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PROJECT #: 04.71

WATER SYSTEM MASTER PLAN

for:

City of Manzanita, Oregon

May 2006 (Final)
April 2006 (Draft)

Project No. 04.71

WATER MASTER PLAN

Prepared for:

CITY OF MANZANITA
P.O. BOX 129
MANZANITA, OREGON 97130

May 2006 - Final
April 2006 - Draft

Prepared by:

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SUMMARY

S.1 Purpose

The purpose of this water master plan is to provide the City of Manzanita with a comprehensive water utility planning document through the year 2028, and to identify potential improvements or management options needed for compliance with current and anticipated future regulatory requirements. In addition, the master plan, with DHS approval, will provide the basis for funding application preparation and approval.

Manzanita's previous master plan was completed in 1990 and is currently out of date. The new master plan was prepared in order to correct this deficiency.

S.2 Population and Growth

Current (2004) resident population is: 630 persons in Manzanita, 410 persons in Wheeler, and 89 persons in other areas of the regional system. Manzanita has a very high ratio of non-resident housing units (67.1%) to occupied resident housing units (28.5%); consequently, the actual population served is much greater than census figures indicate. Manzanita uses a general planning figure of 3% average annual growth rate. The 3% figure is used in the Master Plan for both Manzanita and the regional water system.

S.3 Existing Water System

The City of Manzanita owns and operates a municipal water supply system that serves the City. In addition, it is part of a regional system, jointly managed with the City of Wheeler, that also serves the City of Wheeler, Zaddack Creek Coop, Nehalem Bay State Park, and, to a very limited extent, the City of Nehalem. The oldest components of Manzanita's existing system date to the early 1960's; its earliest water rights date to 1945. The regional system became operational in March 2003 with the completion of two new wells and transmission mains. Manzanita also constructed a membrane microfiltration treatment facility to treat its surface water sources (Anderson Creek) and bring the City into compliance with the federal Surface Water Treatment Rules. Manzanita's system includes three ground level reservoirs and two pressure zones.

S.4 Water Requirements

Current water production requirements for the City of Manzanita are summarized in Table S.1.

Table S.1: Current Water Production Requirements (City of Manzanita)
(Based on October 2003 - September 2004 data.)

Parameter	Demand (MG)[1]	(mgd)[1]	(gpm)[1]	Comments	(gpd/EDU)[1]
Annual	67.573	0.185	128.6		122.4
May-October	41.312	0.226	157.2		149.7
November-April	26.261	0.144	99.9		95.2
Maximum Month	10.228	0.330	229.1	July 2004	218.1
3-Day Maximum	1.313	0.438	303.9	July 3-5, 2004	289.4
Peak Day	0.521	0.521	361.8	July 4, 2004	344.5
Peak Hour	0.039	0.937	650.8		619.5

1. MG: million gallons.
mgd: million gallons per day
gpm: gallons per minute
gpd: gallons per day
EDU: equivalent dwelling units (Manzanita current total: 1512.5 EDUs)

Future demand for the City of Manzanita is summarized in Table S.2. Demand figures are based on current demand (Table S.1) figures increased by three percent per year. The peak hour figure is recomputed according to the equation described in Section 4.2.3.

Table S.2: Future Water Demand (City of Manzanita)

a) mgd

Parameter	Year				
	2010	2015	2020	2025	2028
Annual	0.221	0.256	0.297	0.344	0.376
May-October	0.270	0.313	0.363	0.420	0.459
November-April	0.172	0.199	0.231	0.268	0.293
Maximum Month	0.394	0.457	0.530	0.614	0.671
3-Day Maximum	0.523	0.606	0.703	0.815	0.890
Peak Day	0.622	0.721	0.836	0.969	1.059
Peak Hour	1.101	1.260	1.688	1.656	1.800

S.5 Water Sources

Manzanita's developed surface water sources including two dams and one dam site on the forks of Anderson Creek. Current deficiencies include lack of fish passage on the two dams and the lack of a permanent intake at the site of a former dam. In addition, the existing old, asbestos cement transmission main is in poor condition. Recommendations include provision of fish passage (or conversion to infiltration galleries) at the two dam sites, construction of a seasonal intake at the third site, and replacement of the transmission main and flow regulating facilities. An opinion of probable cost for all the Anderson Creek sources and transmission projects it $2,727,000 including engineering, legal, and administrative costs. The City intends to defer work on these projects because of the costs involved and the availability of the well sources to meet water demand if the Anderson Creek facilities are offline for repairs or replacement.

The regional system's two recently constructed wells have an installed well capacity (1.67 cfs) that will meet projected year 2020 peak day demand for the regional system under well only operation. Utilizing 0.08 cfs of surface water sources (approximately one-tenth of the existing water rights on Anderson Creek), the wells can supply peak day demand projected to year 2025. The projections are tentative and highly dependent on the rate and nature of growth the regional water system experiences. Full utilization of the existing wells (1,500 gpm, 3.34 cfs) will require new pumps, drives, and electrical. A current, order of magnitude, opinion of probable construction cost is $200,000 with a total project cost of $270,000. Full development is also likely to require transmission line improvements (either another line or a larger diameter replacement line) and /or booster pumping. These considerations are not evaluated in detail at this time.

S.6 Treatment and Water Quality

A recently constructed membrane micro-filtration treatment facility is used to filter the City's surface water supply. Treatment for groundwater and filtered surface water is limited to pH adjustment (with soda ash) and disinfection (with hypochlorite). Overall water quality is excellent from both (surface and groundwater) sources. At this time, there are no specific treatment related improvement recommendations.

S.7 Water Storage

Manzanita's three storage reservoirs appear to be in good to excellent condition and well maintained. Existing capacity is more than sufficient for the City's projected year 2028 needs; however the regional system lacks storage facilities and currently relies on Manzanita's reservoirs to supply system needs when the wells are off-line. Flow from

Manzanita's system to the regional system is not metered and contributes to the "unaccounted - for" water loss in Manzanita's system. The lack of a regional water storage reservoir also limits the regional system's capabilities of meeting peak flow demands. A 500,000 gallon reservoir is recommended to provide well equalization, limited emergency supply, and limited fire protection. An opinion of probable construction cost is $730,000 with a total project cost of $1,116,000.

S.8 Recommended Transmission and Distribution Improvements

Manzanita has an ageing distribution system with many lines of substandard dimension (2" diameter) and a central core, primarily between Laneda Avenue and Ocean Avenue, that is predominantly comprised of old (30-40 years) AC mains that have reached the end of their anticipated design life. Given the potential costs involved and the need for the City to prioritize its expenses, replacement of the AC lines should be considered relatively low priority; however, individual AC lines, if defects are sufficiently manifest, should be replaced. Consideration should also be given to replacing AC lines associated with any future street improvement project. This latter consideration extends as well to other substandard mains.

A large diameter (8"-10" diameter) loop serving most of the City is achievable by replacing the existing 3600 lineal feet of 6" AC main that runs along Laneda Avenue, just east of Division Street, then east along Highway 100 to the existing transition from 6" - 8".

All reservoir flows are currently routed to the existing 10" AC main at Ocean Avenue and Nutmeg Street. This is currently being modified by construction of a 10" line down Division Street to North Avenue where it will connect to existing 4" and 6" lines. To enhance overall system reliability and hydraulic performance, the 10" line should be extended down Division Street to Laneda Avenue.

City Staff have indicated a standardization on 4" and 6" lines to meet local distribution needs. This is somewhat smaller than the 6" - 8" lines typically recommended. Given the City's intent to remain a predominantly residential community, its provision of larger diameter service in the central business district, and its experience with fire protection issues in the City[1], the recommended improvement projects do not include increases in line size except for: replacement of 2" lines (use 4" or 6") and major transmission or distribution lines.

[1] According to the City hydrant map, there are only nine hydrants with flows of less than 500 gpm.

From a master planning perspective, improvement recommendations for Manzanita reflect a concern primarily with elements of the system that bear on the overall health, operation, and reliability of the water utility as a whole. In contrast, local improvements, such as a replacement of an undersized line, may have tangible benefits for the relative few customers locally connected, but are unlikely to significantly improve overall system performance to the extent that the City can justify the allocation of the limited funds identified as practicable under current economic and political realities. Accordingly, a broad categorization of priorities for Manzanita includes the following:

- Priority 1 Improvements: address capability and reliability of meeting peak day water supply requirements for the City of Manzanita under circumstances when the Anderson Creek sources are not available.

- Priority 2 Improvements: address reliability and enhanced transmission (to and from the City's finished water reservoirs).

- Priority 3 Improvements: address distribution improvements that both replace mains with known deficiencies and enhance overall distribution system hydraulics.

- Priority 4 Improvements: address distribution improvements that either replace mains with significant deficiencies or replace undersized mains. Benefits are generally more localized than is the case for priority 3 improvements.

Recommended transmission and distribution improvements are described in Section S.9.

S.9 Recommended Capital Improvements

Recommended capital improvements have been divided into two categories: near-term improvements and long-term improvements.

Recommended near-term improvements and budgets by priority are listed below:

Priority 1 Improvements[2]*:*

a) New 500,000 gallon reservoir. $1,116,000

[2] Budget cost includes contingencies, engineering, legal and administrative costs (typically 1.35 x construction costs) plus additional costs such as geotechnical and site acquisition.

This project benefits the regional system by providing well equalization, limited emergency supply, and limited fire protection. It is also essential if Manzanita adds a third pump at the treatment plant.

Priority 2 Improvements:

a)	New (3rd) pump at treatment plant.	$68,000
b)	Replace existing 8" AC transmission main from treatment plant to reservoirs. (See project #34, Table 8.1.) Replace with 8" or 10" line. Evaluate and size along with project 1b noted above.	$68,000
c)	New 10" transmission main along Division Street between North Ave. and Laneda Ave. (See project #9, Table 8.1.)	$111,000
d)	New 10" transmission main from 1.6 MG reservoir to Poysky Ave. and Ocean Ave. (See project #5, Table 8.1.)	$86,000

Priority 3 Improvements:

a)	Replace existing 6" AC line along Laneda Ave. and Highway 101. (See project #34, Table 8.1.)	$365,000
b)	Project #10, #11, #12, and #2 (See Table 8.1)	$127,000

Priority 4 Improvements:

a)	All Distribution Priority II main improvements (See Table 8.1).	$791,000

Priority 1 Subtotal	$1,116,000
Priority 2 Subtotal	$569,000
Priority 3 Subtotal	$492,000

Priority 4 Subtotal	$791,000
Near-term Improvements Total	**$2,968,000**

Long-term improvements include:

Anderson Creek source and transmission improvements	$2,727,000
Well upgrades	$270,000
General AC line replacement	$2,369,000
Long-term Improvement Total	**$5,366,000**

S.10 Capital Improvement Implementation

Near-term improvements have been identified for construction over the next three years. In accordance with the discussion at the February 22, 2006 Manzanita City Council Workshop, the near-term projects total approximately $3,000,000 and could be phased and constructed over the next three years. The regional reservoir is the highest priority improvement; however, it is the most complex and includes issues (land/easement acquisition, environmental review, geotechnical site evaluation, and County approval) that may take significant time to address and resolve. It is recommended that the Priority 1, 2, and 3 improvements (Section 9.4), with a total cost of $2,177,000, be addressed concurrently with the intent of construction the projects in 2007-2008. This would allow ample time to address reservoir issues while maintaining the allowance of approximately $1,000,000 per year for the next three years. Priority 4 improvements could next be addressed after assessing the costs of completing the first projects (Priority 1, 2, and 3) determining the remaining budget, and identifying source(s) of funds.

Long-term improvements do not have a specific timeline. Anderson Creek improvements (source and transmission) will be addressed on an as needed basis with the intent of relying on the regional system as a backup supply. Implementation of well related improvements will depend on their actual system growth that occurs and the ability of the regional reservoir to meet peak diurnal demands. Replacement of old AC lines will depend on budget availability, construction opportunities, and perceived need. From a general planning standpoint, the City should anticipate addressing all of these issues and improvements within the next 20 years.

S.11 Financing

For the budget year ending June 30, 2005, the City's Water Construction Fund had net

assets of $1,723,098. During the same budget year, the City received $148,300 in systems development charges and $35,794 in interest income. It is quite likely that the Construction Fund will have sufficient monies to construct the Priority 1, 2, and 3 improvements without incurring debt or requiring a rate increase. Construction of the Priority 4 improvements ($791,000) are likely to require some outside funding agency participation or other funding source.

Probable financing for Priority 4 improvements is limited to loans (based on project scope, cost, impact on rates, and City eligibility).

