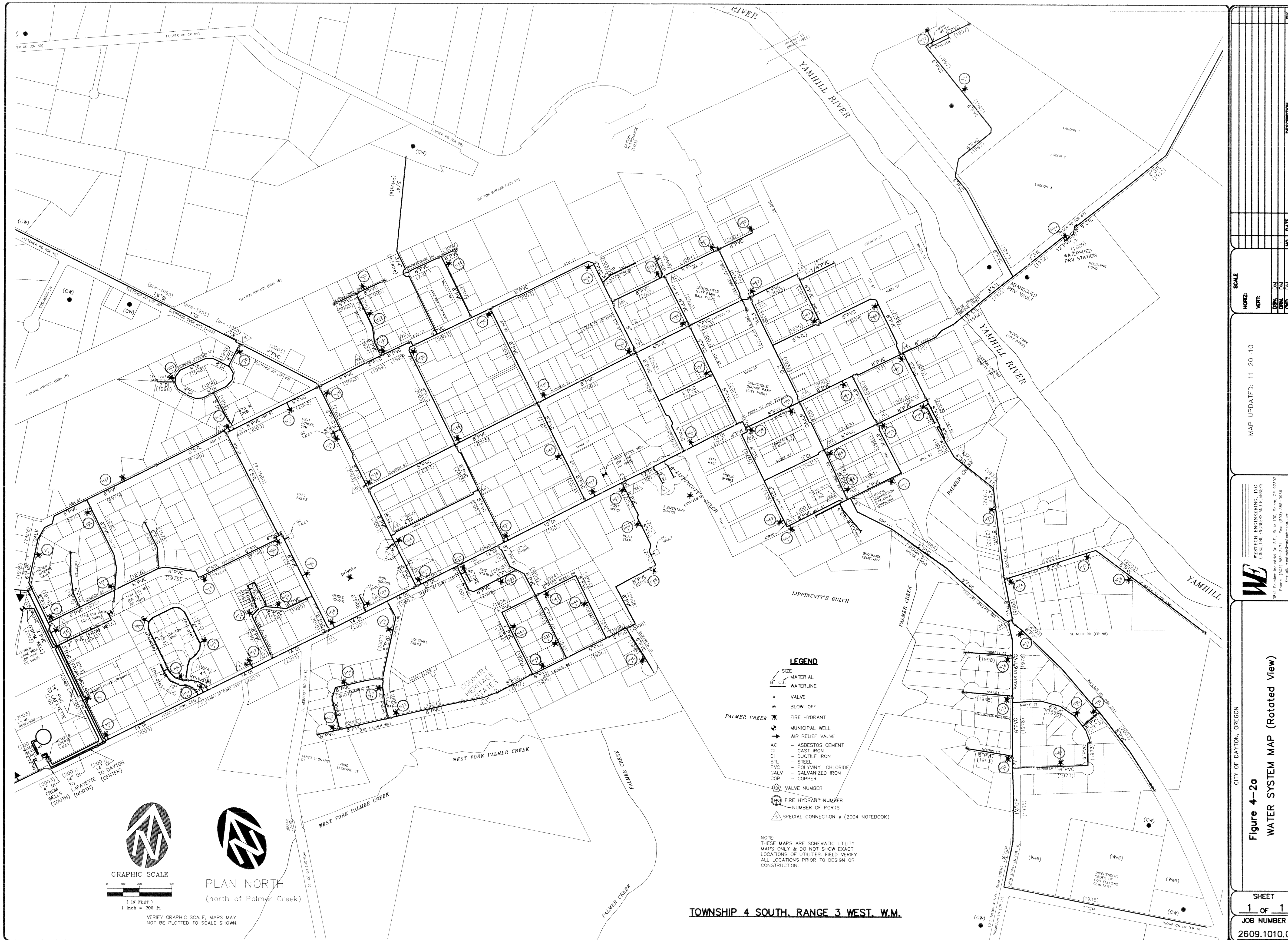


YAMHILL RIVER
LIPPINCOTT'S GULCH
PALMER CREEK
WEST FORK PALMER CREEK
COUNTRY HERITAGE ESTATES
LEGEND
SIZE
MATERIAL
8" C.I.
WATERLINE
VALVE
BLOW-OFF
FIRE HYDRANT
MUNICIPAL WELL
AIR RELIEF VALVE
AC - ASBESTOS CEMENT
CI - CAST IRON
DI - DUCTILE IRON
STL - STEEL
PVC - POLYVINYL CHLORIDE
GALV - GALVANIZED IRON
COP - COPPER
VALVE NUMBER
FIRE HYDRANT NUMBER
NUMBER OF PORTS
SPECIAL CONNECTION # (2004 NOTEBOOK)
NOTE:
THESE MAPS ARE SCHEMATIC UTILITY MAPS ONLY & DO NOT SHOW EXACT LOCATIONS OF UTILITIES. FIELD VERIFY ALL LOCATIONS PRIOR TO DESIGN OR CONSTRUCTION.
GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.
VERIFY GRAPHIC SCALE, MAPS MAY NOT BE PLOTTED TO SCALE SHOWN.
PLAN NORTH
(north of Palmer Creek)
TOWNSHIP 4 SOUTH, RANGE 3 WEST, W.M.
CITY OF DAYTON, OREGON
Figure 4-2a
WATER SYSTEM MAP (Rotated View)
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com
MAP UPDATED: 11-20-10
SHEET 1 OF 1
JOB NUMBER
2609.1010.0

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

SCALE
HORIZ:
VERT:
DSN. DM
DRN. DM
CKD. DM
DATE: AUG 2006

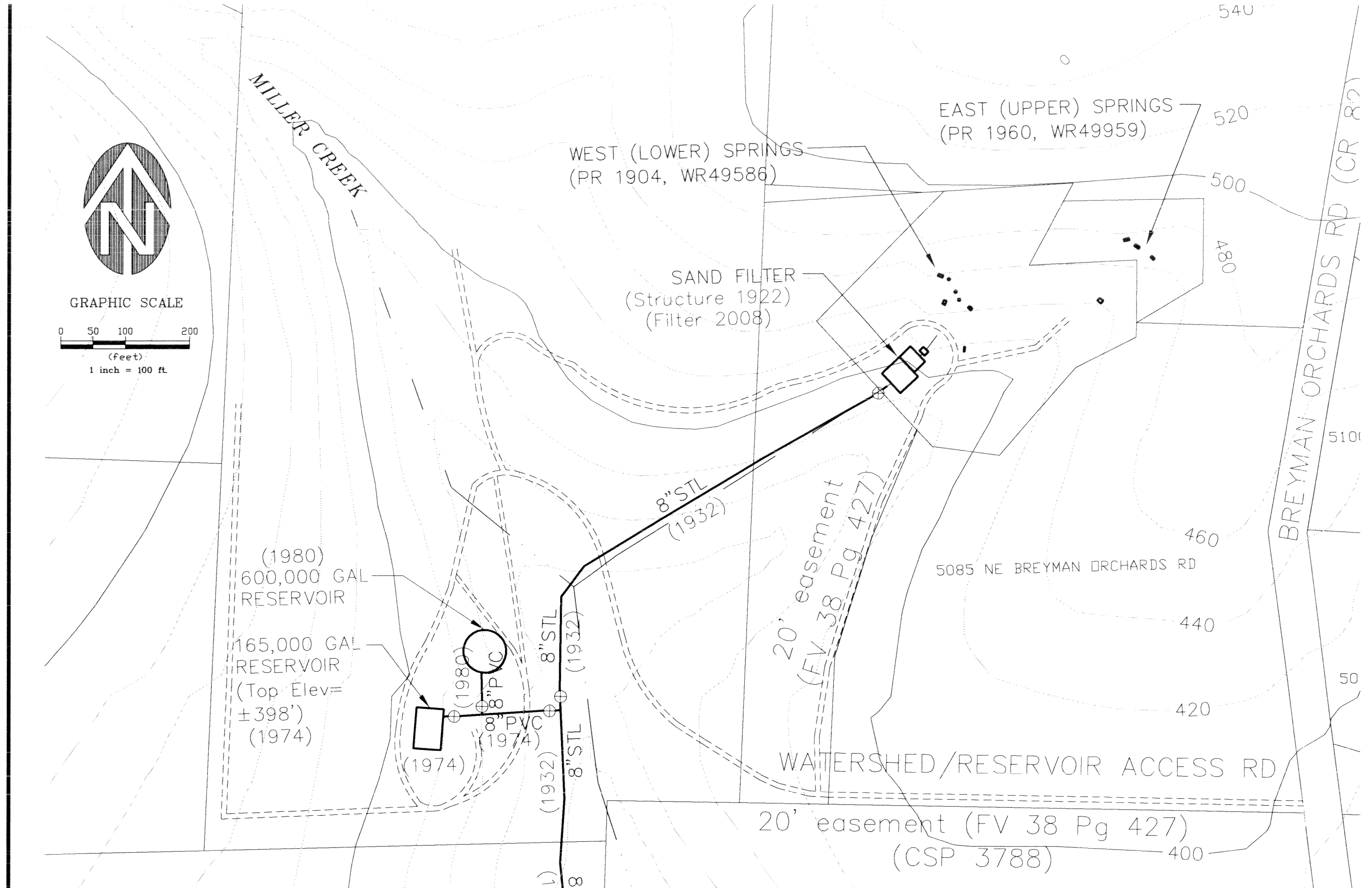
MAP UPDATED: 10-19-10

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

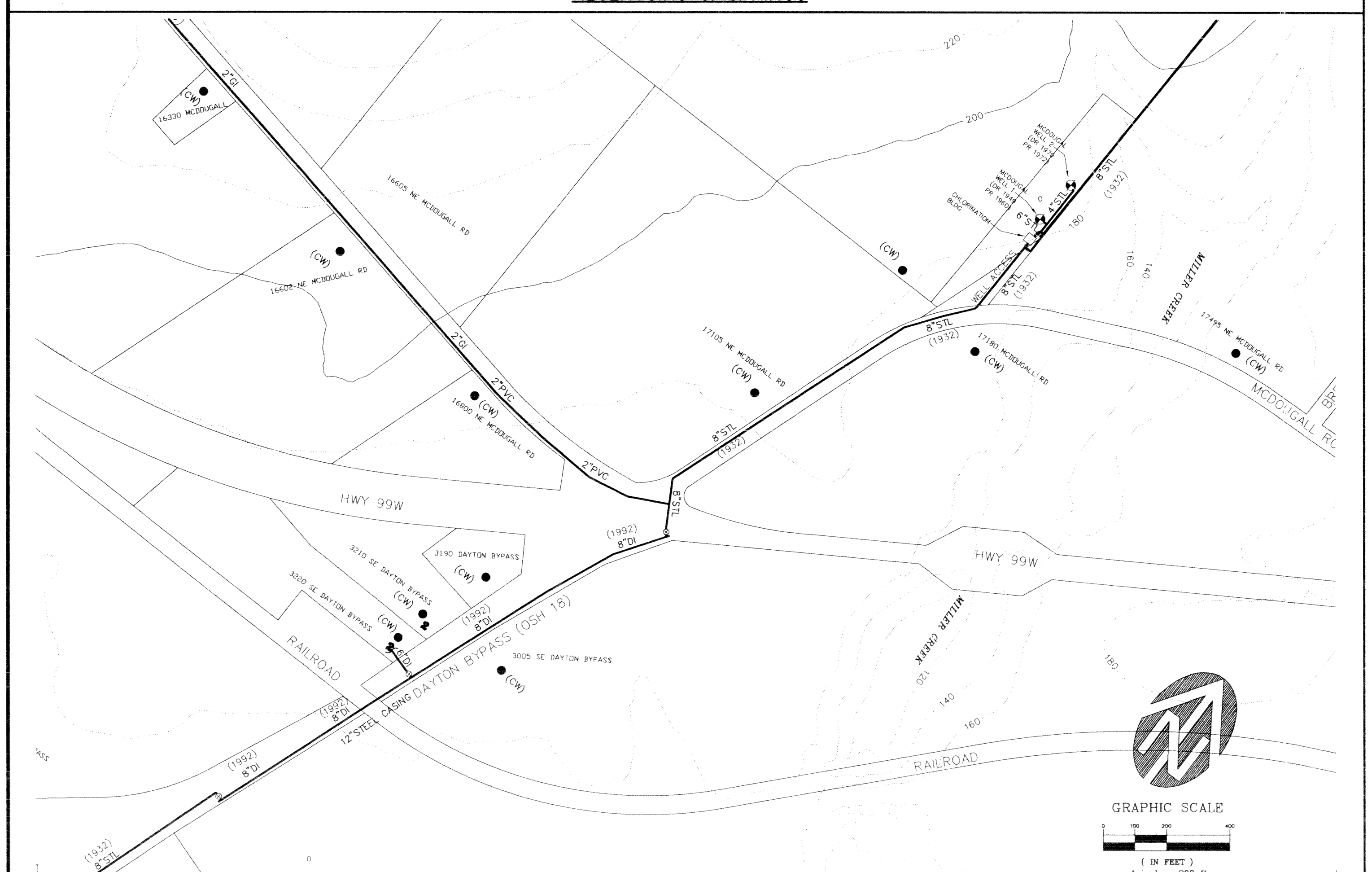
CITY OF DAYTON, OREGON

Figure 4-2b
WATER SYSTEM MAP (North of Hwy 18)

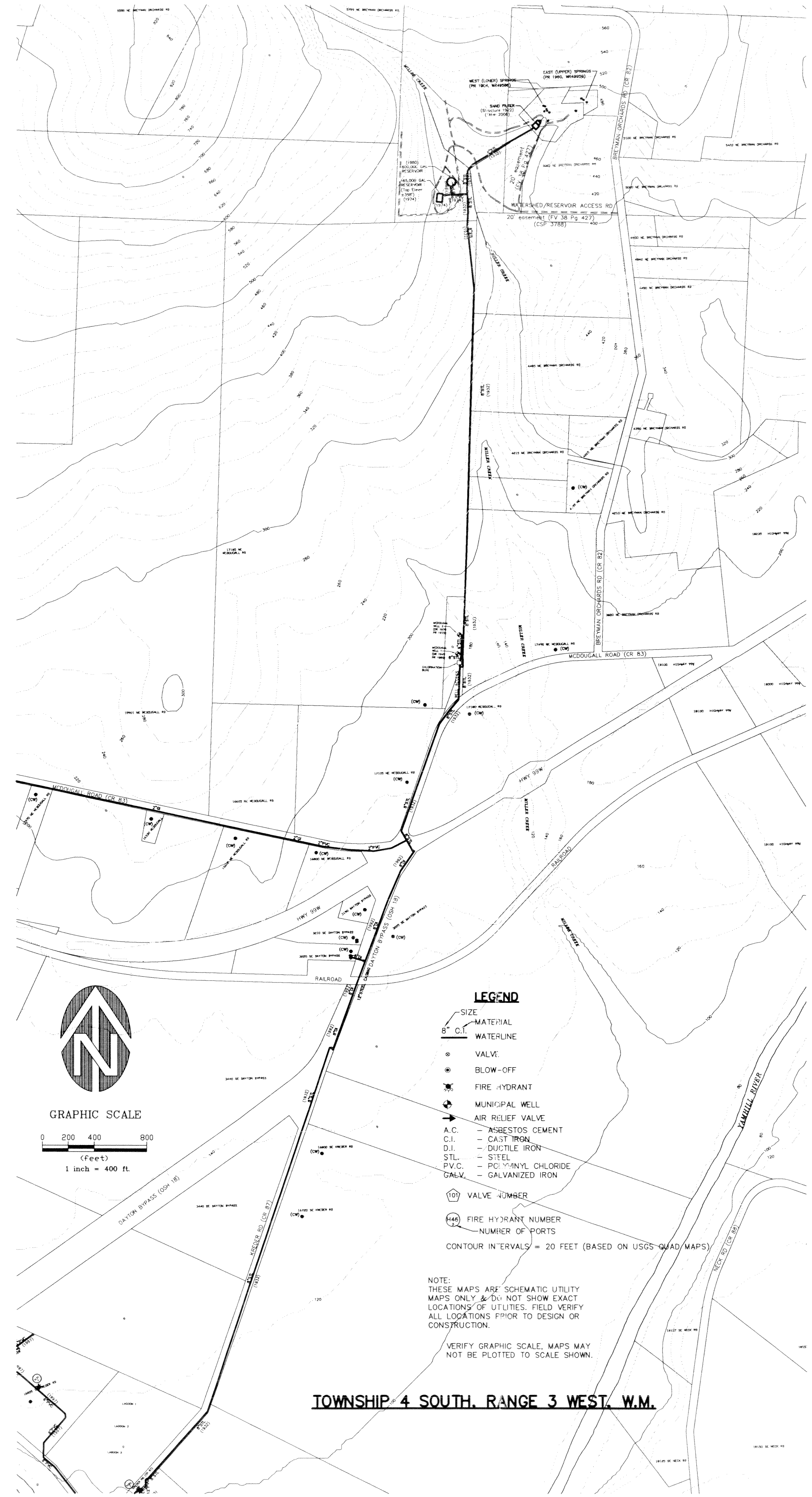
SHEET 1 OF 1
JOB NUMBER 2609.1010.0



RESERVOIRS & SPRINGS



RAILROAD & HWY 99W CROSSING, WELLS, CHLORINATION & FLOW METERING



TOWNSHIP 4 SOUTH, RANGE 3 WEST, W.M.

