge and agricultural experience.

1.E.2. Existing Irrigated Land

Water right data from the Oregon Water Resources Department were used to determine the number of acres which could currently be irrigated in the Umpqua Basin. Table 1.E-5 lists water righted acres by sub-basin, reach and priority date. The dates selected correspond to instream water right priority dates. These instream rights affect the availability of water for irrigation rights which are junior to the instream rights as described in the Supplemental Irrigation Requirements Section.

There are currently surface water irrigation rights for 32,970 acres from major streams and 43,949 acres from all streams (see Table 1.E-5). Table 1.E-6 shows the comparison of existing rights to total potential irrigation land based on the USBR classification and to the aerial photo mapping done by local residents. This comparison shows 70 to 77 percent of the land has existing irrigation water rights. However, only 47 to 52 percent has existing irrigation rights that are prior to the 1974 instream flows that curtail many irrigation rights within the County.

Sub-basin	Reach	Acres by priority date					
		Pre-1958	1958 -74	1974-83	1983-91	91-2007	Total
Coastal / Umpqua River	Coastal	0	0	0	0	0	0
	Smith River	27	197	2	0	0	226
	Umpqua River below Scottsburg	0	1	0	4	2	7
	subtotal	**27**	**198**	**2**	**4**	**2**	**233**
Umpqua River	Scottsburg to Elk Creek	347	336	1,025	220	18	1,946
	Elk Creek to confluence	2,185	1,768	1,314	586	449	6,302
	subtotal	**2,532**	**2,104**	**2,339**	**806**	**467**	**8,248**
North Umpqua River	above Glide	313	31	49	23	1	417
	Glide to mouth	936	919	397	628	231	3,111
	Sutherlin Creek	8	559	33	180	0	780
	subtotal	**1,257**	**1,509**	**479**	**831**	**232**	**4,308**
Elk Creek	Upper Elk Creek[1]	469	246	20	25	0	760
	Lower Elk Creek[1]	690	371	23	3	0	1,087
	subtotal	**1,159**	**617**	**43**	**28**	**0**	**1,847**
Calapooya Creek	above Oakland	626	253	70	10	0	959
	Oakland to Hwy 138	249	355	95	0	0	699
	Hwy 138 to mouth	582	110	107	0	0	799
	subtotal	**1,457**	**718**	**272**	**10**	**0**	**2,457**
South Umpqua River	above Days Creek	395	413	59	1	0	868
	Days Cr to Cow Cr	754	714	586	639	0	2,693
	Cow Creek to Brockway	1,126	390	187	155	0	1,858
	Brockway to mouth	1,720	1,031	837	22	1	3,611
	subtotal	**3,995**	**2,548**	**1,669**	**817**	**1**	**9,030**
Cow Creek	Upper Cow Creek[2]	1,674	217	611	7	0	2,509
	Lower Cow Creek[2]	430	172	148	631	0	1,381
	subtotal	**2,104**	**389**	**759**	**638**	**0**	**3,890**
South Umpqua Tributaries	Deer Creek	74	119	25	4	0	222
	Lookingglass Creek	337	451	36	1	130	955
	North Myrtle Creek	416	191	73	4	0	684
	South Myrtle Creek	538	198	129	30	24	919
	Days Creek	88	34	51	4	0	177
	subtotal	**1,453**	**993**	**314**	**43**	**154**	**2,957**
Total (primary streams only)		**13,984**	**9,076**	**5,877**	**3,177**	**856**	**32,970**
Total (including all tributaries)		**18,415**	**10,959**	**8,009**	**2,885[3]**	**3,681**	**43,949**

Source: Oregon Water Resources Department as of July 2007.

[1] The division between upper and lower Elk Creek is at USGS station 3220 above Drain near Boswell Road.

[2] The division between upper and lower Cow Creek is at the confluence of West Fork Cow Creek.

[3] Acres less due to data obtained from WRD online database rather than GIS data as in Total (primary streams only).

Table 1.E-5: Irrigated acres with water rights on primary streams as of July 2007.