S.12 Water Rates

The last water rate increase was adopted in October 2003. Current base residential rate (includes 6,000 gallons) is $34.50 per month. Average monthly water billing per EDU is $37.94. Current annual water rate revenue is approximately $700,000. No rate increase is recommended at this time.

S.13 Water Rate Impacts

Implementation of the Priority 1, 2, and 3 improvements are not anticipated to result in water rate increases based on utilizing existing and anticipated cash reserves. Funding of the Priority 4 improvements with load funds (only) is likely to result in rate increases of $2.61-$3.96.

S.14 SDC Recommendations

The City adopted a Capital Improvements Plan and SDC Methodology in December 1995. The report provides for periodic updates to account for inflation according to the ENR Construction Cost Index. SDCs were last updated and adopted by Resolution No. 04.10 on September 8, 2004. The current water system SDC is $3,425.00.

It has been 10 years since SCDs were last evaluated for the system. While the City has adjusted the fees, there has been no inclusion of work completed since the original study (such as the treatment plant, wells, and transmission mains). SDCs should be updated to reflect new construction and recommended improvements associated with this Master Plan.

SECTION 1: INTRODUCTION

1.1 BACKGROUND

The City of Manzanita owns and operates a municipal water supply system that serves the City. In addition, it is part of a regional system, jointly managed with the City of Wheeler, that also serves the City of Wheeler, Zaddack Creek Coop, Nehalem Bay State Park, and, to a very limited extent, the City of Nehalem. The oldest components of Manzanita's existing system date to the early 1960's; its earliest water rights date to 1945. The regional system became operational in March 2003 with the completion of two new wells and transmission mains. Manzanita also constructed a membrane microfiltration treatment facility to treat its surface water sources (Anderson Creek) and bring the City into compliance with the federal Surface Water Treatment Rules.

Area growth has been consistently high (approximately 3% per year on an average annual basis) and is anticipated to continue into the foreseeable future. Water supply, assuming a steady 3% growth, is adequate for the planning period (to year 2028); and there are no water quality issues. Primary deficiencies and concerns are associated with old, degraded infrastructure.

1.2 NEED

Manzanita's 1990 Water Master Plan has expired. The Department of Human Services (DHS), in a July 21, 2004 Sanitary Survey, noted this deficiency and indicated that a new plan must be prepared by the City. In addition to the regulatory requirement for a new master plan, the City is aware of existing deficiencies and limitations of the water system; and it desires to develop a coherent and comprehensive plan for improvement implementation.

1.3 PURPOSE

The purpose of this water master plan is to provide the City of Manzanita with a comprehensive water utility planning document through the year 2028, and to identify potential improvements or management options needed for compliance with current and anticipated future regulatory requirements. In addition, the master plan, with DHS approval, will provide the basis for funding application preparation and approval.

1.4 AUTHORIZATION

On October 25, 2004, the City of Manzanita contracted with *HGE, Inc., Architects, Engineers, Surveyors & Planners* for the preparation of this master plan.

1.5 MASTER PLANNING OPINIONS OF PROBABLE COST (OPCs)

1.5.1 General

Opinions of probable cost (OPCs) presented in this water master plan include four components, each of which is discussed separately in this section. It must be recognized that opinions of probable cost are preliminary, and based on the level of planning presented. As specific improvements proceed forward, it may be necessary to update the costs to reflect changes in project complexity or approach.

1.5.2 Construction Cost

Opinions of probable cost in this plan are based on preliminary layouts of the proposed improvement, actual construction bidding results for similar work, published cost guides and the author's construction cost experience within the state of Oregon.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the opinions of probable cost presented herein. For this reason, it is common engineering practice to relate the costs to a particular index that varies in proportion to long term changes in the national economy. The Engineering New Record (ENR) Construction Cost Index is most commonly used. It is referenced to an initial value of 100 for the year 1913.

All costs in this plan are based on the October 2005, ENR Construction Cost Index value of 7563. Opinions of probable costs should be updated at the actual time of completing funding applications, and prior to a general obligation bond election. When the community secures financing, a "reserve factor" should be added at that time for estimated increased cost due to inflation. Since 1994, construction costs have increased an average of 3.0 percent each year. Opinions of probable costs can be prepared at any future day by comparing the future ENR Construction Cost Index with the index value of 7563; however, this approach is generally only considered valid for a 2 or 3 year period since construction techniques and materials change with time. If time has elapsed in excess of 2 or 3 years, opinions of probable cost should be updated by an engineer.

1.5.3 Contingencies

In recognizing that the opinions of probable cost are based on preliminary design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigations, and other difficulties that cannot be foreseen at this time. A contingency factor of 10 percent of the construction cost has typically been added.

1.5.4 Engineering, Construction Observation, and Construction Management

Engineering, construction observation, and construction management costs have been assumed at 20 percent of the construction cost. This includes costs for the engineering company to conduct preliminary surveys, perform detailed design analyses, prepare construction drawings, prepare construction specifications, conduct construction stakeout surveys, provide partial construction observation during construction, administer construction related activities such as change orders, and to prepare record drawings.

1.5.5 Legal and Administrative

An allowance of 5 percent of the projected construction cost has been added for legal and administration. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

1.5.6 Opinion of Probable Cost Summary

Opinions of probable costs presented in this study include a combined allowance of 35 percent for contingencies, engineering, legal and administrative costs.

SECTION 2: STUDY AREA CHARACTERISTICS

2.1 LOCATION

The City of Manzanita is located in northwest Tillamook County adjacent to the Pacific Ocean and Highway 101, approximately 27 highway miles north of the City of Tillamook. In terms of latitude and longitude, the City is located at 45°43'9" North and 123°56'9" West.

2.2 PLANNING AREA

The service area for the Manzanita/Wheeler water system is shown in Figure 3.1. Currently, the system includes the City of Manzanita, the City of Wheeler, the community of Zaddack Creek, and Nehalem Bay State Park. There is an emergency connection with the City of Nehalem. Tideland Water Coop may also be added to the system in the near future. Water rights, sources, and transmission mains are located outside the service area in the hills above Manzanita and Wheeler and near the Nehalem River to the east.

The planning area for this master plan focuses on the City of Manzanita, as defined by its urban growth boundary, and its water sources and transmission facilities. Other areas and communities are discussed as needed to facilitate an understanding of issues as they pertain to Manzanita.

2.3 PHYSICAL ENVIRONMENT

2.3.1 Climate

Manzanita has a mild marine climate with an average annual temperature of 50 degrees[1]. Summers tend to be dry and warm; winters tend to be cool and wet. Cloud cover is likely in winter; summer cloud cover is common as fog or low clouds that move in from the ocean and persist for part of the day. High winds occasionally strike the Oregon Coast during winter storms. Snow or temperatures below freezing are relatively uncommon.

Precipitation events for Wheeler have been mapped by the National Oceanic and

[1] Based on NOAA data for Tillamook for the period 1948 to 2001.

Atmospheric Administration (NOAA)[2]: the 2 year-24 hour rainfall event is 3.5-4.0 inches; the 100 year-24 hour rainfall event is 7.0-8.0 inches. Mapped precipitation totals[3] for Manzanita and Tillamook are similar. Oregon Climate Service (OCS) data for Tillamook indicate an annual precipitation total of 90.4 inches with 83 percent attributable to the period of October through April.

2.3.2 Land Resources

Landscape and Topography. Manzanita extends from sea-level, along the Pacific Ocean, to an elevation of approximately 200 feet. Topography in the City varies, but is generally hilly. Nehalem Bay State Park, immediately south of Manzanita, consists primarily of a long sand spit that separates Nehalem Bay from the Pacific Ocean. The areas north and east of the City are hilly and mountainous. The catchment for the Anderson Creek surface water sources extends to an elevation of 1,860 feet (the sources are located at elevations of 400 to 440 feet. The groundwater sources (wells) are located in the floodplain of the Nehalem River.

Earthquake Potential. The Oregon Coast has a documented history of major earthquakes. The planning area includes old landslides and hillsides with further landslide potential. Liquefaction is also likely in some areas in the event of a strong earthquake. Parts of the City also lie within an identified tsunami zone.

Geology. Most of Manzanita (UGB) consists, geologically, of stable dunes over marine terraces. Manzanita's surface water sources originate near the boundary of Miocene volcanic rocks (basalt) and Oligocene-Miocene sedimentary rocks (that may include sandstone, siltstone, claystone, or shale). The sources (streams) flow primarily through an area of Oligocene-Miocene sedimentary deposits. The well sources are located in gravel deposits along the Nehalem River between mountainous areas geologically classified as undifferentiated Eocene volcanic rocks (primarily basalt).

Soils. Manzanita (UGB) soils have been mapped by the Soil Conservation

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[2, 3] Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. NOAA Atlas 2, precipitation-frequency atlas of the western United States, Volume X -Oregon. National Oceanic and Atmospheric Administration, National Weather Service, Silver Springs, Md.

Service (SCS)[4]. Two soil series predominate: Netarts loamy fine sand and Yaquina loamy fine sand. The former predominates in the north and east parts of the City; the latter predominates in the southwest.

Netarts soils occur on wind worked dunes on marine terraces. The soils are characterized by: excessive drainage, very rapid subsurface permeability, very slow runoff, very low water holding capacity, deep root penetration, sever wind erosion potential, generally low organic content, and are very strongly acidic. Netarts soils, 7-30 percent slopes, are noted by SCS as including isolated or intermittent pockets of various other soil types including sand dunes and Brallier peat. Subsoils may include iron cementation. The soil is underlain by very friable fine sand at a depth of 52 inches.

Yaquina soils occur in dune materials between old dunes. The soils are characterized by: imperfect drainage (water table at 1'-5' depth), very rapid subsurface permeability, very slow runoff, very low water holding capacity, moderately deep root penetration, moderate wind erosion potential, generally low organic content, and are very strongly acidic. Yaquina soils, 0-3 percent slopes, are noted by SCS as including isolated or intermittent pockets of various other soil types including: Netarts soil and Brallier peat.

Most of the surface water sources (streams) flow through various soils of the Astoria series[5]. Astoria soils are derived from weathered soft shale. Astoria soils are characterized by: good natural drainage, moderate subsurface permeability, medium runoff, high water-holding capacity, good root penetration, moderate erosion potential, high organic content, and are very strongly acidic. Astoria soils range up to 60 percent slope and are typically underlain by soft, fractured siltstone at 50 to 77 inches below the surface.

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4 Soil Conservation Service. 1957. Soil survey, Tillamook Area, Oregon. United States Department of Agriculture Soil Conservation Service in Cooperation with Oregon Agricultural Experiment Station, Washington, D.C.

5 SCS mapping does not extend to the water intake locations on Anderson Creek; however, the transmission main does pass through the SCS mapped areas.

2.3.3 Water Resources

Surface and Coastal Water. The City of Manzanita borders the Pacific Ocean. A long, sandy beach runs between the City and the Pacific Ocean; there are no port facilities.

Within the planning area and the areas served by the regional water system there are numerous surface water resources. The largest and most significant, from a regional standpoint, is the Nehalem River and the upper reaches of Nehalem Bay. The regional well field is located near the Nehalem River. The mountains north of Manzanita and Nehalem include: Neahkahnie Creek (and Lake), Alder Creek, Bob's Creek, and Anderson Creek. The City has water rights on all these creeks except Bob's Creek. (Nehalem has water rights on Bob's Creek). Creeks in the other areas are numerous, small, tributary to the Nehalem River, and generally of minor importance or relevance to Manzanita or the regional water system's service area. A possible exception is Gervais Creek and Vosburg Creek on which Wheeler holds, and maintains, surface water rights.

Floodplains. Floodplains are generally limited to the lower sections of the various streams. Floodplains along Nehalem Bay and the Nehalem River are significant and potentially impact the regional water system's service area, wells, and infrastructure. Elevation at the 500-year floodplain in the vicinity of the wells is 34.7 feet. Both Wheeler and Nehalem have experienced significant flooding. The City of Manzanita itself is not directly impacted by floodplains.

Wetlands. Minor wetlands are numerous in the area and generally associated with riparian areas adjacent to the many creeks and drainways, and in low lying areas near the Nehalem River.

Groundwater. Water supply for the regional water system is provided by two wells located in fluvial deposits of silt, sand, and gravel near the Nehalem River. Nehalem Bay State Park, prior to its connecting with Manzanita's system, had a well supply of limited production capabilities and high iron content. In general, groundwater supplies in the area are of limited supply and reliability, with the notable exception of areas adjacent to the Nehalem River, and typically have high iron concentrations. There is no evidence, in the sources reviewed, of the area being underlain by any regional aquifers.

2.4 SOCIO-ECONOMIC ENVIRONMENT

2.4.1 Economic Conditions and Trends

A summary of 2000 Census data is provided below as documentation of current economic conditions in Manzanita. More detailed data is included in Appendix 2.1.