REVISIONS

NO.	DATE	DESCRIPTION	BY

SCALE
HORZ:
VERT:
DSN. DM
DRN. DM
CKD. DM
DATE: AUG 2006

MAP UPDATED: 11-18-10

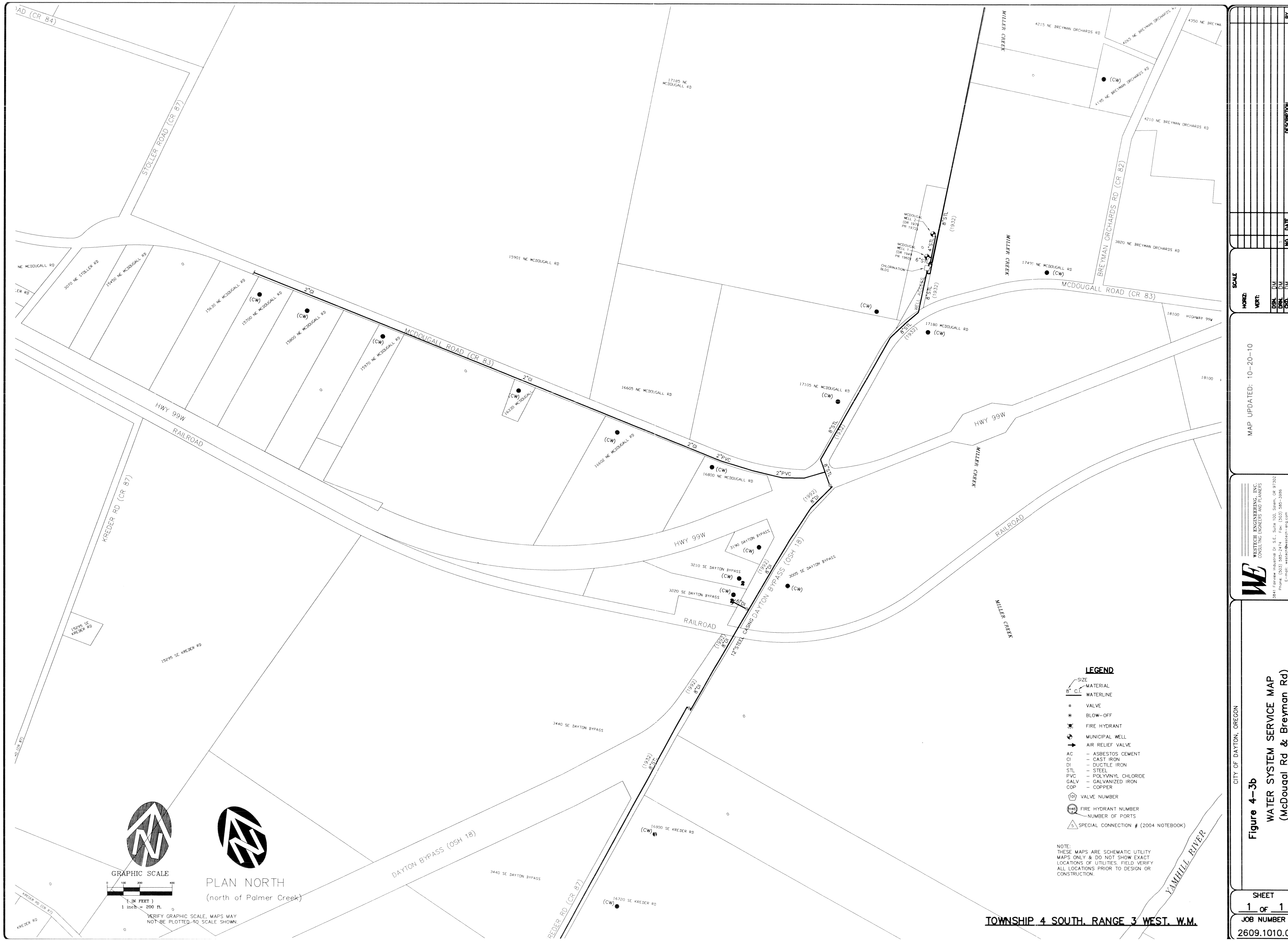
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

CITY OF DAYTON, OREGON

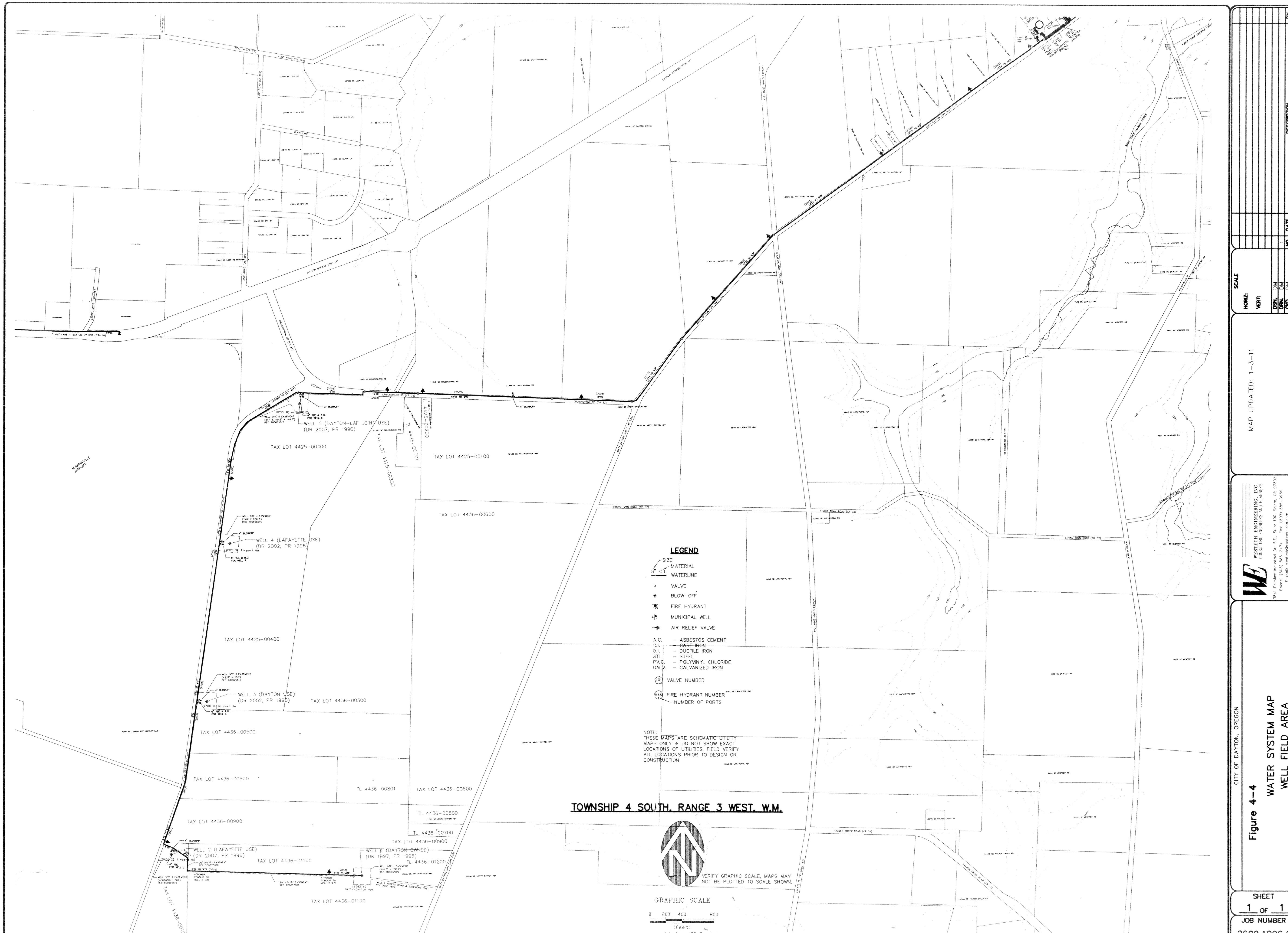
Figure 4–3a
WATER SYSTEM MAP
WATERSHED AREA

SHEET 1 OF 1

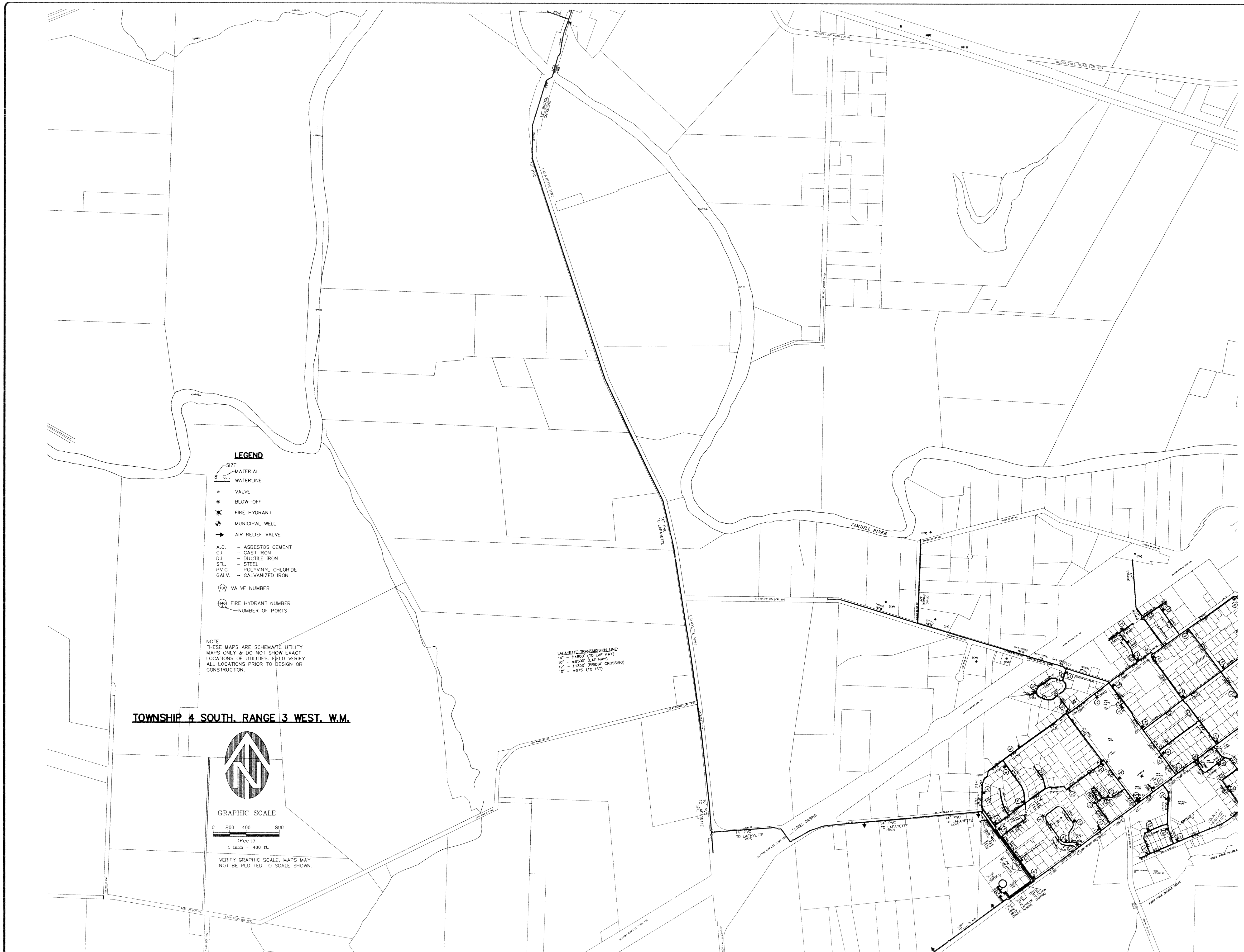
JOB NUMBER 2609.1006.0



STOLLER ROAD (CR 87)
MCDOUGALL ROAD (CR 83)
HWY 99W
RAILROAD
KREDER RD (CR 87)
DAYTON BYPASS (OSH 18)
BREYMAN ORCHARDS RD (CR 82)
MILLER CREEK
YAMHILL RIVER
15901 NE MCDOUGALL RD
16605 NE MCDOUGALL RD
17105 NE MCDOUGALL RD
16800 NE MCDOUGALL RD
17180 MCDOUGALL RD
3210 SE DAYTON BYPASS
3220 SE DAYTON BYPASS
3005 SE DAYTON BYPASS
3440 SE DAYTON BYPASS
15295 SE KREDER RD
16900 SE KREDER RD
16720 SE KREDER RD
4210 NE BREYMAN ORCHARDS RD
3820 NE BREYMAN ORCHARDS RD
4215 NE BREYMAN ORCHARDS RD
18100 HIGHWAY 99W
2"GI
2"PVC
8"STL
8"DI
(1932)
(1992)
12"STEEL CASING
CHLORINATION BLDG
(CW)
LEGEND
SIZE
MATERIAL
WATERLINE
VALVE
BLOW-OFF
FIRE HYDRANT
MUNICIPAL WELL
AIR RELIEF VALVE
AC – ASBESTOS CEMENT
CI – CAST IRON
DI – DUCTILE IRON
STL – STEEL
PVC – POLYVINYL CHLORIDE
GALV – GALVANIZED IRON
COP – COPPER
VALVE NUMBER
FIRE HYDRANT NUMBER
NUMBER OF PORTS
SPECIAL CONNECTION # (2004 NOTEBOOK)
NOTE: THESE MAPS ARE SCHEMATIC UTILITY MAPS ONLY & DO NOT SHOW EXACT LOCATIONS OF UTILITIES. FIELD VERIFY ALL LOCATIONS PRIOR TO DESIGN OR CONSTRUCTION.
GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.
VERIFY GRAPHIC SCALE, MAPS MAY NOT BE PLOTTED TO SCALE SHOWN.
PLAN NORTH
(north of Palmer Creek)
TOWNSHIP 4 SOUTH, RANGE 3 WEST, W.M.
MAP UPDATED: 10-20-10
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
CITY OF DAYTON, OREGON
Figure 4-3b
WATER SYSTEM SERVICE MAP
(McDougal Rd & Breyman Rd)
DATE: AUG 2006
SHEET 1 OF 1
JOB NUMBER
2609.1010.0



LEGEND
SIZE
MATERIAL
WATERLINE
VALVE
BLOW-OFF
FIRE HYDRANT
MUNICIPAL WELL
AIR RELIEF VALVE
A.C. - ASBESTOS CEMENT
C.I. - CAST IRON
D.I. - DUCTILE IRON
STL. - STEEL
P.V.C. - POLYVINYL CHLORIDE
GALV. - GALVANIZED IRON
VALVE NUMBER
FIRE HYDRANT NUMBER
NUMBER OF PORTS
NOTE: THESE MAPS ARE SCHEMATIC UTILITY MAPS ONLY & DO NOT SHOW EXACT LOCATIONS OF UTILITIES. FIELD VERIFY ALL LOCATIONS PRIOR TO DESIGN OR CONSTRUCTION.
TOWNSHIP 4 SOUTH, RANGE 3 WEST, W.M.
VERIFY GRAPHIC SCALE, MAPS MAY NOT BE PLOTTED TO SCALE SHOWN.
GRAPHIC SCALE
0 200 400 800
(feet)
1 inch = 400 ft.
WELL 5 (DAYTON-LAF JOINT USE)
(DR 2007, PR 1996)
WELL 4 (LAFAYETTE USE)
(DR 2002, PR 1996)
WELL 3 (DAYTON USE)
(DR 2002, PR 1996)
WELL 2 (LAFAYETTE USE)
(DR 2007, PR 1996)
WELL 1 (DAYTON OWNED)
(DR 1997, PR 1996)
TAX LOT 4425-00400
TAX LOT 4425-00100
TAX LOT 4425-00300
TL 4425-00200
TAX LOT 4436-00600
TAX LOT 4436-00300
TAX LOT 4436-00500
TAX LOT 4436-00800
TL 4436-00801
TAX LOT 4436-00900
TL 4436-00500
TL 4436-00700
TAX LOT 4436-01100
TL 4436-01200
4" BLOWOFF
CITY OF DAYTON, OREGON
Figure 4-4
WATER SYSTEM MAP
WELL FIELD AREA
MAP UPDATED: 1-3-11
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
SCALE
HORIZ:
VERT:
DSN. DM
DRN. DM
CKD. DM
DATE AUG 2006
NO. DATE
DESCRIPTION
REVISIONS
BY
SHEET
1 OF 1
JOB NUMBER
2609.1006.0



REVISIONS

NO.	DATE	DESCRIPTION	BY

SCALE
HORIZ:
VERT:
DSN. DM
DRN. DM
CKD. DM
DATE AUG 2006

MAP UPDATED: 8-17-10

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS

CITY OF DAYTON, OREGON

Figure 4-5
WATER SYSTEM MAP
LAFAYETTE INTERTIE

SHEET
1 OF 1
JOB NUMBER
2609.1006.0

4.2.2 Agreements Related to the Joint Dayton-Lafayette Water System

The various agreements that pertain to the Joint Dayton-Lafayette Water System, and the manner in which the joint water system is to be operated, as well as the restrictions on such operations, are contained in several documents executed by the cities over the years. These include the Intergovernmental Agreement (IGA) executed between Dayton & Lafayette, as well as the Settlement Agreement executed between Dayton/Lafayette and several local water use entities. These are discussed below.

