City of Ashland
Water Conservation and Reuse Study

Technical Memorandum 10

Talent Irrigation District Supply

FINAL

October 2010

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1.0 INTRODUCTION

The City of Ashland receives a portion of its supply from Talent Irrigation District (TID), which was formed on May 22, 1916 by a group of citizens in the Ashland and Talent areas to provide a reliable irrigation water supply to the area. The purpose of this memorandum is to summarize the existing supply system, as well as to identify opportunities for increasing capacity of the TID supply, as part of completing the Water Conservation and Reuse Study and Comprehensive Water Master Plan (WCRS and CWMP). This TM draws on previously conducted work, including the City of Ashland's 1998 Comprehensive Water Supply Plan as well as the Water for Irrigation, Streams, and Economy (WISE) Project, as documented in the Draft Feasibility Study (August 2009).

2.0 EXISTING SYSTEM

2.1 Water Contracts

The City of Ashland has a permanent contract with TID that provides 769 acre feet (AF) of water per year, as measured at the Starlite Monitoring Station. The 769 AF allocation is actually the result of three separate agreements, as follows:[1]

1. *1924 Agreement*. This agreement authorizes the purchase of 600 AF of water per year deliverable during the irrigation season (not explicitly defined in this agreement). These rights are perpetual and purchased annually. Costs initially were dependent on the construction costs for Emigrant Dam. The City has since completed paying for the cost to initially purchase the water and continues to pay for the operation and maintenance cost of the water used (as adjusted by the 1926 Agreement). The water purchased under this agreement (as clarified in the 1926 Agreement) is a "stored water" right, and authorizes the City to store , and through contract later use, the water behind Emigrant Dam. It is "...understood and agreed that in case of shortage of water in the systems of the District, than and in that event, the City shall only be entitled to its pro rata share during the period of shortage." No restrictions are placed in the use of the water within City limits. However, the TID Board of Directors regulates the use of the water rights.

2. *1926 Agreement*. This agreement authorizes the purchase of 200 AF of water per year, deliverable to a point at the City limits, during the irrigation season ("...at the time the District commences to deliver water to its own users and members to October 1st, of each year,...). The City paid $21,540 for this water purchase, and agreed to pay annual operations and maintenance fees for the water used. The water purchased under this agreement (and also clarified for the 1924 Agreement) is a "stored water" right, and

[1] Based on data provided in the City's 1998 Comprehensive Water Supply Plan (Carollo). All quotes are direct copies from the 1998 report.

authorizes the City to store, and through contract later use, the water behind Emigrant Dam. The "stored water" clarification was with the intent that the City had no desire to use the water until later in the summer and early fall so that the District would be able to hold the water and release upon request to the City. In addition, the agreement stipulates that delivery of the water is subject to the capacity of the District's ditches, and that the City would be "reasonable in its demands respecting delivery of said water." It is further "...understood and agreed that in case of a shortage of water in the systems of the District, then and in that event, the City shall only be entitled to its pro rata share during the period of such shortage." No restrictions are placed on the use of the water within City limits. However, the District Board of Directors regulates the use of the water right.

3. *1935 Agreement (signed May 15, 1935).* This agreement returns 31 AF of water to the District. It appears this was water to be utilized on the old Croman, LTM and State Forest Service Site off Mistletoe Road, and was the responsibility of those owners, not for City oversight.

The City had an additional 1966 Agreement for delivery of 795 AF of water through the District's Ashland Canal. It is our understanding that this agreement expired in 1996 and could not be renewed; this water is no longer available to the City.

The City currently has an annual agreement with the Bureau of Reclamation for an additional 600 AF of stored water in Howard Prairie Reservoir delivered via the Ashland Canal. It is our understanding that this water was originally allocated to the City of Talent, which has no longer been using this water since connecting to the TAP Pipeline. The City is currently negotiating a long-term contract for this water and anticipates negotiations will be successful. The City had planned to use water attained under the long-term contract to meet regulatory requirements or mitigate environmental impacts associated with discharges from the Ashland Wastewater Treatment Plant. However, recently, the City identified a lower-cost alternate approach to meeting discharge requirements for the wastewater treatment plant. Hence, the 600 AF right is now assumed to be available for water supply.

2.2 Conveyance

The TID system currently serves water, mainly used for irrigation, within the Talent and Ashland areas via a number of storage reservoirs and canals. Waters are conveyed to users within the City of Ashland via the Ashland Canal, which extends from the Green Springs Power Station, along the south side of the City, to its terminus at Wrights Creek (see Figure 1). The canal is in operation for the period of April through October. The canal consists of an open ditch among most of its length, though some portions have been piped due to past maintenance issues. Water is generally conveyed to individual users via a combination of piping and ditch systems that run through the City; these networks are owned by either the City, TID, or private land owners. Many of these systems connect with the City's larger stormwater system and are not well mapped. Use of TID water is generally unmetered, with the exception of service to Southern Oregon University (SOU).

The majority of the Ashland Canal is owned and operated by TID, consisting of the portion extending from Green Springs Power Plant to the Starlite Monitoring Station. The portion of the canal downstream of the Starlite Monitoring Station is owned and operated by the City. Flows at Starlite are monitored via a flow measurement weir.