Item	U.S. Bureau of Reclamation (USBR) classification	Aerial photo survey by residents of County
Irrigable land	56,957 acres	62,420 acres
Land with existing irrigation water rights from primary streams only	32,970 acres	32,970 acres
Land with existing irrigation water rights on all streams in the County.	43,949 acres	43,949 acres
Percent of irrigable land with irrigation surface water rights[1]	77 %	70 %
Percent of irrigable land with water rights senior to 1974 instream flows[1]	52 %	47 %
[1] Percent based on land within the County with existing irrigation water rights from all streams.		

Table 1.E-6: Summary of irrigation surface water rights and irrigable land within the County using the two methods for irrigation land assessment.

Many individuals hold supplemental irrigation rights to provide a backup supply in the event their primary source is not available. There are approximately 3,512 acres covered by supplemental rights in the basin, about 8 percent of the total irrigated acres. Only 18 percent of the acres covered by supplemental rights have priority dates senior to the 1974 instream right.

1.E.3. Future Irrigation Land

Table 1.E-7 shows the land within each sub-basin with existing irrigation water rights compared to the amount of mapped potential irrigation land from each type of mapping. The difference is an estimate of future potential irrigation land. The areas with the most potential for increasing irrigated acreage include Elk Creek, the Umpqua River, South Umpqua River, and the South Umpqua River tributaries; primarily Deer Creek, and Lookingglass Creek. The North Umpqua River, Calapooya Creek, and Cow Creek have little opportunity for more irrigation development.

Assuming that the average water need for irrigation land in the future is 2.44 acre-feet per acre, the total water need to develop the additional potential land would be between 47,184 and 52,428 acre-feet of water per year basin-wide. This does not alleviate water needs of those current rights that may be curtailed due to a junior priority date relative to instream water rights. The maximum distribution of water need to irrigate the potential additional acres by basin is shown in Table 1.E-8.

Sub-basin	Existing irrigation rights[1]	Potential irrigation land		Future new irrigation land potential	
		USBR	Aerial photo	USBR	Aerial photo
Coastal / Umpqua River	416	---	460	---	44
Umpqua River	8,292	10,785	11,430	2,493	3,138
North Umpqua River	6,785	1,306	6,130	0	0
Elk Creek	2,472	7,377	6,980	4,905	4,508
Calapooya Creek	3,854	3,419	3,460	0	0
South Umpqua River	10,314	15,166	15,930	4,852	5,616
Cow Creek	5,137	7,191	3,170	2,054	0
South Umpqua Tributaries	6,679	11,713	14,860	5,034	8,181
Total Basin	**43,950**	**56,957**	**62,420**	**19,338**	**21,487**

[1] Includes irrigation water rights on all streams within the sub-basins.

Table 1.E-7: Acres with existing irrigation rights compared to potential irrigation acres assessed using U.S. Bureau of Reclamation classification and aerial photo survey.

Sub-basin	Maximum future irrigation acres[1]	Average annual acre-feet requirement
Coastal / Umpqua River	44	107
Umpqua River	3,138	7,657
North Umpqua River	0	0
Elk Creek	4,905	11,968
Calapooya Creek	0	0
South Umpqua River	5,616	13,703
Cow Creek	2,054	5,012
South Umpqua Tributaries	8,181	19,962

[1] Based on the higher future irrigable land potential estimate in Table 1.E-7.

Table 1.E-8: Maximum distribution of water need for irrigation by sub-basin.

The future potential new irrigation land can be assumed to require an average of 2.44 acre-feet per acre of water to sustain agriculture that requires some form of irrigation in the future. Approximately half of that need would occur in July and August. The future irrigation land calculations are likely to be an upper estimate. Some land included in these estimates is currently in agriculture that does not use irrigation such as livestock grazing and dry haying, much of which may continue into the future. According to the USDA agriculture census, less than 16 percent of the current total cropland is irrigated cropland. Although providing water for irrigation may increase the percentage, it will not likely occur on all mapped irrigation lands. In addition, some land may have been developed for other uses since the mapping occurred. Construction of buildings, roads, or conversion to forest land may have removed land from consideration for future irrigation farming.

2. References

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