Housing:

Housing Units (Total): 1,078
Occupied: 307 (28.5%)
Vacant: 771 (71.5%)
Owner Occupied: 226 (73.6%)
Renter Occupied: 81 (26.4%)
Housing Units Constructed Since 1970: 820 (76.4%)
Housing Units Constructed Since 1990: 364 (33.9%)
Average Household Size (persons per household): . . . 1.84
Median Housing Value: $234,700
Median Rent per Unit: $657

Education:

High School Graduate or Higher: 93.4%

Age:

Median Age (years) 57.2

Employment:

Persons in Labor Force: 239 (52.5%)
Employed: 233 (51.2%)
Unemployed: 6 (1.3%)
Persons Not in Labor Force: 216 (47.5%)
Mean Travel Time to Work (minutes): 17.9

Income:

Median Household Income: $38,750/year
Poverty Status (% of Population): 6.4%

Manzanita is primarily a residential and tourist oriented community. Occupations of residents are primarily white-collar (approximately 70 percent). No resident is employed in farming, fishing, or forestry occupations[6]. Approximately 67 percent of housing units are owned by non-residents. Approximately one-half of the resident population is not in the work force; given the high median age (57.2 years), it is likely that most of these people are retired. The present situation is likely to continue into the future with a similar mix of residents and nonresidents, tourists, and businesses that cater to these peoples.

Additional information on Wheeler is included in Appendix 2.2.

2.4.2 Population

Resident Population Estimates and Census Data. Table 2.1 includes recent decennial census population figures and population estimates from the Center for Population Research and Census at Portland State University.

Table 2.1: Historical and Recent Residential Populations

Year	City of Manzanita Total Population	City of Wheeler Total Population	Zaddack Creek and Tideland Services Coop Total Population	Water System Total Population
1980	443	319	-	-
1990	513	335	-	-
2000	564	391	-	-
2001	580	400	-	-
2002	590	400	-	-
2003	610	410	-	-
2004	630	410	89	1,129

City of Wheeler and City of Manzanita figures:
Source: U.S. Census for 1980, 1990, and 2000 figures. Center for Population Research Census for 2001-2004 figures.
Zaddack Creek and Tideland Services Coop Figure:
Estimate based on 40 service connections and 2000 Census figure of 2.22 persons per occupied household (for Wheeler).

Non-resident Population Estimates. Both Manzanita and Wheeler have significant

[6] 2000 Census data indicates "zero or rounds to zero" for this category.

non-resident populations that are not included in the official census figures and population estimates. Non-resident populations peak during the summer; however, there may also be a significant presence in shoulder periods extending into spring and fall based on weather. Seasonal peaking occurs on summer weekends and holidays (such as the 4th of July). Both cities are located on Highway 101 and receive considerable tourist traffic during the summer season. Proximity to Portland and other major municipalities facilitates visits by non-resident homeowners throughout the year.

Census 2000 figures for Manzanita and Wheeler do show relative proportions of resident and non-resident housing occupancy.

Table 2.2: Housing Occupancy (Source: U.S. Census 2000 Data)

	City of Manzanita	City of Wheeler
Total Housing Units	1,078	244
Occupied Housing Units (residents)	307 (28.5%)	176 (72.1%)
Seasonal, recreational, or occasional use housing units.	723 (67.1%)	52 (21.3%)
Other (vacant) housing units	48	16
Average household size of occupied (resident) units	1.84	2.22

Manzanita, in particular, exhibits a very high ratio of non-resident to resident housing units.

Future Population and Growth Rates. Resident population growth in both Manzanita and Wheeler has averaged approximately 1.5 percent per year since 1990. Tillamook County's recent long term projects for the County as a whole and for each municipality incorporates a rate of 0.98 percent on an average annual growth basis. County provided (high) projections for the municipalities potentially involved with the water system are included in Table 2.3.

Table 2.3: Population Projections
(Source: Tillamook County)

City	2010	2015	2020	2025	2040
Manzanita	655	690	728	764	874
Nehalem	336	354	373	391	448
Rockaway	1,438	1,516	1,598	1,677	1,920
Wheeler	444	468	493	518	592

The most significant additions in resident population for the water system is likely to be the addition of new communities, Rockaway in particular, rather than in population growth within the current service area.

The existing, and potential, service area can be characterized as having considerable potential for expansions in non-resident presence and the businesses that cater to them. Between 1989 and 1996, Manzanita's total water service connections grew at a rate of 3.84 percent per year. High development levels have persisted and as a consequence, Manzanita uses a general planning figure of 3% AAGR (average annual growth rate).

Water system planning is this master plan reflects a 3% AAGR. The growth is in anticipated increases in water demand (and equivalent dwelling units) - *not in resident population.* This reflects an approximate doubling (197.4%) over the planning period ending 2028.

Manzanita's general planning figure of 3 percent AAGR will also be used for general future planning of the joint water system. If one of the larger communities, such as Rockaway, requests to become part of the regional system, planning figures will need to be adjusted and the impacts of the connection assessed. It must also be borne in mind that future system connections, such as Rockaway, may not rely fully on the regional water system and only use it to supplement their own supplies during periods of high demand or for emergencies.

2.4.3 Water Customer Characterization

Communities Served

City of Manzanita	1,459 service connections
City of Wheeler	230 service connections
Zaddack Creek	24 service connections
Nehalem Bay State Park	1 service connection
Total	1,714 service connections

City of Manzanita Customers

Based on February 28, 2005 data, the City of Manzanita serves the following customers:

Residential (3/4" meter)	1,374 meters
Commercial (<2" meter)	56 meters
Commercial (2" or larger meter)	2 meters
Bulk (Nehalem Bay St. Park 2" meter)	1 meter
City of Manzanita Services	12 meters
Service turned off	15 meters
Total	1,460 meters

City of Wheeler Customers

Based on September 2005 data, the City of Wheeler serves the following customers:

Residential (3/4" meter)	200 meters
Commercial	30 meters
Total	230 meters

Other Communities

Zaddack Creek includes 24 residential service connections. Nehalem Bay State Park is included under Manzanita since it is directly fed from the City of Manzanita's distribution system. The City of Nehalem receives some finished water through one connection under emergency or high demand periods.

2.5 LAND USE

The City of Manzanita Comprehensive Plan (Ordinance #95-3) was adopted on March 6, 1996. The comprehensive plan includes a land use plan (Figure 2.1). A brief description of land use categories is provided in Table 2.4. Manzanita has no industrial or general commercial zoning. The Comprehensive Plan notes the City's desire to remain primarily residential with commercial services geared to support the people who live in, or visit, the city.

Both Manzanita and Wheeler have available undeveloped land for continued development. Infill development and subdivisions are also occurring: in April 2005 Manzanita reported 2014 platted lots in developing areas - an increase of 12 percent over the November 2000 figure of 1799 lots.

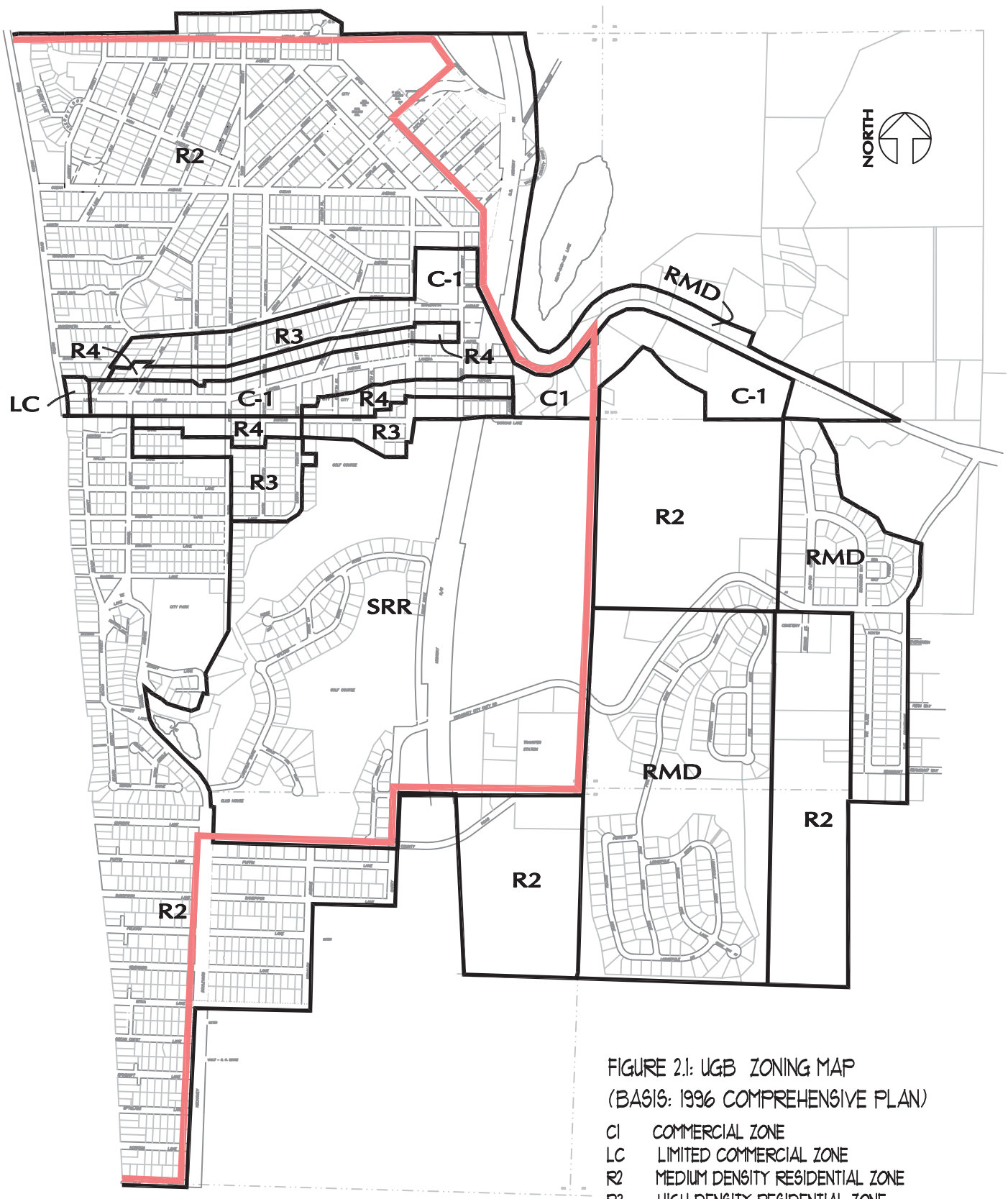


FIGURE 2.1: UGB ZONING MAP
(BASIS: 1996 COMPREHENSIVE PLAN)

CI	COMMERCIAL ZONE
LC	LIMITED COMMERCIAL ZONE
R2	MEDIUM DENSITY RESIDENTIAL ZONE
R3	HIGH DENSITY RESIDENTIAL ZONE
R4	HIGH DENSITY RESIDENTIAL/LIMITED COMMERCIAL ZONE
RMD	RESIDENTIAL MANUFACTURED DWELLING ZONE
SRR	SPECIAL RESIDENTIAL/RECREATIONAL ZONE
	CITY LIMITS
	ZONING BOUNDARY

Table 2.4: Land Use Zoning Summary

Zone	Zone Description
C1	Commercial. Intended to provide for a wide range of retail and service uses.
LC	Limited Commercial. Intended to control the scenic character of the ocean front. Commercial activities limited to tourist accommodations, dining, facilities, and related activities.
R2	Urban Medium Density Residential. Intended for single family dwellings and duplexes on 5,000 square foot (minimum) lots.
R3	Urban High Density Residential. Intended for high density residential development, including multifamily dwellings and apartments. Densities of up to 15 dwellings per acre are permitted.
R4	Urban High Density Residential/Limited Commercial. Intended for high density residential development (as in R3 above) and, in addition, limited commercial uses that serve the local population and provide a transition between the C1 and R3 zone.
RMD	Residential Manufactured Dwellings. Intended to provide an area for manufactured dwellings.
SRR	Special Residential/Recreational Area. Intended for major unplatted land where dwellings are appropriate. Uses may include single family or multifamily dwellings and commercial uses to serve the development. Residential densities shall not exceed 6.5 dwellings per acre.

SECTION 3: EXISTING WATER SYSTEM

3.1 INTRODUCTION

This section includes a brief description of the existing Manzanita water facilities. Selected items from the Wheeler water system are also described. Following sections discuss components of the system in more detail and present recommended improvements.

System locations and sizing were developed from available records including maps provided by the City of Manzanita, prior planning studies and constructions plans, on-site inspections, and with the assistance of City staff.

