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City of Banks Water Management and Conservation Plan

Adopted by City Council October 12, 2010

Golder Associates

P0393519cv02.indd

September 8, 2010 Our Ref.: 073-99792

Kennedy/Jenks Consultants
200 S.W. Market Street, Suite 500
Portland, Oregon 97201

Attention: Gordon A. Munro, P.E

RE: CITY OF BANKS - WATER MANAGEMENT AND CONSERVATION PLAN AND ADENDA

Dear Gordon

This deliverable contains the final City of Banks Water Conservation and Management Plan (WMCP) and associated addenda. The WMCP was submitted to Oregon Water Resources Department (OWRD) for review in April of 2009. Lisa Jaramillo of OWRD responded to the April submittal with a request for clarifications and additional information. The letter response to Lisa Jaramillo is contained here as Addendum 1, dated June 23, 2010. An additional response to OWRD that further clarifies the need for green light water is included as Addendum 2.

Sincerely,

GOLDER ASSOCIATES INC.

Robert E. Long Jr. RG., CWRE
Associate, Senior Consultant

REL/REL

Attachments: City of Banks Water Management and Conservation Plan, April 7, 2009
WMCP Letter to Lisa Jaramillo (Addendum 1), June 23, 2010
Email to Lisa Jaramillo of OWRD (Addendum 2), July 15, 2010

cc: Jim Hough, City Administrator, City of Banks

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CITY OF BANKS
WATER MANAGEMENT AND CONSERVATION PLAN

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April 7, 2009

073-99792

EXECUTIVE SUMMARY

The City of Banks (City) is located approximately 26 miles west of Portland in the eastern foothills of the Coast Range of Oregon. The Water Department of Banks Public Works currently provides water to approximately 1740 residential, commercial, industrial, and irrigation customers in and around the city limits. This Water Management and Conservation Plan provides guidance to City officials to meet the current and future needs of the community, and demonstrates compliance with the requirements set forth in Oregon Administrative Rule Chapter 690 Division 86.

The City obtains water through diversion and treatment of surface water from Green Mountain Springs, located north of Banks, and well appropriation of groundwater from the Columbia River Basalt aquifer. The City of Banks holds two certificated surface water rights providing for water diverted from the Green Mountain Springs, and two permitted groundwater rights providing for appropriation from two wells within the city. The City's water supply system does not benefit from interties with other water providers, and City water sources do not contain listed species, are not water-quality limited, and do not occur in a critical groundwater area.

The City of Banks endeavors to conserve water resources by identifying and repairing leaking or aging infrastructure, implementing public education programs on conservation measures, and providing financial incentives to its customers to repair leaks in a timely manner. The City's Water-Use Curtailment Plan defines the system triggers and conservation actions in the event of a water shortage emergency and dictates the manner in which water-use curtailment is communicated, implemented, and enforced.

Water demand over the years 2005-2007 was fairly consistent and averaged approximately 152 gallons per capita per day. The City of Banks currently has the supply and storage capacities needed to service its existing customers; however, population growth and associated water usage forecasts suggest the City will need to increase its water supply in order to keep up with rising demand. The Banks city planner estimates that full build-out to the urban growth boundary will occur by 2024, at which time the total population of the City is estimated to be 3739. Future anticipated average day demand is significantly in excess of current available supply. The City will need to minimize water loss from the system, encourage water conservation by customers, and develop additional sources of supply in the coming years. Development of this Water Management and Conservation Plan is one of the ways in which the City of Banks is planning for safe sustainable water supply.

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APPENDIX

City of Banks Water Rate Structure

ACRONYMS AND ABREVIATIONS

AWWA	American Water Works Association
cfs	cubic feet per second
CRB	Columbia River Basalt (aquifer)
Division 86	Oregon Administrative Rules, Chapter 690, Division 86
GIS	geographic information system
gpcpd	gallons per capita per day
gpm	gallons per minute
ISO	Insurance Services Office
KJC	Kennedy/Jenks Consultants, Engineers to the City of Banks
MG	million gallons
mgd	million gallons per day
MOU	Memorandum of Understanding
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
ORS	Oregon Revised Statutes
OWRD	Oregon Water Resources Department
POA	point of appropriation (groundwater)
POD	point of diversion (surface water)
SSFP	slow sand filtration plant
TVID	Tualatin Valley Irrigation District
UGB	urban growth boundary
WMCP	Water Management and Conservation Plan

1.0 INTRODUCTION

1.1 Brief Water System Overview

The City of Banks (City), located approximately 26 miles west of Portland in the eastern foothills of the Coast Range, currently provides water to approximately 1740 residents within and outside the city limits. The City obtains water through diversion and treatment of surface water from Green Mountain Springs located north of the city, and appropriation of groundwater from the Columbia River Basalt (CRB) aquifer underlying the city.

The City's water supply system is self-contained and does not benefit from interties with other water providers, which are prohibitively expensive given the City's remote location more than six miles from the nearest neighboring municipality. The City does not appropriate water from sources that affect other local governments.

1.2 Plan Purpose and Sources of Information

Development of this Water Management and Conservation Plan (WMCP or Plan) is one of the ways in which the City of Banks is planning for future growth as additional land is brought within the City's urban growth boundary (UGB). The Plan is intended to provide guidance for management and conservation of existing water supplies as they are developed to meet the current and future needs of the community.

The City's updated Water Master Plan (Kennedy/Jenks, 2009), land use and other planning documents, water ordinances, and the institutional knowledge of city employees, were referenced during the preparation of this WMCP.

1.3 Compliance with Permit Extension Conditions

This Water Management and Conservation Plan is submitted to the Oregon Water Resources Department (OWRD) in partial fulfillment of the conditions set forth in the recent Extension of Permit G-7593, dated November 20, 2008.

1.4 Plan Implementation and Update Schedule

This is the first WMCP the City has submitted for OWRD approval. The City plans to submit a WMCP update in 2018 in compliance with the 10-year schedule required by Division 86 rules. A progress report detailing implementation of this plan will be submitted within 5 years, by 2014.

1.5 Plan Organization

This Water Management and Conservation Plan demonstrates compliance with the requirements set forth in Oregon Administrative Rule Chapter 690 Division 86 (Division 86 rules). Table 1-1 provides a summary of the components required by the Division 86 rules, and the sections of this Plan that address each requirement.

Table 1-1:
Summary of Required WMCP Content and Section(s) in which Requirements are Addressed

Sections and Tasks	OAR Reference	Report Section
Water Supplier Description (Section 2)		
Description of supplier's source(s)	690-086-0140 (1)	2.4
Delineation of current service area	690-086-0140 (2)	2.1
Assessment of adequacy and reliability of existing supplies	690-086-0140 (3)	2.6
Quantification of present and historic use	690-086-0140 (4)	2.3
Summary of water rights held	690-086-0140 (5)	2.5
Description of customers served and water use summary	690-086-0140 (6)	2.1, 2.3
Identification of interconnections with other suppliers	690-086-0140 (7)	2.7
System schematic(s)	690-086-0140 (8)	2.1, 2.4, 5.1
Quantification of system leakage	690-086-0140 (9)	2.8
Water Conservation Element (Section 3)		
Full metering of systems	690-86-0150 (4)(b)	3.1
Meter testing and maintenance program	690-86-0150 (4)(c)	3.2
Annual water audit	690-86-0150 (4)(a)	3.3
Rate structure based on quantity of water metered	690-86-0150 (4)(d)	3.6
Public education program	690-86-0150 (4)(f)	3.7
Progress report on previous WMCP	690-86-0150 (1)	3.9
Documentation of water use measurement and reporting	690-86-0150 (2)	3.11
List of measures already implemented or required by contract	690-86-0150 (3)	3.10
Water Curtailment Element (Section 4)		
Assessing water supply	690-086-160 (1)	4.2
Stages of alert	690-086-160 (2)	4.3
Triggers for each stage of alert	690-086-160 (3)	4.4
Curtailment actions	690-086-160 (4)	4.5
Water Supply Element (Section 5)		
Delineation of current and future service areas	690-086-0170 (1)	5.1
Population projections for service area	690-086-0170 (1)	5.2
Prepare schedule to fully exercise each permit	690-086-0170 (2)	5.5
Prepare demand forecast	690-086-0170 (3)	5.3
Comparison of projected need and available sources	690-086-0170 (4)	5.4
Other Items		
List of affected local governments and their comments	690-086-0125 (5)	1.1
Date for submittal of next update	690-086-0125 (6)	1.4

2.0 WATER SUPPLIER DESCRIPTION

The City of Banks provides water to residential, commercial, industrial, and irrigation customers in and around the city limits. Single family residential dwellings account for the most common and numerous water system hookups, while multi-family residential (apartments), commercial, industrial, and irrigation customers present the largest individual demands on the system. The top ten water users account for approximately 19% of the annual water consumption provided by the Banks water system.

2.1 Service Area

The City of Banks water system service area includes the area with the incorporated city limits and other contiguous or neighboring territory that the City Council determines to serve. At present, a small service area west of the City's UGB and a series of connections along the treated water transmission line running from the City's water treatment plant to the main distribution area are the only areas served that lie outside the city limits. There is currently a moratorium on creating new connections outside the city limits. A map of the current Service Area is presented in Figure 2-1.

2.2 Population Estimates – Current and Historic

The current and historic population of the Banks Water System service area is an aggregate of customers inside and outside of the city limits. Population estimates for the City of Banks were referenced from the 2007 Oregon Population Report compiled by the Portland State University Population Research Center (Proehl, 2008). The Banks City Planner provided an estimate of the population currently served outside the service area. Since the number of water connections outside the city limits has been fixed for some time, the number of customers served is assumed to have been static over the past seven years. A summary of the 2000 through 2007 service area population estimates for the Banks Water System is provided in Table 2-1.

Table 2-1
Banks Water System Service Area Population Estimates

Year	Population Within City Limits[1]	Population Outside City Limits[2]	Total Service Area Population
2000	1310	305	1615
2001	1400	305	1705
2002	1420	305	1725
2003	1430	305	1735
2004	1430	305	1735
2005	1430	305	1735
2006	1435	305	1740
2007	1435	305	1740

[1] Data from PSU-PRC "2007 Oregon Population Report" (Proehl, 2008).
[2] Data provided for 2007 by KJ Won, City Planner (earlier data are assumed)

2.3 Water Demand – Current and Historic

Current and historic water demand was estimated by Kennedy/Jenks Consultants (KJC) during preparation of a 2009 Water Master Plan (KJC, 2009), a concurrent planning effort that focuses on water system infrastructure planning for the City. Historical water use consumption was provided by the City in the form of meter records taken monthly for each customer. Water production information (system demand) was provided by the City in the form of recorded flows out of the slow sand filtration plant (SSFP) and Behrman Well. A summary of the historical population and water usage information for the past three years is provided in Table 2-2.

Table 2-2
Historic Population and System Demands

Year	Total Service Area Population	Average Day Demand (gpm)	Average Day Demand (gpcpd)	Maximum Day Demand (gpm)	Peaking Factor[1]	Maximum Monthly Demand (gpm)
2005	1735	179	149	392	2.2	304
2006	1740	187	155	393	2.1	292
2007	1740	185	153	457	2.5	261
Average:					2.3	

[1] Peaking factor is calculated as Maximum Day Demand (gpm)/Average Day Demand (gpm)
gpm = Gallons per Minute
gpcpd = Gallons per Capita per Day

The per-capita water demand over the years 2005-2007 was fairly consistent and averaged approximately 152 gpcpd. This value falls toward the upper range of national averages, which are approximately 100-150 gpcpd. Initiation of water conservation practices identified in this planning document has the potential to improve (decrease) per-capita water demand in the future.

2.4 Supply Sources

The City's water supply is obtained through diversion and treatment of surface water from Green Mountain Springs located north of the city and appropriation of groundwater from the CRB aquifer underlying the city. A map indicating the location of the City's current water sources is provided in Figure 2-2.

The Green Mountain Springs, tributaries of the West Fork of Dairy Creek, are located approximately 3.5 miles north of Banks. The springs were first developed as the City's water supply source in 1924, and consist of a large spring providing most of the water used by the City and a nearby smaller spring. The City has owned approximately 117 acres of land surrounding the Green Mountain Springs as a water source protection measure since the 1930s and 1940s. The Oregon Health Department has prepared a draft delineation of the recharge area for the springs, indicating infiltrated water contribution from approximately 1000 acres surrounding the spring sites (see Figure 2-3).

Spring flow is captured behind two concrete impoundment and diversion structures built a few hundred feet below the spring outlets. Captured water is transmitted to the City's SSFP and then to the High Zone Reservoir (0.22-MG capacity), located just downhill (southwest) of the SSFP, and a 0.07-MG chlorine contact reservoir (the North Star Reservoir). Treated water is transmitted via a high pressure zone to the Carsten Reservoirs (combined 1.5-MG capacity), located on a hill NE of the city, before delivery to water customers in the lower pressure zone. A small number of customers in the upper pressure zone are served directly from the treated water transmission line between the North Star and Carsten Reservoirs.

The City drilled and completed a 450-ft depth production well (the Behrman Well) in the CRB aquifer between 1977 and 1979. The Behrman Well is located on the south side of Banks Road about 2,000 feet SE of the Carsten Reservoirs (see Figure 2-2). Water appropriated from the well is chlorinated at the wellhead and pumped to the Carsten Reservoirs before delivery to water customers. The City drilled and completed a second production well (Well #2) in the CRB aquifer in 2005. Well #2 had not been outfitted with pump and transmission infrastructure to develop the well as a supply source at the time of the preparation of this WMCP.

2.5 Water Rights

The City of Banks diverts surface water from the Green Mountain Springs under two certificated surface water and appropriates groundwater from the Behrman Well under Permit G-7593. Groundwater Permit G-16312 is associated with the potential development of Well #2. A summary of the City's water rights and historical water use is provided below in Table 2-3.

Table 2-3
Summary of Water Rights Held by the City of Banks

Application Number	Permit Number	Certificate Number	Transfer Number	Priority Date	Type of Use	Source
S-9207	S-6516	5353	--	3-Oct-1923	Municipal	Spring (Large Spring)
S-65611	S-48173	83138	--	25-Aug-1983	Municipal	Spring (Small Springs)
G-8476	G-7593	--	T-10055	29-Sep-1977	Municipal	A well (Behrman Well)
G-15887	G-16312	--	--	5-Dec-2002	Municipal	A well (Well #2)

Application Number	Authorized Use	Max Use To Date	Average Daily Diversion			Authorized Date for Completion of Development
			2005	2006	2007	
	cfs	cfs	cfs	cfs	cfs	
S-9207	0.42	0.42	0.25	0.27	0.29	Certificated
S-65611	0.18	0.18	0	0	0	Certificated
G-8476	0.67	0.61	0.15	0.15	0.12	17-Oct-2017
G-15887	1.00	0.00	0	0	0	28-Apr-2028

Note: these water rights specify a maximum rate, and do not have an associated maximum duty.
cfs = cubic feet per second

The City's water sources do not contain listed species, are not water quality limited, and do not occur in a critical groundwater area. Diversion and appropriation of water from the City's existing sources does not present potential issues for species habitat or resource protection related concerns.