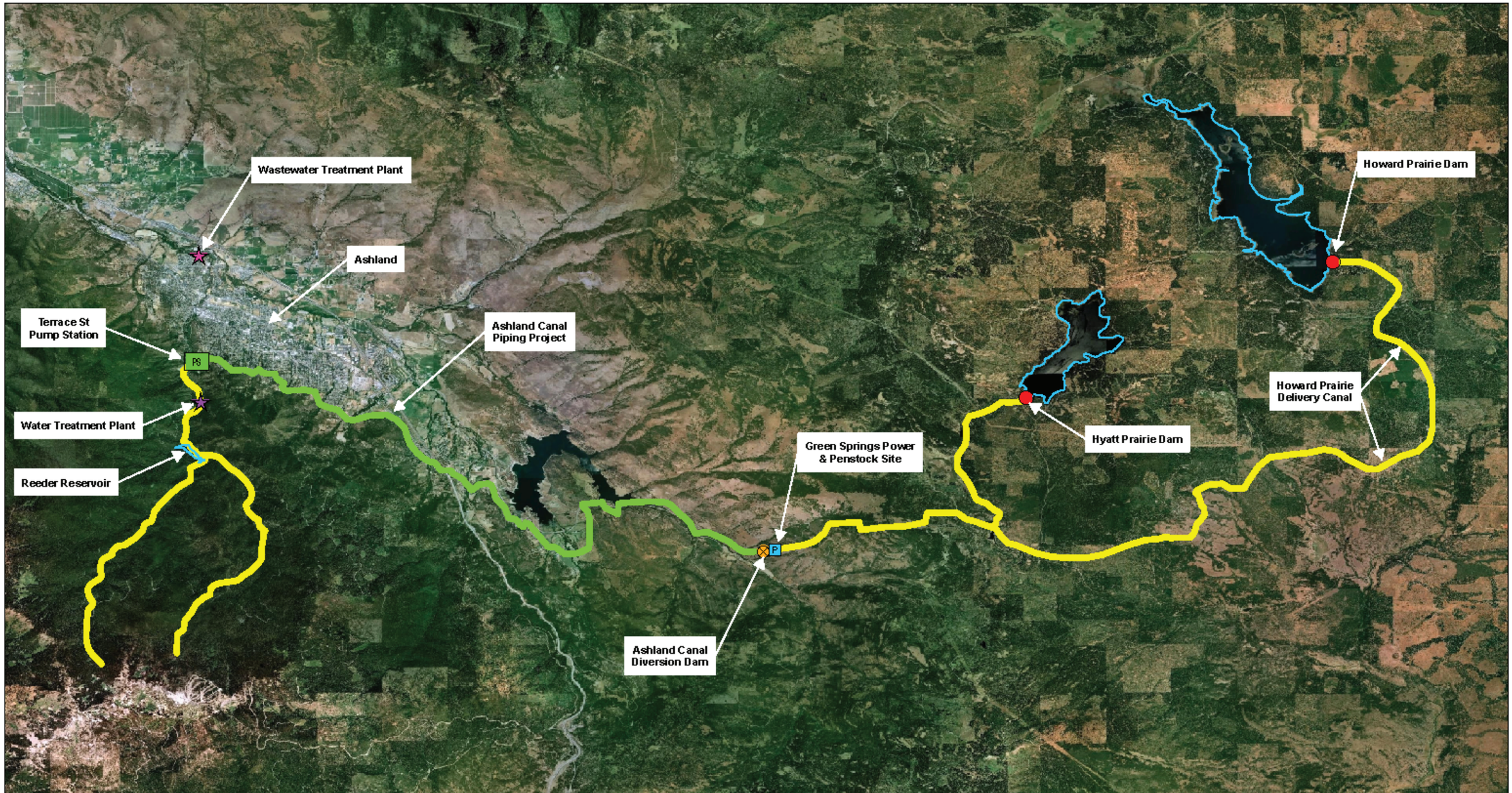
There are three categories of TID usage within the City, as described herein.

TID-Served Irrigation. There are a number of properties within the City limits that have individual TID water rights that are delivered via the portion of the Ashland Canal upstream of Starlite. All rights are comprised of a quantity of 2.65 acre*feet (AF) per acre of land; actual delivered flows are not metered. Property owners are billed annually by TID for their allocated volume. Our understanding is that these individual water rights are defined by their point of use and any change in point of use would require application for a transfer of water right to the TID Board of Directors. The properties served by TID within the City of Ashland are shown in green in Figure 2; the figure is based on the City's geographic information system (GIS) data.

City-Served TID Irrigation. There are a number of additional properties that are served via the Ashland Canal downstream of Starlite; these properties are shown in purple in Figure 2 and include Lithia Park, SOU, and a number of smaller properties[2]. It is our understanding that all distribution piping downstream of Starlite is owned and maintained by the City; none of the piping systems are privately owned. These properties do not have their own TID water rights; service is provided by the City and comes out of the City's TID allocation. The owners of these properties are generally billed annually by the City. The exception is SOU; supply to SOU is metered and SOU is billed monthly based on metered volumes.

Supply to the Water Treatment Plant. TID water can also be conveyed to the Ashland Water Treatment Plant via the Terrace Street Pump Station, shown in Figure 1. The Terrace Street Pump Station has two 200 horsepower (HP) pumps with an approximate capacity of 2,400 gallons per minute (gpm). The pumps feed into a 24-inch diameter line which conveys water to the Ashland Water Treatment Plant, where it is treated along with the City's main Ashland Creek supply. Finished water from the water treatment plant is then conveyed to the City's distribution system. This supply has been used in the past as a back-up supply and was most recently used in 2009 due to low water levels in Reeder Reservoir during the late summer and fall. Prior to 2009, TID had not been used as a supply for the water treatment plant since 2001.

[2] Potable water irrigation service is also available to customers throughout the City, via either a regular potable water service, or a designated potable water irrigation service. The usage from potable water irrigation accounts has been included in the City's demand projections, as documents in TM 2 – Water Needs Analysis.



Legend

- Dam
- Diversion Dam
- Power & Penstock Site
- Pump Station
- Water Treatment Plant
- Wastewater Treatment Plant
- Water Delivery System
- Ashland Canal Piping Project
- Reservoir