3.1.1 Water System - General

Figure 3.1 shows the general location of key water components. (Note Tideland Water Coop is not yet connected to the system.) Figures 3.2-3.4 show the Manzanita distribution system. Figure 3.5 shows the water system in schematic form. Photos of key system facilities are included on photo plates at the end of Section 3.

3.1.2 Source/Treatment

Manzanita currently utilizes both groundwater and surface water sources.

Groundwater sources are limited to well#1 and well #2. Well #1 and well #2 were recently constructed and brought on-line (March 2003). (Selected plan sheets are included in Appendix 3.1.) All phases of their planning, funding, design, construction, and operation were conducted in compliance with prevailing standards and regulatory requirements. Water quality is excellent and treatment is limited to pH adjustment (with soda ash) and disinfection (with hypochlorite). Each well is provided with a 50 Hp pump and variable frequency drive. Well #1 is rated at 500 gpm; installed maximum pumping capacity is 520 gpm (748,800 gpd). Well #2 is rated at 1000 gpm (1,440,000 gpd); installed maximum pumping capacity is 525 gpm. Duplex well pumping capacity is 750 gpm.

Anderson Creek is the only surface source currently utilized. The Anderson Creek sources are located high in the watershed. Locked gates restrict access to the area. The North Fork and West Fork have small, permanent diversion dams to facilitate withdrawals. The Middle Fork diversion dam washed out a few years ago and has not yet been repaired. Water quality is generally excellent. Citizens of Manzanita,

in numerous public meetings, expressed preference and support for continued utilization of the surface water sources rather than reliance on the new groundwater source. Citizen demands resulted in construction of the new membrane filtration plant to treat Andersen Creek water and bring the City into compliance with surface water treatment rules.

The recently constructed Manzanita Water Treatment Plant came online in March 2003. (Selected plan sheets are included in Appendix 3.2.) The facility utilizes a microfiltration membrane process with an installed capacity of 350 gpm. Overall design allows for a future capacity expansion to 690 gpm. Filtered water is disinfected and pumped directly to the City's reservoirs. The facility is new and functioning well.

3.1.3 Transmission

Well water transmission mains were constructed in 2002. The mains are HDPE and include: 1200 LF of parallel 8" main between the wells and the well control building, 22,200 LF of 12" main between the well control building and the Wheeler Inter-tie, 3,300 LF of 8" main between the Wheeler Inter-tie and Wheeler at 1st Street, and 16,900 LF of 12" main between the Wheeler Inter-tie and the Manzanita Water Treatment Plant.

The Anderson Creek sources have collector lines of approximately 1000 LF each that join to the primary raw water transmission main. The transmission main includes a 15,200 LF section of predominantly 8 inch AC pipe and a 5000 LF section of 8 inch PVC pipe that extends to the new treatment facility in Manzanita.

3.1.4 Distribution

The Manzanita distribution system includes two pressure zones and over 15 miles of pipelines. Ocean Avenue is the appropriate boundary with most areas to the north served with the high level system. Diameters range from 2" to 10". Approximately 80 percent of the lines are 6" diameter or smaller. Materials are predominantly AC and PVC. Lower areas of the low elevation pressure zone have static pressures of approximately 20-95 psi.

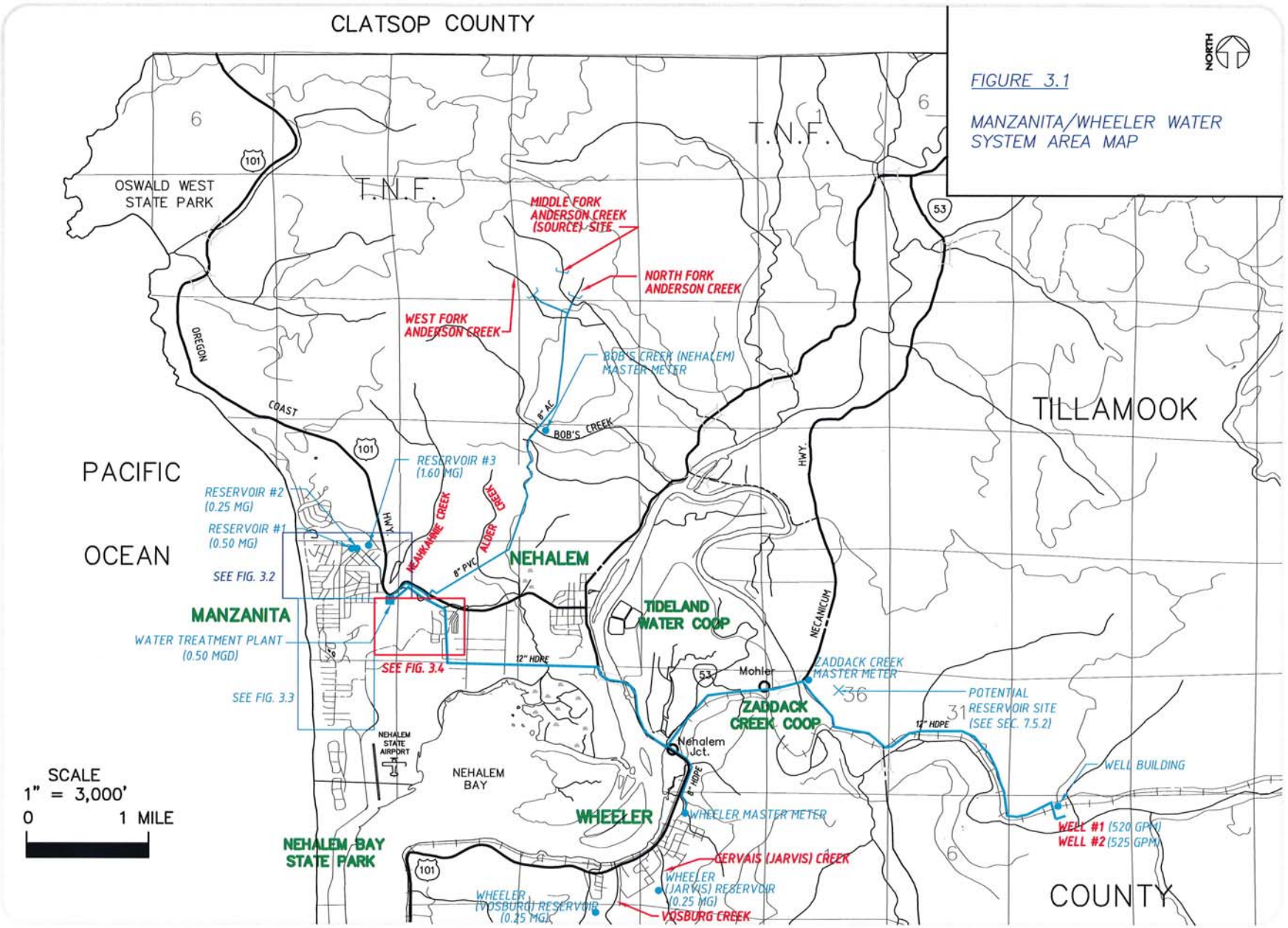
The Wheeler distribution system was extensively upgraded in 2003. The system has two pressure zones. Many older AC mains are still in use. Prior to the departure of the Public Works director in September 2005, several large main leaks were repaired.

3.1.5 Storage

Finished water storage facilities in Manzanita and Wheeler are summarized in Table 3.1:

Table 3.1 : Finished Water Storage Facilities

Owner	Description	Capacity	Construction Date
Manzanita	Reservoir #2 (concrete)	0.25 MG	1960
Manzanita	Reservoir #1 (steel)	0.50 MG	1979
Manzanita	Reservoir #3 (steel)	1.60 MG	1997
Manzanita	Treatment Plant Clearwell	0.07 MG	2003
Wheeler	Jarvis Reservoir	0.25 MG	2003
Wheeler	Vosburg Reservoir	0.25 MG	2003
Manzanita Total Storage Capacity: 2.42 MG			
Wheeler Total Storage Capacity: 0.50 MG			


CLATSOP COUNTY
FIGURE 3.1
MANZANITA/WHEELER WATER SYSTEM AREA MAP
NORTH
OSWALD WEST STATE PARK
T.N.F.
MIDDLE FORK ANDERSON CREEK (SOURCE) SITE
NORTH FORK ANDERSON CREEK
WEST FORK ANDERSON CREEK
BOB'S CREEK (NEHALEM) MASTER METER
8" AC
BOB'S CREEK
OREGON COAST
101
53
TILLAMOOK
HWY.
PACIFIC OCEAN
RESERVOIR #3 (1.60 MG)
RESERVOIR #2 (0.25 MG)
RESERVOIR #1 (0.50 MG)
SEE FIG. 3.2
MANZANITA
WATER TREATMENT PLANT (0.50 MGD)
SEE FIG. 3.4
SEE FIG. 3.3
NEAHKAHNIE CREEK
ALDER CREEK
8" PVC
NEHALEM
TIDELAND WATER COOP
NECANICUM
12" HDPE
Mohler
ZADDACK CREEK MASTER METER
POTENTIAL RESERVOIR SITE (SEE SEC. 7.5.2)
ZADDACK CREEK COOP
Nehalem Jct.
8" HDPE
WELL BUILDING
WELL #1 (520 GPM)
WELL #2 (525 GPM)
NEHALEM STATE AIRPORT
NEHALEM BAY
WHEELER
WHEELER MASTER METER
NEHALEM BAY STATE PARK
CERVAIS (JARVIS) CREEK
WHEELER (JARVIS) RESERVOIR (0.25 MG)
WHEELER (VOSBURG) RESERVOIR (0.25 MG)
VOSBURG CREEK
COUNTY
SCALE
1" = 3,000'
0
1 MILE

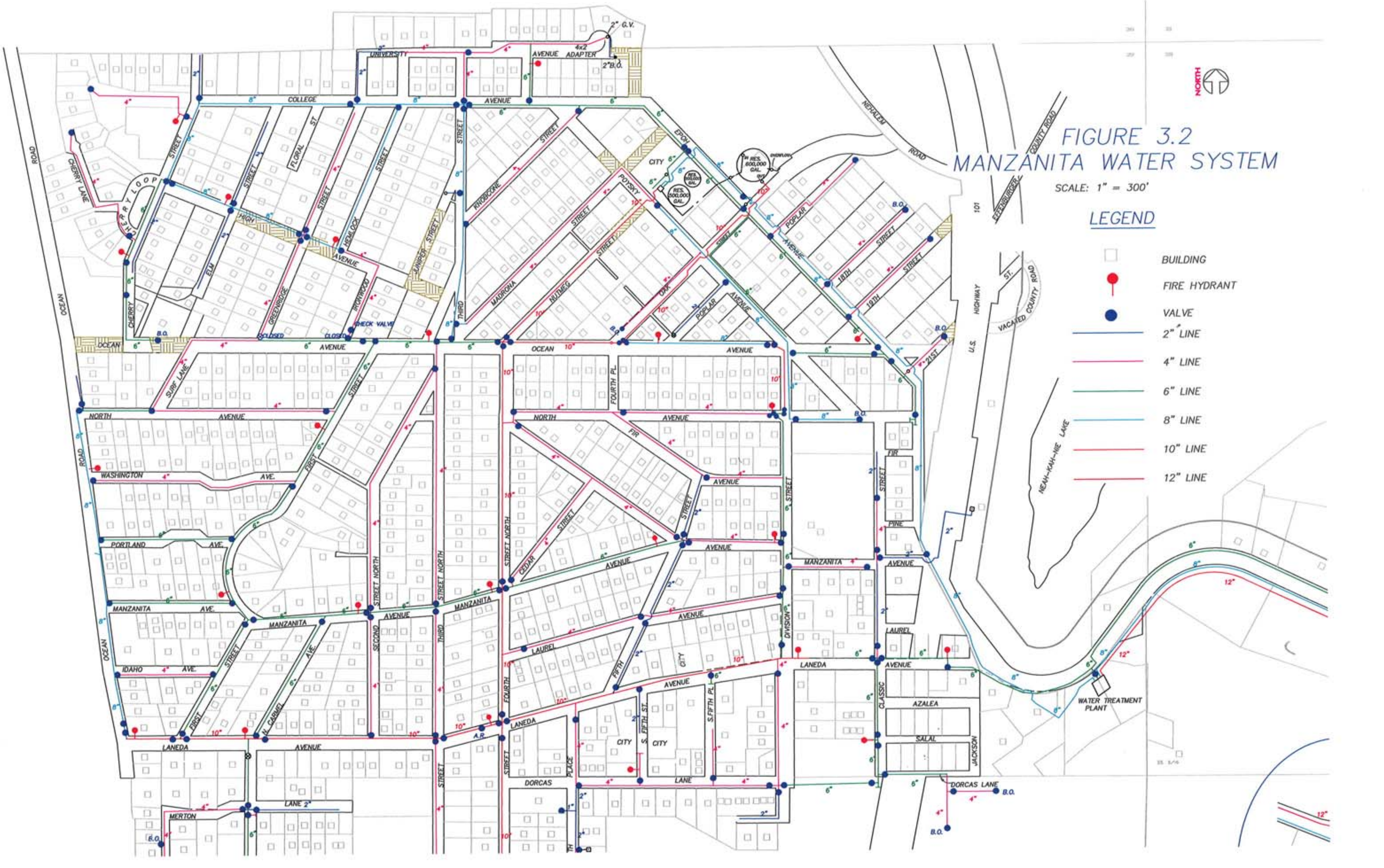


FIGURE 3.2
MANZANITA WATER SYSTEM
SCALE: 1" = 300'
LEGEND
BUILDING
FIRE HYDRANT
VALVE
2" LINE
4" LINE
6" LINE
8" LINE
10" LINE
12" LINE
NORTH
WATER TREATMENT PLANT
NEAH-KAH-NIE LAKE
U.S. HIGHWAY 101
NEHALEM ROAD
OCEAN ROAD
OCEAN AVENUE
LANEDA AVENUE
MANZANITA AVENUE
CLASSIC STREET
DIVISION STREET
DORCAS LANE
CHERRY LANE
COLLEGE AVENUE
RES. 600,000 GAL.
RES. 200,000 GAL.