2.6 Assessment of Adequacy and Reliability of Existing Supplies

The City has historically utilized water diverted from Green Mountain Springs as their dominant water source. However, reported reductions in minimum summer flow rates and high turbidity events in the winter may limit the reliability of the Green Mountain Springs as an adequate source of water for the growing population of Banks. Minimum summer flows from the large spring have reportedly decreased from approximately 110 gpm in the early 1980s to approximately 90 gpm at present.

Turbidity levels in raw spring water may increase during high flow events in wet winter months. Spring discharge at the surface flows within a marine sedimentary bedrock channel before collecting in concrete catchment basins, and high flow events often lead to increased channel erosion and higher turbidity. Because the City's slow-sand filter is sensitive to high turbidity levels in raw water, diversion to the treatment plant is halted during high turbidity events that occur primarily in the winter season. The small springs are more prone to high turbidity due to the longer flow paths between the outlets and the catchment. The small springs are not currently utilized due to the regularity of high turbidity events. The supply from the small springs is not considered reliable.

The Behrman Well was installed in the 1970s as a source of supplemental water supply during the summer months. As the population has grown, and spring flows have decreased, the Behrman well has become the City's dominant water source, and is pumped up to 18-hours per day during the summer months. The groundwater source has a water right that permits peak pumping at a rate of 300 gpm. However, peak production from the well is reported as 230 gpm and at that rate the well is assumed to be a reliable source of water over the long term. However, the well pump and motor are aging and heavily used. This may present a future limitation due to the mechanical reliability of this water supply source.

Well #2 was drilled and completed in the CRB aquifer within 100 feet of the Behrman Well in 2005. Preliminary pump tests conducted at Well #2 suggested that a pumping rate of 300 gpm could be maintained for up to four months. However, the pumping data collected were inconclusive regarding the longer term pumping efforts and the long-term impacts on the groundwater aquifer (Golder, 2008). Well #2 is scheduled for an aquifer test that will assess the boundary conditions and recharge characteristics of the aquifer. This will support the City's interest in the further development of this groundwater source.

Table 2-4 summarizes the limitations of the City's current water supply sources. The reliable water supply rate available to the City during summer peak use periods is approximately 320 gpm, or approximately 378,000 gallons per day. This estimate is based on:

- Operation of the Large Spring at 90 gpm for a 24-hour operational scheme (129,600 gpd).
- Operation of the Behrman Well at 230 gpm for 18-hour per day (248,400 gpd).
- No supply from the small spring under Application Number S-65611 (Certificate 83138). This source is not currently used by the City due to excessive turbidity levels and is not considered a reliable source for the purpose of this estimate.

Table 2-4
Use Limitations of Existing Permitted and Certificated Water Supplies

Application Number	Use Limitations	Current Reliable Minimum Rate
S-9207	Limited summer flow rate of 90 gpm, high potential for winter turbidity levels	90 gpm
S-65611	Limited summer flow rate of 20 gpm, frequent high winter turbidity levels, currently not utilized by the City	0 gpm
G-8476	Maximum pumping rate at Behrman Well, limited by pump/motor size	230 gpm
G-15887	Well #2 installed, pumping and distribution infrastructure not currently in place	0 gpm

2.7 Emergency System Interties

The City's water supply system is self-contained and does not benefit from interties with other water providers. Interties have been deemed prohibitively expensive to date, given the City's relatively remote location more than six miles from the nearest neighboring municipality. However, the City does maintain two separate sources of water supply, the Green Mountain Springs and the Behrman Well, in the event that one source becomes unavailable for short periods of time.

2.8 Water Loss Evaluation

Calculations of unaccounted-for water were made by KJC during preparation of a 2009 Water Master Plan (KJC, 2009). Unaccounted-for water is defined as the difference between the total water produced at the two water supply sources (Green Mountain Springs and Behrman Well) and the total amount of water billed to customers. Differences between recorded treated water (leaving the SSFP and Behrman Well) and metered customer data are due to several factors including leakage losses, meter discrepancies, hydrant and main flushing, street sweeping, operation and maintenance uses, unauthorized connections, fire flow uses, and un-metered miscellaneous uses.

The average unaccounted-for water in the Banks Water System is 26.4 MG per year, or an average of nearly 27 percent of the total treated water. Table 2-5 presents a summary of the total water produced and consumed by the system and the resulting unaccounted-for water for 2006 and 2007. The fluctuation in unaccounted-for water is assumed to be due to differences in fire hydrant and main line flushing. System flushing is a common and important maintenance task, which KJC suggests continuing (KJC, 2009). This Water Management and Conservation Plan presents actions for the City to implement in order to reduce excessive unaccounted for water in Section 3: Water Conservation Element.

Table 2-5
General Water Use Characteristics

	Units	2006	2007	Average
Total Treated Water Produced	(MG)	98.4	97.4	97.9
Water Produced by Slow Sand Filtration Plant	(MG)	63.8	68.0	65.9
	(%)	64.8	69.8	67.3
Water Produced by Behrman Well	(MG)	34.6	29.4	32.0
	(%)	35.2	30.2	32.7
Total Metered Consumption	(MG)	74.4	68.7	71.5
Unaccounted-for Water	(MG)	24.0	28.7	26.4
	(%)	24.4	29.5	26.9

3.0 WATER CONSERVATION ELEMENT

Water conservation can function as an important tool in helping the City use its existing and future water supplies more efficiently. Water conservation can potentially increase system reliability by decreasing the use of the Behrman well, reduce capital expenditures on future water source development, and limit impacts on the CRB aquifer. The City of Banks adopted a comprehensive conservation program in September of 2000 and completed a WMCP in 2001. The current 2008 WMCP is the first WMCP the City has submitted for OWRD approval.

3.1 Full Metering of System

The City's water system is fully metered. Diversion from the Green Mountain Springs is metered at the outlet of the SSFP and groundwater appropriation is metered at the well head of the Behrman Well. The City also meters flow at the North Star and High Zone Reservoirs. Full metering of the City's water consumer hook-ups was completed in 1988.

3.2 Meter Testing and Maintenance Program

The City tests all customer meters prior to installation to ensure that they do not have an error in excess of ±3%. Meter tests are conducted in accordance with the standards of practice established by the American Water Works Association (AWWA, 1999, manual number M-6, 4th edition). The water department has procedures in place to re-test customer meters if meter records suggest a drifting meter or if water customers request a meter test be performed.

The City does not routinely test its supply meters. Newer magnetic meters were installed to most supply locations in 2002.

3.3 Annual Water Audit

The City, with the assistance from an intern from Portland State University, has installed Water Audit software developed and distributed by AWWA. The primary function of the software is to generate an infrastructure leakage index. The program utilizes input information on water supplied to and withdrawn from the system, unmetered loss estimates, and other parameters to produce financial and operation efficiency indicators for use by City staff and engineers. The project is currently in the data input stage; once the initial information is entered, water audit updates are relatively simple. This program will be a useful tool in monitoring overall system activity and performing future system audits

The City currently monitors treated water supply volume and sales volumes. Because the system is fully metered – with meters at all customer locations and supply sources – monthly estimates of water loss can be made.

The City does not meter construction or fire uses by State, County, or Oregon Department of Transportation contractors, but relies on an honor system for reporting these uses.

3.4 Leak Detection Program

Water losses from the system in 2006-2007 were estimated by KJC engineers to be 27%. Some of this loss may be attributed to non-metered uses (see 3.3 above), and some to leakage from the aging

treated water transmission line from the North Star Reservoir to the Carsten Reservoirs. Implementation of annual water auditing will identify water losses more accurately, and allow the City to develop a leakage detection program. The City's goal is an annual water loss of 15% or lower from all sources.

3.5 Leak Repair and Line Replacement Program

The City has identified and repaired significant leaks in the past by replacing aging water distribution line infrastructure. Plans for replacing the aging treated water transmission main between the North Star and Carsten Reservoirs have been drafted and the City is currently planning for funding this water conservation opportunity through the implementation of their Water Master Plan and Capital Improvement Program. Once the transmission line is replaced, KJC engineers predict the system should experience lower leakage loss and higher transmission capacity.

3.6 Rate Structure Based on Quantity of Water Used

The City bills customers for delivered water based in part on metered water usage. Water customers are charged a flat rate for the first 400 cubic feet per month, and a unit price for any water used above that base amount (reflecting a 2007-2008 rate increase of 10%; see Appendix). This rate structure allows water customers on a fixed income to have access to an amount of water to meet basic needs as well as providing an incentive for conservation of water use above these basic needs.

Meters are read manually and bills are rendered on a bi-monthly basis. The City maintains an accurate record of meter readings and customer billings as proof of water service provision and customer use.

3.7 Public Education Program

The City has obtained and distributed informational flyers from AWWA on water conservation measures to its customers. The City has also produced a pamphlet detailing water quality issues and backflow, and measures that their customers may take to prevent backflow. The City also has the capacity to add special alerts or messages to water bills through updated billing system software.

Golder and KJC are currently developing an informational pamphlet on water conservation and the City's WMCP for distribution to Banks water customers and non-metered residents. In conjunction with pamphlet delivery, Golder will present a water conservation workshop at a Banks public meeting in the first quarter of 2009.

3.8 Technical and Financial Assistance Programs

These programs are not required for small water providers. However, the City does provide financial assistance through its leakage repair compensation program. The City will credit a customer up to one half of their water bill if they demonstrate they have identified and repaired leaks in a timely manner. In addition to providing financial assistance, this program encourages water conservation.

3.9 Progress Report on Previous WMCP

The 2001 WMCP listed several recommendations to the City to facilitate fulfilling its water conservation and management goals. Specific benchmarks for each recommendation were not provided; however, Table 3-1 outlines the recommendations and the City's progress toward each.

Table 3-1
Progress Report on Previous WMCP Recommendations

Recommendation	Status of Action
Begin process of switching all large irrigators to TVID water	Currently, there is a moratorium on new service agreements with TVID that is expected to last until the year 2015.
Implement an odd/even day for irrigation	City ordinance instructs irrigators on odd/even usage days as emergency measures.
Assign or hire a Water System Conservation Coordinator position	Not currently hired or assigned.
Require remodels and new construction to install ultra-low flow fixtures	Not currently required.
Perform water audits on commercial customers	The City is currently developing an auditing system using AWWA Water Audit software.
Purchase and mail conservation information	The City has obtained and distributed informational flyers from AWWA on water conservation measures. The City will also host a water conservation workshop at a public meeting in March 2009.
Purchase a supply of door hangers to advise customers when conservation action is requested or required	The City has relied on mailed notifications of a curtailment plan.
Develop year-round use of the small Green Mountain spring by pursuing the install of a flocculation/ clarification system to reduce turbidity	In 2002, a flocculating clarifier was constructed for the small spring, although it is currently not operating. Due to the low flow (12-15 gpm) and generally low quality of the water from this source, the City has elected not to adopt the burdens of chemical treatment and operations maintenance associated with the clarifier at this time.
Authorize a design study for a new well south of town	The design study has not been authorized at the time of this WMCP, but is under consideration with other alternate water supply options.
Begin replacement of old steel and galvanized water lines to reduce water loss	The City has and continues to identify and repair significant leak by replacing aging water distribution line infrastructure.
Continue the moratorium on extension of water service outside City limits	The moratorium is currently active.
Be prepared to enact the provisions of the Water-Use Curtailment Plan	The City has detailed curtailment alerts and actions in its Water-Use Curtailment Plan, and is prepared to enact these provisions.

3.10 Conservation Measures Already Implemented

Banks has adopted a Water Use Curtailment Plan (city ordinance 50.23) instructing its customers on water conservation measures during periods of high demand and/or low supply. More information on the Water Use Curtailment Plan is available in Section 4 of this WMCP.

3.11 Documentation of Water Use Measurement and Reporting

The City of Banks reports monthly water use to OWRD in its Annual Water Use – Monthly Quantities Form. Water use in water-use year 2008 was submitted to OWRD on December 8, 2008.

OWRD has implemented an on-line water use reporting system, and the City intends to report its water use for water-use year 2009 on-line.

4.0 WATER CURTAILMENT ELEMENT

This Section of the WMCP describes the City's Water Use Curtailment Plan and demonstrates compliance with the requirements of the applicable Division 86 rules (OAR 690-086-0160). Curtailment planning enables the City to develop and implement proactive measures that reduce water demand while protecting the health and welfare of the community during periods of drought or catastrophic service interruption.

4.1 Curtailment History

Since 1923 the City of Banks has obtained drinking water from Green Mountain Springs, located approximately six miles north of the city in the coast range foothills. This supply was augmented by the completion of the Behrman production well in 1973. The City has experienced short and longer term disruptions in water supply. However, due to the dual spring and well sources of water, the system failures have not resulted in wide-scale loss of service.

Anecdotal information suggests that approximately 18 years ago, the motor driving the Behrman Well pump failed and was replaced. The entire pump was replaced approximately 12 years ago, which disrupted water supply from the well for approximately three days. The City of Banks experienced a longer-term loss of water from the Green Mountain Springs in February-March 1996 when a mudslide washed away the old intake structure. The City relied on the Behrman Well during this period and did not suffer from severe shortages because demands were modest at that time of year. However, the high-zone customers connected directly to the treated surface water transmission main were without City water service for two weeks. Water was provided in tank trucks by the Oregon National Guard through a Federal Emergency Management Agency program until a temporary intake was installed and service was resumed.

The City has experienced a few recent short-term water supply emergencies due to water line breaks and well system failures. Two interruptions occurred from breaks in the treated water transmission main in October-November 2007 due to a traffic-related incident that sheared off a fire hydrant twice in the two-month period. The Behrman Well failed in 2008 due to lightning strike; the system was repaired within 12 hours of the discovered failure. Adequate system storage allowed these failures to be repaired in a timely manner without requiring the implementation of water use curtailment.