4.2.2.1 Dayton/Lafayette Joint Water System IGA

The responsibilities, obligations and restrictions associated with the operation and maintenance of the Joint Dayton-Lafayette Water System as a whole, as well as financing arrangements, ownership of various assets, etc. are summarized in an Intergovernmental Agreement (IGA) executed between the two cities. The current IGA was approved by the respective City Councils in February 2009 (see **Appendix G**). The current IGA replaces and supersedes the previous joint water system IGAs and amendments. The designation of ownership of the various portions of the joint water system are summarized in IGA exhibit A, summarized as follows in **Table 4-1**. .

Table 4-1 Designation of Assets of Joint Dayton/Lafayette Water Project[1]

Joint Capital Assets (Dayton & Lafayette)
• Easements for Well 2, 3, 4 & 5, including Well 2 water & power easement.
• Well 5 Improvements
• Transmission main from wells to WTP
• WTP, building, accessory structures & equipment (filters & appurtenances, generator, fire pump, etc.)
Separate Capital Assets *City of Lafayette*
• Well 2 & Well 4 Improvements
• Transmission Main from Dayton Reservoir to Lafayette distribution system
Separate Capital Assets *City of Dayton*
• Easements for Well 1, including Well 1 access road.
• Well 1 & Well 3 Improvements
• 1.5 million gallon reservoir at WTP
• WTP & Reservoir site.
Separately Owned but Jointly Used Capital Assets
• 1.5 million gallon reservoir[2].

(1) Designations from Exhibit A of Dayton/Lafayette IGA.
(2) Based on IGA Exhibit A, "*25% of the cost associated with the engineering, construction, operation and maintenance of the reservoir was paid by the City of Lafayette, since the reservoir is intended to perform in lieu of a clear well constructed solely by the City of Lafayette for its use.*"

A technical discussion of the apparent basis for the Lafayette's 25% cost participation in the cost of the WTP reservoir is contained in Section 9.3.1.5. In summary, the bottom 10 to 12 feet of water in the reservoir volume is "*dead storage*" that is required to provide adequate suction pressure for the operation of the Lafayette transfer pumps and the Dayton distribution pumps without significant cavitation damage.

4.2.2.2 Settlement Agreement for Dayton Prairie Water Rights

The responsibilities, obligations and restrictions associated with the operation of the wellfield wells (which are part of the Joint Dayton-Lafayette Water System) are contained in a May 2000 Settlement Agreement (see **Appendix G**) executed between Dayton/Lafayette and three local water use entities (ie. the Dayton Prairie Water Users Association, the Palmer Creek Water Improvement Company, and the Yamhill County Soil & Water Conservation District, collectively referred to as the "Irrigators").

Among other issues, the settlement agreement stipulates that the wellfield wells are designated as supplemental source (ie. secondary source) of water only, and are to be used only to the extent that the pre-existing supply sources (ie. primary sources) are deficient with respect to quantity or quality (agreement recital 3, agreement 2.b). Both cities agreed and represented that they would make repairs as required to minimize deficiencies in their existing systems, and would take all necessary steps to assure that the existing sources are an integral part of a fully developed, efficient water supply (agreement recital 3). Therefore, the Dayton Prairie wellfield wells are designated as secondary water sources, while the City's other sources (watershed springs & wells, in-town wells) are designated as primary sources.

Both cities also committed to "*include a preference for regional water supply development to meet future needs*" in their respective Water Master Plans (agreement 2.b).

City records indicate that the original plan for the Dayton Prairie wellfield included plans for 10 wells tapping the highly productive shallower aquifer which has historically been utilized by area farmers for irrigation source (located near or east of the Amity-Dayton Highway). However, the litigation and resulting settlement agreements resulted in several major changes to this plan. First, the number of wells allowed was reduced from ten to five. Next, the City was prohibited by WRD from withdrawing any water from a depth shallower than 100 feet below grade (per the water right permit conditions). Finally, the well locations were shifted to the northwest from the originally planned locations. All of these resulted in the City wells being restricted to less productive areas and less productive aquifers than were originally planned on.

The settlement agreement also requires that "*the Cities shall each develop a Water Management and Conservation Plan consistent with OAR Chapter 690, Division 86, which will provide for efficient use of water. . . The Water Management and Conservation Plan for each City shall address, among other things, efficient water use and avoidance of waste. The plans shall be integrated into the Cities' ongoing water master planning.*" This requirement for a Water Management and Conservation Plan is also included as a condition of the water rights permit for the wellfield wells.

The City developed a Water Management and Conservation Plan which was approved by the City Council in March 2004.

4.3 WATER SUPPLY

Water supply for the City is comprised entirely of groundwater sources. The City's municipal water system utilizes a series of springs and groundwater wells which supply water into two separate but inter-connected water service levels (watershed service level & City service level).

Based on the 2004 Source Water Assessment Report prepared by ODWP, the City's water system draws water from two separate aquifers, consisting of a confined sand and gravel aquifer within the Willamette Lowland Aquifer (supplying the wellfield wells and in-town wells), and a confined layered basalt aquifer of the Columbia River Basalts (supplying the McDougal wells and the watershed springs).

Groundwater from wells on the valley floor in the Dayton area is characterized by moderate to elevated levels of dissolved minerals which is primarily comprised of iron & manganese, in addition to sodium and dissolved methane in some areas.

The following sections discuss the status of the City's water rights, spring sources and well sources (primary & secondary).

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4.3.1 Current Water Rights

Table 4–2 is a summary of the current water rights held by the City of Dayton, listed by priority date (oldest to newest).

Table 4–2 Water Rights Summary (listed by priority date)

Source Name(1)	Permit Rate cfs (gpm)	Appl #	Perm #	Certificate #	Priority Date	Yamhill County Well Log #
West (Lower) Spring Area (Miller Springs), Dayton Watershed	0.11 (50)	-	-	49586	2-16-1904	-
East (Upper) Springs Area, Dayton Watershed	0.14(2) (63)	S34218	S26950	49959	8-9-1960	-
McDougal Well #1, Miller Creek Basin	0.67 (300)	G-1819	G-1663	35695	8-9-1960	5280
Post Office Well (Ferry Street or Town Well) (7), Palmer Creek Basin	0.17(3) (76)	G-1820	G-1664	35696	8-9-1960	5338
Flower Lane Well(7), Palmer Creek Basin	0.50 (224)	-	-	35696 T10926(4)	8-9-1960	125 1860/1861
11th Street Well, Palmer Creek Basin	0.22 (100)	G-8735	G-8082	61750	4-14-1978	5324
McDougal Well #2, Miller Creek Basin	0.17 (76)	G-5646	G-5466	47233	3-13-1972	465
Dayton/Lafayette Wellfield (5 wells)(5), Palmer Creek Basin	0.67(6) (300) each	G-14385	G-13838(5)	-	9-27-1996	1-50702 2-55101 3-53392 4-53393 5-55102

(1) See Appendix E for water rights and well log information.
(2) 0.14 cfs from East Dayton Springs Area and 0.06 cfs from Miller Creek (Miller Creek diversion no longer utilized).
(3) 0.5 cfs of this water right was transferred to the Flower Lane Well.
(4) Portion of Post Office Well water right (0.5 cfs) was transferred to Flower Lane Well.
(5) Lafayette & Dayton each have water rights to all five wells. Lafayette holds permit G-13839, which is a duplicate of permit G-13838 except for the name of the owner (water rights are overlapping and not additive). Dayton owns the improvements at wells 1, 3 & half of 5. Lafayette owns the improvements at wells 2, 4 and half of well 5.
(6) Permitted rate shown is the maximum from each well individually. Total combined rate from the five wells is limited to 3.34 cfs (1500 gpm).

As shown, all of the City's water rights have been certificated by WRD except for the Dayton/Lafayette wellfield wells (Wells 1–5). The City's hydrogeologist (GSI Water Solutions) indicated that the only additional water rights work needed on the permits for Wells 1-5 includes submittal of partial proof claim of beneficial use reports. The City can submit a partial proof as long as they can show that the City has developed at least 25 percent of the permitted capacity. Each City (Dayton & Lafayette) will need to submit for their respective water rights permits. Before doing so, the City will need to coordinate with

GSI Water Solutions to ensure that they have complied with all permit conditions and have submitted any required pump test reports.

4.3.1.1 Primary vs. Secondary Supply Sources

As noted above, both the Settlement Agreement and the wellfield water rights dictate that the City utilize the watershed and in-town sources as its primary water source (watershed springs, McDougal Wells 1 & 2, as well as the Post Office, 11th Street and Flower Lane wells), with the Dayton-Lafayette wellfield being utilized as a secondary or supplemental source (Wells 1 through 5). Although all five Dayton-Lafayette wellfield wells discharge to the Water Treatment Plant, and the City has water rights to all five wells, Dayton solely owns the improvements at Well 1 & 3, while it owns the improvements at Well 5 jointly with Lafayette.

As noted in the Settlement Agreement above, both Dayton and Lafayette committed to make repairs as required to minimize deficiencies in their existing primary water source systems, and would take all necessary steps to assure that the existing sources are an integral part of a fully developed, efficient water supply. Both Dayton and Lafayette also committed to "*include a preference for regional water supply development to meet future needs*" in their respective Water Master Plans, while maintaining the wellfield wells as a secondary (ie. backup) supply source.

4.3.2 Water Supply, Springs

The City's spring sources are located in the City watershed area located northeasterly of the City. Flows from the springs varies depending on the time of year, with flows during the wet winter months being higher than flows in the late summer being lower, particularly during dry years. The City actually has two separate water-rights for the spring areas, consisting of the lower springs (West Springs) with a priority date of 1904, and the upper springs (East Springs) with a priority date of 1960. The two spring areas are located approximately 200 feet apart from each other.

Both spring areas have multiple spring collection boxes of various vintages. The spring water enters the various spring boxes and flows to a common junction structure just uphill from the original reservoir from the 1920s (the reservoir structure was converted to a slow sand filter in 2006 to 2008). The spring water is metered between the junction structure and the sand filter structure (ie. flow from both spring areas passes through a common meter).

Table 4–3 compares the permitted flow rates (per the water-rights) with the measured flows from the springs. As shown, the maximum measured flow rate is somewhat higher than the existing permitted flows under the water rights certificates.

Currently, the City has not been able to meet demands without supplementing the spring water with groundwater from the McDougal and in-town wells and the Dayton-Lafayette wellfield. As the population continues to grow, shortages may become more likely. The alternatives for addressing the potential shortages are discussed in subsequent chapters. There is currently no telemetry link between the WTP and the watershed springs.

Table 4-3 Springs, Current Production Capacity

Spring Name	Water Right Permit Rate (gpm)	Certificate #	Minimum Flows [1] (gpm)	Average Flows (gpm)	Maximum Flows[2] (gpm)
Lower Springs[4]	50	49586	-	-	-
Upper Springs[4]	63	49959	-	-	-
Combined Flow	113[3]	-	35	57	±140

(1) Minimum flows were based on combined flows recorded on 11/23/2007.
(2) Maximum flows based on combined flows recorded 4/30/08.
(3) Combined water rights for the East & West Springs.
(4) Springs are not metered individually, so flows from the various separate spring sources is not currently available.

4.3.2.1 West (Lower) Spring Area

The West Spring area (also known as Miller Springs, or Lower Springs) is the City's oldest water source. Based on documentation in the Finding of Fact and Order of Determination issued for the Yamhill River Watershed by the Water Resources Department in 1979 (see excepts in **Appendix E**), the City has continuously utilized these spring sources since at least 1904.

The Lower Spring area consists of water diverted via a number of concrete spring boxes located adjacent to and just north of the sand filter access road.

While the City has a water-right certificate authorizing the use of the water from these spring boxes, they do not currently own the land containing the West Spring area (use was covered under a lease agreement). The original lease agreements authorizing the City's use of the spring area land were executed in 1904 and 1932 (see references below). The agreements included rights for the construction and maintenance of the spring boxes, pipelines, access roads and the sand filter structures. In addition, the easement rights for the access road to the spring area (from Breyman Orchards Road) were formalized in a deed recorded in 1957.

Recorded documents related to the Lower Spring area and associated facilities include the following (see also references on CSP 3788, dated Sept 1964).

- 99 year lease (executed 2/16/1904, recorded FV50 P83). Includes westerly half of Tax Lot 4304-1700 (see discussion below regarding new lease).
- 71 year lease (executed 8/19/1932, recorded FV__ P111). Includes easterly half of Tax Lot 4304-1700 (see discussion below regarding new lease).
- 20 foot access road easement (deed dated 8/17/1957, recorded FV38 P427). Includes (#3) easement rights for the access road from Breyman Orchards Road (along the southerly boundary of Tax Lot 4304-1500), up to the spring parcels and the filter structure (along the easterly boundary of Tax Lot 4304-1600), and along the reservoir access road (along the southerly boundary of Tax Lot 4304-1600). This deed also includes references to the 99 year lease (#2) and the 71 year lease (#4).

When the provisions of both the 99 year lease and the 71 year lease expired in 2003, the City continued to operate the system under the terms of the lease agreements until a new agreement could be negotiated and finalized.

In January 2008, the City and the present owners of Tax Lot 4304-1600 & 1700 (Suzanne & Carolyn Hurford) entered into a new lease agreement authorizing the City to utilize the property for maintaining the springs and the City's water supply and facilities. The term of the current lease is for 5 years from October 1, 2007 (ie. expires 10/1/2012).

The City should continue negotiating with the property owners regarding the execution of a long term lease agreement, or the purchase of the property and/or execution of permanent exclusive easements covering the springs, access roads, pipelines and structures utilized in collecting, treating and conveying the domestic water for which the City has water rights certificates, and controlling access to the property.

4.3.2.2 East (Upper) Springs Area & Miller Creek

The East Spring area (also known as the Upper Springs) was developed in the late 1950's and early 1960's. The spring boxes for this spring area are located on two separate tax lots, as follows.

- The southern-most spring box (the green spring house) is located on the north end of Tax Lot 4304-1700 (the West Springs are located on the southern end of this same property). This spring was covered under the terms of the 71 year lease agreement, as well as the new lease executed in 2008.
- The remainder of the spring boxes are located on Tax Lot 4304-1802 (owned by the City of Dayton, property acquired in 1979).

It should be noted that a separate property owner has an overlapping recorded right to utilize water for domestic use from the green spring house location. The records that we have indicate that the terms of this water use right include provisions contained in the following deed references.

- V107 P264 (Sept 1932). Provides for use of a maximum of 300 gallons per day for domestic use. Requires the installation of an electric pump with float valve, as well as a water meter to allow confirmation of the amount of water utilized.
- V118 P33 (Apr 1941). Confirms the provisions of the deed above.
- V38 P427 (Aug 1957). Item #4 confirms right by the offsite owner to utilize a maximum of 10 gpm from this spring source (up to the maximum 300 gpd noted in the deeds above).

In 1979, the City purchased Tax Lot 4304-1802 (V140 P111), which contains the spring boxes in the Upper Spring area (except for the green spring house). Although the City owns the spring area itself, the water from the Upper Spring area flows to the junction structure in the Lower Spring area (ie. the inlet to the sand filter structure), and thence through the pipeline to the City reservoirs. Continued future use of the Upper Spring area will require that the lease, purchase or easement acquisition issues for the Lower Spring area and pipeline (discussed above) be addressed.

4.3.2.3 Spring Water Quality

The raw water quality of the springs is generally good, and has historically been used by the City without treatment (other than chlorination). However, concerns have been raised in recent years about the ability of the existing spring boxes to adequately exclude surface water from the spring collection system. This was noted in the 2005 sanitary survey by ODWP. In October 2007, GSI Water Solutions prepared a report for the City (**Appendix J**) which included the information below.