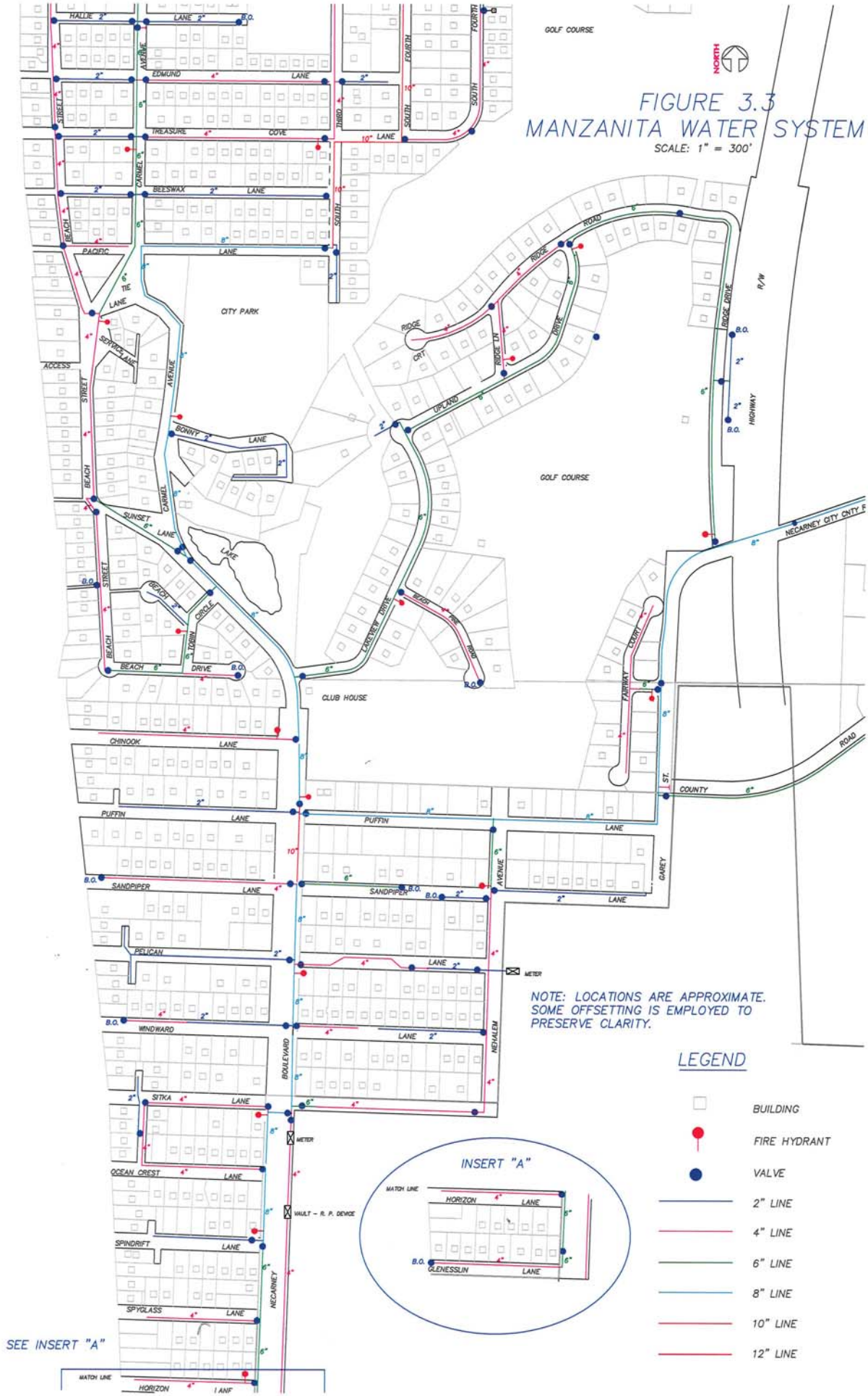


FIGURE 3.3
MANZANITA WATER SYSTEM
SCALE: 1" = 300'
NORTH
GOLF COURSE
CITY PARK
CLUB HOUSE
ACCESS
SEE INSERT "A"
INSERT "A"
NOTE: LOCATIONS ARE APPROXIMATE. SOME OFFSETTING IS EMPLOYED TO PRESERVE CLARITY.
LEGEND
BUILDING
FIRE HYDRANT
VALVE
2" LINE
4" LINE
6" LINE
8" LINE
10" LINE
12" LINE

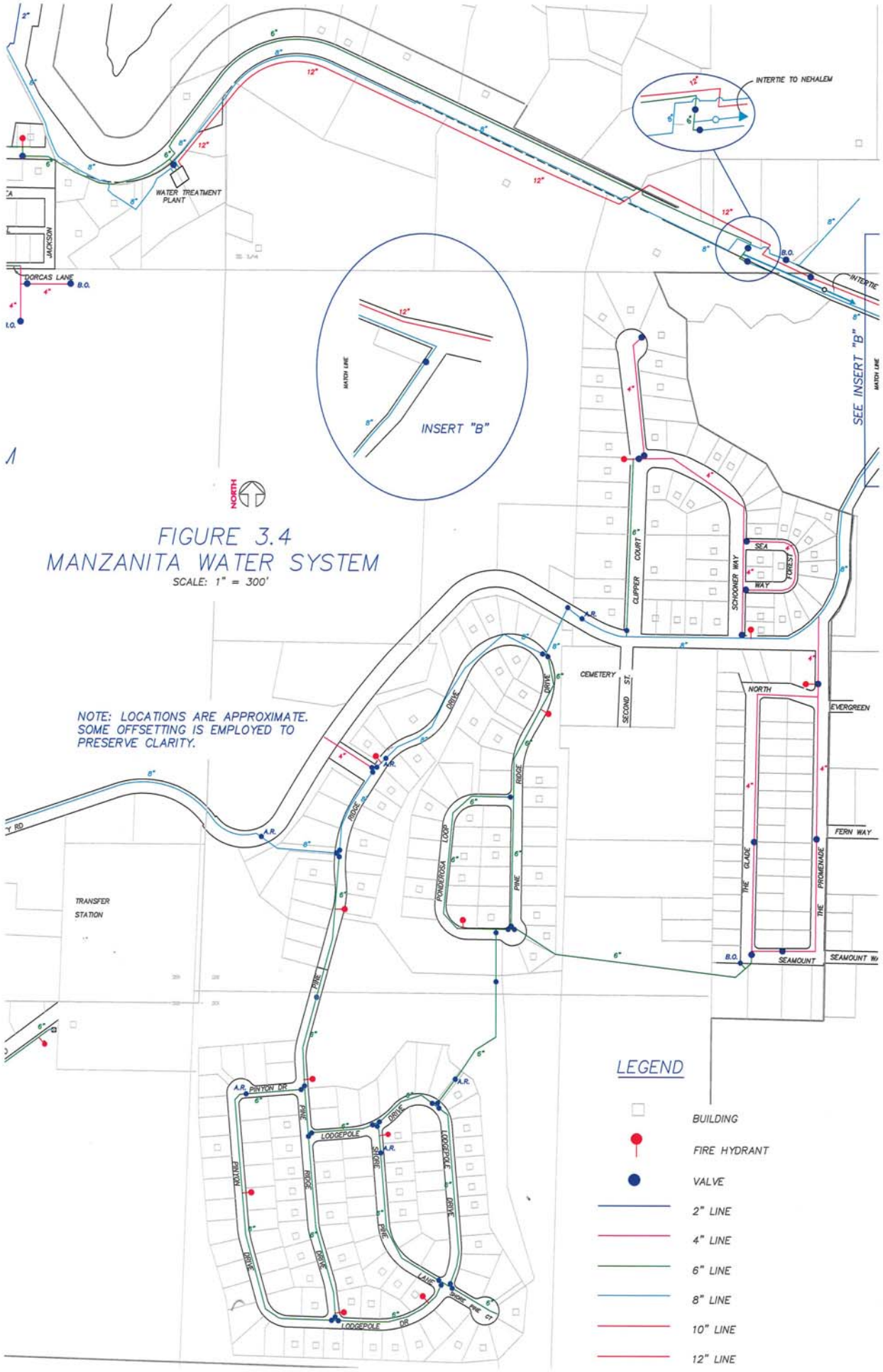


FIGURE 3.4
MANZANITA WATER SYSTEM
SCALE: 1" = 300'

Exhibit 3.5:
Existing Manzanita/Wheeler Water System
(Prepared by John Handler, Manzanita Public Works. Revised 9/16/2005)

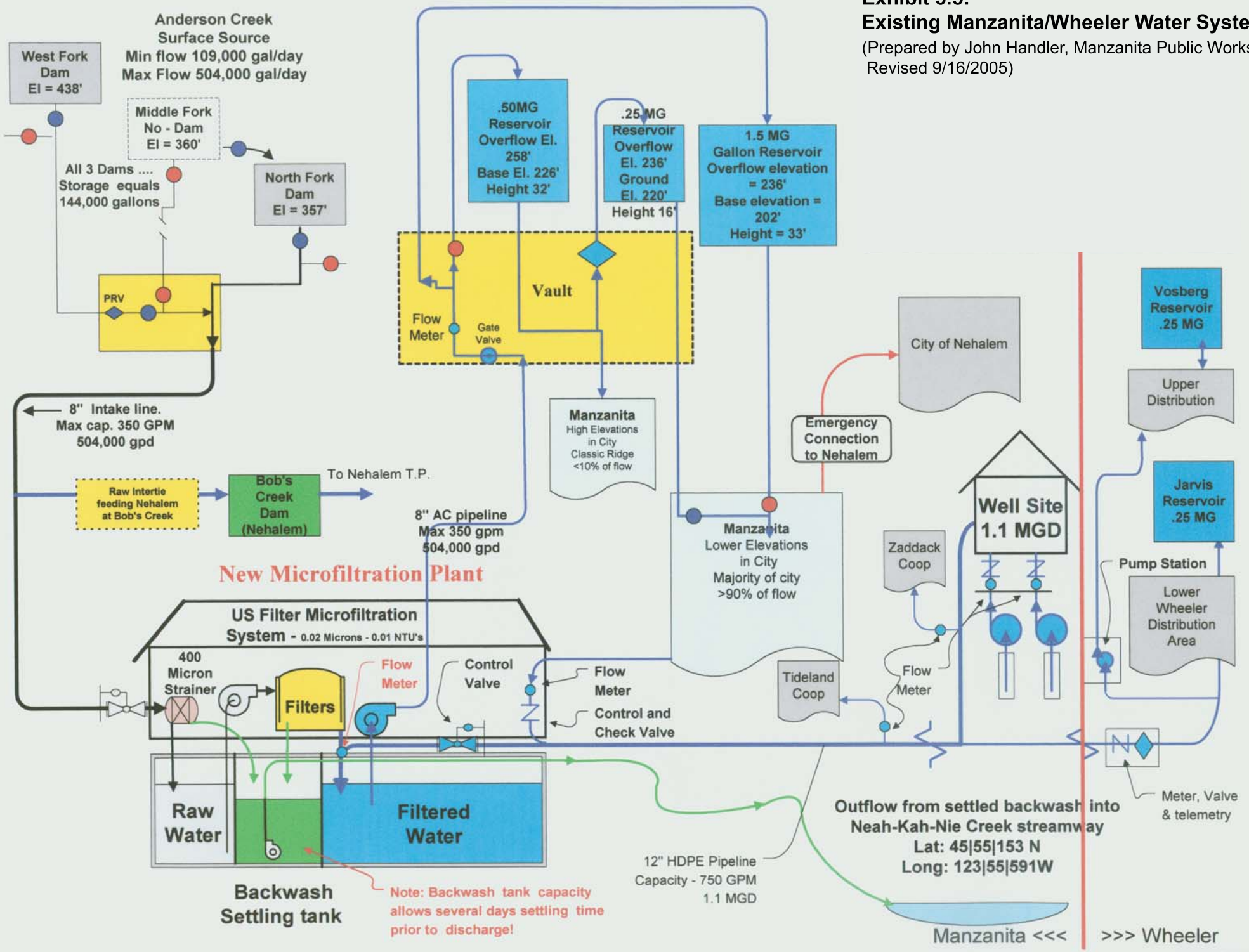


Photo 1: Lower Dam (North Fork Anderson Creek)

