



MEMO

To: Distribution

From: Terry Scanlan

Subject: Pressurized Irrigation System and Potable Water System Water Demand Analysis for Dry Creek Ranch Pressurized Irrigation System

Date: July 18, 2006

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Summary. This memo analyzes anticipated water demands from the non-potable pressurized irrigation system and the potable water system that will serve the Dry Creek Ranch development.

1. Based on estimates of irrigated area, approximately 334 acres will be irrigated from a non-potable pressurized irrigation system and 175.6 acres will be irrigated from a potable (municipal) water system.
2. Existing water rights allow for irrigation of 392 acres from groundwater and Dry Creek sources, with a combined annual diversion volume of 1,764 acre feet.
3. If wastewater is stored for irrigation uses, without seasonal discharge to surface water or subsurface disposal sites, then approximately 499 acre feet of storage volume will be required for 4,800 equivalent residential units. Under this scenario, the water supply needed to support the Dry Creek Ranch project exceeds the volume available from local sources. Therefore, importation of municipal water supplies would be necessary to support in-home uses for approximately 5 to 6 months per year.
4. Wastewater storage is not required if wastewater is discharged to surface water or subsurface disposal sites when not needed for irrigation. However, this option will require (1) an NPDES permit or approval of a large-scale drainfield for wastewater discharge and (2) importation of municipal water supplies to support in-home uses for approximately 8 to 9 months per year to prevent diversion volumes from exceeding current water right diversion volumes.
5. We recommend that the development apply for a new groundwater permit for municipal purposes. The permit will be limited in combination with all existing Dry Creek Ranch water rights to a diversion volume of 1,764 acre feet annually and diversion rate of 7.84 cfs. Dry Creek water will be used to the extent that it is available for irrigation of up to 85 acres annually. This approach will provide

flexibility for pumping groundwater into either the potable or non-potable systems, up to an amount equivalent to historical diversion volume and consumptive use.

Details of the analysis are provided below.

Description of Pressurized Irrigation System. The pressurized irrigation system will deliver non-potable water for irrigation of residential lots, common areas, school sites, and commercial properties. Pressurized irrigation system water sources will include (1) Class A wastewater, (2) groundwater from irrigation wells, and (3) surface water from Dry Creek. The service area for the pressurized irrigation system will be the lower elevations of the development (below elevation 2,808 ft), consisting of approximately 650 acres in the valley floor. We anticipate that the irrigated area under the non-potable pressurized system will be approximately 334 acres as described in Table 1.

Existing Water Rights. The amount of wastewater available for irrigation will influence the ultimate design of both the pressurized irrigation system and the potable (municipal) water system. Water rights for the potable water system will be developed based on existing irrigation water rights. These water rights currently authorize diversion for irrigation of 392 acres, including 307 acres from groundwater only (primary groundwater rights) and 85 acres from combined Dry Creek and groundwater (supplemental groundwater rights).

Analysis of Pressurized Irrigation and Potable Water Demands. The analysis includes the following assumptions.

1. Water and wastewater demands are based on approximately 4,800 equivalent residential units, consisting of approximately 4,300 residential units and 500 equivalent units (commercial, schools, etc.).
2. Each residential unit will produce an average of 205 gallons per day of wastewater on a year-round basis. Each residential unit will require a maximum of 360 gallons of potable water each day for in home use. These estimates are based on United Water Idaho usage rates for homes with pressurized irrigation (Surprise Valley and Harris Ranch developments). The wastewater system will be designed for a higher average flow rate to meet DEQ requirements.
3. Approximately 904 equivalent residential units at elevations above 2,808 feet will receive irrigation from the potable water system. The total irrigated area from the potable water system is approximately 175.6 acres. The remaining residential units and equivalent residential units will receive irrigation from the pressurized irrigation system.
4. The irrigation requirement for landscape and turf under the pressurized irrigation system is assumed to be 85% of the equivalent irrigation requirement for alfalfa hay. Irrigation efficiency for landscape and turf under the pressurized irrigation system is assumed to be 72%. The 72% efficiency means that 72% of the

applied irrigation is consumed by the plant. The remaining 28% either evaporates or infiltrates. For purpose of water budgeting, we have assumed an even split between evaporation and infiltration losses.