4.2 Curtailment Plan

Rapid population growth since the mid-1990s has sharply increased the City's dependence on groundwater resources from the Behrman Well to meet peak summer demands. And while the City has replaced several sections of their pipelines as recommended in the 1998 Master Plan Update, sections of older pipe remain in the distribution system and pose a potential for system supply disruption should they fail. The City currently has no redundancy in its water supply system during periods of high demand, and a disruption in the water supply system could lead to a water shortage. The City currently has a storage capacity to provide approximately 5.5 days of water supply without the implementation of curtailment measures. The City is considering the feasibility of using Well #2 as a source of emergency water supply, but the well does not have adequate infrastructure (pump and distribution tie-in) to be utilized at this time.

In the event of a water shortage, the City's Water-Use Curtailment Plan (authorized by City Ordinance 50.23) defines the system triggers that initiate actions that City will take in the event of a water shortage emergency and dictates the manner in which water use curtailment is communicated,

implemented, and enforced. The curtailment plan may be implemented for rapidly developing emergencies such as those due to natural disasters or infrastructure failure, as well as longer-term water supply reductions due to prolonged drought.

Currently the Behrman Well relies on an aging pump and motor that is used up to 18 hours per day during peak demand periods. A mechanical failure of the production well infrastructure during the summer months would likely cause a water shortage emergency. The duration of this type of emergency would depend on the time required to repair or replace the failed component, which could last up to several weeks and require water use curtailment.

The impacts that a long-term drought would have on the City's water supply are uncertain. It is possible that an extended drought could cause the yield of the springs to decline or groundwater levels to drop in the well. A reduction in the pumping capacity of the well due to aquifer drawdown or a lower flow from the springs could produce water supply shortages of longer duration requiring water use curtailment.

The curtailment plan prioritizes the use of limited water supplies to protect public health and safety during an emergency, and provides for gradually increasing levels of voluntary and mandatory curtailment actions to address a water supply shortage. Water use is prioritized in the following manner:

1. Minimum essential indoor residential use and fire protection;
2. Minimum essential indoor uses by nonresidential customers, including schools, commercial establishments and Banks Lumber;
3. Outdoor uses and discretionary indoor uses by all customers; and
4. Service to new customers who are not served at the time the water shortage occurs.

The amount of water required for essential indoor uses is subjective and depends on the extent to which current water-use patterns are modified by customers. Without significant changes in behavior, average indoor residential water use in Banks is estimated to be about 75 to 80 gallons per capita per day (gpcpd). If the City requested that water use be curtailed due to a shortage, essential use could be expected to be about 70 gpcpd. Public health could still be maintained with lower uses, but significant changes in water use behavior would be needed. The amount of water required to maintain service for categories 2 and 3 listed above would depend on the time of year that the water shortage occurs. Essential indoor uses at the schools would be small during the summer months, but significant during the school year. Conversely, most outdoor uses are generally concentrated from mid-June to mid-September.

4.2.1 Stages of Alert

The City of Banks Water Curtailment Plan prescribes three stages of alert in the event of a water shortage. These increasingly sever water shortage stages trigger predetermined levels of response that prompt notification of specific reductions in use. The shortage levels used to indicate each stage of the curtailment plan are based on critical system operating conditions.

Table 4-1 summarizes the three stages of alert, the shortage conditions that trigger each stage, and the peak water use reduction goal for each stage due to curtailment actions. These shortage conditions and reduction goals are based on summer operation schemes when water demand is at a maximum, and assume alternative supplies (i.e., water from interties or secondary sources) are not available. If alternate backup water supplies are developed the City may reevaluate the conditions used to define

shortage levels, as system redundancy will reduce the potential for shortages in the event that flows from one source of supply are interrupted.

Table 4-1
Water Shortage Stages, Triggers, and Reduction Goals

Stage	Shortage Condition Trigger	Peak Water Use Reduction Goal
1 "mild"	Well running time greater than 20 hrs/day to fill Carsten Reservoirs	15 %
2 "moderate"	Carsten Reservoir water storage approach minimum 685,000 Gallons of Storage (tank elevation 403 feet) Or Well running time of 24 hrs/day (i.e., daily demand exceeds supply) Or Well System failure and anticipated repair/recovery of greater than 48-hours (2-days)	30 %
3 "critical"	Carsten Reservoir below water storage minimum 685,000 Gallons of Storage (below tank elevation of 400 feet) Or Long-term (>3 day) service disruption of spring or well water sources	60 %

4.2.2 Triggers for Each Stage of Alert

The City currently relies on water from Green Mountain Springs and the Behrman Well to meet water demand in the service area, and utilizes storage in the Carsten Reservoirs to meet peak demands. The adequacy of the City's water supply is currently gauged by monitoring the operating water levels in the Carsten Reservoirs. Therefore, water levels in the Carsten Reservoirs and the ability of water sources to maintain reservoir levels are used as benchmarks for initiating curtailment actions.

The City relies heavily on production from the Behrman Well to keep the Carsten Reservoirs full and meet water demand during the summer months. The first water shortage stage is triggered by excessive well operating time. If the well pump is running for more than 20 hours per day in order to fill the Carsten Reservoirs the first trigger for implementation of water-use limits will be met.

Second tier curtailment conditions will be triggered if the Behrman Well runs continuously, indicating that daily demand is in excess of available water supply. Alternately, second tier curtailment will occur if the water surface elevation of the Carsten Reservoirs falls below 403 feet. This water level benchmark is meant to provide response time for implementing water-use curtailment measures in order to avoid tank water levels below 400 feet elevation (the level necessary to meet emergency fire flows, if necessary).

Third tier curtailment conditions will be triggered if water levels in the Carsten Reservoirs fall below 400 feet. A conservative allowance for emergency fire suppression use, determined from the Insurance Services Office (ISO) rating for the City, requires a minimum available water volume of approximately 685,000 gallons. With both tanks in service, a water surface elevation of 400.2 feet in the Carsten Reservoirs provides a volume of 685,000 gallons.

Without the benefit of secondary water sources or system interties, the loss of either the Large Spring or the Behrman Well during the summer would result in supply deficits. Should the City be faced with the loss of either supply source that anticipates a 3-day repair schedule, a third tier condition would be triggered.

4.2.3 Curtailment Actions

The three stages of curtailment actions have been developed assuming that shortages are generally going to occur during peak demand periods in the summer. The plan concentrates first on reducing outdoor water use. If equipment failures result in a supply shortage at a time when outdoor water use is relatively low, then the emphasis of the rationing methods will be shifted to non-essential indoor use.

The curtailment actions for each of the shortage conditions are as follows:

Stage 1: Request major landscape irrigation customers to curtail all outdoor water use. Major irrigation customers currently include Arbor Village Homeowners Association, Quail Hollow Apartments, Banks Lumber Company, the Banks School District #13, and the Banks Sunset Park Association. Identify alternate day irrigation schedules for schools, parks and green space. Issue notice to public requesting all users to voluntarily conserve water.

Stage 2: Mandate major landscape irrigation customers curtail all outdoor water use. Mandate other users limit outdoor water use per the following steps:

1. Unattended outdoor irrigation of turf and plants limited to the period between 5:00 P.M. and 9:00 A.M.
2. Limit the length of time that unattended irrigation can occur in each sprinkler zone to 20 minutes per day.
3. Limit irrigation to alternate day schedule. Even house numbers may water on even days. Odd house numbers may water on odd days.
4. Prohibit home washing of cars or hosing down of patios, walkways and other surfaces.

Stage 3: Order suspension of all outdoor water use and curtail indoor use to limit all customers to uses for public health and preparation of food.

Curtailment requests for reduction of water use should be supported by a public information program aimed at educating the community about water use so they may understand how modifying their habits can affect water consumption. When issuing a notice to the public, examples of ways to conserve water should be provided. For example, the public notification for a First Stage condition should be aimed at outdoor uses. These uses can form a significant proportion of summer residential use and tend to be more discretionary in nature. Specific conservation measures that can be recommended in the notice include the following:

- no landscape irrigation during daylight hours to reduce evaporation;
- limit length of time irrigation system is on to reduce waste from runoff and over watering;
- landscape irrigation no more than three days per week; and
- no home washing of cars or hosing down of patios, walkways, and other surfaces.

Public notification procedures to communicate water curtailment measures should be defined in advance. Press releases through radio, newspaper, and television should be utilized to reach the entire community. Door hangers should also be purchased in advance so that in an emergency all customers can be notified directly and quickly.

These measures are further supported by the public information program that provides guidance and suggestions on water conservation (see Section 3.8).

5.0 WATER SUPPLY ELEMENT

The City of Banks currently has the supply and storage capacities needed to service its existing customers. Planned land use and the population growth associated with water usage forecasts suggest the City will need to increase its water supply in order to keep up with rising demand. The following section details current and future water needs, and recommends potential sources of water to meet these needs.

5.1 Current and Future Service Area

The City of Banks water system service area includes the area within the incorporated city limits and other contiguous or neighboring territory that the City Council determines to serve. At present, a small service area west of the City's UGB and a series of connections along the treated water transmission line running from the City's water treatment plant to the main distribution area are the only areas served that lie outside the city limits. There is currently a moratorium on creating new connections outside city limits; the City is currently reviewing options for expanding its UGB. A map of the current Service Area and adjacent land (currently zoned as agriculture and forest land) that may be incorporated into a future planned service area are presented in Figure 5-1.

5.2 Population Projections

The projected future population of the Banks Water System service area is an aggregate of customers living inside and outside of the city limits. New water connections outside the city limits are no longer allowed, and the number of customers served in that area is assumed to remain at current levels into the future (305 residents). The number of water customers inside the city limits is expected to grow as the City builds out to its UGB. The City's land use plan estimates that full build-out to the UGB will occur by 2024, at which time the total population of the City is estimated to be 3739. A summary of the service area population estimates for the Banks Water System over the next 20 years (between 2008 and 2028) is provided in Table 5-1.

Table 5-1
Banks Water System Service Area Population Estimates

Year	Population Within City Limits[1]	Population Outside City Limits[2]	Total Service Area Population
2008	1570	305	1875
2013	2245	305	2550
2018	2920	305	3225
2023	3595	305	3900
2028	3739	305	4044

[1] Data 2008 - 2028 provided by KJ Won, City Planner, assuming a uniform average growth rate over the period from 2007 to 2024, when full build-out is expected to occur.
[2] Data provided by KJ Won, City Planner.

5.3 Water Demand Forecast

Water demand forecasts were estimated by the City Engineer (KJC) during preparation of a 2009 Water Master Plan (KJC, 2009), a concurrent planning effort focused on water system infrastructure planning for the City. A summary of the projected population and water usage information for the Banks Water System over the next 20 years (between 2008 and 2028) is provided in Table 5-2. Future water demand projections were based on future population estimates (see Section 5.2) and estimated per-capita use based on water billing and production data for the past three years. It was assumed that the rate of increase in water use for commercial and industrial users will follow the same pattern as for the residential population.

Table 5-2
Projected Population and System Demands

Year	Total Service Area Population	Average Day Demand (gpm)	Average Day Demand (gpcpd)	Maximum Day Demand (gpm)	Peaking Factor[1]	Maximum Monthly Demand (gpm)
2008	1875	198	152	456	2.3	304
2013	2550	269	152	621	2.3	414
2018	3225	340	152	785	2.3	523
2023	3900	412	152	949	2.3	633
2028	4044	427	152	984	2.3	656

[1] Peaking factor is calculated as Maximum Day Demand (gpm)/Average Day Demand (gpm)
gpm = Gallons per Minute
gpcpd = Gallons per Capita per Day

5.4 Comparison of Water Demands and Available Sources

A discussion of the City's reliable water sources was provided in Section 2.6, and summarized in Table 2-4. The reliable water supply rate available to the City during summer peak use periods is an instantaneous 320 gpm, or approximately 378,000 gallons per day.

Given that the future anticipated Average Day Demand of 427 gpm by 2028 is 133% of the current available supply (320 gpm), and the 2028 Maximum Day Demand of 984 gpm is 308% of the current supply, the City will need to minimize water loss from the system, encourage water conservation by customers, and develop additional sources of supply in the coming years.

The City's conservation planning will focus on reducing water loss from 27% to 15% of diverted water or less in order to maximize delivery of currently available water sources. Achieving a 15% water-loss goal would conserve over 14 MG per year. This is equivalent to approximately 729 hours of pumping at the Behrman Well.

The City's overall conservation goal is to reduce per capita water demand on the system from 152 gpcpd toward the national average (near 125 gpcpd). This program will require the implementation of water conservation measures as identified in Section 3 of this WMCP, continued outreach to the community, increased rate structures for service beyond basic services, and the replacement of existing infrastructure. However, even with full implementation and success of these conservation

measures, reductions to 15% leakage loss, and a reduced demand to 125 gpcpd the City is projected to have a water supply deficit requiring additional sources of supply by 2018 (see Table 5-3).

Table 5-3
Projected Future Water Supply Balance after Conservation Efforts

Year	Maximum Day Demand (given 152 gpcpd)	Current Firm Source Water Availability[1]	Current Water Delivery (given 27% leakage)	Estimated Water Supply Balance[2]	Maximum Day Demand (assuming 125 gpcpd)	Potential Water Delivery (assuming 15% leakage)	Estimated Water Supply Balance[3]
	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
2008	456	320	233.6	-222.4	375	272	-103
2013	621	320	233.6	-387.4	511	272	-239
2018	785	320	233.6	-551.4	646	272	-374
2023	949	320	233.6	-715.4	780	272	-508
2028	984	320	233.6	-750.4	809	272	-537

[1]refer to Section 2.6 Assessment of Adequacy and Reliability of Existing Supplies
[2]calculated as current water delivery minus the current Maximum Day Demand
[3]calculated as potential water delivery (with goal of 15% loss) minus potential Maximum Day Demand (with less water use per capita than current)

5.5 Water Rights Implementation Schedule

The City plans to continue to develop their groundwater permits in the coming years. A complete list of the City's water right holding are presented in Table 2-3 and options for all water rights are discussed in Section 5.6. This section focuses on developing water right permits that require additional development to become permanent certified water rights. Table 5-4 presents the available groundwater permits that are not yet fully utilized (put to beneficial use) and certificated. These permits are scheduled for development and partial or full certification of beneficial use within the next three years.

Additional evaluation of water right options, to increase the City's ease of use and flexibility under these permits, may be explored in the years following the development of Well #2. The following schedule outlines the current proposed schedule for putting the groundwater permits to beneficial use.

5.5.1 Water Right Permit Development Actions for 2009 to 2014

1) The City will pump test and develop the wellhead infrastructure and conveyance for Well #2 under Permit G-16312. The permit will be amended to include Well #1 and other potential points of appropriation (POA) and for an area identified for well field development (Southwest Wellfield, Figure 5-2).