Photo 2: View Upstream from Lower Dam

Photo 3: Upper Dam (West Fork Anderson Creek)

Photo 4: View Upstream from Upper Dam

Photo 5: Middle Dam Site (Middle Fork Anderson Creek)

Photo 6: Junction Box for Lines from Upper Dam and Lower Dam

Photo 7: Master Meter (City of Nehalem near Bob's Creek)

Photo 8: Master Meter (Zaddack Creek)

Photo 9: Blank

Photo 10: Well No. 1 (Foreground) and Well No. 2 (Background)

Photo 11: Well Building

Photo 12: View Inside Well Building of Soda Ash Tank and Chemical Feed

Photo 13: Water Treatment Facility (WTP)

Photo 16: Reservoir #2 (0.25 MG, concrete)

Photo 14: WTP Microfiltration Unit (Foreground)

Photo 17: Reservoir #1 (0.50 MG, welded steel)

Photo 15: WTP Chemical Feed

Photo 18: Reservoir #3 (1.6 MG, bolted steel)

SECTION 4: WATER REQUIREMENTS

4.1 INTRODUCTION

This section analyzes current water requirements for Manzanita and the water system as a whole, including water production and water demand. The analysis was developed using water production records provided by the City.

4.1.1 Basis for Projected Future Water Requirements.

Future water requirements are based in part, on future water demand being proportional to future system growth based on a 3 percent AAGR. Implicit in this determination is the assumption that the relative proportions of residential, commercial, and institutional use will remain constant.

4.1.2 Demand Definitions.

The following terminology is used to define characteristics of water use:

Average Daily Demand (ADD): Total use for the year divided by the number of days in the year; expressed in gallons per day (gpd).

Maximum Month Demand (MMD): Total use for the month with the highest total use during the year, divided by the number of days in the month; expressed in gpd.

Maximum Day Demand (MDD): Total use for the day with the highest total use during the year; expressed in gpd.

Peak Hour Demand (PHD): Total use for the hour with the highest total use for the year; expressed in gpd.

Flow and demand parameters are typically abbreviated and expressed as:

mgd: millions of gallons per day
gpd: gallons per day
gpcd: gallons per capita per day

Other flow and demand rates commonly used include:

gpm: gallons per minute
cfs: cubic feet per second

Totalized flow and demands are commonly referred to as:

gal: gallons
MG: million gallons
cf: cubic feet

4.2 CURRENT WATER REQUIREMENTS (For Regional Water System)

4.2.1 Recent Water Withdrawals (Regional Water System)

Well #1 and #2, and the Manzanita Water Treatment Plant, came on-line in March 2003. Zaddack Creek came on-line in September 2004. Prior to March 2003, Manzanita and Wheeler had separate systems. Water withdrawals for water years 2003-2004 and 2004-2005 are shown in Table 4.1 for each active source.

Table 4.1: Recent Water Withdrawals (Source: OWRD Water Use Reporting Forms)
2003-2004

Month/Year	Well #1	Well #2	Anderson Cr. N. Fork	Anderson Cr. W. Fork	Total
Oct 2003	1,236,164	3,154,185	2,386,000	2,386,000	9,162,349
Nov 2003	1,364,480	2,779,584	2,299,215	2,299,215	8,742,494
Dec 2003	2,661,835	1,980,320	2,709,442	2,709,442	10,061,039
Jan 2004	1,533,660	2,146,441	2,701,038	2,701,038	9,082,177
Feb 2004	1,437,567	1,208,947	1,997,659	1,997,659	6,641,832
Mar 2004	1,422,960	1,207,407	2,531,472	2,531,472	7,693,311
Apr 2004	1,252,268	1,141,808	2,468,601	2,468,601	7,331,278
May 2004	1,394,049	1,182,319	2,759,492	2,759,492	8,095,352
June 2004	1,691,686	734,234	3,143,043	3,143,043	8,712,006
July 2004	1,734,160	2,247,276	5,363,728	5,363,728	14,708,892
Aug 2004	266	4,176,718	4,953,783	4,953,783	14,084,550
Sept 2004	910,737	1,953,267	3,941,830	3,941,830	10,747,664
2003-04 Total	16,639,832	23,912,506	37,255,303	37,255,303	115,062,944
% of Total	**14.46%**	**20.78%**	**32.38%**	**32.38%**	**100%**

2004-2005

Month/Year	**Well #1**	**Well #2**	**Anderson Cr. N. Fork**	**Anderson Cr. W. Fork**	**Total**
Oct 2004	1,394,560	1,115,191	2,673,582	2,673,582	7,856,915
Nov 2004	2,084,093	2,146,017	1,112,316	1,112,316	6,454,742
Dec 2004	2,524,047	3,708,240	786,048	786,148	7,804,483
Jan 2005	2,972,148	2,926,222	168,650	168,650	6,235,670
Feb 2005	3,521,806	2,212,809	206,124	206,124	6,146,863
Mar 2005	2,526,811	4,296,866	207,513	207,513	7,238,703
Apr 2005	2,666,621	3,561,172	157,308	157,308	6,542,409
May 2005	3,501,241	4,896,163	175,033	175,033	8,747,470
Jun 2005	4,829,308	4,632,135	188,381	188,381	9,838,205
Jul 2005	6,079,746	6,908,156	61,516	61,156	13,110,574
Aug 2005	5,523,361	8,190,691	170,328	170,328	14,054,708
Sep 2005[1]	4,752,300	5,632,700	170,000	170,000	10,725,000
2004-05 Total	42,376,042	50,226,362	6,076,799	6,076,539	104,755,742
% of Total	**40.45%**	**47.95%**	**5.80%**	**5.80%**	**100%**

[1] September 2005 data estimated based on ratio of August 2004 total and September 2004 total; assumption that Anderson Creek withdrawals will be similar to previous month; and ratio of well withdrawals, for period Oct 2004-August 2005, to allocate remainder between well #1 and well #2.

4.2.2 Seasonal Usage and Peaking (Regional Water System)

Seasonal peaking typically occurs in July and August with the largest (recent) water withdrawal in July 2004 (see Table 4.1). Annual average withdrawal for the system is 303,600 gpd (October 2003-September 2005). Peak month is 474,500 gpd (July 2004). For the month of July 2004, Manzanita utilized an average of 319,968 gpd of source water with a peak day of 422,000 gpd; the ratio of peak day to peak month is 1.32. Table 4.2 shows measured and estimated peaking for the system's raw source water. Peak hourly demand is computed in Section 4.2.3.

Table 4.2: Raw Water Withdrawals (Regional Water System)

Parameter	gpd	gpm	cfs	Peaking Factor
Average Day	303,600	210.8	0.47	1
Peak Month	474,500	329.5	0.73	1.56
Peak Day	626,300	434.9	0.97	2.06[2]

4.2.3 Peak Hourly Demand (Regional Water System)

The PHD estimate is based on an empirical formula (Equation 5-3) from "*Water System Design Manual*, August 2001" by the Washington State Department of Health (DOH #331-123). The equation and computation are provided below:

$$\mathbf{PHD = (MDD/1440)[(C)(N)+F]+18}$$

Where:

PHD = *Peak Hourly Demand (gallons per minute, gpm)*
C = *Coefficient Associated with Ranges of ERUs*
N = *Number of Service Connections, ERUs*
F = *Factor Associated with Ranges of ERUs*
MDD = *Maximum Day Demand, (gpd/ERU)*

For purposes of the computation, equivalent residential units (ERUs) are estimated at 1900[3]. For a range of **N**(ERUs) greater than 500: **C** = 1.6 and **F** = 225.

---

[2] Product of 1.56 x 1.32. (1.32 = ratio of peak day to peak month.)

[3] Based on City EDU Summary dated March 16, 2005. Includes: 1512.5 EDUs for Manzanita, 285.5 EDUs for Wheeler, and 102 EDUs to allow for other connections (Zaddack Creek, Nehalem, etc.).

$$MDD = \frac{(626{,}300 \text{ gpd})}{1900 \text{ ERUs}}$$

PHD = (MDD/1440)[(1.6)(1900)+225]+18
= 765.4 gpm
= 1.102 mgd

4.2.4 Current Regional Water System Production Demand Summary

Current water demands are summarized in Table 4.3.

Table 4.3: Current Water Production Demands (Regional Water System)

Demand Parameter	Current Demand (mgd)	Ratio of Demand Parameter to ADD	Estimated Production Flow per Capita[1] (gpcd)
ADD	0.304	1	269
MMD	0.475	1.56	421
MDD	0.626	2.06	554
PHD	1.102	3.63	976

[1.] Based on a full-time Resident Population of 1129

4.2.5 Water System Efficiency

Typical Residential Water Usage. Typical residential water usage is Manzanita and Wheeler is shown in Table 4.4.

Table 4.4: Typical Metered Residential Water Usage
(Manzanita data: October 2003 - September 2004)
(Wheeler data: September 2004 - August 2005)

Parameter	Manzanita	Wheeler
Gallons per Day (gpd)		
Minimum	57,819	12,792
Average	84,384	18,740
Maximum	154,098	25,281
Gallons per Capita per Day (gpcd)[1]		
Minimum	91.8	31.2
Average	133.9	45.7
Maximum	255.6	61.7
Gallons per Residential Connection per Day[2]		
Minimum	42.1	64.0
Average	61.4	93.7
Maximum	112.2	126.4

1. Manzanita resident population: 603; Wheeler resident population: 410.
2. Manzanita: 1,374 residential connections; Wheeler: 200 residential connections.

The per capita figures for Manzanita are somewhat misleading in that there is a significant non-resident presence in the community even in winter.

Unaccounted Water. For the one-year period (October 2003 to September 2004), Manzanita produced an average of 185,378 gpd of finished water. The service meter total for the same period is 144,969 gpd. Based on this data, there is an estimated unaccounted for water fraction of 21.8 percent. During this time, the City had conducted widespread and frequent line flushing in efforts to clear a "white water" problem that lasted for well over a year. The problem, dissolved oxygen concentrations as high as 130 percent of saturation, was recently rectified.

For the one-year period (September 2004 to August 2005), Wheeler's master meter indicated 80,060 gpd supplied finished water to the City. The service meter total for this period is 60,258 gpd. Based on this data, there is an estimated unaccounted for water fraction of 24.7 percent.

Unaccounted for water computed above does not include estimates for hydrant flushing, construction activities, or discovered/repaired leaks. As noted above, Manzanita had conducted extensive hydrant flushing during this period. Both communities have also located and repaired leaks.

4.3 CURRENT WATER REQUIREMENTS (CITY OF MANZANITA)

4.3.1 Current Water Production Requirements

Current water production requirements for the City of Manzanita are summarized in Table 4.5.

Table 4.5: Current Water Production Requirements (City of Manzanita)
(Based on October 2003 - September 2004 data.)

Parameter	Demand (MG)	(mgd)	(gpm)	Comments	(gpd/EDU[1])
Annual	67.573	0.185	128.6		122.4
May-October	41.312	0.226	157.2		149.7
November-April	26.261	0.144	99.9		95.2
Maximum Month	10.228	0.330	229.1	July 2004 (includes net reservoir volume change)	218.1
3-Day Maximum	1.313	0.438	303.9	July 3-5, 2004 (includes net reservoir volume change)	289.4
Peak Day	0.521	0.521	361.8	July 4, 2004 (includes net reservoir volume change)	344.5
Peak Hour	0.039	0.937	650.8	Use equation described in Section 4.2.3.	619.5

[1] 1512.5 EDUs

4.3.2 Metered Water Usage by Customer Category (City of Manzanita)

Metered water usage by customer category for the year (October 2003 - September 2004) is summarized in Table 4.6.