N

0 1.5 3 Miles

Figure 1
ASHLAND CANAL PIPING PROJECT
WCRS and CWMP
City of Ashland

carollo

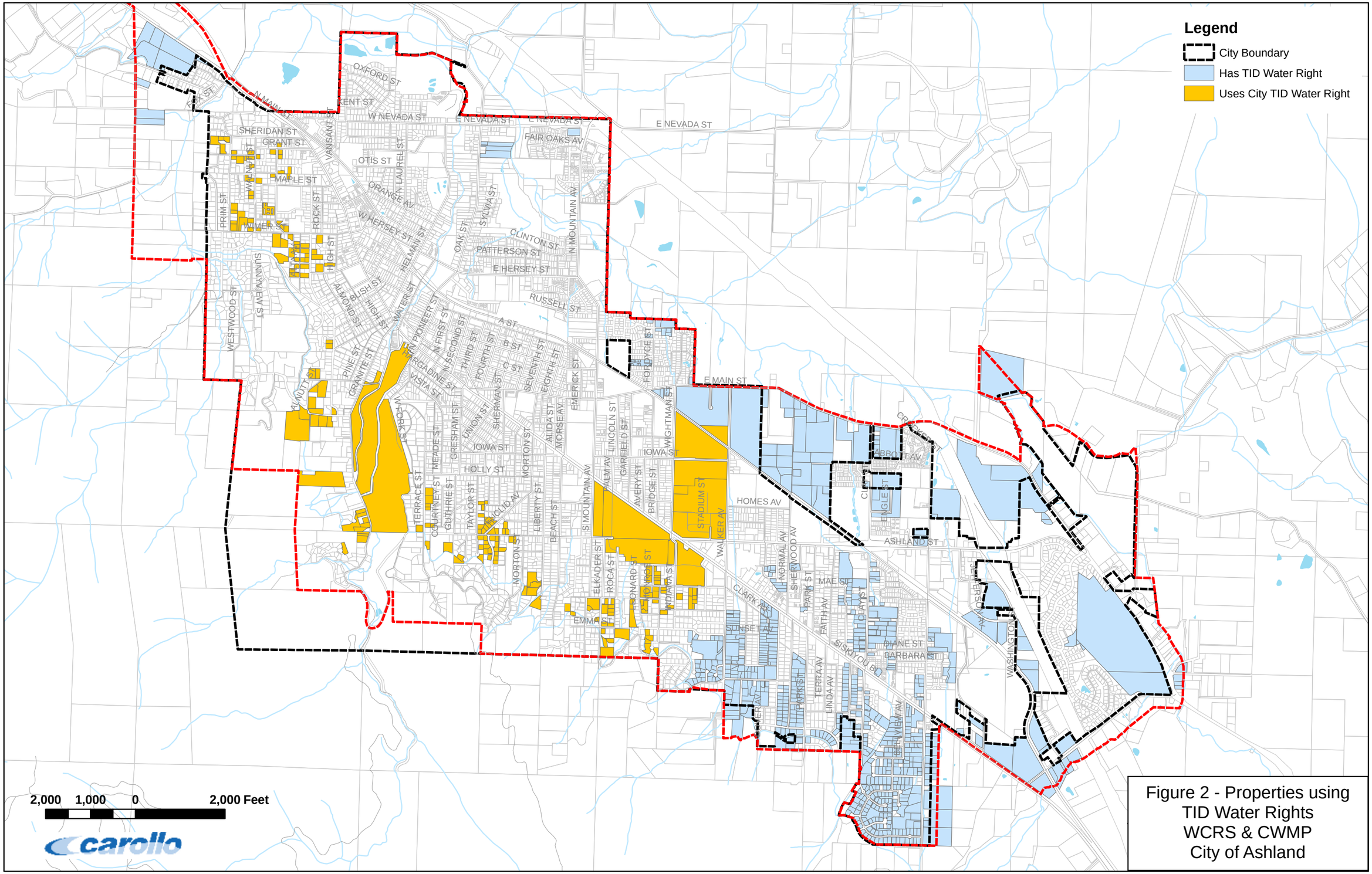


Figure 2 - Properties using TID Water Rights
WCRS & CWMP
City of Ashland

2.3 Current Annual Usage

Though the majority of TID usage within the City is not metered, total usage was estimated based on current allocations. Table 1 summarizes estimated usage, divided into three categories: TID-Served Irrigation, City-Served TID Water, and SOU. Usage for the first two categories is estimated based on total acreage served and the annual allocation of 2.65 AF/acre. Estimates of acres served in each class were based on GIS data provided by the City. The volume stated for SOU is the average of metered usage over the past 5 years, as summarized in Table 2; data were based on City billing records.[3] The average SOU usage of 220 AF of water is approximately 26 percent less than a theoretical usage based on a 2.65 AF/acre allocation (296 AF). Of the SOU data evaluated, 2008 had the highest usage at 258 AF, still 13 percent less than its theoretical allocation.

Table 1 Estimated Current Annual TID Use within the City of Ashland
City of Ashland – Water Conservation and Reuse Study

Customer Class	Area Served (acres)[1]	Estimated Usage (AF/year)[2]
TID-Served Irrigation	699	1,852
City Irrigation Usage		
City-Served TID Irrigation	123	325
Southern Oregon University	112	220
City Sub-total	*234*	*546*
Total	**933**	**2,398**

Notes:
1. Estimated area served based on City GIS data. TID-served area also includes North Mountain Park and Bellview Elementary School properties, which were identified by City staff as missing from the GIS map. City-served areas include Lithia Park and SOU, which were also identified by City staff as missing from the GIS map.
2. Estimated usage based on allocation of 2.65 AF/acre/year. Usage for SOU based on City billing data, as summarized in Table 2.
3. All values shown in this table are shown rounded to the nearest unit. However, additional decimal places have been carried through the calculations to increase the accuracy of the final numbers.

[3] Volumes for SOU are for TID water only; SOU also has potable water service that has been included in the overall historical and projected demands documented in *TM 2 – Water Needs Analysis*.

Table 2	Historical Southern Oregon University Water Usage *City of Ashland – Water Conservation and Reuse Study*	
Year	**Metered Usage (CF)[1,3]**	**Metered Usage (AF)[3]**
2005	10,031,110	230
2006	8,898,420	204
2007	8,185,880	188
2008	11,254,190	258
2009	8,515,750	195
Average[2]	9,592,400	220

Notes:
1. Based on City billing data in hundreds of cubic feet (CCF).
2. Average excludes data from 2009 due to voluntary and mandatory curtailments in that year.
3. All values shown in this table are shown rounded to the nearest unit. However, additional decimal places have been carried through the calculations to increase the accuracy of the final numbers.

2.4 Estimated System Losses

Total usage by the City is measured by the weir at the Starlite Monitoring Station. Historical flows at the station are summarized in Table 3, and would include all properties served by the City, including SOU, as well as any operational losses.[4] Losses within the system include seepage losses, overflows to Ashland Creek at the Terrace Street Pump Station, and overflows to Wrights Creek at the end of the canal.

[4] All TID flows to SOU are served via piping downstream of the Starlite Monitoring Station. However, a portion of the property has its own TID water right. TID subtracts estimated usage for this portion from measured flows at Starlite. This amount was considered negligible and was not included in calculations.

Table 3	Historical Flows at Starlite Monitoring Station *City of Ashland – Water Conservation and Reuse Study*			
Month	**Usage (AF)[1,2]**			
	2006	**2007**	**2008**	**2009**
April	110.9	18.0	26.9	26.7
May	31.7	73.3	112.3	64.7
June	115.0	98.2	123.2	71.9
July	118.0	99.0	118.6	115.0
August	125.9	118.0	140.6	186.3
September	118.8	121.4	135.0	290.7
October	39.6	32.3	70.0	140.0
Total	**659.9**	**560.1**	**726.6**	**895.4**

Notes:
1. Based on weir data collected and provided by TID.
2. All values shown in this table are shown rounded to the nearest unit. However, additional decimal places have been carried through the calculations to increase the accuracy of the final numbers.

A comparison of estimated usage by the City to flows at the Starlite Monitoring Station is presented in Table 4. Data are available for years 2006 through 2009; 2009 data were excluded because in that year TID waters were used to supply the Ashland Water Treatment Plant. The losses in 2006 and 2008 were similar, averaging 137 AF or 20 percent. Losses in 2007 were significantly less. Based on the lower usage by SOU in 2007, it is likely that the unmetered usage by the other properties served by the City was also lower in that year; hence, the lower losses for 2007 are likely inaccurate and were excluded.

Table 4	Comparison of Flows at Starlite Monitoring Station to Theoretical City Irrigation Use *City of Ashland – Water Conservation and Reuse Study*		
Parameter	**2006**	**2007**	**2008**
Total Annual Flows at Starlite (AF)[1]	659.9	560.1	726.6
Total Estimated City Usage[2]	530	513	584
Percent Lost or Unaccounted for Water	20%	8%	20%
Volume of Estimated Losses (AF)	130	47	143

Notes:
1. Based on weir data collected and provided by TID, as presented in Table 1.
2. Based on metered SOU flows, as presented in Table 2, and estimated flows based on 2.65 AF/acre allocation to remaining acreage served by City, as presented in Table 1.