2) The City will amend Permit G-7593 to include Well #2, other potential POA, and an area for well field development (Southwest Wellfield, Figure 5-2).

3) A claim of beneficial use will be completed for the final 0.06 cfs (27 gpm) of appropriation under Permit G-7593, and the permit will be certified through a claim of beneficial use.

4) A partial perfection of Permit G-16312, of 25% or more, will be made if the mutual capacity of the Behrman Well and Well #2 prove sufficient to support the production of the combined permits.

Table 5-4
Summary of Unperfected Water Right Permits

Application Number	Permit Number	Certificate Number	Transfer Number	Priority Date	Type of Use	Source
G-8476	G-7593	--	T-10055	29-Sep-1977	Municipal	A well (Behrman Well)
G-15887	G-16312	--	--	5-Dec-2002	Municipal	A well (Well #2)

Application Number	Authorized Use	Max Use To Date	Average Daily Diversion			Authorized Date for Completion of Development
			2005	2006	2007	
	cfs	cfs	cfs	cfs	cfs	
G-8476	0.67	0.61	0.15	0.15	0.12	1-Oct-2017
G-15887	1.00	0.00	0	0	0	28-Apr-2028

5.5.2 Water Right Permit Development Actions for 2014 to 2020

1) The City will assess the viability of developing the Golf Course well with the present owner, Quail Valley Golf Course, under both Permits G-7593 and G-16312. This could be done by adding the Quail Valley Well as an additional POA to both water rights. A hydrogeologic determination of "same source" would also have to be completed.

2) The hydrogeologic and engineering viability of the Southwest Wellfield will be assessed.

3) Investigate feasibility for integrating Aquifer Storage and Recover (ASR) into water supply system. ASR can optimize the existing water supply system by storing available winter flow from senior water rights at the spring sources.

5.5.3 Water Right Permit Development Actions for 2020 to 2028

The construction phases of the options selected will be completed, if necessary.

5.6 Source Alternatives Analysis

The City plans to meet future system demands through conservation measures that will minimize water loss from the system, encouraging water conservation by customers, and developing additional sources of supply in line with the City's current water right holdings. Demand projections, outlined in Section 5.3, indicate the City cannot currently meet the 2008 Maximum Day Demand, and will not meet the Maximum Monthly Demand by 2013. In addition to conservation measures, additional water supply will be required to meet these demands. A number of supply options are reviewed in this section and are categorized under the general areas of near-term and long-term supply options.

In the short term, the City will continue measured development and exploration of additional groundwater resources to ensure near-term municipal demands are met and to develop system redundancy to supply water in the event of primary water source disruptions. In the long term, the City will continue to evaluate options to develop interconnections with regional water suppliers.

5.6.1 Near-term (one to five years)

Currently, several short-term source water alternatives exist for the City of Banks. These options include completing the development of the existing ground water right permits in Table 5-4, developing Well #2, exploring options for utilization of the Quail Valley Golf Course Well, and assessing options for the Southwest Wellfield. The City may also consider improving the delivery of water supplies on existing spring water right certificates by investigating options to transfer spring water rights to groundwater rights (Sellers Road Wellfield); thereby reducing or eliminating the need for filter treatment.

5.6.1.1 Well #2 Wellhead Development

This supply option will provide near term additional water supply to the City and act as a back up well to the Behrman Well. Development of the Well #2 option may yield up to 450 gpm of reliable water supply. If the well is found to have the capacity to sustain this amount of water for a sufficient period of time, the development of the pumping and conveyance system could increase the reliable supply by 220 gpm, assuming that the Behrman Well was not in operation. This option will require a long-term constant-rate pumping test to prove out the pumping capacity and accurately size the pumping system. Other infrastructure required will include the wellhead design and construction, a chlorine treatment system, and a short conveyance pipeline to intertie with the Carston reservoirs.

5.6.1.2 Quail Valley Golf Course

The Quail Valley Golf Course located to the east of the City of Banks has an existing groundwater well which could be a potential alternative source of water. Current water rights for this well are permitted for a maximum rate of 0.89 cubic feet per second (399 gpm) for supplemental irrigation. This well is presently pumped to storage ponds on the golf course. The irrigation water is then pumped from the pond to irrigate the golf course when Tualatin Valley Irrigation District cannot supply irrigation water to the course. If found to be hydraulically connected, this well could yield a significant municipal water supply under the City's existing water rights. Use of this water supply option would require a Memorandum of Understanding (MOU) between the City and Quail Valley Golf course regarding their need for emergency use, and annexation of part or all of the golf course and surrounding lands. A water supply pipeline would be constructed from the well to an intertie in the of the Behrman well to tie into the existing pipeline along NW Banks Road at the Behrman well (see Figure 5-3), which would be approximately 4000 feet long.

5.6.1.3 Sellers Road Wellfield

This water supply option would require a hydrogeologic feasibility study of the basalts above the existing spring sources north of the City. This would include drilling and pump testing a well, and would require a water right transfer of a portion of the spring water right to the new groundwater well. The City maintains two spring intakes north of town, located off Sellers Road. The supply from the springs has experienced long-term reductions in production capacity over the last 20 years and the surface water captured requires expensive filtration and treatment to meet drinking water quality standards. If this option proved successful, the water drawn from the groundwater source in connection with the springs could be increased from the current 90 gpm to the full water right of 269

gpm, an increase of 179 gpm. The groundwater from the wells is unlikely to require filtration treatment. The potential improved water quality could greatly reduce or eliminate the cost of operating the City's slow sand filter. The hydrogeologic feasibility study would include refining a hydrogeologic conceptual model, selecting a well location based on hydrogeologic features, legal access Sellers Road, and then drilling a test well and completing a pumping test.

A successful outcome to the feasibility study could initiate the development of a well field along Sellers road (see Figure 5-4). Two to five wells could be drilled to a depth of 50 to 350 feet, with an estimated production of approximately 50 to 150 gpm each. The development goal would be to reach 269 gpm, the total water right now available at the current spring sources. In addition to drilling the wells, other infrastructure would be required including power supply, approximately 3500 feet of pipeline conveyance from the new wells to a tie-in at the existing spring intake, pumps and motors, and a control system for operations.

5.6.1.4 Proposed Well Field Southwest of City Center

Located to the southwest of the City of Banks is an area of land that has been considered as a possible location for a new well field (Figure 5-2). The location is to the west of Nehalem Hwy between NW Wilson River Hwy and NW Dierick Road. This land is currently being used for agricultural purposes, but may be in a location which could produce significant quantities of groundwater. It is proposed that two wells could be drilled in this area. A pipeline would be constructed to tie in to the existing water distribution system for the City to the north along S Main Street, and would be approximately 2500 feet in length (see Figure 5-3). The wells may be planned in conjunction with construction of a storage tank on the south side of the City, offering operational advantages for the water distribution system. The City's junior water right permit allows for development of up to 1cfs (~450 gpm) of additional water supply from the CRB aquifer. A 300-gpm portion of Permit G-16312 could be available for development after the successful development of Well #2. Similar production wells completed in the CRB aquifer in the area have production rates ranging from approximately 100 to 500 gpm (Squire, 1994). A new well located on the south side of town may encounter as much as 400 feet of overburden sediment, and would benefit from being drilled at least 400 feet into the CRB aquifer, for a total depth of approximately 800 feet.

5.6.2 Longer-Term Supply Options (five to 20 years)

Over the long term, the City will continue to evaluate options to develop interconnections with regional water suppliers. The City may also consider optimizing long-term production from the CRB aquifer by developing an Aquifer Storage and Recovery (ASR) Program. This program would allow the City to store excess winter water from the spring water right certificates, or another source, into the CRB aquifer wells in and around the City Center (Behrman Well, Well #2, and potentially the Quail Valley Well and the proposed Southwest Wellfield).

5.6.2.1 Non-potable Water Delivery from Tualatin Valley Irrigation District (TVID)

The City has considered purchasing non-potable water from TVID in order to supply large-volume water customers with an alternative source of irrigation water. This arrangement has the potential to significantly reduce potable water use by these customers and thus provide "additional" potable water to meet residential water needs.

A purchase agreement with TVID would need to be accompanied by concurrent water rights amendments to allow use of TVID water to irrigate land serviced by the City, as well as a modest

investment in infrastructure to allow delivery of non-potable water to large-volume irrigation users. It is our current understanding that there is a moratorium on new service agreements with TVID that is expected to last until the year 2015. However, the status of moratoriums can change on a year-to-year basis and Banks should begin planning and negotiations with TVID at this time in order to be ready to take advantage of a potential TVID connection when the opportunity arises.

5.6.2.2 Install Pipeline to Develop Interties with Neighboring Water Providers

Developing interties with neighboring water providers has the potential to provide a significant source of water to the City, as well as a reliable redundant supply in the event of a water supply failure from one or more of the system's major water sources. Intertie construction and purchasing water from outside sources is also the most expensive option for developing additional/redundant supply. Interties with the City of Forest Grove, the City of North Plains, the Joint Water Commission and/or the Tualatin Valley Water District may be considered. It is suggested that an intergovernmental agreement with one or more of these water providers be drafted before pipeline development is conducted.

5.6.2.3 Aquifer Storage and Recovery

An ASR system requires a significant alternate source of water supply to recharge a subsurface reservoir. Banks has one marginal near-term option and one long-term option for alternate water sources that could be used to recharge the CRB aquifer near the town center.

- Near-Term Source: Winter water supply in excess of demand from the Water Treatment Plant or the groundwater developed under the Sellers Road well field concept could be used to develop a ASR project at the Behrman Well or Well #2. However, the small volume of excess winter water from the Water Treatment Plant is not an economically viable option for ASR. The Sellers Road well field supply capacity is currently uncertain and will not be known unless the concept is developed. This limits the near-term options for ASR.
- Long-Term Source: Water supply contracts with regional suppliers or other small cities may include provisions for off-peak water delivery at a significantly reduced cost per gallon. If this is the case, the City may consider storing winter water purchased through such a contract for an ASR system utilizing Well #2 or the Behrman Well.

ASR is a water management approach that typically uses wells to store treated drinking water in a suitable aquifer system, and recovers that water through the same wells at a later date. Aquifer storage displaces the native groundwater and effectively creates an underground reservoir of water than can be recovered for a wide variety of applications. ASR systems have been designed and operated to meet a wide range of objectives at sites with many different physical and hydrological conditions and water sources. The number of active ASR projects in Oregon has increased from zero in 1995 to 10 in 2008, with at least 20 wells in use or in development.

ASR systems are often operated to take advantage of available water treatment plant capacity during winter months to store treated water, and recover that water through wells during the summer months to help meet peak demands. Recovered water quality in most ASR systems generally reflects the source water, although some mixing with native groundwater does occur. In many cases, ASR systems can be designed to meet a primary objective as well as to provide several secondary benefits. In addition to providing a source option, the potential benefits of a Banks ASR system include:

- Optimization of water treatment plant capacity, by using recovered ASR water to meet peak demands and extend the length of time before water treatment facility expansion is required;

- Storage capacity can be added at locations within the water supply system where demand is increasing, where there is a benefit to enhancing chlorine residuals, or where there is a benefit to delivering water directly to different pressure zones;
- Creation of environmental benefits through reduction of stress on water-related habitats during drought periods.

An ASR well will deliver water at the rate associated with any appropriately designed water supply well. The target aquifer systems are usually confined systems both to provide a groundwater protection benefit, and to limit the potential for the interaction with nearby shallow domestic wells and surface water features. Consequently, Banks-area ASR wells would have the same location targets and potential yields as the groundwater supply well options. Based on the evaluation of the Behrman Well, Well # 2 and the Quail Valley Well, the most likely yield of any new ASR well would be near 300 gpm. The well log review indicates that where wells encounter greater thickness of higher permeability basalts, well yields are substantially higher.

Because recharge rates in ASR wells are typically held to 75% of the production rates, a 300-gpm production well would recharge in the vicinity of 225 gpm. Over a 6-month recharge period, approximately 58 MG would be stored in the subsurface. If 90% of this volume were recovered to the system with a single well, it would require approximately 4 months of pumping to recover the stored water.

Groundwater rights are not required for ASR well operations. The permitting process requires a valid water right to appropriate the source water for storage, and an assessment of the potential for impacts to nearby groundwater users. Because ASR systems typically operate in a fashion that has no net impact on the annual groundwater budget, it is more likely that an ASR system would be viewed as having less impact on nearby surface water and groundwater supplies than a groundwater extraction wellfield. Consequently, ASR permitting is likely to be less costly, require less stringent mitigation planning, and has a greater chance of success than obtaining a new groundwater right.

In order to evaluate the feasibility of developing an ASR operation to integrate with The City of Banks' water supply system, the city should evaluate the following conditions:

- Identify whether ASR development costs at Well #2 are higher or lower than the costs to build onsite reservoirs.
- Evaluate whether there are portions of the service area that could benefit from additional pressure, chlorine residual, or supply in addition to the benefit of having an additional source in the event of WTP shutdown or loss of another water supply sources due to some other system failure.
- Evaluate options for additional alternative sources outside the City including additional local water rights, options for teaming with other Cities to develop a co-owned and operated ASR system, and regional water supply options that include reduced winter water rates that could benefit ASR system development.

5.7 Quantification of Maximum Rate and Monthly Volume (Request "Greenlight" Water)

OAR 690-086-0170(6) requires a quantification of the maximum rate of withdrawal and maximum monthly use if water allocated under existing permits is necessary to meet demands in the 20-year planning horizon. As described above in Table 5-2, the City's water demand by 2028 could exceed a Maximum Day Demand of 984 gpm (1.42 mgd) or approximately 2.19 cfs. Therefore, in addition to

the firm supply of 320 gpm (0.46 mgd) from wells and springs, an additional 1.2 mgd or 1.73 cfs will be needed from the City's water right permits and certificates.

Given that current Maximum Day Demand is in excess of reliable supply, the City requests that OWRD "green-light" the full remaining undeveloped portion of both Permits G-16312 and Permit G-7593, in the amount 1 cfs (448.83 gpm) and 0.06 cfs (27 gpm) respectively. This green-light water is required to provide necessary water supply and increased instantaneous supply to meet peak events over the 20-year planning horizon.

5.8 Mitigation Actions under State and Federal Law 690-086-0170(7)

Under OAR 690-086-0170(7), for expanded or initial diversion of water under an existing permit, the water supplier is to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act (ESA), Clean Water Act and other applicable State or Federal environmental regulations. The City will obtain all required permits prior to its initial diversion of water under its water right permit should it decide to develop a water diversion requiring state and federal permitting.