5. Landscape and turf irrigation requirements will vary by month, with peak requirements of 0.305 inches per day in July. Annual requirement is 41.8 inches (3.5 af/ac) per year of which 30 inches will be consumptively used and 12 inches will be lost to deep percolation, runoff, or wind drift. Table 2 provides estimated irrigation requirements on a monthly basis for alfalfa hay, along with estimates of irrigation delivery required for landscape and turf. The monthly estimate is significant, as it shows that wastewater flows will support more acres early and late in the irrigation season when irrigation demands are low, and less acres during mid irrigation season when irrigation demands are high.
6. The area irrigated from the pressurized irrigation system will be approximately 334 acres, irrigated from wastewater and freshwater (groundwater or Dry Creek) sources. The ratio of freshwater to wastewater used for irrigation of the 334 acres will vary based on (1) the volume of treated wastewater storage and (2) the number of equivalent residential units contributing wastewater to the system. For purposes of this analysis, the irrigated area will be 334 acres each year, regardless of the number of units developed.

Treated wastewater storage volume could potentially vary from a few acre feet of operational storage (so that treated wastewater produced in excess of the instantaneous irrigation demand will be discharged to Dry Creek or to a subsurface drainfield) to complete non-irrigation season storage of all treated wastewater without discharge to Dry Creek or drainfields. These two extremes are described below.

Scenario 1 –100 Percent Winter Wastewater Storage (Zero Wastewater Discharge)

If all wastewater is stored for irrigation use, then 4800 equivalent residential units will support the irrigation demand for approximately 316 acres (Table 3). A minimum storage volume of approximately 499 acre feet would be required.

Under this scenario, existing groundwater rights would not be able to support the project. Approximately 45 percent of the annual in-home potable water requirement would need to be supplied from outside water sources. Table 4 provides an analysis of water use under this scenario.

Scenario 2 –No Winter Wastewater Storage (NPDES/Drainfield Wastewater Discharge)

If wastewater is not stored for irrigation use, 4800 equivalent residential units will support the average annual irrigation demand for approximately 173 acres. The 4800 equivalent residential units will support the peak month irrigation demand for up to 119 acres (Table 5). The irrigation source for any remaining acres under the pressurized irrigation system

will be freshwater (groundwater or surface water). Approximately 40 to 50 percent of the wastewater generated each year would be discharged to waste, with the balance used for irrigation purposes.

In this scenario with 4800 units, existing groundwater rights would not be able to support the project. Approximately 70 percent of the annual in-home potable water requirement would need to be supplied from outside water sources. Table 6 provides an analysis of water use under this scenario.

Discussion

Winter storage of wastewater is desirable to make the project water efficient. Existing water rights could be converted to support irrigation and potable demands for approximately 4800 equivalent residential units.

However, winter storage of wastewater is undesirable due to the cost of the storage facility and the associated land cost. If wastewater is not stored, then approximately 40 to 50 percent of the wastewater generated on an annual basis will be discharged to waste. Potable water will need to be imported to Dry Creek Ranch to prevent groundwater diversions from exceeding annual volumes under existing water rights.

There are probably no "in between" scenarios that make a lot of sense. If the project can discharge all non-irrigation season wastewater, then it probably makes sense to maximize discharge and minimize wastewater storage. If the project cannot discharge most of the non-irrigation season wastewater, then storage of up to 449 acre feet for irrigation use is recommended.

From a practical perspective, if United Water Idaho supplies the project, they would probably operate one or more wells at Dry Creek Ranch to produce their allowable water right volume during summer months (when the United Water system is short of capacity), and idle the wells during winter months. Winter water supply would be pumped into the area from United Water wells or surface water plants.

This analysis is based on rather broad assumptions relative to irrigated areas. Changes to these assumptions will influence the water balance for the project.