The ODWP has had concerns that the springs are under direct influence of surface water. Community water systems being supplied by springs must meet additional disinfection and filtration requirements if they are determined to be groundwater under the direct influence of surface water (GWUDI). The term GWUDI specifically refers to groundwater sources where conditions are such that pathogens, such as *Cryptosporidium* or *Giardia lamblia*, are proven or likely to travel from nearby surface water into the groundwater source (springs in this case). For a groundwater source (wells, springs, and infiltration galleries) to be potentially GWUDI, the source must be:

1) Within 500 feet to a surface water source, and either:

2a) Have shown a source-related presence of coliform bacteria (a surrogate indicating surface water influence), or

2b) Have an inadequate grout seal or no impervious aquifer barrier.

During the past several years, the City has exchanged correspondence with ODWP regarding whether the springs are potentially GWUDI (see Attachment A of the GSI report in **Appendix J**). In April 2002, DHS sent a letter to the City stating that they believed that there was a potential for the springs to be in hydraulic connection with surface water and that MPA testing should be done. In September 2004, the DHS issued a Source Water Assessment Report for all of the City's water sources, including the springs. This Source Water Assessment Report was intended to assess the relative threat of contamination from human activities and from surface water influence. The DHS report made the following observations about the spring sources:

- The springs are highly sensitive to contamination because the aquifer supplying the springs is shallow and unconfined (meaning there are no low permeability layers separating the aquifer from the surface), the spring boxes lack a water tight hatch, screened vent, and diversion ditches, there is moderate infiltration potential for water from the surface, and the spring system is old.
- Potential contaminant sources identified by ODWP within the spring critical recharge area (e.g., stables and agricultural activities) pose a relatively moderate risk to the drinking water supply.
- The springs are considered susceptible to viral contamination.

The ODWP Source Water Assessment report did not mandate that improvements be made or require the City to implement a source water protection plan (because this was voluntary under the rules at the time). However, it was clear that improvements would be needed. In a June 27, 2006 letter to the City, the ODWP stated that MPA testing was no longer being required because the Source Water Assessment report concluded that the springs are hydraulically connected with nearby surface water. No specific rationale for this conclusion was provided. However, we infer that because the springs were considered to be highly sensitive (for the reasons provided in the previous paragraph), DHS determined that they have the potential to be hydraulically connected to surface water.

Page 3 & 4 and Table 1 in GSI's 10/22/07 report contain detailed information on the condition and configuration of the various spring boxes.

GSI Water Solutions provided the City with a follow up memo on the spring system dated 2/25/09 that summarizes some of their recommended improvement priorities (high priority & moderate priority) (**Appendix J**).

On April 14, 2009 the ODWP provided an informal inspection of the watershed spring system and formalized their findings in a June 12, 2009 letter (refer to **Appendix J**). Per the ODWP letter there are a number of deficiencies related to the spring boxes, which include the following:

- Not all the spring boxes are constructed such that surface water is excluded. The "green house" spring box showed significant sediment and leaf debris. One of the spring boxes in the lower spring area also showed evidence of surface water intrusion and root masses.
- Spring boxes do not have overlapping, water tight lids. The lack of overlapping, water tight lids could result in debris and surface water entering the spring boxes.
- The spring boxes do not have ditches installed to effectively divert surface water.

To remedy the above problems, ODWP describes two options:

- The first option would be to bring the spring boxes up the construction standards found in OAR 333-061-0050(2)(b) such that the spring water can be considered groundwater and not subject to the surface water treatment rules.
- The second option would be for the City to accept that the watershed springs are GWUDI and subject to the Surface Water Treatment Rules. The SWTRs require that all GWUDI be filtered. The City's slow sand filter would have to be re-evaluated to determine whether or not it is approved for surface water treatment and is filtering properly. The existing slow sand filter project has not yet demonstrated compliance with the plan review conditions for surface water treatment in terms of design, flow rate, and filtration loading rate. One of the conditions of the original plan review was quarterly coliform counts on the filtered water to demonstrate the slow sand filter is capable of pathogen removal. If the slow sand filter is not capable of the appropriate log removal for surface water treatment, then the slow sand filter would need to be reconstructed if feasible or a new filtration plant would be required.

The ODWP letter also indicated that a Corrective Action Plan was required describing one of the two options above along with compliance dates for specific steps, including plan review and full compliance. On 8/14/09 the City submitted the Action Plan to ODWP. A modified Action Plan was subsequently submitted to ODWP on 9/30/10 (**Appendix J**).

One of the recommended high priority improvements that was completed by the City in 2010 (after the previous inspection) was to modify the grading and install drains around the green spring house to more adequately direct surface runoff away from and around the spring house.

A more detailed discussion of recommended solutions to the issues raised in the memos and letters from GSI Water Solutions and ODWP is contained in Chapter 7.

A discussion of the existing slow sand filter that currently receives water from the watershed springs is contained below under the discussions on water treatment in Section 4.4.3.

4.3.3 Water Supply, Wells

The City currently utilizes 10 municipal wells (McDougal Wells 1 & 2, Flower Lane Well, 11th Street Well, Post Office Well, and Dayton-Lafayette wellfield Wells 1-5). Although all five wellfield wells discharge to the City WTP, Dayton actually only owns the improvements at 2½ of these wells (Well 1, 2 & half of 5), although both Dayton and Lafayette have full water-rights from each well in the wellfield.

As previously noted, under the terms of the City's water rights, the watershed wells and the in-town wells are the City's primary production wells, while the wellfield wells are the secondary source wells.

Table 4–4 lists the estimated long term production flowrates for the active wells as estimated based on currently available information (not based on actual production testing). It should be noted that the estimated production rates listed are approximate, and are based on anticipated summer flows moving into the future. As noted in Section 6.7.2, it is recommended that the City retain GSI Water Solutions (or other hydrogeologist) to assist the City in performing detailed production and efficiency testing on all of the City's wells, to verify the condition of the wells and to verify assumptions behind these anticipated long term pumping rates (and correct these estimates if necessary).

Table 4-4 Wells, Estimated Long Term Production Capacity

Well Name	Estimated Long Term Production Rate(1) (gpm)
McDougal Well #1	30 (5)
McDougal Well #2	65 (5)
Flower Lane Well	25 (6)
11th Street Well	25 (6)
Wellfield Well # 1	40 (7)
Wellfield Well # 2(2)	40 (8) (Lafayette)
Wellfield Well # 3	90 (9)
Wellfield Well # 4(2)	70 (Lafayette)
Wellfield Well # 5(3)	60 (50% Lafayette)
TOTAL	445 (305 w/out Lafayette owned wells)
Post Office Well(4)	-

(1) Based on consultations from GSI Water Solutions and recent City production records.
(2) Although Lafayette owns Wells 2 & 4, both Dayton and Lafayette have full water-rights from each well.
(3) Although Dayton & Lafayette equally share ownership of Well # 5, both Dayton and Lafayette have full water-rights from each well.
(4) Post Office Well is currently utilized only for irrigation of park land within the City.
(5) Assumes both McDougal wells pumping, post rehab of these wells.
(6) Based on combined flows of 50 gpm from Flower Lane & 11th Street wells
(7) Well 1 production is currently 0 gpm due to biofouling & inadequate pump control systems. The value listed assumed well rehab is successfully completed, and that the pump control systems are upgraded.
(8) Well 2 production is currently 20 gpm due to production problems (assumed to be biofouling). The value listed assumes well rehab is successfully completed.
(9) Well 3 pump control systems are inadequate to prevent drawdown into screens. The value listed assumes pump control systems are upgraded.

The Post Office Well is currently used only for irrigation of the City park property (since a raw water pipeline from the well to the WTP does not exist), and is not included for finished water purposes.

4.3.3.1 Well Discharge Rate Control Strategy

The City uses two different control strategies on their various wells to control the rate at which water is discharged from the wells. Control of the discharge rate is important in order to avoid excessive drawdown of the water level. The well drawdown needs to be controlled to ensure that the water level never drops below the top of the well screen or the perforated portion of the casing. If the water level is allowed to drop below the top of the screen or perforated casing, the groundwater begins to cascade into the well bore, resulting in the aeration of the groundwater, which in turn promotes bacterial growth that tends to foul and blind off the well screen and aquifer (thereby reducing the capacity of the well by reducing the amount of water that can flow to the pump). It also leads to excessive flowrates through the aquifer, which can result in damage to the aquifer structure itself (for alluvial aquifers), such as transport of fines to the area outside the screen or into the well bore.

4.3.3.1.1 Manual Throttling Control Strategy

The discharge rate for the City's primary production wells (McDougal wells & in-town wells) is controlled by manually setting a throttling valve on the wellhead discharge piping, based on the flowrate as measured by a mechanical flow meter mounted in the wellhead piping. This requires that the City regularly monitor the water level and manually adjust the throttling valve and discharge rate to keep the water level above the top of the screen or perforated casing. Since the discharge rate of the pump is dependent on the level of the water in the well, this results in a variable flowrate (ie. as the water level drops, the well pump discharge rate decreases since it has to expend more energy to lift the water higher out of the well).

A similar configuration is currently used for Wellfield Well 1 and Well 3, even though these wells (in addition to the throttling gate valve) are also equipped with an automatic blowoff valve (ie. discharges water to the adjacent field when the well first starts up), and a backpressure valve (ClaVal style). Once again, this results in a flowrate that can vary significantly as the water level in the well drops during pumping. Since the methane strippers require a relatively constant flowrate to avoid overfilling, this configuration has not worked well since the system went on-line in 2004. Lafayette recently converted Well 4 over to the automated control strategy summarized below. Dayton plans to convert Wells 1 & 3 in the near future.

4.3.3.1.2 Automated Discharge Control Strategy

Due to lack of discharge control (ie. with the manual control strategy) at the City's original Wellfield wells, a different approach was taken when Well 2 & Well 5 were constructed in 2009. A magnetic flow meter was installed on the well discharge line, with the flow meter sending a 4-20 mA signal (proportionate to flowrate) to the control panel. The flowrate signal was connected to a Variable Frequency Drive (VFD) capable of automatically controlling the speed of the well pump motor, which in turn controls the rate of discharge from the well. The operators enter the discharge flowrate desired into the control system, and the VFD controls the well pump speed to maintain that discharge rate (ie. as the water level drops in the well, the VFD speeds up the well pump to compensate). The water level in the well is constantly monitored by a down-hole level transducer, and if the water level gets too low (ie. too close to the well screen), the control system slows the well pump down to keep the water level from dropping below the top of the screen. Pumping the well at a constant flowrate and preventing the water level from dropping too low maximizes the efficiency of the well, and maximizes its service life between upgrades or rehabilitation.

4.3.3.2 Primary Production Wells (McDougal 1& 2, Flower Lane, 11th Street and Post Office)

As noted above, under the terms of the City's water rights, the Dayton-Lafayette wellfield wells are designated as secondary production sources, after full utilization of the City's other wells and springs. **Table 4–5** contains a summary of some of characteristics of the City's primary production wells.

Table 4-5 Well Summary, Primary Production Wells

Well → Well Information	McDougal Well 1	McDougal Well 2	Flower Lane	11th Street	Post Office
Date Drilled	1949	1970	1990	1977	1953
Yamhill County Well Log #	5280	465	125 1860/1861	5324	5338
Approximate Ground Elev	±184'	±186'	±163'	±167'	±157'
Well Depth	208'	219'	164'	135'	155'
Casing	10" to 120'	▪ 8" to 75' ▪ 6" to 219	8" to 105'	8" to 107'	10" to 155'
(S) Screen Interval or (P) Perforated Casing Interval	(P) 10" 92' to 209'	(P) 6" 140' to 150' 189' to 219'	(S) 7" 108' to 128' 150' to 155' 155' to 160'	(S) 8" 112' to 123' 123' to 128'	(P) 10" 73' to101' 117' to 131' 135' to 155'
Well Pump ▪ Type ▪ Diameter ▪ Motor size ▪ Motor speed ▪ Power ▪ Intake Depth (BGS) ▪ Motor Control	 ▪Submersible ▪__" ▪15 hp ▪__ rpm ▪__V, 3φ ▪__' ▪FVNR	 ▪Submersible ▪__" ▪10 hp ▪__ rpm ▪__V, 3φ ▪__' ▪FVNR	 ▪Submersible ▪__" ▪15 hp ▪__ rpm ▪__V, 3φ ▪154' ▪FVNR	 ▪Submersible ▪__" ▪7.5 hp ▪__ rpm ▪__V, 3φ ▪131' ▪FVNR	 ▪Submersible ▪__" ▪10 hp ▪__ rpm ▪__V, 3φ ▪__' ▪FVNR
Transducer depth (BGS)	__'	__'	__'	__'	__'
Onsite Treatment	None	None	None	None	None
Flow Meter	Yes (no telem)	Yes (no telem)	Yes (no telem)	Yes (no telem)	Yes (no telem)
Discharge Rate Control Technique	Manual Throttling Valve	Manual Throttling Valve	Manual Throttling Valve	Manual Throttling Valve	Manual Throttling Valve
Auxiliary Power	None	None	None	None	None
Discharge location	Watershed Waterline (flow to town & reservoir)	Watershed Waterline (flow to town & reservoir)	Raw water line to WTP	Raw water line to WTP	Courthouse Square Park irrigation
Telemetry to WTP?	No	No	Radio	No	No

Well pump information listed is based on City records, and was not field verified. Blanks in table represent unknown information that should be verified by the City. BGS = Below Ground Surface.

A short history & overview of each of the primary production wells is presented below.

4.3.3.2.1 McDougal Well 1 & Well 2

McDougal Wells 1 and 2 were installed in 1949 and 1970, respectively, and are located northeast of Dayton (north of Hwy 99W) near where Miller Creek crosses McDougal Road. McDougal Well 1 is located approximately 330 feet north of McDougal Road, with McDougal Well 2 being about 140 feet further north. Both wells are located on property owned by the City of Dayton (Tax Lot 4309-300, property acquired in 1949). McDougal Well 1 was originally provided with a 30 hp lineshaft turbine pump, but this was subsequently replaced by a 15 hp submersible turbine well pump.

Based on the 2004 Source Water Assessment Report prepared by ODWP, McDougal Well 1 & 2 were determined to be potentially susceptible to surface water contamination due to concerns with whether the well casings are adequately sealed down to an impermeable confining layer. The well log for the 1949 McDougal Well 1 has no information on the installation of a well seal (although it appears that the original well log was not filed as required, and a late registration was submitted about 5 years after the well was drilled, and may not be complete). The well log for the 1970 McDougal Well 2 lists insufficient cement to fill the annular space, and the casing is not extended far enough to avoid co-mingling water from two separate aquifers.

In 2006, the ODWP required the City to perform Microscopic Particulate (MPA) testing on the McDougal wells to confirm whether or not they were surface water influenced (GWUDI) sources. This testing was performed in 2007 and 2008 by GSI Water Solutions and City staff, and it was determined that the wells were not under the direct influence of surface water (see 7/7/08 GSI memo in **Appendix J**).

The watershed chlorination building is located just south of the McDougal Well 1, as discussed in a section below.

4.3.3.2.2 Flower Lane Well

The Flower Lane Well was installed 1990, and is located on the southwest side of the intersection of Flower Lane and Ash Road. The well is located on property owned by the First Baptist Church of Dayton (Tax Lot 432BB-1400 & 1500). This well discharges to a raw water pipeline that runs south along Flower to the WTP (where it is treated with the wellfield water due to high concentrations of iron and manganese). The Flower Lane well was constructed to supplement the Post Office well water right. In April 2010, the WRD approved a water rights transfer application which transferred a portion of the Post Office well water right to Flower Lane as an additional point of appropriation.

4.3.3.2.3 11th Street Well

The 11th Street Well (also referenced as Palmer well) was installed in 1977, and is located on the south side of Church Street east of 11th Street. This well is located on property owned by the City of Dayton (Tax Lot 4317CC-1025, property acquired in 1976). This well discharges to a raw water pipeline that runs west along Park Place and south along Flower to the WTP (where it is treated with the wellfield water due to high concentrations of iron and manganese).

4.3.3.2.4 Post Office Well

The Post Office Well (also referenced as Ferry Street well) was constructed in 1953, and is located on the north side of Ferry Street across from the Post Office. This well is located on property owned by the City of Dayton (Tax Lot 4317DB-7800, property acquired in 1954). This well also has high concentrations of iron and manganese, and also has a reported issue with hydrogen sulfide.

Although this well was historically connected directly to the water distribution system, it was typically only used during emergency conditions, due to taste and odor problems and the fact that it produced significant amounts of sand under some pumping conditions. The well was originally provided with a 30 hp lineshaft turbine pump, but this was subsequently replaced by a submersible turbine well pump. A sand trap tank was provided on the original well to minimize the injection of sand into the distribution system.

Currently, water from this well is currently being used solely for irrigating the Courthouse Square City Park. The well log for the Post Office well has no information on the installation of a well seal, and has been deemed by the ODWP as inadequate pending additional testing (per 2004 Source Water Assessment). Since the City does not use this well for domestic production, it has not proceeded with any testing that may be required to demonstrate whether the well seal is adequate.