5.9 Acquisition of New Water Rights 690-086-0170(8)

Under the present growth and water use projections, if the City can successfully implement plans that fully utilize their existing water rights and implement conservation measure to control annual losses, then the City anticipates needing no new water rights until approximately year 2028. However, the implementation of all the City's water rights is dependent on hydrogeologic uncertainties associated with developing groundwater sources. In the event that the available options discussed in this document provide incomplete satisfaction of the existing water rights, the City of Banks reserves the right to revisit this plan and pursue new water rights and examine opportunities for purchasing existing water rights.

6.0 REFERENCES

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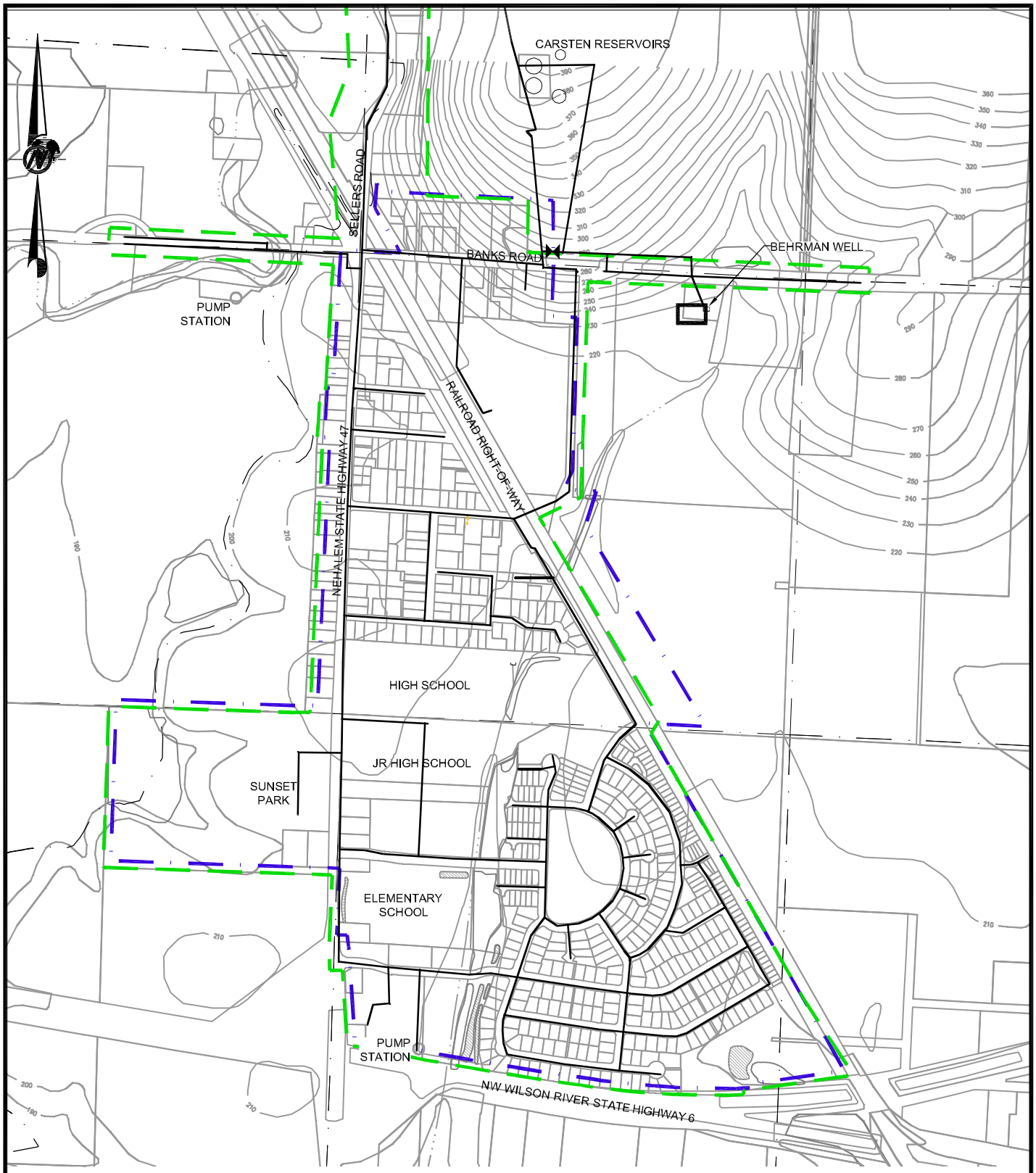
APPENDIX



GENERAL LEGEND

- STREAMS
- QUARTER SECTIONS
- TAX LOTS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- SERVICE AREA

0 800 1,600
SCALE IN FEET

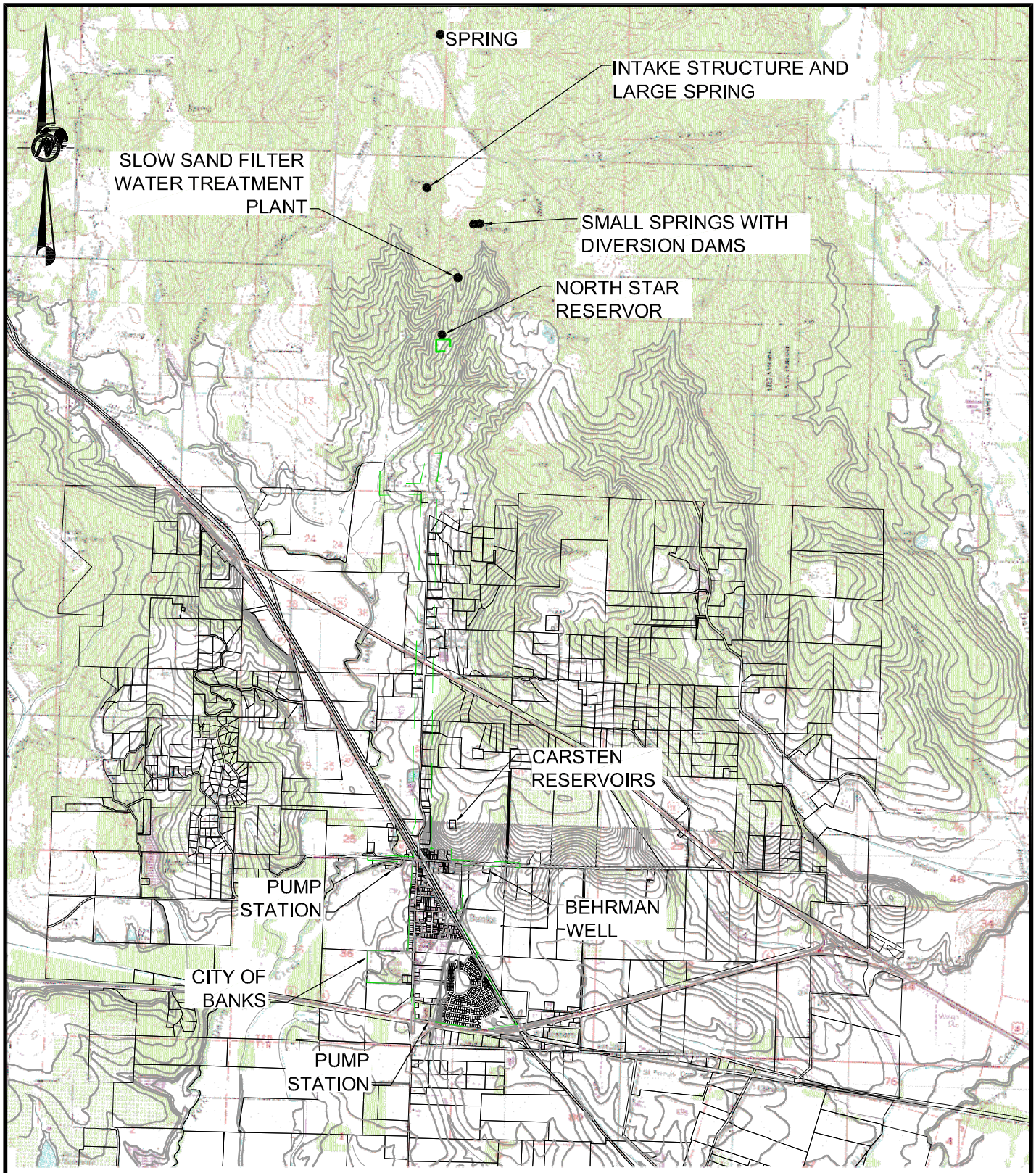
FIGURE **2-1**

CURRENT SERVICE AREA

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS

K:\CAD\Projects\2007\07399792\r2\0739979201-F2_F4r2.dwg | FIGURE 2-1 | Mod: 03/18/2009, 15:51 | Plotted: 03/18/2009, 15:52 | SSimmons

Golder Associates



GENERAL LEGEND

STREAMS

TAX LOTS

URBAN GROWTH BOUNDARY

0 3,500 7,000

SCALE IN FEET

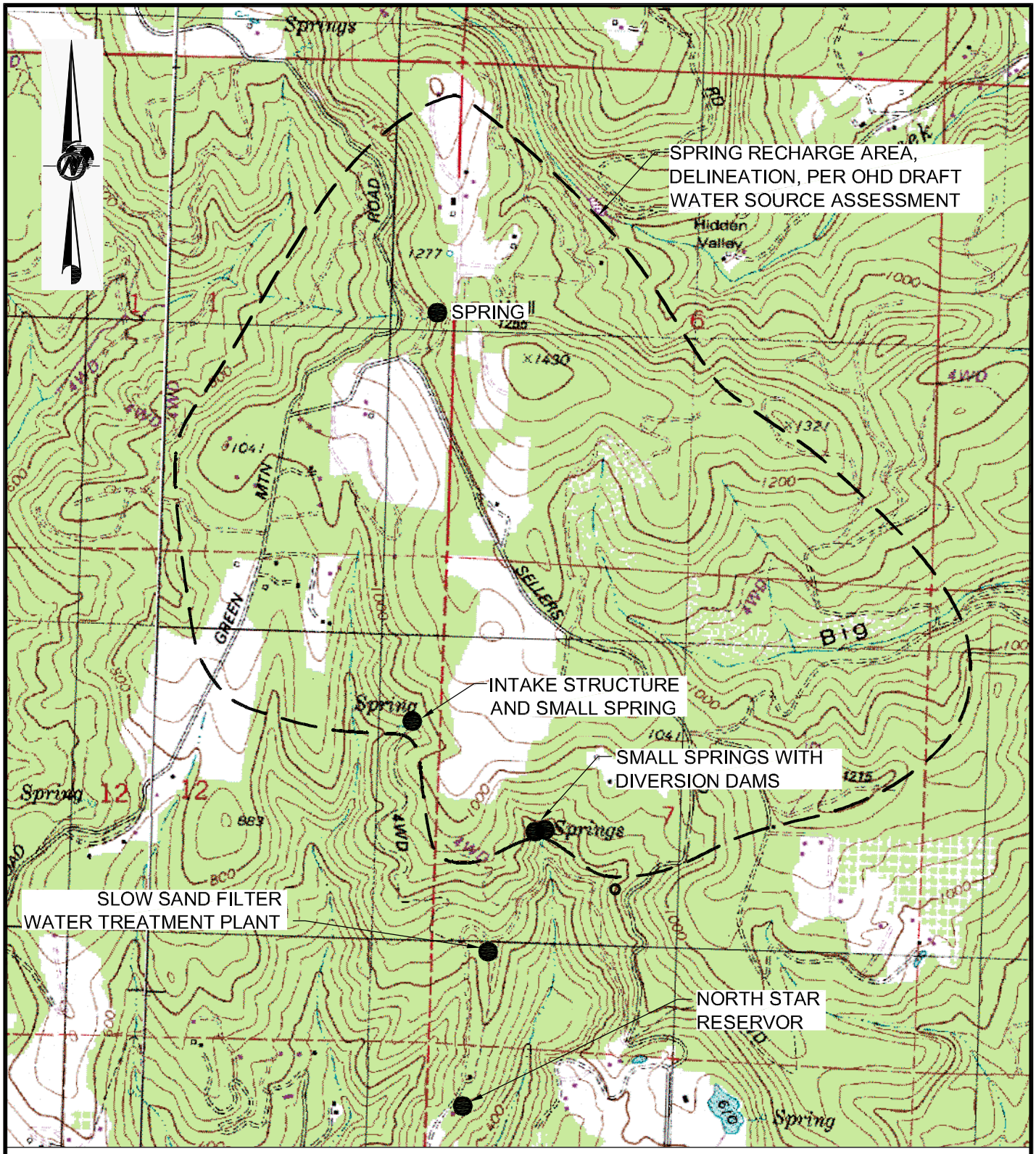
FIGURE **2-2**

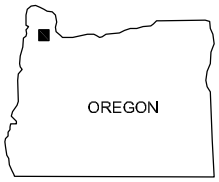
CURRENT WATER SOURCES

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS

K:\CAD\Projects\2007\07399792\r2\0739979201-F2_F4r2.dwg | FIGURE 2-2 | Mod: 03/13/2009, 11:49 | Plotted: 03/13/2009, 11:56 | SSimmons