2.5 Current Peak Usage

Peak TID system usage was also estimated, for the purpose of evaluating the capacity of identifying the peak flow rates in the Ashland Canal and comparing it to available information regarding its hydraulic capacity. The 2009 WISE Report estimated a peak flow of one-eightieth of a cubic foot per second per acre served (1/80 cfs/acre). The resulting estimated usage is summarized in Table 5. For this analysis, estimated SOU flows were based on acreage served, rather than on metered usage, as monthly SOU records were not available. Losses were estimated at 20 percent of total flows.

Table 5 Estimated Peak TID Use within the City of Ashland
City of Ashland – Water Conservation and Reuse Study

Customer Class	Area Served (acres)[1]	Estimated Flow Rate (cfs)[2,3]
TID-Served Irrigation	699	8.7
City-Served TID Irrigation	123	1.5
Southern Oregon University	112	1.4
Total Estimated Peak Usage		**11.7**
Estimated Leakage		2.9
Total Estimated Canal Flows		**14.6**

Notes:
1. Estimated area served based on City GIS data.
2. Estimated usage based on rate of one-eightieth of a CFS per acre.
3. All values shown in this table are shown rounded to the nearest unit. However, additional decimal places have been carried through the calculations to increase the accuracy of the final numbers.

2.6 Capacity Evaluation

Two aspects of the capacity of the TID system were evaluated:

- Evaluation of current use of the City's TID allocation by irrigation customers; and
- Evaluation of the ability of the Ashland Canal to convey current and potential future flows.
- Evaluation of the ability of the Terrace Street Pump Station to convey potential future flows to the Ashland Water Treatment Plant.

A comparison of current City TID water use to the City's TID contracted amount is presented in Table 6. Current City usage was based on the flow at Starlite Monitoring Station for 2008, which was the greatest flow in the evaluated 2006 through 2008 period. Again, 2009 data are excluded because these flows included deliveries to the Ashland Water Treatment Plant. As shown in the table, approximately 642 AF of the City's contracted volume is available. It was assumed that there would be additional system losses associated with delivery of this

volume; losses were assumed to be 20 percent of the delivered volume. After leakage, the remaining usable TID capacity available to the City is 514 AF. This additional volume could be used for either increased irrigation supply within the City or for delivery to the Ashland Water Treatment Plant for potable water supply. This capacity was used for the evaluation of the adequacy of existing supplies to meet projected demands, as documented in *TM 5 - Existing Supply Evaluation.*

Table 6 Comparison of Current Usage to City TID Allocation
City of Ashland – Water Conservation and Reuse Study

Item	Annual Volume (AF)
City's TID Allocation[1]	1369
Maximum Historical TID Flows to the City for Irrigation[2]	727
Remainder of City's TID Allocation	642
Additional Estimated Leakage on Available Flows[3]	128
Estimated Usable TID Capacity	**514**

Notes:
1. Sum of 769 AF and 600 AF contracts.
2. Based on measured flows at Starlite Monitoring Station for 2008 (Table 3).
3. Estimated additional leakage assumed to be 20 percent of available flows.

The capacity of the Ashland Canal was also evaluated, as presented in Table 7. The capacity of the Ashland Canal was estimated and documented as part of the 2009 Draft WISE Report. The report stated that the design capacity of the Ashland Canal is 48 cfs, which was assumed for this analysis. Note, there are additional irrigation users on the Ashland Canal, upstream of the City, that are not considered here.

Table 7 Comparison of Current Peak Flows to Ashland Canal Capacity
City of Ashland – Water Conservation and Reuse Study

Item	Flow Rate (cfs)
Ashland Canal Capacity[1]	48
Current Estimated Peak Flows[2]	14.6
Available Canal Capacity	**33.4**

Notes:
1. Based on reported capacity within the WISE Draft Feasibility Report (HDR, 2009)
2. Based on total acreage served within the City.
3. Estimated additional leakage assumed to be 20 percent of available flows.

The total peak usage on the Ashland Canal is 14.6 cfs, as determined in Table 3. Hence, an additional 33.4 cfs of capacity appears to be is available in the canal. This additional capacity is available for delivery of the remainder of the City's current allocation. Note, if the additional capacity were used for water supply to the Ashland Water Treatment Plant, the estimated period of usage would be 153 days (June 1 through October 31). The flow rate required to

deliver the City's available capacity (642 AF including losses) over the 153 day period is approximately 2.1 CFS. Hence, based on this information, there appears to be more than sufficient canal capacity available to deliver the City's contracted water.

As an additional check on canal capacity, actual monitored daily flows at Starlite were evaluated. Table 8 shows the average and maximum daily flows at Starlite for the years 2006 through 2009. Data from 2009 differ from the other years because in 2009 TID supply from the Ashland Canal was delivered to the Ashland Water Treatment Plant as a potable water supply. Hence, peak usage in 2009 (5.3 cfs) was much greater than in other years (average of 2.37 cfs). Though City and TID staff indicated additional monitoring of the canal was required during the high usage period in 2009, the capacity of the canal was not exceeded (there were no overflows). The difference between peak usage in 2009 and 2008 was 2.5 cfs; indicating there is at least 2.5 cfs of capacity available in the canal beyond current irrigation usage. As noted above, a flow rate of 2.1 cfs would be needed to deliver the City's available capacity (642 AF including losses) over a 153-day period. This confirms there appears to be sufficient capacity available in the canal to deliver the additional available water.

Table 8 Maximum Daily Flows at the Starlite Monitoring Station
City of Ashland – Water Conservation and Reuse Study

Year	Average Daily Flow (cfs)[1]	Maximum Daily Flow (cfs)[1]
2006	1.95	2.1
2007	1.57	2.2
2008	1.91	2.8
2009	2.47	5.3

Notes:
1. Based on weir data at the Starlite Monitoring Station, as provided by TID.

The capacity of the existing Terrace Street Pump Station is summarized in Table 9. Based on the above discussion, the pump station would require a capacity of 2.1 cfs (or 940 gallons per minute, gpm). The existing pump station has a capacity of approximately 4,800 gpm. Hence, the available pump station capacity greatly exceeds potential requirements.

Overall conclusions of the capacity evaluation are as follows:

- The usable capacity of the TID system available to the City under current contracts, net of current irrigation commitments, is 514 AF.
- The Ashland Creek Canal appears to have sufficient existing capacity to convey the available flows.
- The Terrace Street Pump Station has sufficient existing capacity to deliver the available flows to the Ashland Water Treatment Plant.