A raw water pipeline from the Post Office well to the WTP was not constructed as part of the 2004 water project. Although the City apparently completed an emergency connection from the well to the Ferry Street distribution line in about 2008, the well has not been utilized for domestic use.

The City has not been able to locate the existing waterline between this well and the Courthouse Square irrigation system, nor even identify its alignment. It is anticipated that the irrigation line is of a similar vintage as the steel distributions lines that were replaced along Ferry Street (ie. from the 1930s), and needs to be replaced. However, since this line is not part of the drinking water system, cost estimates and replacement recommendations are not included in this report.

It should be noted that the majority of the water-right for this well was transferred to the Flower Lane Well (as a separate point of appropriation).

4.3.3.3 Secondary Production Wells (Dayton-Lafayette Wellfield Wells 1-5)

The joint Dayton-Lafayette Wellfield is located in the Dayton Prairie about 4 miles southwest of Dayton and 5 miles south of Lafayette (across Airport Road from the McMinnville Airport). Currently the wellfield has 5 wells which include methane strippers at each site. The improvements at Well 1 and 3 are owned by Dayton, while the improvements at Wells 2 and 4 are owned by Lafayette, and the improvements at Well 5 is jointly owned by both cities.

In addition to dissolved iron and manganese, all of the wellfield wells also contain dissolved methane. As such, methane strippers were installed at each of the well sites to provide on-site treatment and removal of methane. At each site, the well water is discharged into the onsite methane stripper, after which a booster pump at each site pushes the water through a common raw water pipeline to the WTP, where it is treated for iron and manganese removal, and chlorinated prior to discharge to the distribution system.

Table 4–6 contains a summary of some of important characteristics of the City's secondary production wells (wellfield wells).

Table 4-6 Well Summary, Secondary Production Wells

Well → Well Information	Wellfield Well 1	Wellfield Well 2	Wellfield Well 3	Wellfield Well 4	Wellfield Well 5
Date Drilled	1997	2008	2003	2003	2008
Yamhill County Well Log #	50702	55101	53392	53393	55102
Ground Elev (1929 datum)	±157'	±157'	±156'	±155'	±155'
Well Depth	275'	247'	275'	275'	196'
Casing	12"	10"	10"	10"	10"
(S) Screen Interval or (P) Perforated Casing Interval	(S) 12" 137' to 151' 169' to 177' 192' to 200' 204' to 219' 235' to 249' 254' to 265'	(S) 10" 193' to 218' 238' to 243'	(S) 10" 126' to 139' 142' to 148' 159' to 167' 172' to 174' 185' to 196' 214' to 217'	(S) 10" 136' to 170' 216' to 227' 258' to 264'	(S) 10" 158' to 188'
Well Pump ▪ Type ▪ Diameter ▪ Motor size ▪ Motor speed ▪ Power ▪ Intake Depth (BGS) ▪ Motor Control	 ▪Submersible ▪6" ▪20 hp ▪___ rpm ▪480V, 3φ ▪158' ▪FVNR	 ▪Submersible ▪6" ▪15 hp ▪3450 rpm ▪480V, 3φ ▪220' ▪ VFD	 ▪Submersible ▪6" ▪20 hp ▪___ pm ▪480V, 3φ ▪149' ▪FVNR	 ▪Submersible ▪6" ▪15 hp ▪3450rpm ▪480V, 3φ ▪173' ▪ VFD	 ▪Submersible ▪6" ▪15 hp ▪3450 rpm ▪480V, 3φ ▪193' ▪ VFD
Transducer depth (BGS)	137'	200'	142'	138'	182'
Onsite Treatment	Methane Stripper	Methane Stripper	Methane Stripper	Methane Stripper	Methane Stripper
Stripper Booster Pump ▪ Motor size ▪ Motor speed ▪ Power ▪ Motor Control	 ▪10 hp ▪3600 rpm ▪480V, 3φ ▪ VFD	 ▪15 hp ▪3600 rpm ▪480V, 3φ ▪ VFD	 ▪10 hp ▪3600 rpm ▪480V, 3φ ▪ VFD	 ▪10 hp ▪3600 rpm ▪480V, 3φ ▪ VFD	 ▪15 hp ▪3600 rpm ▪480V, 3φ ▪ VFD
Flow Meter	mag meter on stripper discharge	mag meter on well discharge	mag meter on stripper discharge	mag meter on well discharge	mag meter on well discharge
Discharge Rate Control Technique	Backpressure Valve & Manual Throttling Valve	VFD based on 4-20 mA signal from flow meter	Backpressure Valve & Manual Throttling Valve	VFD based on 4-20 mA signal from flow meter	VFD based on 4-20 mA signal from flow meter
Auxiliary Power	MTS	MTS	MTS	MTS	MTS
Discharge location	Raw water line to WTP	Raw water line to WTP	Raw water line to WTP	Raw water line to WTP	Raw water line to WTP
Telemetry to WTP?	Radio	Radio	Radio	Radio	Radio

Well pump information listed is based on City records, and was not field verified. Blanks in table represent unknown information that should be verified by the City. BGS = Below Ground Surface.

A short history & overview of the secondary production wells is presented below.

4.3.3.3.1 Wellfield Well 1

Wellfield Well 1 was drilled in 1977, and the wellhead improvements were completed as part of the 2003 water project. The well is located west of the Amity-Dayton Highway (Hwy 233) north of its intersection with Starr Quarry Road. This well is located on property that is owned by KCK Farms (KCK Partners LLC) (Tax Lot 4436-1100), within an easement to the City of Dayton (rec # 200307606). This well discharges to a raw water pipeline that runs due west to SE Airport Road adjacent to Well 2. Power for Well 1 is provided by PGE, fed from a power service from Amity-Dayton Highway (Hwy 233).

This well includes an on-site methane stripper to remove dissolved methane prior to the water being pumped to the WTP. The well discharge is currently controlled by the manual discharge rate control strategy (see 4.3.3.1), although the City is planning to upgrade this well to the automatic discharge rate control strategy in the near future.

4.3.3.3.2 Wellfield Well 2

Wellfield Well 2 was drilled in 2008, and the wellhead improvements were completed in 2009. The well is located on the east side of SE Airport Road due west from Well 1. This well is located on property owned by Evergreen Agriculture (Tax Lot 4436-0100), within an easement to both the City of Dayton and the City of Lafayette (rec # 200108467), subject to amendments to the easement recorded in 2006 (rec # 200625056). This well discharges to a common raw water pipeline that runs north along the west side of SE Airport Road toward Well 3. Power for Well 2 is provided by PGE, with the primary power line located in an easement with the raw water pipeline from Well 1 (ie. service from Amity-Dayton Highway).

This well includes an on-site methane stripper to remove dissolved methane prior to the water being pumped to the WTP. The well discharge is currently controlled by the automatic discharge rate control strategy (see 4.3.3.1).

4.3.3.3.3 Wellfield Well 3

Wellfield Well 3 was drilled in 2003, and the wellhead improvements were completed as part of the 2003 water project. The well is located on the east side of SE Airport Road north of Well 2. This well is located on property owned by Evergreen Agriculture (Tax Lot 4436-0400), within an easement to both the City of Dayton and the City of Lafayette (rec # 200108467), subject to amendments to the easement recorded in 2006 (rec # 200625056). This well discharges to a common raw water pipeline that runs north along the west side of SE Airport Road toward Well 4. Power for Well 3 is provided by McMinnville Water & Light, with the primary power line located in an easement along the west side of SE Airport Road.

This well includes an on-site methane stripper to remove dissolved methane prior to the water being pumped to the WTP. The well discharge is currently controlled by the manual discharge rate control strategy (see 4.3.3.1), although the City is planning to upgrade this well to the automatic discharge rate control strategy in the near future.

4.3.3.3.4 Wellfield Well 4

Wellfield Well 4 was drilled in 2003, and the wellhead improvements were completed as part of the 2003 water project. The well is located on the east side of SE Airport Road north of Well 3. This well is located on the same property as Well 3 (ie. owned by Evergreen Agriculture, Tax Lot 4436-0400), within an easement to both the City of Dayton and the City of Lafayette (rec # 200108467), subject to amendments to the easement recorded in 2006 (rec # 200625056). This well discharges to a common raw water pipeline that runs north along the west side of SE Airport Road toward Well 5 at Cruikshank Road. Power for Well 3 is provided by McMinnville Water & Light, with the primary power line located in an easement along the west side of SE Airport Road.

This well includes an on-site methane stripper to remove dissolved methane prior to the water being pumped to the WTP. The well discharge is currently controlled by the automatic discharge rate control strategy (see 4.3.3.1).

4.3.3.3.5 Wellfield Well 5

Wellfield Well 5 was drilled in 2008, and the wellhead improvements were completed in 2009. The well is located on the southeast corner of the intersection of SE Airport Road & Cruikshank Road. This well is located on the same property as Well 3 & 4 (ie. owned by Evergreen Agriculture, Tax Lot 4436-0400), within an easement to both the City of Dayton and the City of Lafayette (rec # 200108467), subject to amendments to the easement recorded in 2006 (rec # 200625056). In addition, there is a power easement to MW&L from Cruikshank Road to the stripper building (rec #200904986). This well discharges to a common raw water pipeline that runs east along Cruikshank Road toward Dayton. Power for Well 3 is provided by McMinnville Water & Light.

This well includes an on-site methane stripper to remove dissolved methane prior to the water being pumped to the WTP. The well discharge is currently controlled by the automatic discharge rate control strategy (see 4.3.3.1).

4.4 WATER TREATMENT

Dayton employs several treatment processes in various parts of the water system, including chlorination, methane strippers at the wellfield wells, a pressure filtration WTP in town, and a slow sand filter at the watershed springs.

4.4.1 Chlorination

Water from the various sources is chlorinated at two locations in order to maintain a disinfection residual in the distribution system (at the Dayton-Lafayette WTP, and just downhill from the McDougal wells).

4.4.1.1 Chlorination at the Dayton-Lafayette WTP

The first chlorination location is at the Dayton-Lafayette WTP. The water from the Wellfield wells and the in-town wells is chlorinated both prior to filtration, as well as after treatment by injection into the pipe line from the recirculation pump to the 1.5 MG ground storage reservoir. The WTP has an on-site hypochlorite generation system, with the liquid hypochlorite being stored in a tank next to the WTP. The WTP is equipped with an on-line chlorine residual analyzer (Hach CL17) utilized to monitor the chlorine residual at the point of entry to the distribution system.

4.4.1.2 Chlorination at McDougal Wells

The second chlorination location is the chlorine building adjacent to and downstream of the McDougal well. The chlorination building is partially below grade, and is accessed by steps. Chlorine (liquid hypochlorite) is injected into the watershed water as it passes through the watershed chlorination building on the way to the City (ie. on the downstream side of the flow meter in the watershed chlorination building). The discharge line from the two McDougal wells ties into the reservoir transmission main just upstream of the chlorination building, and well water flows either to the watershed reservoirs, or through the chlorination building to town. The current configuration does not appear to provide chlorination of the well water that flows from the wells up to the reservoirs. The injection rate of the chemical feed pump is manually adjusted. This location does not currently have a chlorine analyzer. There is currently no telemetry link between the watershed chlorination building and the WTP.

A discussion of requirements related to the required CT contact time at the first water service is contained under Section 4.6.6 below.

4.4.2 Corrosion Control

The City does not currently utilize any specific corrosion control measures.

4.4.3 Spring Area Slow Sand Filter

In a project that stretched from about 2006 through 2009, the City retrofitted the twin concrete tanks at the spring sites (tanks constructed in 1922) into a slow sand filter that is intended to filter the spring water prior to being conveyed to the storage reservoirs and disinfection. The spring water flows first through a small (±9'x7'x4' deep) junction structure, and then on the first concrete tank (±24'x30'x9' deep, ±48,000 gallons full) which contains the sand filter, and then to the second tank (±33'x42'x9' deep, ±93,000 gallons full) which is a clearwell (receiving the filtered water).

This filter was not required by the ODWP, and unfortunately the plans for these improvements were not submitted to the ODWP for review & approval prior to construction. A letter dated October 19, 2006 from DHS to PacWest Engineering acknowledged that they had received the plans for a slow sand filter system (after construction), and that in order for the project to be approved the City must provide operational testing to demonstrate that the sand filter performed as required. After a problem with the gradation of the initial sand utilized was corrected (ie. original sand was removed & replaced), the filter was put on-line in early 2009. The ODWP allowed the filter to remain in service, but required additional raw and finished water sampling until such time as the design was confirmed and approved by ODWP.

It appears that the slow sand filter design did not conform with the accepted design standards for slow sand filters treating surface water or a GWUDI groundwater source. Among the major design issues include the following (based on *Manual of Design for Slow Sand Filtration, AWWA Research Foundation, 1991*, as well as OAR 333-061-0032.4&5 and OAR 333-061-0050.4.c).

- Per the design, there is only 6-inches of head available to drive the water through the filter. This is the elevation difference between a full filter and the discharge pipe into the basin adjacent to the filter. Typically, slow sand filters have 4 to 5 FEET of available head to drive the water through the filter. When the filter is clean, there may only be 1 foot of water over the filter, but as the filter begins to form the smutzdecke (biologically active top sand layer), more head is required and then the filter is typically cleaned when the head is at the maximum level, usually 4 to 5 feet above the sand.

- It is not possible to lower the water level in the second tank (ie. finish water clearwell) in order to provide additional head through the sand filter (the overflow elevation of the main watershed reservoirs is approximately the same as the overflow elevation of the sand filter tanks), without significantly decreasing the available storage in the watershed. Even if a pump were installed to pump water from the clearwell tank to the watershed reservoirs, the tanks are sufficiently deep to provide the required filter bed thickness, maintain minimum water level over the filter bed, and provide the 4 to 5 feet of head required to maintain design flows through the filter bed over time (per the AWWA design guide, the clearwell water level must be maintained at a minimum of 1 foot above the top of the sand in the adjacent filter bed).
- The underdrain system is slotted ADS storm pipe. Based on manufacturer's data, the slots are 0.125" wide x 0.875" long, with 54 slots per foot. This gives over 14,000 orifice openings based on the design underdrain lengths. With that many openings and only flowing 50 gpm, the headloss through the orifice slots is insignificant. By contrast, slow sand filter design requires *"designing the orifice area/conduit area ratio such that headloss within the underdrain is negligible relative to the orifice"* [AWWA p108], or in other words, the headloss through the orifices must be significantly greater than the headloss through the underdrain system (so that the underdrain system collects water evenly across the filter).
- The design flowrate for the slow sand filter was 50 gpm, while the maximum recorded winter flows from these springs is approximately 140 gpm, and the City's water-right for these springs is approximately 115 gpm. Therefore, the sand filter cannot accommodate the peak spring flows without exceeding the design filter rate.
- Pilot testing was not performed as required by OAR 333-061-0050.4.C, and to date it has not been demonstrated that the filter can provide the required log removal efficiency for surface water or GWUDI spring water.

In addition to the design issues with the existing slow sand filter system, there are several other issues related to the existing structures and surrounding area that need attention by the City.

- The roofs on the 3 spring area structures are old and in need of repair.
- The junction structure has a moss covered shingle roof in need of repair and replacement.
- The two main filter structures have open wall wood frame walls covered with wire mesh fabric, topped by wood trusses and corrugated metal roofing. The roofing appears to be in reasonable condition. However, the two roofs slope to a gutter over the common center wall between the two tanks. If the gutter is not consistently maintained and cleaned out, it is possible for the gutter overflow to flow through the joint between the two roofs and into the filter tanks.
- At some locations, the top of the concrete walls is only a few inches above surrounding grade. Regrading the areas along the uphill edge and the sides of the tank to provide additional freeboard to protect against splashing water is recommended.
- There are a significant number of very large trees that have grown up during the 100 years since the lease was originally executed. Some of these trees are located close to the sand filter structures and

are close enough to the filter structures to cause damage if they fell, and some are either overhanging the filter structures, leaning toward the structures, or have visible root damage. The City should remove all trees that are large enough or close enough to the filter buildings to damage or destroy the roof when they fall, as soon as feasible.

- As with the springs themselves, the filter structures, as well as the waterline between the filter structures and the watershed reservoirs, are located on property that is not currently owned by the City, and for which the current lease expires in 2012. Continued use of the filter structures and associated waterlines will require that the lease, purchase or easement acquisition issues be addressed (summarized under the Lower Spring area discussion above).

There is currently no telemetry link between the WTP and the slow sand filter site.

4.4.4 Dayton-Lafayette WTP & Pump Station

The joint Dayton-Lafayette treatment facilities and pump station were placed in service in July 2004. The treatment facilities consist of pressure filters designed to remove iron and manganese from the Dayton-Lafayette wellfield wells (and in-town wells). The WTP also provides disinfection prior to distribution, and contains the service pumps that pressurize the Dayton distribution system (as well as the transfer pumps that send water to Lafayette). The Dayton-Lafayette wellfield wells contain dissolved methane, which is removed at each wellhead via air stripping prior to being pumped to the treatment plant.