Golder Associates





QUADRANGLE LOCATION

0 1,500 3,000

SCALE IN FEET

REFERENCE:
BUXTON, OREGON 1979; REVISED 1992
MEACHAM CORNER, OREGON 1979; REVISED 1992

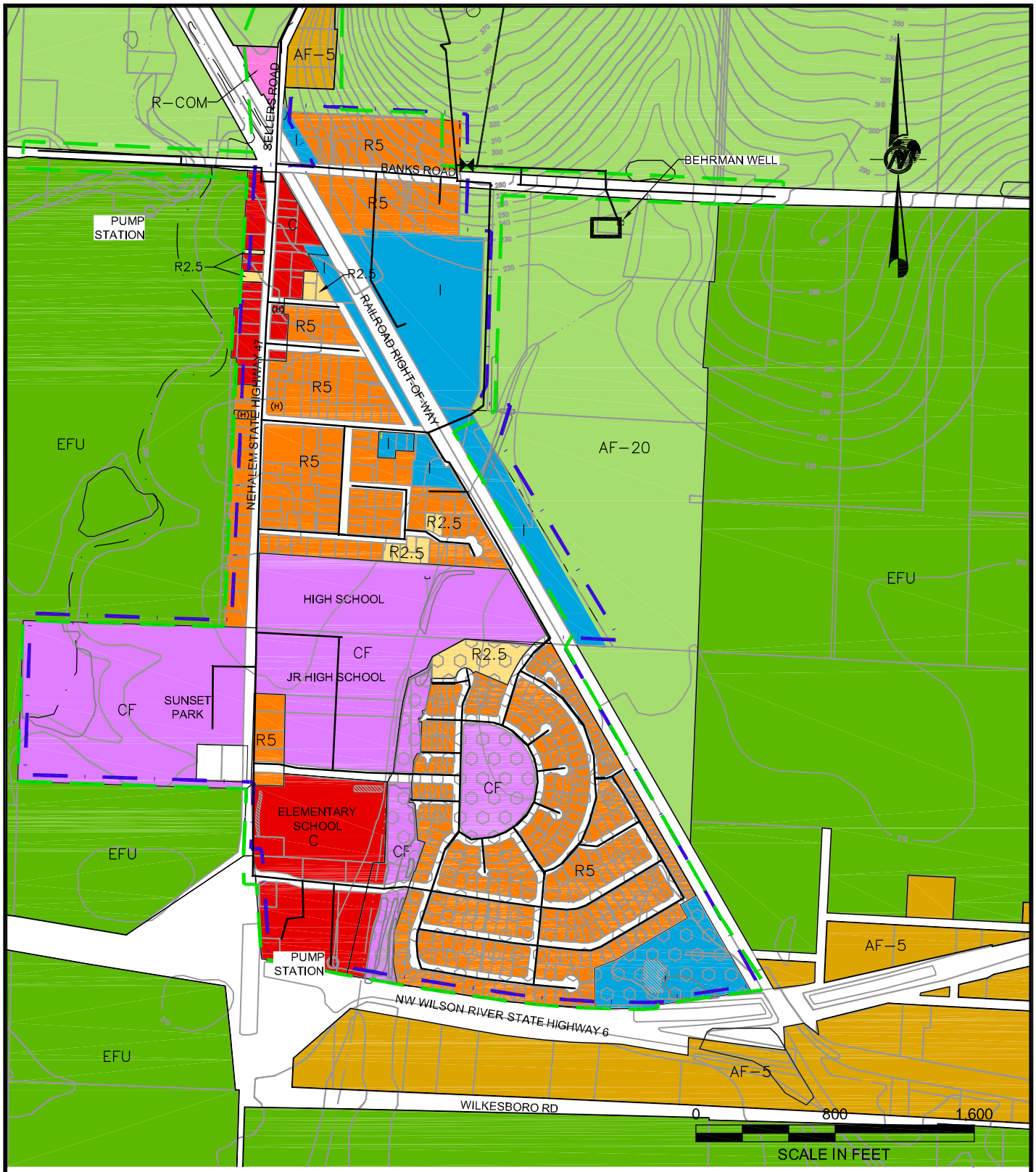
FIGURE **2-3**

SPRING RECHARGE AREA

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS

K:\CAD\Projects\2007\07399792\Working\0739979201-recharge map.dwg | FIGURE 2-3 | Mod: 12/11/2008, 11:13 | Plotted: 12/11/2008, 15:25 | SSimmons

Golder Associates



GENERAL LEGEND

- STREAMS
- QUARTER SECTIONS
- TAX LOTS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- SERVICE AREA

ZONING LEGEND

CITY OF BANKS ZONING DISTRICTS

- SINGLE FAMILY RESIDENTIAL (R5)
- MULTI-FAMILY RESIDENTIAL (R2.5)
- COMMUNITY FACILITIES (CF)
- GENERAL COMMERCIAL (C)
- GENERAL INDUSTRIAL (I)
- (H) HISTORIC RESOURCE OVERLAY (H)
- PLANNED DEVELOPMENT (PD)

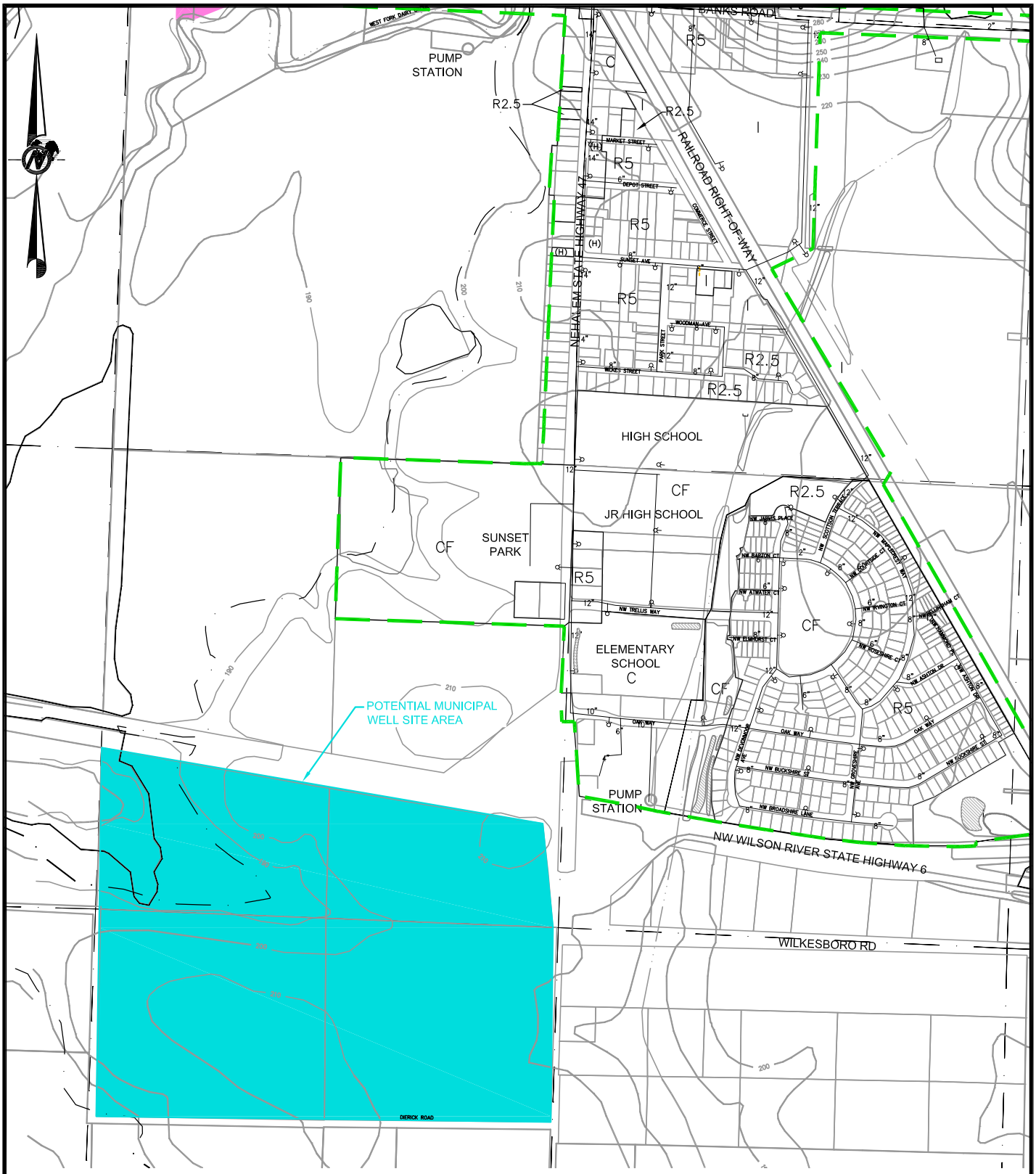
WASHINGTON COUNTY ZONING DISTRICTS

- EXCLUSIVE FARM USE (EFU)
- AGRICULTURE AND FOREST-20 (AF-20)
- AGRICULTURE AND FOREST-10 (AF-10)
- AGRICULTURE AND FOREST-5 (AF-5)
- RURAL RESIDENTIAL-5 (RR-5)
- RURAL COMMERCIAL (R-COM)

FIGURE **5-1**

PLANNED SERVICE AREA

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS



GENERAL LEGEND

- STREAMS
- QUARTER SECTIONS
- TAX LOTS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- POTENTIAL MUNICIPAL WELL SITE AREA

0 800 1,600

SCALE IN FEET

FIGURE **5-2**

POTENTIAL FUTURE WELL

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS

K:\CAD\Projects\2007\07399792\r2\0739979201-F2_F4r2.dwg | FIGURE 5-2 | Mod: 03/13/2009, 11:49 | Plotted: 03/13/2009, 12:08 | SSimmons

Golder Associates

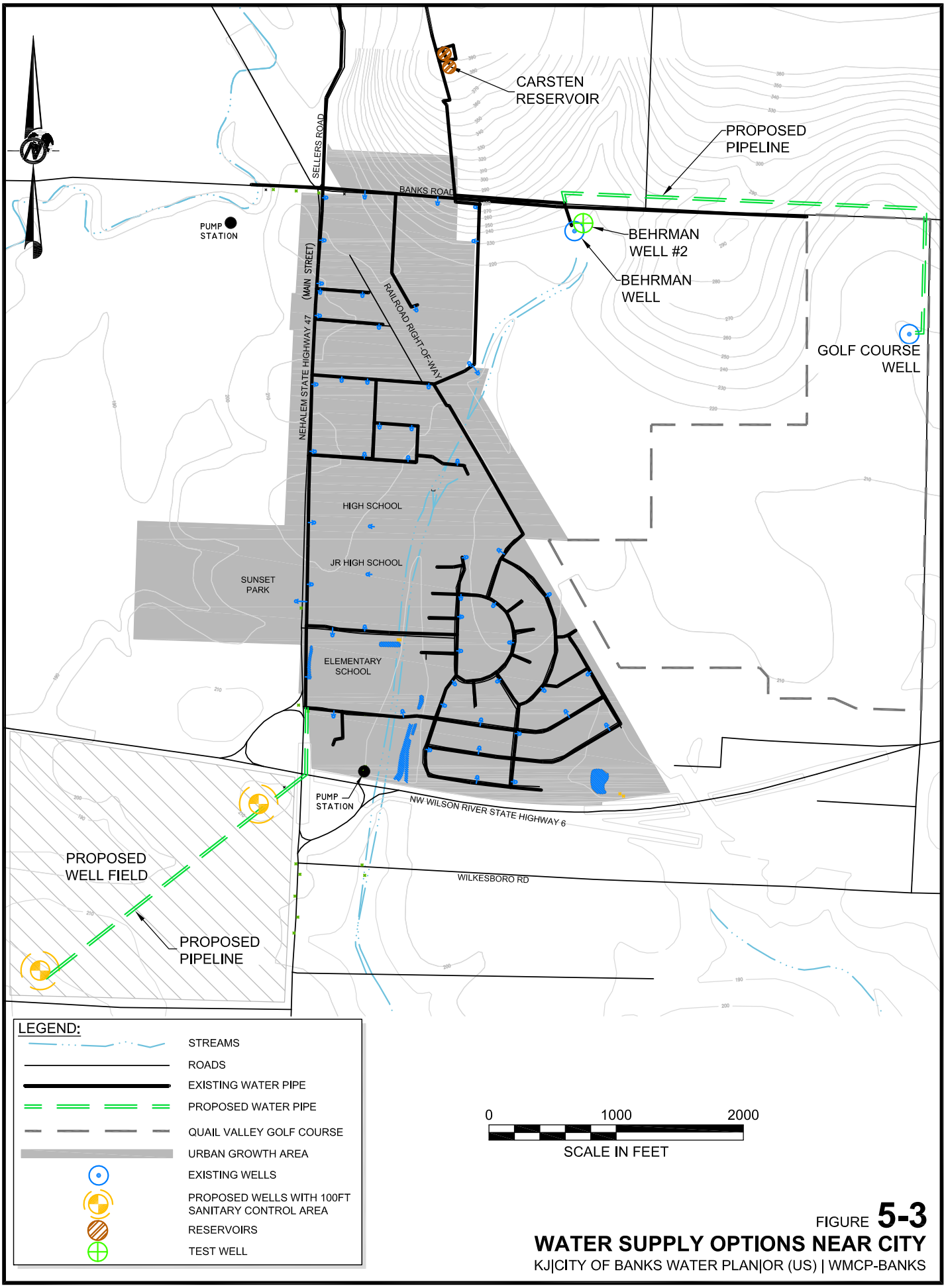
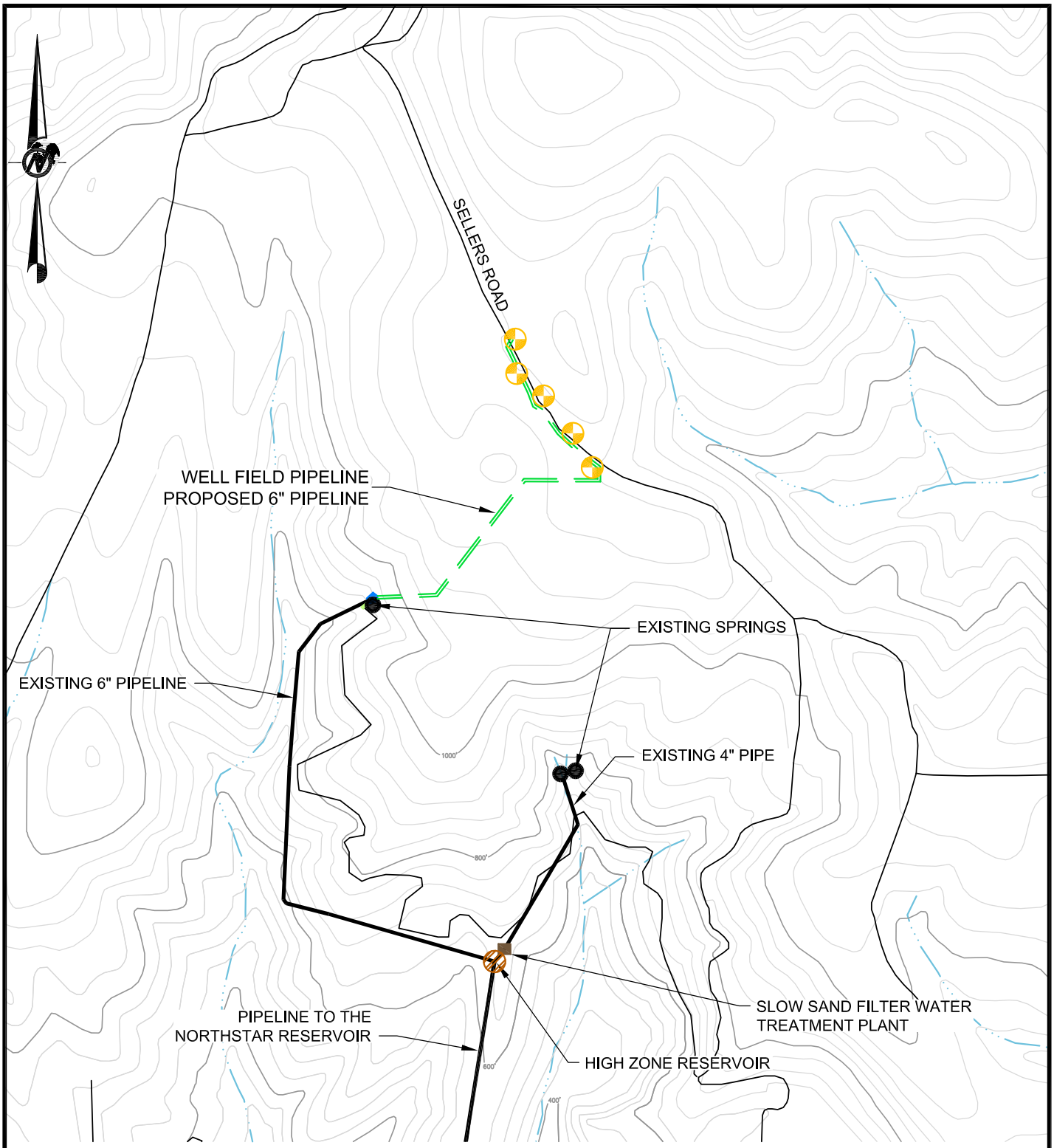