Table 9	Terrace Street Pump Station Capacity *City of Ashland – Water Conservation and Reuse Study*
Parameter	**Value**
Number of Pumps	2
Horsepower	200 hp[1]
Approximate Design Head	250 feet
Approximate Design Flow Per Pump	2,400 gpm[1]
Approximate Total Design Flow Rate	4,800 gpm

Notes:
1. Based on pump curve data provided by the City.
2. Based on difference in elevation between the Terrace Street Pump Station (2,310 feet) and the Ashland Water Treatment Plant (2,460 feet) plus 100 feet for estimated friction losses.

3.0 ALTERNATIVES FOR EXPANSION OF TID CAPACITY

A number of past water supply studies have evaluate a variety of approaches for expanding capacity of TID supply to the City of Ashland. Alternatives for expanding the TID supply were most recently evaluated as part of the WISE Study. Alternatives that have been previously evaluated include the following:

Piping of the Ashland Canal. In the 1998 Study, this alternative consists of replacing the Ashland Canal with a pipeline from the Green Springs Turnout to the Terrace Street Pump Station, with associated flow measurement, valving, turnouts for existing TID customers, and piping to connect to the City system. The 1998 Study noted that the Bureau of Reclamation and TID had recently completed a study that estimated annual water savings of 3,000 AF by piping the canal. The savings included potential water recovery from mitigation of seepage losses, as well as recovery of water from more efficient irrigation off the pressurized supply. The 1998 Plan estimated that one third of the savings would be due to seepage mitigation. This alternative is discussed further below. Both lining and piping of the Ashland Canal were also evaluated as part of the WISE Study; lining was rejected as infeasible. The WISE Study recommended that piping of the Ashland Canal be retained for further consideration. However, the WISE Study also identified that piping of a number of other canals, that would not affect the City of Ashland, would yield greater water savings in proportion to the required investment. This is the main alternative considered as part of the current study.

Increased Storage. The 1998 Study noted that increased storage in Emigrant Lake may be possible. The WISE Study identified four main options for increasing existing reservoir storage, focused on the Agate Reservoir, Fourmile and Fish Lakes, Emigrant Lake, and Hyatt Prairie Reservoir. It is our understanding that the projects to increase storage are not being considered further as part of WISE; these options were not considered as part of the current study.

Water Banking. This alternative was noted in the 1998 Study and was intended to provide additional storage for the City by “banking” water in the TID system in years of above normal

precipitation. However, the report noted that TID does not currently allow banking and that the TID Board of Directors would likely be resistant to considering banking. This alternative was considered infeasible for the current evaluation.

Reallocation of Water Rights. This alternative was noted in the 1998 Study and was intended to provide additional supply for the City by re-allocating irrigation water rights to municipal/industrial rights on existing City-owned property. The current rights apply only to irrigation use, and only on the specific property with the entitlement, so the City would need to obtain a change in the place and type of use. The City does own a large property referred to as the Imperatrice Property, located north of the City limits. There are TID water rights associated with a portion of the Imperatrice Property. However, the City intends to use this water right either for the Imperatrice Property or to meet regulatory requirements or environmental mitigation associated with discharges from the Ashland Wastewater Treatment Plant. The City has not identified any other specific properties owned by the City for which rights are available; hence reallocation of water rights was not considered for the current evaluation.

Purchase of Additional Water Rights. The potential to attain TID water rights through purchase of additional property was noted in the 1998 Study. It is our understanding from TID that water in the TID system is fully allocated and there are over 800 acres of property waiting to attain rights on the TID system, as they become available. Hence, it is unlikely for the City to attain additional water rights through the District's water rights pool. However, it would still be possible for the City to negotiate with individual land owners to attain their TID rights. If the opportunity arises for the City to purchase additional rights, the City may want to pursue this option.[5] However, as the availability is completely out of the City's control, this alternative was not considered as part of the current study.

Water Marketing. Under this scenario, additional supply for the City would be provided via a water exchange with existing TID customers. The City would establish contractual agreements with TID customers such that the City could purchase the water from them for domestic use during drought conditions. This alternative is allowed under Oregon law, though it would require a change to the place and type of use within the water marketing agreement (from irrigation to municipal), and would require approval of the TID Board of Directors. The willingness of current TID rights holders to enter into such agreements is uncertain at this time, as is the cost that would be associated with this alternative. As it was not possible to confirm the feasibility of this alternative within the scope of the current study, this alternative was not included.

Overall, the main alternative considered for expansion of the TID supply was piping of the Ashland Canal, which is discussed further herein.

[5] Purchase of water rights for properties located within the City limits will have a varying impact on water supply depending on whether the property is currently using its TID water right. Properties currently using their right may switch to use of potable water for irrigation, thereby increasing demands on the City's system. Hence, there would not necessarily be a net gain in supply if rights were attained for these properties.

As part of the current study, distribution of recycled water to irrigation customers within the City of Ashland is being considered as one water supply alternative. Delivery of recycled water to current TID customers may increase the volume of TID water available for municipal purposes. Potential availability and use of this TID water is considered as part of the recycled water system in *TM 8 - Recycled Water System Piping Analysis* and is not discussed herein.

4.0 PIPING OF THE ASHLAND CANAL

As discussed above, the main alternative for expanding the TID supply considered in the current study is piping of the Ashland Canal. There were two main alternatives considered:

- Alternative 1 - A new pipeline extending from the Green Springs Diversion to the Terrace Street Pump Station – the extents are shown in Figure 1.
- Alternative 2 - A new pipeline covering the City-owned portion of the canal.

Alternative 2 was introduced after it was determined that Alternative 1 could not be used to increase the City's TID allocation based on state water rights law. This issue is further discussed herein and in *TM 12 – City of Ashland Water Rights Summary*.

4.1 Alternative 1 - Piping of the Majority of the Ashland Canal

For the first alternative, it is assumed that new pipeline would extend from the Green Springs Diversion to the Terrace Street Pump Station – the extents are shown in Figure 1. The pipeline is divided into two segments:

- Segment 1 from Green Springs Turnout to the Starlite Monitoring Point, owned and operated by TID.
- Segment 2 from the Starlite Monitoring Point to Terrace Street Pump Station, owned and operated by the City of Ashland.

The WISE Study (HDR, 2009) evaluated piping Segment 1, from the Green Springs Diversion to the Starlite Monitoring Point. It is assumed that the City would wish to extend the piping along Segment 2, to the Terrace Street Pump Station, allowing any water savings to be delivered to the Ashland Water Treatment Plant.

The total length of the pipeline was assumed to be 89,319 feet, or 16.6 miles. This is based on the length stated in the 2009 WISE Report (see Appendix A) for Segment 1, plus an additional 9,600 feet for Segment 2 from Starlite to Terrace Street Pump Station (based on GIS estimate).