The Dayton-Lafayette treatment plant is automatically controlled by a PLC/computer system and a SCADA system. The system controls all aspects of treatment plant operation plus the operation of the wellfield wells and in-town wells (except for the Post Office Well). The SCADA system also communicates with the new Pressure Reducing Valve (PRV) station on the watershed transmission main, and monitors the water level in the watershed reservoirs. There is also a radio telemetry link to the Lafayette watershed control building to monitor the Lafayette reservoir level and allow the SCADA system to automatically control the Lafayette transfer pumps as required.

The Dayton-Lafayette treatment plant was originally constructed based on the assumption that the wellfield wells would each produce approximately 300 gpm each, which would have provided the required flow to adequately and reliably backwash the pressure filters. However, the actual production rates of the Wellfield wells is significantly lower than was originally anticipated. Therefore, unless all of the Wellfield wells are operational and producing at optimum flowrates, the flow from the wells may be less than is required to backwash the pressure filters. Please refer to Chapter 7 for our recommendations on improvements to address this issue.

Figure 4-6 is a basic schematic of the Dayton WTP. A summary of some of the design characteristics of the WTP are listed in **Table 4-7**.

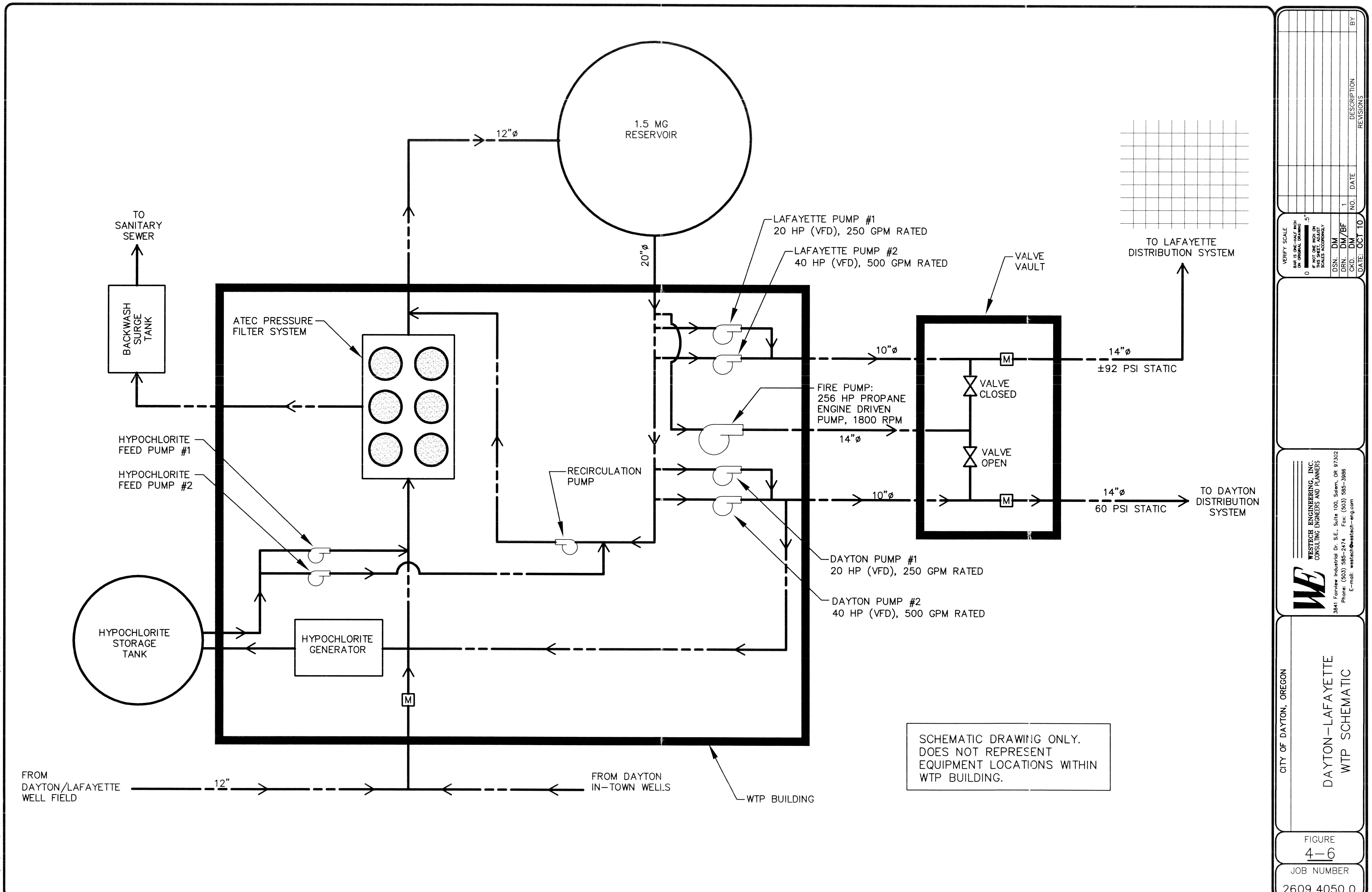

1.5 MG
RESERVOIR
12"ø
20"ø
TO
SANITARY
SEWER
BACKWASH
SURGE
TANK
ATEC PRESSURE
FILTER SYSTEM
HYPOCHLORITE
FEED PUMP #1
HYPOCHLORITE
FEED PUMP #2
RECIRCULATION
PUMP
HYPOCHLORITE
STORAGE
TANK
HYPOCHLORITE
GENERATOR
LAFAYETTE PUMP #1
20 HP (VFD), 250 GPM RATED
LAFAYETTE PUMP #2
40 HP (VFD), 500 GPM RATED
FIRE PUMP:
256 HP PROPANE
ENGINE DRIVEN
PUMP, 1800 RPM
14"ø
10"ø
DAYTON PUMP #1
20 HP (VFD), 250 GPM RATED
DAYTON PUMP #2
40 HP (VFD), 500 GPM RATED
VALVE
VAULT
VALVE
CLOSED
VALVE
OPEN
TO LAFAYETTE
DISTRIBUTION SYSTEM
14"ø
±92 PSI STATIC
14"ø
60 PSI STATIC
TO DAYTON
DISTRIBUTION
SYSTEM
FROM
DAYTON/LAFAYETTE
WELL FIELD
12"
FROM DAYTON
IN-TOWN WELLS
WTP BUILDING
SCHEMATIC DRAWING ONLY.
DOES NOT REPRESENT
EQUIPMENT LOCATIONS WITHIN
WTP BUILDING.
NO. DATE DESCRIPTION BY
REVISIONS
VERIFY SCALE
DSN. DM
DRN. DM/BF
CKD. DM
DATE: OCT 10
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com
CITY OF DAYTON, OREGON
DAYTON–LAFAYETTE
WTP SCHEMATIC
FIGURE
4–6
JOB NUMBER
2609.4050.0

Table 4-7 WTP General Operating & Design Criteria

Process System	**Design Criteria**
Raw Water Sources	Estimated Long Term Prod Rate (gpm)
Wellfield Wells	
Well 1	40 gpm
Well 2	40 gpm (Lafayette)
Well 3	90 gpm
Well 4	70 gpm (Lafayette)
Well 5	60 gpm (50% Lafayette)
In-Town Wells	
Flower Lane Well	25 gpm
11th Street Well	25 gpm
Current estimated sustained raw water inflow rate	350 gpm
Pressure Filter System	
Filter manufacturer	ATEC Systems
Parallel filter banks (skid mounted)	1 bank installed Piped for installation of 2nd
Filters per filter bank	6
Filter	-
Underdrain system	Stainless steel wedge wire screens
Base layer	3/8-3/4 washed rock
Filter media	AS-741M granular Magnesium Dioxide (MnO_2) on a pyrolusite base (adsorption)
Media depth	36"
Media volume (ft^3 for one filter)	37.71
Filter design criteria	-
Filter flow type	Down-flow
Filter Dimensions	-
Sidewall diameter	48"
Sidewall height	60"
Filter area (per filter)	12.57 sf
Filter Design Service Conditions	-
Design filtration rate	9.6 gpm/sf
Total WTP capacity	750 gpm
Capacity per filter tank	125 gpm
Influent iron	±0.32 mg/L
Influent manganese	±0.894 mg/L
Water temperature range	45-60°F
pH range	6-7
System operating pressure	≥45 psi
Treated Water Objective	-
Effluent iron	<0.01 mg/L
Effluent manganese	<0.01 mg/L
Free Chlorine Residual	≥0.5 mg/L

Raw Water Pretreatment	-
Hypochlorite	2.0 mg/L recommended to maintain continuous regeneration of filter media
Potassium Permanganate	___ mg/L
Filter Control Valve Type	Pneumatic
Finished water discharge location	Pipeline to reservoir
Backwash	
Backwash water source	Filtered water from other 5 filters
Backwash flow type	Up-flow
Filter backwash rate	24-27 gpm/sf
Backwash flowrate	301-340 gpm per one tank
Design backwash duration	±4 minutes/tank (adjustable)
Design backwash volume	1200-1360 gallons
Backwash initiation	Timer or pressure differential
Backwash cycle design intervals	2/day typical
Backwash discharge location	Backwash surge tank
Sodium Hypochlorite System	
System Type	On-site generation (brine electrolysis)
Hypochlorite form	___ % solution
Storage tank capacity	2500 gallon
Injection Points	-
Filter influent	target = 0.5 to 1.0 mg/L through filter
Reservoir recirculation pump	target = 1.0 mg/L in reservoir
Finished Water Pumps	
Flow & Pressure Measurement	-
Dayton Meter (in yard vault)	Magnetic flowtube
Dayton Pressure Sensor (in yard vault) for control of Dayton distribution pumps	Transducer
Lafayette Meter (in yard vault)	Magnetic flowtube
Dayton Distribution Pumps	-
Static pressure @ pump discharge	±60 psi
Number	2
Pump Type	Vertical-Mounted End-Suction Centrifugal
Motor	Electric, 480V, 3φ
Driver Type	VFD
Pump Capacity	-
Dayton Distribution Pump 1	250 gpm @ 197' TDH (20 hp) PACO 1.1 LCV Series, s/n 32454
Dayton Distribution Pump 2	500 gpm @ 197' TDH (40 hp) PACO 1.1 LCV Series, s/n 32456
Dayton Distribution Pump 3	Future (40 hp assumed)
Pump Speed Control by pressure	60 psi target pressure

Dayton Fire Pump	-
Static pressure @ pump discharge	±60 psi
Number	1
Pump Type	End Suction Centrifugal
Motor	Gas (propane), 256 hp
Driver Type	Engine governor (1800 rpm)
Pump Capacity	4830 gpm @ 172' TDH (±74.5 psi) 3000 gpm @ 200' TDH (±86.5 psi) Shutoff head = 210' (±91 psi)
Dayton Reservoir Recirculation Pump	-
Number	1
Pump Type	End Suction Centrifugal
Motor	Electric, 3 hp, 480V, 3φ
Driver Type	FVNR
Pump Capacity	450 gpm @ 7' TDH
Lafayette Transfer Pumps	-
Static pressure @ pump discharge	93 psi
Number	2
Type	End Suction Centrifugal
Motor	Electric, 480V, 3φ
Driver Type	VFD
Pump Capacity	-
Lafayette Transfer Pump 1	±213 gpm (25 hp) (full speed, reservoir full) PACO 1.1 LCV Series, s/n ____
Lafayette Transfer Pump 2	±325 gpm (50 hp) (full speed, reservoir full) PACO 1.1 LCV Series, s/n ____
Lafayette Transfer Pump 3	Future (50 hp assumed)
Pump Speed Control	Manually set by flowrate
Finish Floor Elevations	-
WTP building	161.5'
WTP reservoir	161.2'
Auxiliary Power	
Type	Trailer Mounted, Diesel Powered
Size	125 KW, 480 V, 3φ
Fuel Tank Size & Tank Run Time	__ gallon on trailer __ hrs @ 100% load __ hrs @ 50% load
Minimum Equipment to Run	Dayton distribution pumps (both), Lafayette transfer pumps (smaller pump), Reservoir recirculation pump, Fire pump controls, WTP filters, equipment & controls, hypochlorite system, etc.
Equipment excluded `	Lafayette transfer pump #2 (larger pump), Future Dayton distribution pump, Future Lafayette transfer pump

4.4.4.1 WTP Pressure Filter System

The pressure filter system includes six pressure filter tanks filled with granular media. Each tank is supplied with pneumatic valves that are controlled to operate the filters in either a filtration or a backwashing mode. Pressure filter tanks backwash one tank at a time (the other five filter tanks remain on-line). During backwashing, the pressurized, filtered water discharging from the other five operating filters is used to backwash the specified filter tank. Backwash water flows to a backwash surge tank located adjacent to the water treatment plant building. The backwash tank discharge flows to the gravity sewer system.

Sodium hypochlorite solution is added upstream of the pressure filtration tanks to provide disinfection and to regenerate the filter media. Chlorination also provides residual chlorine in the filters to ensure that iron and manganese bacteria, which may be present in the well water, don't grow in the filters. Early chlorination also provides a residual in the reservoir and water distribution system. When operated in the automatic mode, chlorine addition is flow paced based on the influent flowrate to the WTP. If chlorine residuals downstream of the filters fall below setpoint concentrations, chlorine addition can be provided at locations downstream of the filters, on the line from the recirculation pump.

4.4.4.1.1 Filter Tanks & Filter Media

The pressure filtration system includes six 48-inch diameter welded steel pressure vessels filled with a granular media which has oxidizing and catalytic properties and was selected based on its ability to remove iron and manganese. The six pressure filters have a total filtration capacity of 750 gpm and require approximately 350 gpm minimum of backwash water to backwash each filter tank individually. Piping and valves were installed in the WTP building to allow six additional pressure filters to be added in the future (ie. same configuration as the existing filter bank).

The filter media is a pyrolusite type media which provides iron and manganese removal by oxidation and adsorption. By providing a free residual chlorine of approximately 1.0 mg/L through the filters, the oxide surface of the filter media is continually regenerated, maintaining its adsorption capacity.

The WTP has problems backwashing the pressure filters when the Dayton-Lafayette wellfield well production is very low. As illustrated in **Table 4-7**, the recommended long term pumping rate of the Wellfield wells, Flower Lane well and the 11th Street well combined is 350 gpm (assuming all wells are on-line and producing at their full long-term production capacity), while the required backwash rate for a single filter is also 350 gpm. If any of the wells are offline for any reason, the pressure filters are poorly backwashed due to the low flow rates available. Backwashing is very important to successfully clean the media bed, allowing the contaminants to be removed. If the backwash flow rate is too low, the media beds will not be fluidize properly, leaving many of the contaminants in the filter bed (as well as leading to media clumping), eventually leading to poor filtration and premature media replacement.

4.4.4.2 Dayton Distribution Pumps

The Dayton distribution pumps that pressurize the Dayton distribution system are controlled based on the pressure as measured in the valve vault in the WTP yard. The Dayton distribution pumps are set to maintain 60 psi at the WTP valve vault via the VFD controllers on the Dayton distribution pumps (ie. 59.6 to 60 psi). The pressure setpoints are adjustable through the WTP SCADA system. During automatic operation, the lower capacity (250 gpm) pump is started first and its speed is ramped up as required to maintain system pressure. If the discharge from the smaller pump is insufficient to meet demand, the pump flow is reduced slightly as the larger (500 gpm) pump is started in order to provide a smooth pressure transition in the system.

The valve vault in the WTP yard contains the flow meter that monitors the discharge from the Dayton distribution and fire pumps.

4.4.4.3 Dayton Fire Pump

The pressure transducer in the valve vault is also used to control the startup of the WTP fire pump, as summarized below. The fire pump (run by a 256-hp gas powered Cummins' engine) delivers fire flows to the Dayton distribution system during fires or other periods of elevated demand. The fire pump is started based on system pressure. The fire pump start is typically set at 45 psi, and the fire pump is typically on-line and pumping within 10-15 seconds. Once the fire pump is started, the pressure is no longer a variable used in the logic control of the fire pump. Once started, the fire pump is designed to full speed until the flowrate (measured by the meter in the valve vault) is reduced to a point where the Dayton distribution pumps can keep up (typically 250 gpm, which matches the rated capacity of the smaller of the Dayton distribution pumps). These start and stop setpoints are adjustable through the WTP SCADA system. Since the shutoff head of the fire pump is about 90 psi, this operational methodology can result in higher system pressures at the WTP while the fire pump is in operation (which will typically result in the Dayton distribution pumps turning off), but once the flow drops below 250 gpm and the fire pump goes off-line, the Dayton distribution pumps will return to service and keep the system pressure at about 60 psi.