Table 4.6: Metered Water Usage (City of Manzanita)

Rate Code	Customer Category	Supplemental Description	Jan-March 2004		July-Sept 2004		Oct 2003 -Sept 2004	
			Accounts	(MG)	Accounts	(MG)	Accounts	(MG)
1	Residential (Within City)	Single Unit	951	5.276	1,029	14.061	1,066	30.800
4	Residential (Within City)	Multiple Units	29	0.399	28	0.738	29	1.957
3	Residential (Outside City)	With Fire Protection	76	0.681	88	1.039	89	3.117
5	Residential (Outside City)	Multiple Units	1	0.001	1	0.001	1	0.009
15	Residential (Outside City)	No Fire Protection	97	0.651	132	1.808	133	3.849
6	Residential (Outside City)	3/4" meter	28	0.612	30	1.136	31	3.072
7	Commercial (Within City)	1" meter	19	0.712	19	1.493	19	3.601
9	Commercial (Within City)	2" meter	2	0.186	2	0.506	2	1.119
11	Commercial (Outside City)	3/4" meter	1	0.001	2	0.086	2	0.098
12	Commercial (Outside City)	1" meter	2	0.030	2	0.063	2	0.162
14	Commercial (Outside City)	2" meter	1	0.256	1	1.877	1	3.273
2	Misc. Accounts	Temporarily Off	3	0.043	3	0.040	6	0.144
16	Misc. Accounts	Public Accounts	9	0.181	11	2.519	13	3.388
17	Misc. Accounts	Old accounts to remove	24	0.237	0	-	37	0.512

	Jan-March 2004		July-Sept 2004		Oct 2003 -Sept 2004	
	Accounts	(MG)	Accounts	(MG)	Accounts	(MG)
Residential Subtotal	1,154	7.008	1,278	17.647	1,318	39.732
Commercial Subtotal	54	1.797	56	5.161	57	11.325
Misc. Subtotal	36	0.461	14	2.559	56	4.044
Total	**1,243**	**9.266**	**1,348**	**25.367**	**1,431**	**55.101**
Inside City Subtotal	1,029	7.185	1,108	17.934	1,147	40.549
Outside City Subtotal	179	1.620	226	4.874	228	10.508

4.4 WATER CONSERVATION

As a general term, water conservation refers to the recognition of water as a limited resource and the policies and efforts implemented to limit water withdrawals accordingly. Conservation (in Oregon) is defined more formally by OAR 690-400-0010(5) as meaning elimination of waste "or otherwise improving efficiency in the use of water while satisfying beneficial uses by modifying the technology or method for diverting, transporting, applying, or recovering the water, by changing management of water use, or by implementing other measures."

Increased competition for an ever dwindling resource has prompted the State to approach the matter through regulatory actions. Oregon Administrative Rules Chapter 690, Division 86, includes requirements for preparation and submittal of Water Management and Conservation Plans (WMCP). A WMCP is a document that describes the supplier's system, usage, management, and conservation. The WMCP is a likely requirement for action by Oregon Water Resources Department (OWRD) on water rights related work such as permit extensions, or approvals. Originally, it provided OWRD with information on the supplier's system and needs, and guidance on planning and conservation matters for the supplier. Today, it is interpreted more as a contract between the supplier and the State. OWRD is looking for concrete and verifiable plans, and implementation schedules, rather than general recommendations or exhortations "to consider . . ." WMCP updates are required every 10 years; a progress report is required 5 years after submittal of the WMCP. WMCPs are taking on an importance comparable to Water Master Plans

Water rights permit G-13479 which governs withdrawals at the system's two new wells includes a requirement that a water management and conservation plan (WMCP) consistent with OAR Chapter 690, Division 86, be submitted to the Oregon Water Resources Department (OWRD).

4.4.1 Previous and Current Conservation Efforts

Metering. Metering and data acquisition is currently in place for:

- All raw water sources. Anderson Creek North Fork and West Fork water passes through the same meter; Manzanita assumes a 50/50 contribution from each of these sources.
- All interties and bulk sales. The only exception is the finished water intertie with Nehalem. Manzanita is currently planning to install a meter.
- All customer service connections.
- Reservoirs
- Treatment processes including backwashing and discharge to waste.

Full metering of customer service connections provides data for usage based rates and billing. Metering and usage based rates are probably the single most effective means of promoting water conservation. Both Manzanita and Wheeler are fully metered and base water billings in part of metered usage.

Service meters are read quarterly in Manzanita and every other (odd numbered) month in Wheeler.

Manzanita has an active meter testing and replacement program. Approximately one tenth of Manzanita's service meters are replaced annually.

Monitoring. Manzanita is highly vigilant in monitoring data for changes, discrepancies, or other indicators of problems in the system. The City's SCADA system is set up to compile and compare usage throughout the system, including Wheeler's. Leaks as small as that occurring in 3/4-inch service lines can be detected. (The SCADA system is configured to establish the general area in which a leak occurs; it cannot establish the exact location.) Manzanita's Public Works Department maintains exhaustive computer files and spreadsheets that track and compare planning, flow, water quality, and usage data. The City's billing software also tracks usage and notes departures from previous usage patterns and/or excessive use.

Leak Detection and Repair. Reported leaks, and potential leaks identified by the SCADA system or billing programs, are promptly addressed by public works personnel. Manzanita also monitors (via SCADA) Wheelers system and notifies Wheeler Public Works if there is a potential leak detected.

Manzanita has installed new valves in many areas to facilitate isolation of lines and repairs. Both Manzanita and Wheeler have replaced many older AC lines. Manzanita has replaced sections of the raw water transmission line from the Anderson Creek sources to correct leaks. Wheeler recently (September 2005) located and repaired several very large leaks.

Policies. Manzanita currently requires installation of Lo-Flow water fixtures on all new (or remodel) construction. The City also recommends native plant landscaping during plan review; however, there are no requirements that recommendations be implemented. The City reports that most new homes in the area are opting for native landscaping. Drip irrigation is recommended for those that do choose to irrigate plantings. The City also reports a significant number of residents have changed their plantings to low (or no-use) water demand landscaping because of the relatively high water rates stemming, in part, from debt service on recent improvement projects.

Manzanita Public Works will check suspected leaks, or customers suspicions of a leak, at no charge to the customer. Customers who have a leak repaired are eligible to have the effected billing adjusted to what the average billing would have been upon proof of the repair (such as a receipt from a plumber) and a City follow-up check of the water meter. Manzanita also follows up (with an onsite visit) on water accounts that are flagged by the City's billing software as exhibiting abnormal usage.

4.4.2 Planned Conservation Measures

Currently, the area has sufficient water rights and source development to meet customer needs and to allow for system growth; consequently, conservation efforts are not being driven by water demand. Both Manzanita and Wheeler have recently completed extensive improvement projects including source development/expansion and a new surface water treatment plant in Manzanita; consequently, conservation efforts are also not being driven by economics. Manzanita's conservation efforts to date reflect a progressive attitude toward the inherent benefits of conservation and the long-term sustainability and reliability of its water supply. It also reflects a commitment by the City and Public Works Department to promptly address system deficiencies within the constraints of affordability and practicability. Manzanita

extends its assistance to Wheeler in monitoring the system and providing technical assistance.

Policies and practices currently in place are anticipated to be carried forth indefinitely into the future. Additional measures to be implemented by the City of Manzanita include:

- Install a water meter on the (finished) water line that connects to the City of Nehalem's system. The line is currently unmetered and used for emergencies.
- Replace the existing transmission line from the Anderson Creek sources. The line is old and susceptible to breakage.
- Replace AC and other old mains as practicable and affordable.
- Develop short articles and information on conservation for inclusion in the City's quarterly newsletter.
- Annual water audit that includes detailed estimates of all unmetered usage (such as hydrant flushing).
- Complete a new water master plan.

OAR 690-086-0150 (4) requires all water suppliers to implement the following conservation measures:

- An annual water audit.
- Full metering of service connections.
- A meter testing and maintenance program.
- A rate structure that reflects and incorporates consideration of metered water consumption.
- A leak detection program if the annual water audit indicates system leakage in excess of 10 percent.

- A public education program to encourage efficient water use and low water use landscaping.

Manzanita is largely in compliance with these requirements; Wheeler needs to develop programs and policies that reflect these requirements. The City of Wheeler has not, to date, implemented specific conservation related measures other than replacement of defective mains, and repairs of leaks, to the extent practicable and affordable, complete metering of service connections, and the development of usage based water rates. The City has part-time public works staff with multiple responsibilities and a very limited public works budget. Currently, the City is looking for a new public works director to fill the vacancy left by the departure of the prior director in September 2005. Implementation of new conservation measures is unlikely until a new director is hired, oriented, and allowed to catch up on other pressing matters. The implementation schedule reflects this consideration.

Specific conservation and related measures to be implemented by Wheeler include:

- Compile list of known or suspected leaks (if any) that need to be checked or corrected.
- Develop a plan to check and correct known or suspected leaks.
- Implement leak correction plan.
- Conduct an annual water audit. The audit should include all metered connections and estimates of all unmetered usage (such as hydrant flushing).
- Develop a plan for service meter testing/repair and/or replacement.
- Implement service meter plan
- Develop a public education program that, at a minimum, provides information on low water use landscaping, encourages efficient water use, and provides information on Wheeler's conservation activities and implementation schedule.
- Implement public education program.

4.4.3 Conservation Measures Summary and 5-Year Implementation Plan

OAR 690-086-0150(4) requires a list of the 5-year conservation measures (benchmarks) and an implementation schedule. 5-year benchmarks and implementation schedules are provided below in Table 4.7 and Table 4.8 for Manzanita and Wheeler respectively. Manzanita is currently completing a water system master plan (anticipated complete in November 2005) that will address recommended improvement projects; consequently, improvement scheduling is very approximate and tentative. As noted above, Wheeler is currently recruiting a new public works director. The City has had several staff changes in recent years; consequently, there is a limited knowledge/experience base or extant records upon which to draw for planning and implementation of the measures listed. The benchmark schedule for Wheeler is therefore also tentative and subject to change; however, the overall goal is full implementation of the listed measures prior to the WMCP update in five years (2010).

Table 4.7: City of Manzanita 5-Year Conservation Benchmarks

Benchmark	Date (Goal)	Frequency
Ongoing Efforts		
Service meter replacement	September 2005	10-yr. cycle
Service meter checking	September 2005	On-call
System monitoring	September 2005	(Varies according to parameter)
Leak detection and repair	September 2005	As required
Lo-flow water fixture requirements	September 2005	Policy
Financial incentives for leap repair	September 2005	Policy
Water audit	September 2005	Annually
Newsletter with information on conservation	September 2005	Quarterly
Planned Programs		
Install water meter on Nehalem connection	2006	-
Replace Anderson Creek transmission main	2007	-
Replace selected AC and other old mains	2010	-
Public information on conservation	January 2006	Quarterly
Complete water system master plan	April 2006	-

Table 4.8: City of Wheeler 5-Year Conservation Benchmarks

Benchmark	Date (Goal)	Frequency
Planned Programs		
Compile list of known or suspected leaks (if any)	May 2006	-
Develop plan to check and correct leaks	July 2006	-
Implement leak correction	September 2007	-
Conduct annual water audit	November 2008	Annually
Develop plan for service meter check/repair or replacement program	July 2006	-
Implement service meter plan	August 2006	According to plan
Develop public education plan	December 2006	According to plan
Implement public education plan	April 2007	According to plan

4.4.4 Curtailment Plan Elements

Context. With development of the new well source and transmission mains, it is unlikely that water supply will be affected by seasonal weather patterns or changes in raw water availability. Disruptions in supply will likely be limited to emergencies or localized impacts from construction or maintenance activities. Manzanita has

prepared a detailed emergency response plan that addresses water related emergencies. Construction and maintenance activities are typically coordinated to avoid unnecessary disruptions of water supplies.

Curtailment Plan. A proposed curtailment plan is described in Table 4.9. Development of a water curtailment ordinance would allow the designated City authority to promulgate a water supply emergency, enact the curtailment plan, and police customer compliance through the issuance of warnings and fines. Without an ordinance, the curtailment plan becomes an advisory plan that can be used as a reference to base requests for public actions to reduce consumption. The issue is complicated by the multiple jurisdictions involved. It is strongly recommended that Manzanita and Wheeler coordinate prior to the development and adoption of curtailment ordinances (should they desire to do so) so as to maintain consistency and to avoid potential conflicts.