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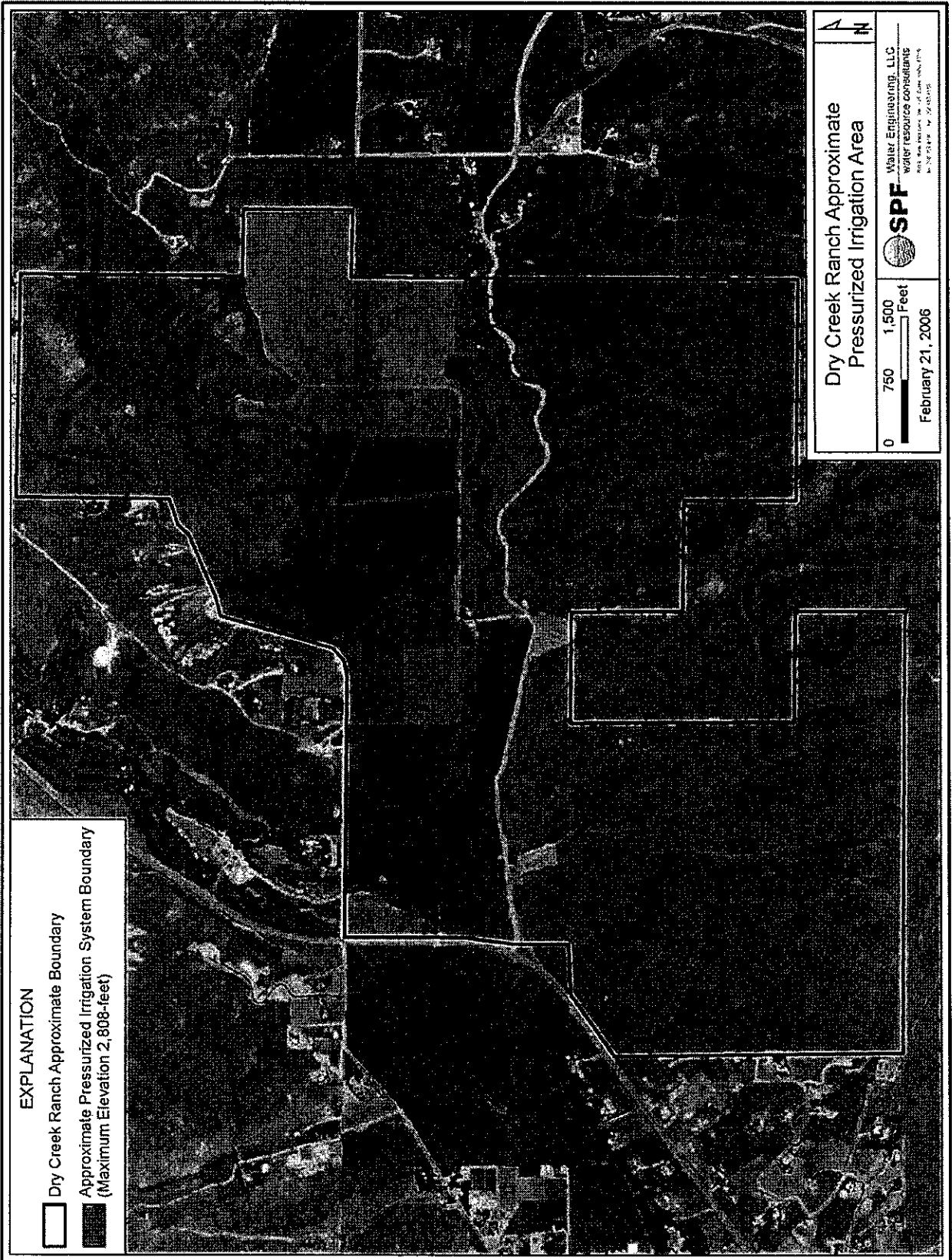