For reasons that are not immediately apparent, the fire flows measured in the distribution system are significantly less than would be expected based on the rated flow-head curve of the fire pump provided. The City should troubleshoot the cause of this discrepancy and determine what can be done to resolve it. Please refer to Chapter 7 & 8 for our recommendations.

One issue that bears reiteration is the question as to whether the fire pump in the WTP is designed to provide fire flows to Lafayette as well as to Dayton. The answer to this question is that the fire pump was **NOT** designed to pump water to Lafayette. Since the fire pump has a shutoff head of ±91 psi, and the static pressure at the Dayton WTP on the Lafayette transmission main is ±93 psi (assuming Lafayette reservoir is full), the static pressure (ie. no flow conditions) exceeds the maximum head that can be produced by the Dayton fire pump. Therefore, the existing fire pump is not capable of pumping any water to the Lafayette system under normal pressure conditions.

While there is valving in the WTP yard vault between the Dayton and Lafayette transmission mains, from a review of the 2004 water project documentation, it appears that this interconnect was used to supply water from the Lafayette system during the filling and testing of the new WTP piping and the new Dayton distribution piping. This interconnection cannot be used to send water to Lafayette in an emergency situation, since the static pressure of the Lafayette system is so much higher than the Dayton system.

4.4.4.4 Lafayette Transfer Pumps

The WTP also includes transfer pumps that send water to the Lafayette distribution system (through a transmission main owned by the City of Lafayette, which runs along Flower Lane, Ash Road and the Lafayette Hwy). As noted above, the static pressure (at the WTP) for the Lafayette transmission main is about 33 psi higher than the pressure in the Dayton distribution system (ie. ±93 psi versus 60 psi). The Lafayette transfer pumps are therefore higher head pumps than the Dayton distribution pumps, and are not interchangeable. As noted above, the Dayton pumps (both the Dayton distribution pumps and the Dayton fire pump) are NOT capable of pumping to the Lafayette system except under critical emergency conditions (such as if the Lafayette reservoir were either empty or off-line). The flowrate for the Lafayette transfer pumps is currently set manually (adjustment of the VFD based on the discharge flow meter).

4.4.4.5 Finished Water Quality

The City's finished water quality from the Dayton-Lafayette WTP is generally good. As required by the ODWP, water from the City water system is tested periodically for bacteriological contamination, organic and inorganic chemical contaminants, disinfection byproducts, and a variety of radioactive compounds.

Based on conversations with City personnel there does not currently appear to be any known problems with water quality under normal conditions.

4.5 WATER STORAGE

Water storage reservoirs provide at least four important functions as follows:

- They provide a reservoir of water to draw upon during short-term peak system consumption.
- They provide a reserve supply of water to meet fire demands.
- They allow water sources to be taken out of service for repairs or maintenance.
- They help in keeping system pressures reasonably constant.

The City presently has three water storage reservoirs (excluding the clearwell structure at the watershed sand filter). The main reservoir is a ground storage tank located adjacent to the Dayton-Lafayette water treatment plant, while the other two reservoirs are located in the watershed, for a total combined storage of 2.265 million gallons.

The evaluation of the storage capacity and hydraulic performance is presented in Chapter 9.

4.5.1 Ground Storage (WTP 1.5 MG Reservoir)

The City's main reservoir is also the newest, completed in 2003 in conjunction with the WTP construction, and located adjacent to the Dayton-Lafayette WTP. This reservoir is a 1.5 million gallon welded steel tank with a diameter of 94 feet, a water depth of 28.75 feet (sidewall height of 32'), a bottom elevation of 161.2 and an overflow elevation of approximately 189.95 (±3.25 feet below the top of the side walls). The reservoir has two floor penetrations (an inlet and an outlet), as well as an overflow pipe. The outlet is shown with a 6" tall silt ring.

Overflow piping consists of an internal weir and drain piping that is external to the reservoir, and discharges overland to the drainage swale east of the reservoir. The water level in this reservoir is monitored with the use of a mechanical half-travel level indicator, as well as a level transmitter connected to the WTP SCADA system.

This reservoir is set entirely above grade, and vehicular access is available to all sides of the reservoir. Water from the reservoir is pumped into the Dayton distribution system or the Lafayette transmission line by pumps equipped with VFDs.

4.5.2 Watershed Storage Reservoirs

The City has two main storage reservoirs are located in the City watershed northeast of town. Both watershed reservoirs are located below the spring area, but above the McDougal wells and the chlorination building. In addition, there is an old covered tank at the spring area that functions as the clearwell for the sand filter discharge (and also provides some storage volume). The watershed reservoirs are connected to Dayton by an 8-inch steel transmission main. Water from these reservoirs flows to Dayton by gravity, and passes through the PRV station prior to entering the main Dayton in-town distribution system. A short description of each of the watershed reservoirs is presented below.

The two main watershed reservoirs are located adjacent to each other, and share a common overflow elevation. However, since these reservoirs are different depths, the smaller (ie. shorter) concrete reservoir is empty when the taller steel reservoir is still about half full. The old tank at the spring area is also shallower than the main steel reservoir, and is empty when the taller steel reservoir is still about half full.

Due to the difference in reservoir depths, the majority of the storage volume is located in the upper half of the reservoir height of the taller tank (ie. when the steel reservoir is half full, there is only about 35% of the total storage volume remaining). It should be noted that for purposes of storage capacity evaluation, the existing tank at the spring site were not considered, as its primary purpose is currently as a clearwell for the spring slow sand filter.

4.5.2.1 165,000 Gallon Concrete Reservoir

The older of the main watershed reservoirs is a rectangular cast-in-place concrete tank (with a concrete roof) constructed in 1974, with a capacity of 165,000 gallons. The reservoir has inside dimensions of about 61.7 feet long and 39 feet wide, with a water depth of 9 feet. This reservoir has separate inlet and outlet pipes, with the inlet located near the southeast corner, and the outlet pipe located at the center of the tank. There is no separate overflow for this reservoir (this reservoir shares a common overflow point in the 600,000 gallon reservoir). There is no separate water level measurement for this reservoir (water level is monitored based on the 600,000 gallon reservoir as discussed below).

This reservoir is set partially below grade, with the roof on the uphill side being approximately 30-inches above grade. Vehicular and maintenance access is available to all sides of the reservoir. This reservoir is located on property owned by the City of Dayton (Tax Lot 4304-01900).

4.5.2.2 600,000 Gallon Steel Reservoir

The newer of the main watershed reservoirs is a cylindrical, welded steel tank constructed in 1980, and located about 75 feet east of the concrete reservoir.

This reservoir is a welded steel tank with a diameter of 68 feet, a water depth of 22 feet (sidewall height of 23 feet), a bottom elevation of 374 feet and an overflow elevation of approximately 396 feet. The reservoir has a single floor penetration for a common inlet and outlet, as well as an overflow pipe. The inlet/outlet is shown with a 10" tall silt ring.

Overflow piping consists of a weir and drain piping that is internal to the reservoir, and discharges to the storm drain pipe that flows to Miller Creek south of the reservoir site.

The water level in this reservoir is monitored with the use of a mechanical half-travel level indicator, as well as a level transmitter connected to the WTP SCADA system. Since there is no power to the reservoir site, a solar power system provides power for the level transducer, as well as the SCADA controller and radios. The telemetry panel has provisions to connect a small gas powered generator in the event that the solar cells cannot keep the batteries charges (ie. due to snow, ice, prolonged heavy overcast, etc.).

This reservoir is set entirely above grade, with vehicular and maintenance access is available to all sides of the reservoir. This reservoir is located on property owned by the City of Dayton (Tax Lot 4304-01900).

4.5.2.3 93,000 Gallon Spring Sand Filter Clearwell Tank

The existing tank located on the downhill side of the access road for the watershed springs, and is located approximately 800 feet north of the main reservoir site.

As was noted under Section 4.4.3 above, the clearwell tank at the spring sand filters is an open topped, rectangular cast-in-place concrete tank constructed in 1922, with a capacity of approximately 93,000 gallons. The tank is about 24 feet wide and 30 feet long, with a water depth of about 9 feet, and shares a common wall with the smaller sand filter tank. Both tank structures have open wall wood frame walls covered with wire mesh fabric, topped by wood trusses and corrugated metal roofing that slopes to a gutter over the common center wall between the two tanks.

Based on an old survey, it appears that the top of the walls of this tank are approximately the same elevation as the main reservoir overflow elevations. The tank outlet connects to the 8-inch steel transmission line that runs to the main reservoir site, and thence on to town. There is no water level measurement for this reservoir (other than visual observation of the water level).

This tank is set partially below grade, with the top of the concrete walls is only a few inches above surrounding grade in some locations. Vehicular and maintenance access is available to only two sides of the tank. This tank is located on property which is leased by the City of Dayton (Tax Lot 4304-01700) as discussed in Section 4.4.3 above.

4.6 DISTRIBUTION SYSTEM

Based on City records, the City's original water distribution system was installed in 1904, with significant modifications in the 1930s and later. With the exception of the transmissions mains from the watershed area and the wellfield area, the system is predominantly a looped network and is constructed largely within the public road rights-of-way.

4.6.1 Pipe Network

The major components of the water distribution system are shown in the figures and maps in Chapter 4.

Although all public waterlines within the study area are owned by the City, there are three separate entities which have jurisdiction over the right-of-ways within which the water mainlines are located. In addition to the City, the Oregon Department of Transportation (ODOT) has jurisdictional oversight for

1 - 8½ x 11

color

4-38, 4-39

facilities constructed within or along 3rd Street, Ferry Street, Hwy 18 or Hwy 99W, while Yamhill County has jurisdictional oversight for facilities constructed within County right-of-ways.

The current transmission system consists of a mix of PVC, ductile/cast iron, dipped & wrapped steel and galvanized steel. Many of the old steel pipelines within town were replaced in the 2003/04 water project. Many of the remaining steel pipelines date from the 1930s to 1950s, and are beyond the end of their service life and are in need of replacement. The distribution system (exclusive of the Wellfield & Watershed transmission mains) is comprised of ±11.8 miles of pipe, inventoried by pipe material and pipe diameter as shown in **Figure 4-7** and **Figure 4-8**.

Figure 4-7 Distribution Pipe Inventory by Material Type

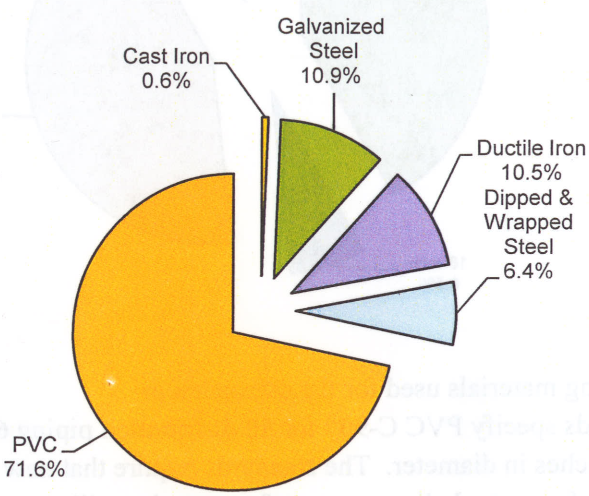
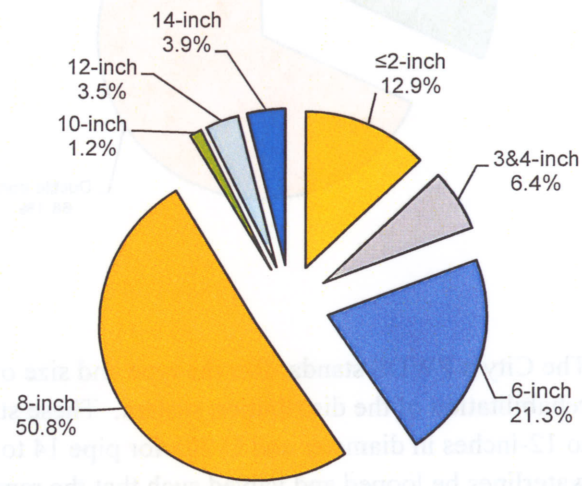


Figure 4-8 Distribution Pipe Inventory by Diameter



The Wellfield transmission main is comprised of the following pipe sizes and approximate lengths (±3.67 miles).

- 6" DI - 2,490' (Well 1 to Well 2)
- 8" DI – 1,950' (Well 2 to Well 3)
- 10" DI – 2,000' (Well 3 to Well 4)
- 12" DI – 12,890' (Well 4 to WTP)

The Watershed transmission main (springs to the PRV station) is comprised of the following pipe sizes and approximate lengths (±2.16 miles).

- 8" Steel - 800' (springs to reservoir)
- 8" PVC – 250' (reservoirs to transmission main)
- 8" Steel – 8,750' (reservoir site to town, excluding the DI pipe at McDougal Corner)
- 8" DI – 1,600' (Hwy 99W & railroad crossing @ McDougal Corner)

The transmission main system (ie. the Wellfield & Watershed transmission mains) is comprised of ±5.82 miles of pipe, inventoried by pipe material and pipe diameter as shown in **Figure 4-9** and **Figure 4-10**.

Figure 4-9 Transmission Pipe Inventory by Material Type

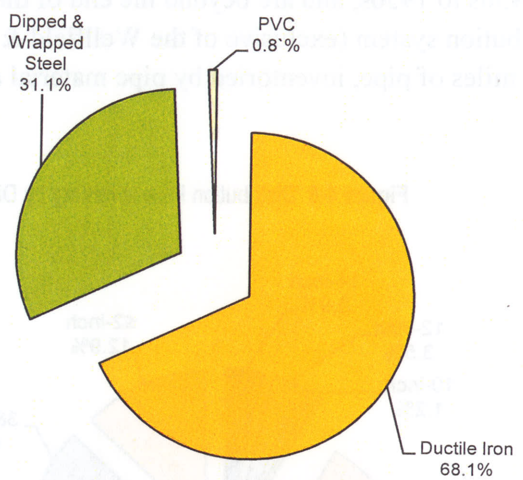
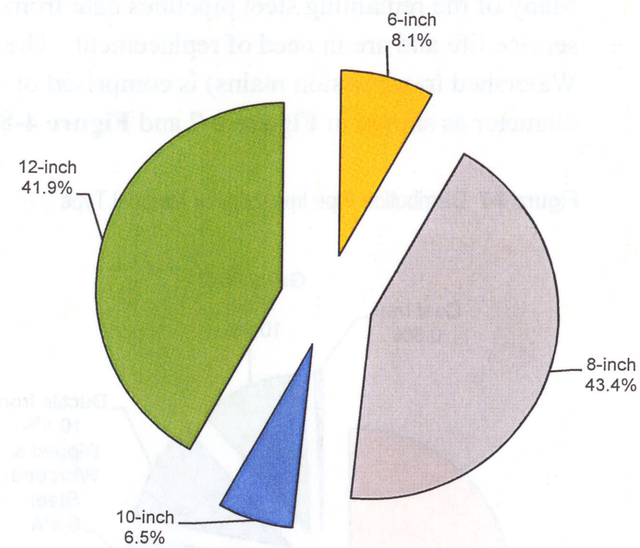


Figure 4-10 Transmission Pipe Inventory by Diameter



The City's PWDS standardize the type and size of piping materials used for the expansion or rehabilitation of the distribution system. These standards specify PVC C-900 for all distribution piping 6 to 12-inches in diameter and C-905 for pipe 14 to 24-inches in diameter. The standards require that new waterlines be looped and valved such that the removal of any single line segment from service will typically not result in more than one fire hydrant being taken out of service.

The layout of the existing water system appears to be adequate to deliver the required domestic flow rates to the community. However, some portions of the system do not have the capacity to deliver required fire flows while maintaining the required 20 psi residual pressure at all service connections. This lack of capacity is the result of the configuration of the distribution system and the undersized pipes that lack conveyance capacity.

Much of the older pipe in the distribution system does not meet the current standards, either for size or material type. As extensions, repairs or alterations are made to the undersized portions of the distribution system, it is advisable that the new components conform to the current standards and conform with size recommendations as discussed under recommended distribution improvements in Chapter 8.

The following discussion relates to specific unique features of the Dayton distribution system which require discussion and attention.

4.6.2 Water Service Levels

Water must be supplied to the customers at sufficiently high pressures to prevent contamination and to ensure that appliances operate correctly. Excessive pressures must also be avoided to prevent damage to the distribution system and private plumbing fixtures. City standards provide for a typical water pressure range between 40 and 100 psi. The City currently has two water service levels, consisting of the main Dayton Service Level and the Watershed Service Level, with the Watershed Service Level being the higher pressure zone.

The Dayton Service Level encompasses the majority service area, including all of Dayton west of the Yamhill River, as well as the RV Park and residences on the east bank of the Yamhill River. The Main Service Level currently has static pressures ranging from approximately 60 to 80 psi (elevations range from approximately 110 feet to 160 feet).