Estimated Cost. Costs were based on those in the 2009 WISE Study, which included the following assumptions:

- Low head pipe at cost of $4.50 per inch diameter per linear foot (in/LF), based on $1.50/in/LF for materials and $3.00/in/LF for construction.

- High head pipe at a cost of $6.00/in/LF, based on $3.00/in/LF for materials and $3.00/in/LF for construction.
- Minor fittings were included in the unit cost for pipe.
- No right-of-water acquisition.
- Additional items such as booster pump station and valves were included in the contingency incorporated into the above estimates.
- Cost covered only main canals; replacement of laterals was not included.

The costs are summarized in Table 10. The assumed pipeline profile and cost estimate from the 2009 Draft WISE Report are shown in Appendix A. Costs were assumed to be in January 2009 dollars. Additional costs for the segment from Starlite Monitoring Station to Terrace Street Pump Station were calculated based on the WISE assumptions for low head pipe and an assumed diameter of 30 inches. Costs were then escalated to August 2010 dollars based on the Engineering News Records' 20-Cities Average Construction Cost Index (ENR CCI). The ENR CCIs in January 2009 and August 2010 were 8549 and 8858, respectively.

Table 10 Estimated Cost for Piping of Ashland Canal – Alternative 1
City of Ashland – Water Conservation and Reuse Study

Segment	Jan 2009 Dollars	August 2010 Dollars[3]
Segment 1 - Green Springs Diversion to Starlite Monitoring Station[1]	$14,680,000	$15,210,000
Segment 2 - Starlite Monitoring Station to Terrace Street Pump Station[2]	$1,296,000	$1,343,000
Total Cost	**$15,976,000**	**$16,553,000**

Notes:
1. Cost based on estimate from WISE Report – as shown in Appendix A.
2. Cost based on length of 9,600 feet, diameter of 30 inches, and unit cost of $4.50 per inch of diameter per foot.
3. Escalated based on ENR indices of 8549 (January 2009) and 8858 (August 2010) respectively.

Estimated Capacity. Total water savings from piping the canal were estimated separately for each segment as summarized in Table 11. The estimate for Segment 1 was based on the average of two estimates provided within the report "*WISE Project Subtask 4.6, Groundwater Investigations*" (Golder and Associates, October 25, 2005). The report provided two estimates for seepage losses from the Ashland Canal, as shown in Appendix B:

- 1,658 AF/year based on the WISE Conceptual Model developed by HDR
- 1,427 AF/year based on Bureau of Reclamation Model data.

The average estimated seepage losses of 1542 AF/year were included in Table 10. Losses for Segment 2 were estimated based on the estimated losses calculated above in Section 2.4. The total system losses for the City's portion of the Ashland Canal were estimated at 20 percent. The City's total losses if fully utilizing the City's current allocations would be 274 AF (20 percent of 1,369 AF). Segment 2 from the Starlite Monitoring Point to Terrace Street Pump Station is approximately half the total length of the City's portion of the canal. Hence, it was assumed that 50 percent of City's total losses (137 AF) would be saved by piping Segment 2. Based on these calculations, total savings would be approximately 1,679 AF/year.

Table 11 Estimated Water Savings from Piping the Ashland Canal
City of Ashland – Water Conservation and Reuse Study

Segment	Estimated Water Savings (AF/year)
Segment 1 - Green Springs Diversion to Starlite Monitoring Station[1]	1,542
Segment 2 - Starlite Monitoring Station to Terrace Street Pump Station[2]	137
Total Savings	**1,679**

Notes:
1. Based on average of WISE and USBOR seepage estimates – as shown in Appendix B.
2. Based on total losses of 20 percent in City's section of canal, with 50 percent of those losses being avoided by piping approximately half the length of the City's canal.

Limitations. Based on the water rights evaluation documented in *TM 12 – City of Ashland Water Rights Summary*, though the lining of the TID portion of the Ashland Canal would increase the reliability of the City's supply, it would not increase the City's water allocation. The only way for the City to obtain "new water" through such a canal-lining project would be through the "allocation of conserved water program." Through this program, a portion of the water conserved can be used for new purposes and another portion must be dedicated to instream use. However, this program is complex and success is uncertain. Further, both TID and BOR would need to consent to the project and give approval for the City to obtain a water rights for the conserved water. Based on this finding, it was determined that this alternative would not lead to any reliable increase in TID capacity for the City and this alternative was eliminated from further consideration.

4.2 Alternative 2 - Piping of the City's Portion of the Ashland Canal

For the second alternative, it is assumed that new pipeline would extend from the Starlite Monitoring point to the end of the canal at Wrights Creek. The total length of the pipeline is approximately 19,200 feet based on an estimated measurement in GIS. The diameter of the pipeline was assumed to be 30 inches.

Estimated Cost. Costs were based on those in the 2009 WISE Study for low-head pipe, as described for Alternative 1 above. Costs were then escalated to August 2010 dollars based on the Engineering News Records' 20-Cities Average Construction Cost Index (ENR CCI). The ENR CCIs in January 2009 and August 2010 were 8549 and 8858, respectively. The estimated cost is summarized in Table 12.

Table 12 Estimated Cost for Piping of Ashland Canal – Alternative 2
City of Ashland – Water Conservation and Reuse Study

Segment	Jan 2009 Dollars[1]	August 2010 Dollars[2]
Starlite Monitoring Point to Wrights Creek	$2,592,000	$2,686,000

Notes:
1. Cost based on length of 19,200 feet, diameter of 30 inches, and unit cost of $4.50 per inch of diameter per foot.
2. Escalated based on ENR indices of 8549 (January 2009) and 8858 (August 2010) respectively.

Estimated Capacity. Total water savings for Alternative 2 were based on the estimated operational and seepage losses for the City's portion of the Ashland Canal. These losses (assumed to be 20 percent of total flows) are estimated to be approximately 274 AF/year with full use of the City's allocation. It was assumed that 100 percent of these losses would be recovered by piping this portion of the canal.

Limitations. There is not currently an overflow located at the Starlite Monitoring Point. Hence, if the City were to pipe its portion of the canal independent of a larger TID project to pipe the entire extent, some provision would need to be made for dealing with operational overflows. One option would be to pipe a further extent of the canal, back to the existing overflow at Tolman Creek. The additional costs that would be incurred have not been considered here.

5.0 RIGHT WATER RIGHT USE

Aside from increasing the capacity of the TID supply available to the City, there is also interest in using TID water to serve the irrigation needs to properties currently using potable water for irrigation. The intent is to reserve the Ashland Creek supply, which is perceived as being of greater quality than the TID supply, for potable water use. Decreasing demands on the potable water system would also have other benefits, potentially decreasing the capacity of required improvements to the Ashland Water Treatment Plant and distribution system infrastructure.