Table 1 - Pressurized Irrigation Service Area

| Development Area | Total Acres in Pressurized Irrigation Area | Estimate % Irrigated | Estimated Irrigated Acres | Irrigation Demand (3.5 feet per acre) (acre-feet) | Dwelling Unit Density (D.U. per Acre) | Total Dwelling Units Served by Pressurized Irrigation System |
|-----------------------------|--|----------------------|---------------------------|---|---------------------------------------|--|
| S.F. Equestrian | 41 | 80% | 33 | 114.8 | 2 | 82 |
| S.F. Low Hillside | 77 | 40% | 31 | 107.8 | 4 | 308 |
| Institutional | 102.5 | 70% | 72 | 251.125 | 0 | 0 |
| S.F. High | 25.6 | 30% | 8 | 26.88 | 15 | 384 |
| S.F. High Hillside | 15 | 30% | 5 | 15.75 | 10 | 150 |
| S.F. Medium | 81 | 50% | 41 | 141.75 | 8 | 648 |
| S.F. Medium Hillside | 58 | 40% | 23 | 81.2 | 6 | 348 |
| S.F. Low | 40.3 | 60% | 24 | 84.63 | 4 | 161 |
| Mixed Use | 34.6 | 20% | 7 | 24.22 | 0 | 0 |
| Multi-Family | 47.5 | 30% | 14 | 49.875 | 20 | 950 |
| Commercial | 12.3 | 30% | 4 | 12.915 | 0 | 0 |
| Village Center | 30.4 | 20% | 6 | 21.28 | 12 | 365 |
| Utilities | 10 | 20% | 2 | 7 | 0 | 0 |
| Parks | 62 | 90% | 56 | 195.3 | 0 | 0 |
| Roadside/Trails (estimated) | 10 | 100% | 10 | 35 | 0 | 0 |
| Total | 647.2 | | 334 | 1169.525 | | 3396 |

Table 2 - Irrigation Demand Calculations

| Boise WSO AP Consumptive Use from Allen and Brockway 83 | | | | | | | | | | | |
|--|--------|-----------|-----------|-----------|-----------|-----------|-----------|---------|-------|--|--|
| *** Monthly average daily (mm/day) and Seasonal Totals (mm) ** | | | | | | | | | | | |
| | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Total | | |
| Etr (reference Et) | | | | | | | | | | | |
| Mean Etr mm/day) | 2.17 | 4.29 | 5.91 | 7.65 | 8.29 | 6.72 | 5.24 | 3.38 | 1335 | | |
| STDV Etr (mm/day) | 0.31 | 0.38 | 0.46 | 0.47 | 0.32 | 0.4 | 0.44 | 0.32 | 35 | | |
| <u>Alfalfa Hay</u> | | | | | | | | | | | |
| Mean consumptive use (mm/day) | 0.76 | 3.67 | 5.41 | 6.61 | 6.73 | 5.11 | 3.68 | 1.45 | 1021 | | |
| Mean irrigation requirement (mm/day) | 0.22 | 2.93 | 4.63 | 5.86 | 6.56 | 4.84 | 3.33 | 1.04 | 899 | | |
| Mean irrigation requirement (in/day) | 0.009 | 0.115 | 0.182 | 0.231 | 0.258 | 0.191 | 0.131 | 0.041 | 35.4 | | |
| <u>Irrigation requirement adjustment for Landscape and Turf</u> | | | | | | | | | | | |
| Mean irrigation requirement (in/day) | 0.007 | 0.098 | 0.155 | 0.196 | 0.220 | 0.162 | 0.111 | 0.035 | 30.1 | | |
| Irrigation Efficiency | 72% | 72% | 72% | 72% | 72% | 72% | 72% | 72% | 72% | | |
| Application Requirement (in/day) | 0.010 | 0.136 | 0.215 | 0.272 | 0.305 | 0.225 | 0.155 | 0.048 | 41.8 | | |
| Application Requirement (gpd/ac) | 278 | 3698 | 5843 | 7396 | 8279 | 6108 | 4203 | 1313 | | | |
| Pressurized irrigated area (ac) | 334 | 334 | 334 | 334 | 334 | 334 | 334 | 334 | | | |
| flow rate required for PI area (gpd) | 92,738 | 1,235,101 | 1,951,712 | 2,470,202 | 2,765,277 | 2,040,235 | 1,403,715 | 438,398 | | | |
| units required at 205 gpd/unit to meet flow rate from wastewater | 452 | 6025 | 9521 | 12050 | 13489 | 9952 | 6847 | 2139 | | | |

Table 3 - Pressurized Irrigation with Full Wastewater Storage

| equivalent residential housing units | wastewater flow rate (gpd/unit) | wastewater flow rate (gpd) | annual wastewater volume (Mgal/yr) | annual wastewater volume (af/yr) | landscaping irrigation demand (af/ac) | area irrigated from wastewater (acres) | storage volume required (af) | irrigated area from P.I. system (acres) | area irrigated from freshwater (acres) | freshwater volume required for P.I. system (af) |
|--------------------------------------|---------------------------------|----------------------------|------------------------------------|----------------------------------|---------------------------------------|--|------------------------------|---|--|---|
| 4,800 | 205 | 984,000 | 359 | 1,102 | 3.5 | 316 | 489 | 334 | 18 | 61 |