FIGURE **5-3**

WATER SUPPLY OPTIONS NEAR CITY

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS



LEGEND:

- STREAMS
- ROAD
- EXISTING WATER LINE
- PROPOSED WATER PIPE
- PROPOSED WELLS
- RESERVOIR

0 1000 2000

SCALE IN FEET

FIGURE **5-4**

WATER SUPPLY OPTIONS NORTH OF CITY

KJ|CITY OF BANKS WATER PLAN|OR (US) | WMCP-BANKS

ADDENDUM 1

June 23, 2010 073-99792

Lisa Jaramillo
Oregon Water Resources Department
North Mall Office Building
725 Summer Street NE, Suite A
Salem, OR 97301-1266

RE: CITY OF BANKS WATER MANAGEMENT AND CONSERVATION PLAN

Dear Lisa:

The following is a response to your letter dated August 21, 2009 regarding the Oregon Water Resource Department's (OWRD, or the Department) comments on the proposed City of Banks Water Management and Conservation Plan (WMCP) submitted to the Department on April 17, 2009. Thank you for your comments and communications provided on this plan to date, and for the opportunity to respond to your letter.

The Department requested that the proposed WMCP establish five-year conservation benchmarks identifying the actions to which the City of Banks has committed, and the schedule proposed to carry out those conservation activities. Please consider this letter a supplement to the WMCP, providing responses to OWRD's comments and requests for additional information in the format provided in OWRD's comment letter of August 21, 2009.

OAR 690-086-0140 Water Supplier Description	
(3) An assessment of the adequacy and reliability of the existing water supply considering potential limitations on continued or expanded use under existing water rights resulting from existing and potential future restrictions on the community's water supply;	OWRD noted that although it is not a requirement, the City of Banks may consider placing its water right certificate (#83138) instream, either on a permanent or time-limited basis. As the City is not continuously utilizing this water right due to turbidity events, such a transfer may benefit restoration activities of stream flows in the area. However, it is not clear that this spring directly contributes surface flows **to** another down gradient stream or river. The City of Banks is interested in supporting OWRD's Flow Restoration Program, and will follow up with the Department to further discuss this option.
(4) A quantification of the water delivered by the water supplier that identifies current and available historic annual water use, peak seasonal use, and average and peak day use;	Table 2-2 (page 4) of the proposed WMCP listed current and historic use data for the City of Banks; however, average annual water use was not included. Based on the average day demand over the years 2005-2007, and the respective total service population for each of those years, annual water use in million gallons per year (mgy) in the City of Banks

Golder Associates Inc.
9 Monroe Parkway, Suite 270
Lake Oswego, OR 97035 USA
Tel: (503) 607-1820 Fax: (503) 607-1825 www.golder.com

Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

	was approximately 94.4 mgy (2005); 98.4 mgy (2006); and 97.2 mgy (2007).
(5) A tabular list of water rights held by the municipal water supplier that includes the following information: (c) Source(s) of water;	Please see Attachment A The source for Certificate 83138 is listed in the WMCP as "Spring (Small Springs)." The Certificate identifies the source as "Two Unnamed Streams." This discrepancy is entirely a semantic one; the two Small Springs are the source for the Two Unnamed Streams which run from the spring sources to a diversion structure within 20 to approximately 200 feet of their origin. Each spring has its own small diversion dam which captures the flow from the springs. The age of the diversion structures is not known but is reported as part of the original 1920s water supply project. The discharge from the springs is trapped behind each diversion structure and conjoined into one pipe for conveyance to the filter plant gallery where the meter is located. Neither the Small Springs nor Two Unnamed Springs would contribute to flows down stream when 100% utilized under the water right. Records provided to OWRD indicate that the City uses this source intermittently from year to year. Under Cert. 83138 the two diversions are measured together, as two smaller separate pipelines for each is considered impractical. The water use is reported to OWRD under either Report ID 11173 or 11174 by the City for Cert. 83138. The locations of the spring origins and diversion structures have very difficult access on steep slopes and slippery trails. This health and safety concern limits regular access to the diversion structures.
(5) A tabular list of water rights held by the municipal water supplier that includes the following information: (f) Maximum instantaneous and annual quantity of water diverted under each right to date;	Please see Attachment A. Table 2-3 (page 5) of the proposed WMCP lists maximum instantaneous use to date from each water right held by the City of Banks; Attachment A supplements this information with the Maximum instantaneous and annual quantity of water diverted under each right to date. For more information, please see the City's

	annual water use reporting data, submitted pursuant to OAR 690, Chapter 85.
(5) A tabular list of water rights held by the municipal water supplier that includes the following information: (g) Average monthly and daily diversions under each right for the previous year; and if available for the previous five years;	Please see Attachment B for the requested information.
(5) A tabular list of water rights held by the municipal water supplier that includes the following information: (h) Currently authorized date for completion of development under each right; and	Table 2-3 (page 5) of the WMCP contains a typographical error. The authorized date for completion of construction and development under application S-8476 (Permit G-7593) is acknowledged to be October 1, 2017. This correction is made in Attachment A.
(5) A tabular list of water rights held by the municipal water supplier that includes the following information: (i) Identification of any streamflow-dependent species listed by a state of federal agency as sensitive, threatened or endangered that are present in the source, any listing of the source as water quality limited and the water quality parameters for which the source was listed, and any designation of the source as being in a critical ground water area.	In general only the two surface water Certificates (83138 and 5353) have the potential to affect water quality of the Tualatin Sub-basin, specifically the West Fork of Dairy Creek. Both Certificate diversions are isolated and generally capture 100% of the stream/spring flow when they are in use. Because the diversion structures capture the flow within 20 to 200 feet of the spring source**,** there are no known listed species in this initial reach of the stream/spring system which is located in the mountainous area of the northern Tualatin Basin. The diversion structures are not designed for fish passage and these high reaches are not known to harbor any listed species. The stream channels immediately below the diversion structures are filled with soil and rock for access roads and in some cases revegatated because the former streambed is used so infrequently. Regular drainage from upland areas surrounding the springs are captured in road side ditches and directed to small under-road culverts. Because of the isolation of these sources and the generally good water quality, a tabular listing of water quality limitations is not applicable to these springs. Downstream reaches in Dairy Creek, the Tualatin River and Willamette River do have water quality limitations but a tabulation of those limitations and threatened and endangered species associated with larger water sources downstream is not warranted for these certificated water rights. The tabular list for the

	water rights, water quality limitations, and listed species is presented in Attachment D. When the diversions are not in use or when some excess water flows from the springs, typically during wet winter months, the excess water spills over the top of the diversion structures and moves as overland flow and subsurface flow along topographic lows**,** and eventually discharges to an unnamed tributary of Dairy Creek. This contributes to the winter flow of Dairy Creek, which flows to the Tualatin River and on to the Willamette River. The waters of Dairy Creek, the Tualatin River and Willamette River have several listed species. In the Upper Willamette River Steelhead (*Onocorhynchus mykiss*) and Chinook Salmon (*Onocorhynchus tshawytscha*) are listed as Threatened under the federal Environmental Species Act.
(6) A description of customers served including other water suppliers and the estimated numbers; general water use characteristics of residences, commercial and industrial facilities, and any other uses; and a comparison of quantities of water used in each sector with the quantities reported in the water supplier's previously submitted water management and conservation plan and progress reports;	The City has not submitted a WMCP or progress report since 2001. The 2001 plan did contained eight categories of estimated water consumers. The City no longer tracks use in eight categories and has revised the water use into three categories that are tracked with some accuracy. Please also refer to Attachment C. There are three Categories of water customers in Banks. **1. Commercial/Industrial** **2. Residential** **3. Bulk Water** Please refer to Attachment C, which presents the water use patterns of these three customer sectors. In general**,** commercial/industrial use has declined and residential use has increased over the record of use from 2006 to 2009. The overall customer metered water use has declined by 13.8 percent over this period.
OAR 690-086-0150 Water Conservation Element	
(2) A description of the water supplier's water use measurement and reporting program and a statement that the program complies with the measurement standards in OAR Chapter	The City of Banks meters and reports all source water diverted from each water source per OAR Chapter 690, Division 85. The water rights for each water source are metered

690, Division 85, that a time extension or waiver has been granted, or that the standards are not applicable;	individually.
(4) A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers: (a) An annual water audit that includes a systematic and documented methodology for estimating any unmetered authorized and unauthorized uses;	As stated in the proposed WMCP, the City's annual water use audit is currently under development (in the data input stage). Implementation of an annual water audit will begin within the next five years (no later than 2014). The proposed water audit software is systematic and will provide documented methods for estimating authorized and unauthorized use through AWWA software. The City will maintain this database monthly for comparison with measured water diversions. The City has also instituted a program for assessing leaks across the entire system. The leak detection survey will be completed every five years. The first survey was completed August 12, 2009. The survey identified system and customer leaks for prioritization and repair. The next scheduled survey is for 2014.
(4) A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers: (c) A meter testing and maintenance program;	The City currently conducts meter tests on its customer meters in accordance with AWWA standards of practice (manual M6, 4th edition, 1999), at the time of installation and if meter records subsequently suggest drifting. Supply meters will accordingly be tested on a regular basis following AWWA guidelines and manufacture's recommendations. The City will develop its supply meter testing program and begin implementing the program within five years (not later than the end of 2014). Currently monthly inspection is completed by the City Water System Operator during the meter reading rounds. This will continue. The City has also instituted a meter change-out program that will take 5 years to complete. After that all meters will be changed on a 10 year cycle.
(4) A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers: (e) If the annual water audit indicates that system leakage exceeds 10 percent, a	The AWWA water audit software proposed in the City's WMCP is systematic and may provide documented methods for estimating authorized and unauthorized water use. The City will continue to review the AWWA software as a potential auditing program component, along with other options to enable

regularly scheduled and systematic program to detect leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the municipal water supplier; and	the City to develop a Water Use Audit Program. The Program will serve as a leak detection program, estimating system leakage on an annual basis. Identification of consistent leakage exceeding 10 percent from year to year will enable the City to respond with a systematic review of water use and distribution infrastructure condition. The Program will also be of assistance in tracking the effectiveness of City measures implemented to reduce leakage in its water system. Implementation of an annual Water Use Audit Program will begin in within the next five years (no later than November 30, 2014), and will incorporate review and action-implementation strategies to reduce water loss. The City has also implemented a direct leak detection survey on a regular 5-year schedule. The initial leak survey was competed August 12, 2009.
(4) A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers: (f) A public education program to encourage efficient water use and the use of low water use landscaping that includes regular communication of the supplier's water conservation activities and schedule to customers;	Golder Associates Inc. and Kennedy/Jenks Consultants Inc. developed an informational pamphlet on water conservation measures, and presented a water conservation workshop to the City at a public meeting in the first quarter of 2009. The Water Conservation Pamphlet is available to the public and is on display at the City Offices. The City does not propose a regular schedule for delivering special alerts with its water bills, but rather will distribute notices as needed based on a review of seasonal water supply and use conditions and following the annual water audit review. The City has implement a program that delivers semi-annual educational messages and water conservation tips with water bills, updating water customers on the City's conservation activities and customer conservation options including messages on efficient water use and the use of low water demand landscaping. The tips originate from an AWWA water conservation education program. The City maintains historical documentation of educational messages and

	water conservation tips delivered to customers.
OAR 690-086-0170 Municipal Water Supply Element	
(5) If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown in section (3) of this rule, an analysis of alternative sources of water that considers availability, reliability, feasibility and likely environmental impacts. The analysis shall consider the extent to which the projected water needs can be satisfied through: (b) Interconnection with other municipal supply systems and cooperative regional water management; and	There are no existing water supply interconnections with other municipal sources or regional cooperative water management agencies that provide available, reliable, and known feasible solutions for alternative water sources that would not require additional planning, design, and construction. All options for additional water involve increased summer diversions from the Tualatin River subbasin surface water or from storage at Scoggins Reservoir; generally both options potentially reduce surface water availability to flow-dependant listed species in the Tualatin subbasin. The options proposed have been evaluated in terms of cost in the City's 2009 Water Master Plan. OWRD has specifically requested additional information regarding feasibility of the following alternative sources: 1) Section 5.6.2.2 Purchase of non-potable water from Tualatin Valley Irrigation District (TVID) in order to supply large-volume water customers with an alternative source of non-potable irrigation water. This option refers to an evaluation for building an intertie with TVID. However, TVID would have to conduct its own feasibility study and supply analysis, which would cost the City approximately $35,000. The driver for this idea was to off load the School District irrigation water use from the City's drinking water supply. Subsequent investigation found that the School District did not use City drinking water for irrigation, but had its own groundwater source. Therefore there would be no cost or environmental benefit for the TVID intertie. 2) Section 5.6.2.2 Developing an intertie with the closest city, Forest Grove, would involve negotiating an agreement for Forest Grove water or purchasing water wheeled through the Forest Grove system from Tualatin Valley Water District (TVWD) or Joint Water Commission. Both options would involve the construction of a 5.3-mile pipeline from Banks

	to Forest Grove. The 2001 cost estimate for that work was $3.2 million. This cost is still considered non-feasible by the City council and is not required based on the available groundwater right permits held by the City. Utilization of Forest Grove's water rights would directly impact the live summer flows on the Tualatin. The purchase from TVWD might depend on a dam raise or reconstruction of Scoggin's Reservoir, a project with uncertain feasibility. The environmental benefits of both options are considered neutral because each alternative source has a direct impact on the Tualatin River. The development of the groundwater rights held by the City provides the least impact alternative for enhancing the City's water supply and adding redundancy to the system with the incorporation of an existing, improved second well.