As discussed above in Section 2.4, the majority of the City's 769 AF contracted volume from TID has already effectively been allocated to existing irrigation customers. As such, there is limited capacity potential for additional "right water right use" with the City's existing

allocation. Also, the City already has a process for serving the TID supply to additional properties.

For properties in the area of Ashland in which the City provides TID irrigation service, property owners can request connection to the City's portion of the TID system. If distribution piping is located proximate to the property, it is our understanding that these requests are normally approved. Until recently, City staff installed the service, at a fee of $1,850 to the property owner. Recently, the City changed its policy such that property owners are responsible for hiring a contractor expose the distribution piping, with City staff only making the service connection. The new fee for this service is $495. In addition, owners are responsible for installing cross connection control, at an estimated additional cost of $600 to $800, which are inspected by City staff. This service is available, but is neither promoted nor funded by the City.

For properties in the area of Ashland served by TID, it is not currently possible for new properties to connect to the TID system, as water rights on the TID system are not available. As discussed above, it is possible that additional water rights may become available. However, the availability of additional water rights is not under City control and cannot be replied upon for future supply based on current information.

The City may desire to develop an agreement with TID to serve properties upstream of Starlite with the City's current TID allocation. It is our understanding that the City's existing contracts allow for usage anywhere within the City limits, hence this would not require a change to the City's water rights. As this would not create any additional water supply it is not included as a water supply alternative.

Based on the above, further evaluation of potential TID service to additional customers was not evaluated. Additional TID water rights may be made available if a recycled water irrigation service were established within the City; potential use of the available water is discussed in *TM 8- Recycled Water System Piping Analysis* and is not discussed in this TM.

6.0 SUMMARY

The most feasible alternative for increasing TID supply to the City of Ashland appears to be piping of the City's portion of the Ashland Canal. This project has an estimated cost of $2.7 million and is estimated to yield an additional 274 AF of supply. The City may also choose to pursue additional water through land purchase or water marketing if these options are available in the future; these alternatives are not currently being evaluated as part of the WCRS and CWMP.

Appendix A

PIPING COST ESTIMATE FROM WISE DRAFT PRELIMINARY FEASIBILITY STUDY (AUGUST 2009)

D-R-A-F-T

Water for Irrigation, Streams, and Economy
Jackson County Oregon

Preliminary Feasibility Study

Bear Creek and Little Butte Creek Watersheds

DRAFT

Prepared by:

August 2009

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1001 SW Fifth Ave, Suite 1800
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HDR Project No. 84296

In cooperation with:
ICF Jones and Stokes, Inc.
Golder Associates
Eric Dittmer

File	Job No.	No.

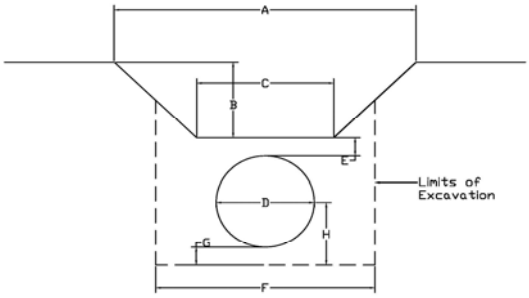
HDR Computation

Project	WISE	Computed	AHR	Date	8/4/2009
Subject	Cost assumptions	Checked		Date	
Task		Sheet		Of	

Typical canal cross section with pipe installed beneath canal and canal restored.

General assumptions

1. Access road is available on at least one side of the canal.
2. Nearby paved road access is available at least every mile
3. Canal is restored after pipe placement
4. Canal side slopes are 1.5H:1V



Assumed Dimensions

Pipe Diameter, in	Assumed Average Dimensions for quantity calculations, ft							
	A	B	C	D	E	F	G	H
12"-24" (avg 18")	12	3	3	1.5	2	3.5	0.5	1.25
30"-48" (avg 36")	17	4	5	3	2	5	0.5	2
54"-72" (avg 66")	28	6	10	5.5	2	7.5	0.5	3.25

Notes:
1. F = D + 2
2. H (bedding) = G + D/2

Assumed Quantities

Pipe Diameter, in	Quantity, CY/LF		
	Excavation	Bedding	Backfill
12"-24" (avg 18")	0.519	0.129	0.356
30"-48" (avg 36")	1.019	0.239	0.648
54"-72" (avg 66")	2.222	0.463	1.319

WISE
Pipe size analysis (Alternatives C1 and C2)

Global Data:

Mannings n =	0.012	HDPE N-12 (per ADS recommendation)
Slope =	0.001	ft/ft
Flow =	1/80	cfs/ac
Cost basis =	$4.50	per inch diameter per LF (low head pipe)
		($1.50/in/LF materials, $3/in/LF installation)