Table 4 - Potable Water Demand Estimates Assuming Full Wastewater Storage

| total equivalent residential housing units | peak day potable demand (gpm) | peak day potable demand (gpd/unit) | annual potable volume (af/yr) | annual residential housing units irrigating from non-potable system | estimated residential housing units irrigating from potable system | Average irrigated area per unit from potable system (ac) | Irrigated area from potable system (acres) | Annual irrigation demand from potable system (af/yr) | peak month irrigation demand (gpd/ac) | peak month irrigation demand (gpd) | peak month irrigation demand (acres) | peak day demand for irrigation plus peak day potable (gpd) | peak day demand for irrigation plus peak day potable (af/yr) | Annual Freshwater Demand from Potable and Non-Potable Systems (af/yr) | Annual demand from potable system (af/yr/unit) | Annual demand from potable system (af/yr) | Existing Ground-Water Right Diversion Volume Estimate (af/yr) | Water Right Deficit (-) or Surplus (+) (af/yr) |
|--|-------------------------------|------------------------------------|-------------------------------|---|--|--|--|--|---------------------------------------|------------------------------------|--------------------------------------|--|--|---|--|---|---|--|
| | | | | | | | | | | | | | | | | | | |
| 4,800 | 1,200 | 360 | 1,935 | 3,896 | 904 | 0.15 | 176 | 612 | 8,279 | 1,453,792 | 18 | 3,181,792 | 2,210 | 2,547 | 0.53 | 2,608 | 1,764 | -844 |

Table 5 - Pressurized Irrigation without Wastewater Storage

| equivalent residential housing units | wastewater flow rate (gpd/unit) | wastewater flow rate (gpd) | annual wastewater volume (af/yr) | peak month area irrigated from wastewater (acres) | peak month area irrigated from wastewater available for irrigation (af/yr) | wastewater volume from irrigation sources at 3.5 af/ac (acres) | irrigated area from wastewater discharged to waste (acres) | wastewater volume from P.I. system (acres) | area irrigated from freshwater (acres) | freshwater volume required for P.I. system (af) |
|--------------------------------------|---------------------------------|----------------------------|----------------------------------|---|--|--|--|--|--|---|
| | | | | | | | | | | |
| 4,800 | 205 | 984,000 | 1,102 | 119 | 603 | 173 | 489 | 334 | 161 | 560 |

Table 6 - Potable Water Demand Estimates Assuming No Wastewater Storage

| total equivalent residential housing units | peak day potable demand (gpm) | peak day potable demand (gpd/unit) | annual potable volume (af/yr) | annual residential housing units irrigating from non-potable system | estimated residential housing units irrigating from potable system | Average irrigated area per unit from potable system (ac) | Irrigated area from potable system (acres) | Annual irrigation demand from potable system (af/yr) | peak month irrigation demand (gpd/ac) | peak month irrigation demand (gpd) | peak month irrigation demand (acres) | peak day demand for irrigation plus peak day potable (gpd) | peak day demand for irrigation plus peak day potable (af/yr) | Annual Freshwater Demand from Potable and Non-Potable Systems (af/yr) | Annual demand from potable system (af/yr/unit) | Annual demand from potable system (af/yr) | Existing Ground-Water Right Diversion Volume Estimate (af/yr) | Water Right Deficit (-) or Surplus (+) (af/yr) |
|--|-------------------------------|------------------------------------|-------------------------------|---|--|--|--|--|---------------------------------------|------------------------------------|--------------------------------------|--|--|---|--|---|---|--|
| | | | | | | | | | | | | | | | | | | |
| 4,800 | 1,200 | 360 | 1,935 | 3,896 | 904 | 0.15 | 176 | 612 | 8,279 | 1,453,792 | 18 | 3,181,792 | 2,210 | 2,547 | 0.53 | 3,108 | 1,764 | -1,344 |