The Watershed Service Level encompasses the area from the watershed down to the PRV Station (east of the Yamhill River). The Watershed Service Level provides water to businesses and residential homes located near the intersection of Hwy 18 & Hwy 99W (McDougal Corner), as well as along McDougal Road.

No changes are anticipated to the City's current water service level configuration.

4.6.3 Watershed PRV Station

The City of Dayton has one PRV station (Watershed PRV Station), located east of the Yamhill River on Kreder Road near the center of the wastewater lagoon frontage. The original PRV was constructed along with the mainline from the watershed about 80 years ago. In 2009, the City replaced the old PRV with a new automated PRV Station that is tied to the WTP through the SCADA system.

The PRV station is an above grade facility located in an insulated weatherproof enclosure. To accommodate various flow rates, the PRV station consists of a 6" main PRV, as well as a 2" bypass PVC. Since failure of the PRV diaphragm will result in over-pressurization of the in-town distribution system, the PRV station is also provided with a pressure relief valve with a limit switch (limit switch triggers an alarm callout in the event of a failure of the PRV valve). The PRV station is also provided with a magnetic flow meter to monitor the amount of water conveyed from the watershed to the in-town distribution system. The PRV inlet & outlet piping was sized to accommodate the future 12-inch waterline from the watershed area to town.

The new PRV Station has the capability to adjust pressures (and associated flow rates) remotely though the SCADA system, in order to optimize use of the watershed sources (as required by the City's water rights). There is also a radio telemetry link to the Watershed reservoirs to allow the PRV to automatically close in the event that the Watershed reservoir levels drop too low.

4.6.4 Waterline Bridge, River or Stream Crossings

There are four locations in Dayton where water mainlines cross rivers, streams or bridges. These include the Yamhill River crossing (the transmission line from the Watershed), the Hwy 221/3rd Street bridge crossing over Palmer Creek (transmission main), a pipeline crossing under Palmer Creek east of the Hwy 221 Bridge (distribution line), and a pipeline crossing Hwy 18 at the Fletcher Road overpass (distribution line). A short discussion of these crossings follows.

4.6.4.1 Yamhill River Bridge Crossing (Ferry Street Bridge)

As shown in **Figure 4-2**, the transmission main from the Watershed area crosses the Yamhill River, suspended under a pedestrian footbridge located at the east end of Ferry Street. The pedestrian footbridge is a 540-foot long wooden suspension bridge originally constructed in 1980. The pedestrian footbridge also supports the sanitary sewer force main that conveys the sewage flow from the main portion of Dayton to the wastewater treatment plant.

In 2007, the City hired OBEC Consulting Engineers to inspect and evaluate the bridge structure and design some necessary structural repairs. In 2008, OBEC completed a technical memo that includes life expectancy and cost analysis for the Ferry Street Bridge (see **Appendix K**). Per the OBEC memo dated 7/11/08, the pedestrian footbridge contains many timbers that are near the end of their useful life. Maintenance costs will continually increase as the bridge ages and it could need replacement. It is anticipated that the timber glulam decking will need replacement sometime between 2011 and 2013, which is anticipated to cost the City approximately $200,000. Also, the timber bridge rail does not meet current safety design standards, and it is anticipated to cost up to $300,000 to upgrade the rail to current standards. Also, it is anticipated that some of the timber glulam columns, caps and girders will need to be replaced between 2018 and 2020, with an estimated costs exceeding $200,000.

OBEC estimated the replacement cost of the Ferry Street Bridge would range from approximately $3.8 to $6.9 million, depending on the replacement bridge type. OBEC also mentioned that the design life of a bridge of this type (located in the Pacific Northwest) is 35 years. The bridge is now 30 years old.

The Newberg-Dundee Bypass Tier 2 Draft Environmental Impact Statement (released in June 2010) includes a plan to replace the existing pedestrian bridge with a new vehicular bridge at the same location (ie. to connect Kreder Road and Ferry Street across the Yamhill River). See Chapter 8 for more discussions.

4.6.4.2 Palmer Creek Bridge Crossing (Hwy 221 Bridge)

As shown in **Figure 4-2**, a water distribution main crosses Palmer Creek at the Hwy 221 bridge, suspended under the ODOT bridge. The Hwy 221 bridge is a concrete vehicular bridge constructed by ODOT in 1984. In addition to the waterline, the ODOT bridge also supports the sanitary sewer force main that conveys the sewage flow from the portion of Dayton south of Palmer Creek.

The existing waterline across the ODOT bridge is in good condition, but is inadequately sized to convey the fire flows required for the south portion of Dayton.

4.6.4.3 Palmer Creek Waterline Crossing (1st Street to Palmer Lane)

As shown in **Figure 4-2**, there is a second water distribution main that feeds the south portion of Dayton, crossing Palmer Creek between the south end of 1st Street and the east end of Palmer Lane. This crossing consists of a 4-inch steel waterline down the ravine banks and across the creek. Based on City records, it appears that this waterline was installed in 1932. As such, it is well beyond the end of its useful design life, and needs to be replaced and removed from service. At the point where it crosses under Palmer Creek, it is estimated that this mainline experiences in excess of 95 psi static pressure. Based on the vintage of this line, a major failure of old steel waterline is only a matter of time.

4.6.4.4 Fletcher Road Waterline Crossing (Bridge over Hwy 18)

As shown in **Figure 4-2**, a small diameter galvanized steel water distribution line crosses Hwy 18 where the Fletcher Road overpass bridge crosses the highway. The existing line is not suspended under the overpass, so it appears that it is buried line under Hwy 18. The City has no record of the actual age of this line (although other lines of this size & material type were installed between the 1930s and the 1950s), or whether it crosses the highway in a casing. This line feeds a number of lots north of Hwy 18, along Fletcher Road and Foster Road. The Fletcher Road overpass bridge is a concrete vehicular bridge constructed by ODOT in 1955, and the overpass plans include a note about an existing 1-inch buried waterline crossing. There is no City sewer service to any of the lots north of Hwy 18. Based on the estimated age of this line and the type of material, failure of the buried portion of this waterline is only a matter of time.

4.6.5 Water Meters

Of the roughly 824 water meters in service, approximately 94% are residential meters, 3% are commercial, and 1% are multi-family meters. A more detailed summary of water meters and water use by user category is contained in Section 5.4.5.

Based on information in the City's 2004 Water Management and Conservation Plan, the City (in 2002) replaced 530 existing water meters to new touch read meters, and retrofitted an additional 250 existing meters with touch read heads. We have no record of which meters were replaced and which were simply retrofitted. All meters are currently touch read style.

4.6.6 CT Values to First Water Service

One of the requirements under the new Groundwater Rule was that the City demonstrate that the system provided the minimum chlorine contact (CT) value between the point of chlorination and the first user to provide a 4-log inactivation of viruses. As discussed in Section 3.3.9, CT values are used to verify the level of treatment or inactivation. CT is achieved by providing enough time for chlorine to inactivate potentially harmful organisms in drinking water before it is consumed. CT represents an abbreviation of chlorine Concentration (measured at the first user of the drinking water) multiplied by the contact **Time** (the water's time of travel between the point of chlorine addition to the first user).

In late 2009, the City provided information to the ODWP documenting the City's status relating to the CT values required under the Groundwater Rule (minimum CT of 6, per Carrie Gentry). In particular, the City documented the CT value for the first water service downstream of the chlorination building. The calculated CT of 6.94 was based on an assumed minimum chlorine residual of 1.09 mg/L, with 61 feet of 8" pipe (chlorination building to first service) with a maximum flowrate of 265 gpm (0.59 minutes), followed by 350 feet of ¾" pipe with a flowrate of 2000 gpd (1.4 gpm) for a time of 5.78 minutes. The resultant CT value reported was 6.94.

It should be noted that (as discussed in Section 4.3.2), the private water service drawing water from one of the watershed springs is not part of the City's water system. The original lease agreement authorized the City to utilize spring water from this source, but specifically noted that the property owner had a pre-existing private water service from this source (this user has a pre-existing, first right to the water from this spring source for their personal use, with the City authorized to utilize any water in excess of that withdrawn by the property owner). Therefore, since this is a separate private water system sharing a common source, the City is not subject to the CT requirements of the Groundwater Rule with respect to this separate private water system.

Also, as noted in the discussions under Section 8.4.2.4, the City needs to investigate and verify the location of the service tap for the water service to 4195 NE Breyman Orchards Road. This property is located north of the chlorination building, but the tap location is unknown. If the tap is located below the chlorination building, the length of the water service from the chlorination building to the existing house (±1600 feet) should be sufficient to provide the required CT value. However, if the tap is upstream of the chlorination building, this water service would be supplied by a mainline containing un-chlorinated water.

4.6.7 Fire Hydrants

A review of existing records shows that the City has approximately 90 fire hydrants. Since 1997, the Kennedy Guardian K81D hydrant with two 2½ inch ports and one 4½-inch port (and a 5" Storz adapter) has been adopted as the City standard hydrant. Hydrants in the distribution system are generally well distributed around the system, providing some level of coverage to nearly all of the developed areas. As with any municipality, there are a number of instances where hydrant spacing exceeds the recommended spacing.

The City's PWDS require that all new hydrants be connected to the distribution main with a minimum 6-inch diameter lateral. It is recommended that as hydrants are replaced that the lateral diameter is also evaluated to ensure compliance with the standard.

4.7 SCADA & TELEMETRY SYSTEM

The City currently has a supervisory control and data acquisition (SCADA) system (located at the WTP) that allows for centralized monitoring and control of the system by the system operators from a centralized location. The system is based on a programmable logic controller (PLC) that controls both the WTP operation and the remote sites. The system includes a graphic based SCADA interface that allows system operators to access the main PLC system through a desktop computer. Measured variables can be viewed, trended and saved on the computer, and operating parameters can be changed. The computer-based interface also provides centralized alarm management with stored alarm logs. The City also has a laptop configured for remote access to the SCADA system to allow programming and troubleshooting of the SCADA system from any remote site.

The City has a radio telemetry system that communicates between the WTP and the various well sites, the watershed reservoir and the PRV station. The radio telemetry system is based on a licensed radio frequency.

Local programmable logic controllers (PLCs) are installed many of the water system facilities to transmit collected data to the central SCADA PLC at the WTP. These local PLCs are utilized to disseminate command information from the central PLC to the process equipment and devices as directed.

Telemetry data transmitted to a central SCADA system is available immediately and is thus more useful than data that is stored at a remote pumping station or reservoir facility. Telemetered alarms provide immediate warning of malfunctions and low water levels, reducing the response time for emergency situations. The electronic collection of operational data in a centralized location improves operator efficiency and the reliability of collected data and enhances the operation of the water system.

4.8 SANITARY SURVEY RESULTS

As previously noted, the ODWP conducts a sanitary survey of each public water system on a regular basis. For the City water system, the last sanitary survey was conducted on August 25, 2005. While the report indicated that the water system was in good physical condition, it did identify a number of deficiencies to be corrected, although a timeframe for correction was not mandated as that time. Deficiencies related to the wells and springs included the following (italics). The status of known corrective action by the City are summarized following the deficiency listing (this listing may not be complete, since all of the City personnel who were present when the 2005 sanitary survey was conducted are no longer with the City).

- *Wells*. Indentified deficiencies related to City wells included the following.
  (1) *The 11th Street well lacks a watertight protective housing. Provide a housing to protect the wellhead from exposure*. The 11th Street Well has a well house to protect the well pump controls (OAR 333-061-0050.2.a.L.xi), and a CMU block enclosure with a lid at the wellhead. We assume that this addressed this deficiency.
  (2) *Multiple casing slabs have large cracks and fissures. Repair cracks as needed to prevent intrusions into the annular space of the casing*. Without more detail on exactly what this entailed, we assume that this issue was addressed.
- *Springs*. Indentified deficiencies related to City watershed springs included the following. These items have not yet been addressed by the City.
  (1) *An interception ditch is missing on both spring systems.*
  (2) *Spring boxes lack water tight, lockable, shoebox lids.*
  (3) *Spring boxes and collection basins lack screened overflows.*
  (4) *Spring and collection basins lack adequate shut-offs for maintenance.*

To date, the identified spring deficiencies have not been addressed by the City. As previously discussed in Section 4.3.2.3, the ODWP provided an informal follow up inspection of the watershed spring system in April 2009. The ODWP formalized their findings in a June 12, 2009 letter to the City, which included many of the same discrepancies noted in the 2005 sanitary survey. On 8/14/09 the City submitted a Corrective Action Plan for the spring area to ODWP in August 2009 (subsequently modified in later September 2010). The corrective action plan requested that the City be allowed to complete this Water Master Plan prior to proceeding with the correction of the spring discrepancies. Under the schedule proposed in the 9/10 Corrective Action Plan, after approval of this Water Master Plan, the City anticipates pursuing funding sources and completing the design for improvements to the spring area by the end of 2011, with construction anticipated to occur during the summer of 2012 (assuming that funding can be obtained within the timeframe assumed). Depending on the availability of funding, the City may proceed with the design and construction of spring area improvements (on a staged basis) earlier than that date.

4.9 EXISTING WATER SYSTEM FUNDING MECHANISMS

Funding for the City's existing water system comes from two major sources, user fees and System Development Charges (SDCs). Since SDCs can't be used to finance operation, maintenance and replacement costs of a water system, the O&M and repair costs must be financed from user fees.

4.9.1 Water User Rates

The City's water fund must provide sufficient revenues to properly operate and maintain the water system and provide reserves for normally anticipated replacement of key system components such as pumps, motors, hydrants, waterlines, valves, etc. Although the City relies exclusively on water user fees for operation and maintenance of the water system, the water fund cannot typically finance major capital improvements without outside funding sources.

The existing monthly user rates are determined by adding a fixed base charge to a volume charge for water consumed in excess of 400 CF. The base charge per EDU (equivalent dwelling unit) is fixed for in-town residents, with a $5 surcharge to the base rate added for out-of-town water users. A volume charge is also added for additional water consumed above 400 CF. The current water user rates are listed in **Table 4–8** (see **Appendix C** for a copy of the user rate resolution). The water use resolution also establishes the procedure for establishing the number of EDUs for water users other than single family residential units, or for users with higher than average water usage.

Table 4-8 Existing Water User Rates

Cubic Feet	Inside City Limits (1)	Outside City Limits (1)
Base Rate per EDU 0 – 400	$52.50	$57.20
401 – 600	$2.76	$2.76
601 – 1000	$1.40 / additional 100 CF	$1.40 / additional 100 CF
1001 – 2000	$2.10 / additional 100 CF	$2.10 / additional 100 CF
2001 – 3000	$2.80 / additional 100 CF	$2.80 / additional 100 CF
3001 – 4000	$3.50 / additional 100 CF	$3.50 / additional 100 CF
4001 – 5000	$4.10 / additional 100 CF	$4.10 / additional 100 CF
5001 – 6000	$4.80 / additional 100 CF	$4.80 / additional 100 CF
6001 & up	$5.50 / additional 100 CF	$5.50 / additional 100 CF

(1) Water rates effective as of July 1, 2010

Assuming an average residential consumption of 100 gallons/capita/day, an average household size of 2.91 residents/household and a 30 day month (8,730 gallons, or 1,167 cubic feet), the typical monthly user charge (for in-City users) would be approximately $63.20 for a single family residence. For per capita usage rates or household sizes that are different from these assumptions, the monthly user charge will change proportionally.

4.9.2 System Development Charges

Dayton's SDCs are based on the size of the water meter size per **Table 4-9**. SDCs are used for capital improvement projects. The SDCs consist of two portions, reimbursement fee and the improvement fee. The reimbursement fee portion is the only portion of the SDC that is guaranteed to be available to the City to use towards repayment of loans for capital improvement projects, since the improvement fee portion of the SDC is available as an SDC credit for developers who complete water system projects that are identified in the City's CIP (on which the SDCs are based). The total price for SDCs range from $3,633 for 5/8-inch and ¾-inch water meters to $38,752 for an 8-inch water meter. Approximately 7% of the SDC fee schedule is the reimbursement fee portion, while remaining 93% is the improvement fee portion.

Table 4-9 Existing Water SDC Schedule

Meter Size	Reimbursement Fee	Improvement Fee	Total Water SDC
5/8 and 3/4 Inch	$240	$3,393	$3,633
1 Inch	$319	$4,513	$4,513
1 ½ Inch	$480	$6,786	$7,266
2 Inch	$639	$9,049	$9,688
3 Inch	$959	$13,573	$14,532
4 Inch	$1,279	$18,097	$19,376
6 Inch	$1,918	$27,146	$29,064
8 Inch	$2,558	$36,194	$38,752

4.10 Recommendations

The intent of this chapter is to provide an inventory and summary of the existing water system and existing conditions. Subsequent sections of this report, as detailed in the table of contents, evaluate the various components of the water system and present detailed improvement plans for the system as a whole. Recommendations related to specific improvements are contained in the subsequent chapters.

5