								Case 1: Per Acreage		Case 2: Historical Use			
Canal	**Segment**	**US Node**	**DS Node**	**Segment Length, ft**	**Demand Node (Supply) @ US end**	**Acres @ demand node(s)**	**Demand Flow @ US node**	**Flow in Segment, cfs**	**Pipe Dia, calculated, in**	**Flow in Segment, cfs**	**Pipe Dia, calculated, in**	**Std Pipe Dia, in**	**Segment Cost (Pipe only)**
Ashland	1	A1	A2	21,357	(Emigrant Cr)		0.0	22.7	35.9	35.0	42.2	42	$4,036,473
Ashland	2	A2	A3	44,020	dTID499	353	4.4	18.3	33.1	30.6	40.1	42	$8,319,780
Ashland	3	A3	A4	14,342	dTID274	793	9.9	8.4	24.7	20.7	34.6	36	$2,323,404
Ashland	4	A4	City of Ashland	0	dTID500	666	8.3	0.0	3.6	12.4	28.5	30	$0
												Subtotal Ashland Canal =	***$14,679,657***
East	1	EmigrantRes	E2	35,000	(Emigrant)		0.0	134.0	69.8	124.0	67.8	72	$11,340,000
East	2	E2	E3	5,641	dTID275	929	11.6	122.4	67.5	112.4	65.3	72	$1,827,684
East	3	E3	E4	7,273	dTID276	381	4.8	117.6	66.5	107.6	64.3	72	$2,356,452
East	4	E4	E5	10,432	dTID277	568	7.1	110.5	64.9	100.5	62.7	72	$3,379,968
East	5	E5	E6	4,743	West		41.2	69.3	54.5	60.5	51.8	60	$1,280,610
East	6	E6	E7	4,517	dTID278	236	3.0	66.4	53.6	57.6	50.8	60	$1,219,590
East	7	E7	E8	10,322	dTID281	703	8.8	57.6	50.8	48.8	47.8	60	$2,786,940
East	8	E8	E9	10,522	dTID280	634	7.9	49.7	48.1	40.9	44.7	48	$2,272,752
East	9	E9	E10	6,084	dTID282	1245	15.6	34.1	41.8	25.3	37.3	42	$1,149,876
East	10	E10	E11	4,883			0.0	34.1	41.8	25.3	37.3	42	$922,887
East	11	E11	E12	10,487	dTID284	984	12.3	21.8	35.3	13.0	29.1	36	$1,698,894
East	12	E12	E13	10,480	dTID285.1	600	7.5	14.3	30.2	5.5	21.1	36	$1,697,760
East	13	E13	E14	6,974	dTID285.2	600	7.5	6.8	22.8	-2.0	#NUM!	24	$753,192
East	14	E14	spill	0	dTID285.3	575	7.2	-0.4	#NUM!	-9.2	#NUM!	18	$0
												Subtotal East Canal =	***$32,686,605***
West	1	E5	W2	6,744	(East)		0.0	41.2	44.8	40.0	44.3	48	$1,456,704
West	2	W2	W3	20,468			0.0	41.2	44.8	40.0	44.3	48	$4,421,088
West	3	W3	W4	5,579	Frederick/UW		0.0	41.2	44.8	36.0	42.6	48	$1,205,064
West	4	W4	W5	7,410	dTID289	525	6.6	34.6	42.0	29.4	39.5	42	$1,400,490
West	5	W5	W6	4,281	dTID290	479	6.0	28.7	39.1	23.5	36.3	42	$809,109
West	6	W6	W7	2,643			0.0	28.7	39.1	23.5	36.3	42	$499,527
West	7	W7	W8	14,257	dTID291	495	6.2	22.5	35.7	17.3	32.4	36	$2,309,634
West	8	W8	W9	8,440	dTID292	190	2.4	20.1	34.3	14.9	30.6	36	$1,367,280
West	9	W9	W10	23,936	dTID293	95	1.2	18.9	33.5	13.7	29.7	36	$3,877,632
West	10	W10	W11	13,034	dTID294	675	8.4	10.5	26.8	5.3	20.7	30	$1,759,590
West	11	W11	T9	3,912	dTID295	454	5.7	4.8	20.0	-0.4	#NUM!	24	$422,496
												Subtotal West Canal =	***$19,528,614***
Frederick	1	W3	F1	12,833	(West)		0.0	4.8	20.0	4.0	18.7	24	***$1,385,964***

Appendix B

ESTIMATED SEEPAGE LOSSES FROM REPORT ON WISE PROJECT SUBTASK 4.6 ~ GROUNDWATER INVESTIGATIONS (OCTOBER 2005)

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REPORT ON

WISE PROJECT SUBTASK 4.6
GROUNDWATER INVESTIGATIONS

Submitted to:

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Submitted by:

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1 Copy - Golder Associates Inc./Seattle

October 25, 2005 033-1008-001.000

102705rb1.doc

Calculated Seepage per Canal Segment
WISE Groundwater Study
WISE Project, Southwest Oregon

Canal Name	WISE Conceptual Model Calcualted Seepage		USBOR Model Data Average Diversion[1]	Distribution Losses[2,3]		USBOR minus WISE Model Data Difference	Factor
	(ft3/day)	(ac-ft/yr)	(ac-ft/yr)	(% diversion)	(ac-ft/yr)	(ac-ft/yr)	(-)
Antelope Feeder Canal	22,194	186	1,400	0.26	357	171	1.92
Ashland Canal	197,857	1,658	6,344	0.23	1,427	-231	1.16
Bear Creek Feeder Canal	34,046	285	28,072	0.26	285	0	1.00
Bear Creek Siphon	4,714	40	18,792	0.17	37	-3	1.08
Beaver Canal	40,331	338	24,200	0.08	51	-287	6.68
Brown Mountain Lava Beds	260,431	2,182	6,200	0.33	405	-1,777	1.33
Cascade Canal	70,402	590	6,200	0.33	1,641	1,051	1.46
Conde Canal	168,081	1,409	17,800	0.21	1,320	-89	1.07
Daley Canal	309,583	2,594	17,800	0.21	2,824	230	1.09
Deadwood Tunnel	123,524	1,035	17,800	0.21	436	-600	2.38
East Canal	947,448	7,940	34,989	0.23	7,873	-67	1.01
Frederick Canal	53,936	452	13,145	0.23	401	-51	1.13
Green Springs	103,227	865	6,344	0.23	826	-39	1.05
Hopkins Canal	4,190	35	28,072	0.26	34	-1	1.02
Hopkins Canal_FeederCanal	57,509	482	28,072	0.26	269	-213	1.79
Hopkins Canal_NWCS	736,052	6,168	28,072	0.26	6,515	347	1.06
Hopkins Canal_OCS_Willow	83,232	697	16,092	0.26	725	27	1.04
Hopkins Canal_SWCS	406,792	3,409	16,092	0.26	3,379	-30	1.01
Howard Prairie	195,479	1,638	24,200	0.08	1,516	-122	1.08
Joint System Canal	998,322	8,366	35,300	0.25	8,199	-167	1.02
McDonald Ditch	405,186	3,395	17,000	0.23	3,335	-60	1.02
MID Canal	214,786	1,800	18,792	0.17	1,791	-9	1.00
MID EAST MAIN CANAL	176,806	1,482	18,792	0.17	1,367	-115	1.08
North Fork Canal	83,262	698	35,300	0.25	626	-72	1.11
Phoenix Canal	599,923	5,027	30,262	0.17	4,989	-38	1.01
Phoenix Canal_Expand	20,862	175	30,262	0.17	156	-19	1.12
Soda Creek Feeder Canal	28449.2655	238	24,200	0.08	127	-111	1.87
South Fork Canal	386,434	3,238	17,800	0.21	3,236	-3	1.00
Talent Canal	351,460	2,945	13,145	0.23	2,958	12	1.00
Upper West Canal	53,662	450	17,000	0.23	358	-91	1.26
West Canal	318,470	2,669	17,000	0.23	2,575	-93	1.04
Total		62,487			60,037	-2,449	1.04

1. Calculated from data presented in #2 below and from data presented on the MID website, <http://www.medfordid.org/mn.asp?pg=roguebasinwater>
2. Data from BOR document: DRAFT, "Little Butte and Bear Creek Surface Water Distribution Model ", Model Version March 26, 2003
3. Calculated from data presented in #2 above as well as MID website, <http://www.medfordid.org/mn.asp?pg=roguebasinwater>

Note: Calculations estimating seepage were calibrated to yield conservatively high results, the total estimated seepage is 43% of the total volume of water assumed to flow through the canal system on an annual basis (approx. 145,500 ac-ft/yr)

Data from BOR RRBP Website, <http://www.usbr.gov/dataweb/html/pnrogengdata.html>, Downloaded August 2005
Personal communication, Bo Bergren, TID Field Supervisor, 17Oct05