The City of Banks is committed to water conservation, and is pleased to work with the Department's Field Services Division to satisfy OWRD regulations regarding water management and conservation planning. We hope you will find this Water Management and Conservation Plan Supplement sufficient to answer your requests for additional information.

Sincerely,

GOLDER ASSOCIATES INC.

Bob Long, Jr., RG, CWRE
Associate Senior Consultant

Kara Warner
Environmental Scientist

cc: Darrell Hedin, District 18 Watermaster, OWRD
James Hough, City of Banks City Administrator, 120 S. Main Street, Banks, OR 97106
Fred Evers, City of Banks Public Works Supervisor, 120 S. Main Street, Banks, OR 97106
Gordon Munro, Kennedy/Jenks Consultants, 200 SW Market St., Ste 500, Portland, OR 97201

Encl: Attachment A: Maximum Instantaneous Rate and Annual Quantity
Attachment B: Metered Water Use per Water Right
Attachment C: Consumed Water Metered to Customers by Market Sector
Attachment D: Tabular List Stream Flow Dependant Species and Water Quality Limitations

ATTACHMENTS

City of Banks
Water Management and Conservation Plan; Supplement
OAR 690-086-0140 (5) (a)(b)(c)(d)(e)(f)(h) Maximum Instantaneous and Annual Rate

Report ID	Application	Permit	Certificate	Transfer	Sources of Water	Priority Date	Completion Date	Types of Beneficial Uses	Maximum Instantaneous Rate Allowed (cfs)	Maximum Annual Quantity Allowed (mcf)	Maximum Instantaneous Rate to Date (cfs)	Maximum Annual Quantity to Date	Comments
11173	S-65611	S-48173	83138		Unnamed Str. (Small spg.)	25-Aug-1983	Complete	Municipal	0.18	5.68	0.18	9.10	The maximum reported annual total (9.10) is from a 2002 data sheet. This maximum seems unlikely for this source and is probably a transcription error. This total is likely for Cert. 5353 in 2002. We note that Cert. 5353 has no flow reported for 2002 on the OWRD database. The totals reported in 2009 for Cert. 83138 are Annual Max. of 4.20 mcf and average daily rate of 0.13 cfs. The total of 4.20 mcf is a more defensible Maximum Annual Quantity . No daily data were available.
11174	S-65611	S-48173	83138		Unnamed Str. (Small spg.)	25-Aug-1983	Complete	Municipal					
11175	G-8476	G-7593		T-10055	Well 1 (Behrman Well)	29-Sep-1977	17-Oct-2017	Municipal	0.67	21.13	0.61	6.37	Maximum total from 2001
11176	S-9207	S-6516	5353		Large Spring	3-Oct-1923	Complete	Municipal	0.42	13.25	0.42	9.24	Maximum total from 2003
62979	G-15887	G-16312			Well 2	5-Dec-2002	28-Apr-2028	Municipal	1.00	31.54	0.00	0.00	Under development

Notes: cfs -Cubic Feet Per Second
mcf- Million Cubic Feet
Likely Error See comments for discussion and clarification.

City of Banks
Water Management and Conservation Plan; Supplement
OAR 690-086-0140 (5)(g) Water Use per Water Right

Report ID	Application	Permit	Certificate	Transfer	Sources of Water	Average Monthly Diversion-Gallons 2009	Average Monthly Diversion-Gallons 2008	Average Monthly Diversion-Gallons 2007	Average Monthly Diversion-Gallons 2006	Average Monthly Diversion-Gallons 2005	Average Daily Diversion-Gallons 2009	Average Daily Diversion-Gallons 2008	Average Daily Diversion-Gallons 2007	Average Daily Diversion-Gallons 2006	Average Daily Diversion-Gallons 2005
11173	S-65611	S-48173	83138		Unnamed Str. (Small spg.)	2,619,517	0	0	0	0	86,121	0	0	0	0
11174	S-65611	S-48173	83138		Unnamed Str. (Small spg.)										
11175	G-8476	G-7593		T-10055	Well 1 (Behrman Well)	3,039,650	2,552,317	2,482,367	2,921,833	3,310,992	99,934	83,912	81,612	96,060	108,855
11176	S-9207	S-6516	5353		Large Spring	2,319,612	4,848,058	5,536,908	5,050,550	3,557,608	76,261	159,388	182,035	166,045	116,962
62979	G-15887	G-16312			Well 2	0	0	0	0	0	0	0	0	0	0

City of Banks
Water Management and Conservation Plan: Supplement
OAR 690-086-0140 (6) Metered Water Use by Market Sector

Consumed Water Metered to Customers in Cubic Feet (CF)

	2006	2007	2008	2009	Commments
Commercial/Industrial	3,205,934	2,652,931	1,636,487	1,228,595	Includes: School District -6 connections, Saw mill- 1 connection, and approx. 5-resturants.
Residential Use	6,720,214	6,563,956	7,203,880	7,468,367	1740 residents
Bulk Water	339,750	204,700	319,300	145,450	Construction, street cleaning and other city use
Total Metered (CF)	10,265,898	9,421,587	9,159,667	8,842,412	

City of Banks
Water Management and Conservation Plan; Supplement
OAR 690-086-0140 (5) (i) Stream Flow Dependant Species and Water Quality Limitations

OWRD Source Report ID	Application	Permit	Certificate	Transfer	Sources of Water	Stream Flow Dependant State and Federal Listed Species	Water Quality Listed	Types of Beneficial Uses
11173	S-65611	S-48173	83138		Unnamed Str. (Small spring)	In the West Fork of Dairy Creek-Steelhead (*Onocorhynchus mykiss*) is listed as Threatened under the federal Environmental Species Act.	Not limited in this upper reach above the West Fork of Dairy Creek.	Municipal
11174	S-65611	S-48173	83138		Unnamed Str. (Small spring)	In the West Fork of Dairy Creek-Steelhead (*Onocorhynchus mykiss*) is listed as Threatened under the federal Environmental Species Act.	Not limited in this upper reach above the West Fork of Dairy Creek.	Municipal
11175	G-8476	G-7593		T-10055	Well 1 (Behrman Well)	Not Applicable		Municipal
11176	S-9207	S-6516	5353		Large spring	In the West Fork of Dairy Creek-Steelhead (*Onocorhynchus mykiss*) is listed as Threatened under the federal Environmental Species Act.	Not limited in this upper reach above the West Fork of Dairy Creek.	Municipal
62979	G-15887	G-16312			Well 2	Not Applicable		Municipal

ADDENDUM 2

From: Long, Robert
Sent: Thursday, July 15, 2010 4:02 PM
To: Lisa Jaramillo
Cc: J. A. Hough (citymanager@cityofbanks.org); Gordon Munro
Subject: Second Amendment to City of Banks WCMP

Dear Lisa,

This second addendum to the City of Banks Water Management and Conservation Plan (WMCP) dated April 7, 2009 is meant to clarify a request for additional "green light" water. In the WCMP the City of Banks requests additional greenlight water for both its groundwater rights. The request for additional greenlight water is pertinent only to G- 7593. It is our current understanding that greenlight water is not required for water appropriated under groundwater permit G-16312. Permit G-16312 is a newer water right with a 20-year development period that ends April 28th 2028, at which time the ground water well must be fully developed. The City is not restricted from developing this permit to its full potential of 1.0 cfs during this time period and up until the completion date of April 28th 2028. Please amend the Banks WMCP to address this issue and approve the additional greenlight water for G-7593.

Based on our conversation it is my understanding that the draft of the Final Order will be provided for the City to review before the Final Order is issued by OWRD. We look forward to reviewing that draft in the next few weeks.

Best Regards- BL

Bob Long | Associate and Senior Consultant| **Golder Associates Inc.**
9 Monroe Parkway, Suite 270, Lake Oswego, Oregon, USA 97035
T: +1 (503) 607-1820 | **F:** +1 (503) 607-1825 | **E:** blong@golder.com | **www.golder.com**

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Oregon
Theodore R. Kulongoski, Governor

Water Resources Department
North Mall Office Building
725 Summer Street NE, Suite A
Salem, OR 97301-1271
503-986-0900
FAX 503-986-0904

August 11, 2010

City of Banks
Attn: Fred Evers, Public Works Supervisor
120 S. Main
Banks, OR 97106

Subject: Water Management and Conservation Plan

Dear Mr. Evers:

Thank you for your response to my review of your water management and conservation plan (plan) and submittal of revisions to your plan.

The Department has reviewed the revised plan and determined it to be generally consistent with the relevant requirements under OAR Chapter 690, Division 086. Therefore, please find the enclosed final order approving your water management and conservation plan and authorizing the diversion of up to 0.67 cfs of water under Permit G-7593.

We appreciate your cooperation in this effort. Please do not hesitate to contact me at 503-986-0880 or Lisa.J.Jaramillo@wrd.state.or.us if you have any questions.

Sincerely,

Lisa J. Jaramillo
Water Management and Conservation Analyst
Field Services Division

Enclosure

cc: WMCP File
Application G-8476 (Permit G-7593)
Darrell Hedin, District #18 Watermaster
Scott Kudlemeyer, Water Right Extensions
Golder Assoc., Inc., Attn: Bob Long, 9 Monroe Pkwy, Ste. 270, Lake Oswego, OR 97035
Kennedy/Jenks Consultants, 200 SW Market Street, Ste. 500 Portland, OR 97201
City of Banks, Attn: J.A. Hough, City Manager, 120 S. Main, Banks, OR 97106

BEFORE THE WATER RESOURCES DEPARTMENT
OF THE
STATE OF OREGON

In the Matter of the Proposed Water Management and Conservation Plan for City of Banks, Washington County	)))	FINAL ORDER APPROVING A WATER MANAGEMENT AND CONSERVATION PLAN

Authority

OAR Chapter 690, Division 086, establishes the process and criteria for approving water management and conservation plans required under the conditions of permits, permit extensions and other orders of the Department. An approved water management plan may authorize the diversion and use of water under a permit extended pursuant to OAR Chapter 690, Division 315.

Background

On April 17, 2009, the City of Banks submitted a draft Water Management and Conservation Plan for review under OAR Chapter 690, Division 086 (November 2002). Submittal of the plan was required under the Final Order approving an Extension of Time for Permit G-7593.

The Department published notice of receipt of the plan on April 21, 2009, as required under OAR Chapter 690, Division 086. No public comments were received.

The Department provided comments on the plan to the City on August 21, 2009, and, in response, the City submitted supplemental information revising the plan on June 28 and July 15, 2010.

Findings of Fact

1. The City of Banks Water Management and Conservation Plan contains all of the plan elements required under OAR 690-086-0125.

2. The projections of future water needs in the plan demonstrate a need for over 0.67 cfs of water available under Permit G-7593 to meet demands for the population anticipated in 20 years. These projections are reasonable and consistent with the City's land use plan.

3. The plan includes 5-year benchmarks for installation and maintenance of new water audit software, implementation of an annual water audit and a meter replacement program, as well as the continuation of customer meter testing, leak detection surveys and the semi-annual inclusion of educational messages and water conservation tips on water bills. The system is fully metered and the rate structure includes a base rate and volumetric charge. Unaccounted-for water is estimated at 29.5 percent.

4. The plan includes 5-year benchmarks for the evaluation, development, and implementation of a program to regularly test the City's supply meters.

This final order is subject to judicial review by the Court of Appeals under ORS 183.482. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.482(1). Pursuant to ORS 536.075 and OAR 137-003-0675, you may petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

5. The plan identifies unnamed surface water springs and streams in the West Fork Dairy Creek subbasin and ground water (all within the Tualatin River Basin) as the sources of the City's water rights. The plan also accurately and completely describes the federally listed Upper Willamette River Steelhead and Chinook Salmon as threatened species, and identifies water quality issues in Dairy Creek, the Tualatin River and the Willamette River downstream of the City's source water.

6. The water curtailment element included in the plan satisfactorily promotes water curtailment practices and includes a list of three stages of alert with concurrent curtailment actions.

7. The diversion of water under permit G-7593 will be expanded during the next 20 years and is consistent with OAR 690-086-0130(7), as follows:

   a. As evidenced by the 5-year benchmarks described in Findings of Fact #3 and #4, the plan includes a schedule for development of conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources;

   b. Considering fiscal limitations that, at this time, make it impractical for the City to install infrastructure necessary to purchase and convey additional water from other entities and considering limitations in the City's available supply from their surface water sources due to high turbidity levels in the winter and limited summer flow rates, increased use from the City's ground water source is the most feasible and appropriate water supply alternative to the supplier; and

   c. The City is not required to provide mitigation to address limitations or restrictions on the development of their ground water permits, as no resource issues pertaining to those permits have been identified under OAR 690-086-0140(5)(i).

Conclusion of Law

The water management and conservation plan submitted by the City of Banks is consistent with the criteria in OAR Chapter 690, Division 086.

Now, therefore, it is ORDERED:

1. The City of Banks Water Management and Conservation Plan is approved and shall remain in effect until August 9, 2020, unless this approval is rescinded pursuant to OAR 690-086-0920.

2. The limitation of the diversion of water under Permit G-7593 established by the Extension of Time approved on November 20, 2008, is removed and, subject to other limitations or conditions of the permit, the City of Banks is authorized to divert up to 0.67 cfs under Permit G-7593.

3. The City of Banks shall submit an updated plan within 10 years and no later than August 9, 2020.

4. The City of Banks shall submit a progress report containing the information required under OAR 690-086-0120(4) by August 9, 2015.

Dated at Salem, Oregon this 10 day of August, 2010.

Doug Ford for

Phillip C. Ward, Director

Mailing date: AUG 11 2010

Global Issues

At GOLDER ASSOCIATES, we strive to be the most respected global group specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Local Solutions

Worldwide

Africa
27.11.254.4800

Asia
852.2562.3658

Australasia
61.7.3721.5400

Canada
1.403.299.5600

Europe
44.1628.586.213

North America
1.800.275.3281

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