Table 4.9: Proposed Curtailment Plan

Stage	Trigger	Goal	Implementation Measures
Mild	Use reaches 80% of capacity	General awareness and modest reductions in consumption.	• Activate curtailment plan • Provide information (guidance) to the public on conservation methods. • Request customers to limit irrigation. • Avoid flushing hydrants.
Moderate	Use reaches 90% of capacity	Enhanced awareness and moderate reductions in consumption.	• Continue "mild" stage measures. • Request irrigation be minimized to that necessary for plant survival. • No lawn irrigation.
Critical	Use reaches 95% of capacity	Awareness of critical supply shortage and maximum reduction in consumption.	• Continue "moderate" stage measures. • No outdoor irrigation. • No vehicle washing. • No hosing of paved surfaces.

4.5 FIRE FLOW REQUIREMENTS

The amount of water used for fire fighting in comparison to total yearly water consumption is negligible; however, heavy demands during major fires greatly influence the design of the distribution system and storage reservoirs. Recommended quantities of fire flow are different for commercial and residential property, and are dependent on a number of factors such as building size, distance between buildings, building construction, etc.

Recommended fire flows for single-family residential dwellings can be based on a complicated formula that includes square footage as a variable. A typical residential fire flow recommendation is 1,000 to 1,500 gpm, though smaller dwellings and wider spacing generally reduce the actual need. Dwellings with less than 3,600 square feet are identified by the Uniform Fire Code (UFC) as requiring a minimum of 1,000 gpm. Insurance Services Office (ISO) recognizes distance between residences as a significant factor. ISO recommendations include a needed fire flow of 500 gpm for one and two family dwellings, two stories or less, with a distance between buildings of over 100 feet. The ISO recommendations increase to 1,500 gpm for separation distances of less than 11 feet. AWWA recommendations, for public water systems used for fire suppression is a minimum of 500 gpm with a residential pressure of 20 psi at any point in the system. The need to prioritize system improvements according to financial resources and realities may result in some areas, such as higher level pressure zones or isolated properties/areas, having more limited fire protection capabilities. Higher fire flows are needed for larger buildings and higher densities of construction characteristic of many core commercial areas and schools. Actual fire flow needs in any given area may vary widely according to the actual construction present.

In 1995, ISO evaluated the Manzanita Fire District which includes the City of Manzanita and the Neahkanie Water District. The Manzanita Fire District was given a Class 5 protection rating (where Class 1 is best and Class 8 is worst). 40 percent of the overall rating is based on the community's water supply and characteristics. The class rating is very important in establishing local property insurance premiums. Costs of maintaining or upgrading a water system can sometimes be offset, at least in part, by reduced insurance premiums associated with a more favorable system rating; however, an increase from Class 5 to Class 4 would probably not result in significant insurance savings for residents of Manzanita.

Manzanita's 1990 Water Master Plan recommended a general fire flow allowance of 2,140 gpm, for a duration of four hours, to estimate a fire flow (reserve) storage volume of 513,600 gallons. As a general fire flow reserve, this is probably more than adequate in view of the City's desire to remain primarily residential (see Section 2.5). A desirable minimum flow in residential areas is 500-1000 gpm. In most communities, there are peripheral or isolated structures that have lower fire flow capabilities because of higher elevation (resulting in low water pressure), small pipe diameters, dead-end lines, or long pipe runs (resulting in high friction losses and reduced flow capacity). While it is always possible to improve local fire flows, the cost of doing so may be out of proportion to the theoretical benefits. In addition, most communities have to focus on improvements that benefit the community as a whole, rather than individuals, because of limited financial capabilities and/or willingness of the community to entertain rate increases or higher debt service.

As a final note: from a fire flow perspective, more is always better; however, no specified flow/duration capability can assure the City that it is fully protected from all fire related scenarios.

4.6 PROJECTED WATER PRODUCTION REQUIREMENTS

4.6.1 Future Demand (Regional Water System)

Planning for the regional water system anticipated the eventual future connection of: Neahkahanie Water District, Tideland Water Coop, Brighton, City of Rockaway Beach, and Watseco/Barview Water District. There is no schedule for adding communities; communities must obtain approval from both Manzanita and Wheeler City Council's before being admitted to the regional water system. Since there are no requirements for the identified communities to join the system, motivation or reticence will likely be driven by local politics and the perception of an actual or impending water supply crisis.

Resident population growth in both Manzanita and Wheeler has averaged approximately 1.5 percent per year since 1990. Tillamook County's recent long term projection for the County as a whole and for each municipality incorporates a rate of 0.98 percent on an average annual growth basis. County provided (high) projections for the municipalities potentially involved with the water system are included in Table 4.10.

Table 4.10: Population Projections
(Source: Tillamook County)

City	2010	2015	2020	2025	2040
Manzanita	655	690	728	764	874
Nehalem	336	354	373	391	448
Rockaway	1,438	1,516	1,598	1,677	1,920
Wheeler	444	468	493	518	592

The most significant additions in resident population for the water system is likely to be the addition of new communities, Rockaway in particular, rather than in population growth within the current service area.

The existing, and potential, service area can be characterized as having considerable potential for expansions in non-resident presence and the businesses that cater to them. Between 1989 and 1996, Manzanita's total water service connections grew at

a rate of 3.84 percent per year. High development levels have persisted and as a consequence, Manzanita uses a general planning figure of 3% AAGR (average annual growth rate). Growth pressures have increased in Wheeler as well and the City is seeing considerable activity and interest in new residential development. Accommodating the growth does not appear problematic. Both Manzanita and Wheeler have available undeveloped land for continued development. Infill development and subdivisions are also occurring: in April 2005 Manzanita reported 2014 platted lots in developed areas - an increase of 12 percent over the November 2000 figure of 1799 lots.

Manzanita's general planning figure of 3 percent AAGR will be used for general future planning of the joint water system until more accurate planning data is available. If one of the larger communities, such as Rockaway, requests to become part of the regional system, planning figures will need to be adjusted and the impacts of the connection assessed. It must also be borne in mind that future system connections, such as Rockaway, may not rely fully on the regional water system and only use it to supplement their own supplies during periods of high demand or for emergencies.

Future water demand based on 3% average annual growth are presented in Table 4.11. As noted above, this is a tentative planning figure and does not take into account major system expansions, to accommodate new communities, as discrete events.

Table 4.11: Future System Water Demand (Regional Water System)
(Based on 3% AAGR)

Parameter	2005	2010	2015	2020	2025	2050
Average Day						
gpd	**303,600**	352,000	408,000	473,000	548,000	1,148,000
gpm	210.8	244	283	329	381	797
cfs	0.47	0.54	0.63	0.73	0.85	1.78
Peak Month						
gpd	**474,500**	550,000	638,000	739,000	857,000	1,794,000
gpm	329.5	382	443	513	595	1,246
cfs	0.73	0.85	0.99	1.14	1.33	2.78
Peak Day						
gpd	**626,300**	726,000	842,000	976,000	1,131,000	2,368,000
gpm	434.9	504	585	678	786	1,645
cfs	0.97	1.12	1.30	1.51	1.75	3.66

The demand figures do not take into account reductions in demand due to water conservation efforts. Improved water auditing needs to be performed on the system to more accurately determine the nature of the unaccounted for water. Manzanita has conducted numerous flushing operations without estimating water utilized and there is an occasional problem with finished water recycling back into the clearwell (in effect getting metered twice). Wheeler has old water service meters, and based on very low per capita usage (Table 4.4), it is very possible the meters are, on average, under reporting. With implementation of improved auditing and conservation measures, more accurate data should be available for the WMCP update in 2010.

4.6.2 Future Demand (City of Manzanita)

Future demand for the City of Manzanita is summarized in Table 4.12. Demand figures are based on current demand (Table 4.5) figures increased by three percent per year. The peak hour figure is recomputed according to the equation described in Section 4.2.3.

Table 4.12: Future Water Demand (City of Manzanita)

a) mgd

Parameter	Year				
	2010	**2015**	**2020**	**2025**	**2028**
Annual	0.221	0.256	0.297	0.344	0.376
May-October	0.270	0.313	0.363	0.420	0.459
November-April	0.172	0.199	0.231	0.268	0.293
Maximum Month	0.394	0.457	0.530	0.614	0.671
3-Day Maximum	0.523	0.606	0.703	0.815	0.890
Peak Day	0.622	0.721	0.836	0.969	1.059
Peak Hour	1.101	1.260	1.688	1.656	1.800

b) gpm

Parameter	Year				
	2010	**2015**	**2020**	**2025**	**2028**
Annual	153.4	177.8	206.2	239.0	261.2
May-October	187.4	217.2	251.8	292.0	319.0
November-April	119.4	138.4	160.5	186.0	203.3
Maximum Month	273.6	317.2	367.7	426.3	465.8
3-Day Maximum	363.2	421.0	488.1	565.8	618.3
Peak Day	432.0	500.8	580.6	673.1	735.5
Peak Hour	764.7	874.8	1172.4	1150.3	1250.2

c) cfs

Parameter	Year				
	2010	**2015**	**2020**	**2025**	**2028**
Annual	0.342	0.396	0.459	0.533	0.582
May-October	0.418	0.484	0.561	0.651	0.711
November-April	0.266	0.308	0.358	0.415	0.453
Maximum Month	0.610	0.707	0.819	0.950	1.038
3-Day Maximum	0.809	0.938	1.088	1.261	1.378
Peak Day	0.963	1.116	1.294	1.500	1.639

SECTION 5: WATER SOURCES

5.1 WATER RIGHTS INVENTORY

Manzanita's water rights are described in Table 5.1. Water right certificates are included in Appendix 5.1. Table 5.1 also includes Wheeler's water rights for well #1 and well #2.

Table 5.1: Water Rights Summary
City of Manzanita

Owner	Priority Date	Permit No.	Certificate No.	Use	Type	Rate (cfs)	Description[1]
Manzanita	12/15/1978	43756	NA	MU	S	0.50	W. Fork Anderson Cr.
Manzanita	12/10/1945	17073	4775	MU	S	0.25	Middle Fork Anderson Cr.
Manzanita	12/10/1945	17073	4775	MU	S	0.25	N. Fork Anderson Cr.
Manzanita	8/14/1950	21913	21707	MU	S	0.867	Neahkahanie Cr.
Manzanita	9/14/1948	18634	21684	MU	S	0.50	Alder Cr.
Manzanita	6/12/1951	21913	21708	MU	R	(1.23 ac-ft)	Alder Cr./ Neahkahnie Cr.
Manzanita	8/14/1950	21913	21707	MU	S	0.433	Alder Cr.
Wheeler	7/29/1993	G12196	NA	MU	GW	3.60	Well #1 and #2

Abbreviations: NA - not applicable
MU - municipal
S - surface water
R - reservoir
GW - ground water

[1] Current place name. Certificate in Appendix 5.1 may indicate historic place names not currently in use.

Manzanita utilizes Well #1 and Well #2, and the Anderson Creek surface water sources for municipal supply. Manzanita has not utilized its other surface water sources in recent years due to low flows and reported high iron concentrations.

5.2 WELL SOURCES

Well data for Well #1 and Well #2 is summarized in Table 5.2. Well locations are shown in Figure 3.1. Well logs are included in Appendix 5.2.

Table 5.2: Well Data Summary

Item	Well #1	Well #2
Drilled Date	July 24, 1996	July 25, 1996
Constructed Date	December 2002	December 2002
Elevations[1]		
Vent	37.00	37.00
Ground	27.30	27.30
Top of Pump	(-)7.7	(-)12.2
Top of Well Screen	(-)12.7	(-)17.2
Bottom of Well Screen	(-)14.7	(-)32.7
Bottom of Well Casing	(-)22.7	(-)33.7
Static Water Level (elev)	13.3	13.3
Casing Diameter/length	12 inch / 7 feet	12 inch / 15 feet
Well Pump		
Type	Submersible	Submersible
Drive Type	Variable Frequency	Variable Frequency
Manufacturer	Goulds	Goulds
Model	SV9RCHC-7STG	SV9RCHC-7STG
Horsepower	50	50
Capacity[2]/TDH	525 gpm/296 ft.	525 gpm/296 ft.
Flowmeter		
Type	Magnetic	Magnetic
Manufacturer	Dan Foss	Dan Foss
Model	Mag 3100 Water	Mag3100 Water
Serial Number	031129T172	18329T222

[1] Source: Record Drawings, 2001
[2] Combined capacity: 750 gpm

The wells pump water through independent 8" transmission lines to the well building where water is disinfected and caustic soda added for corrosion control. The building measures 20 feet x 32 feet and includes: electrical panels, chemical storage, a MIOX mixed oxidant on-site disinfectant system, soda ash tank, chemical feed equipment and a standby power

generator. The wells and well building are relatively new (constructed in 2002) and in excellent condition.

5.3 SURFACE WATER SOURCES

5.3.1 Anderson Creek Sources

The three Anderson Creek sources are the City's only currently developed surface water sources. Approximate locations of the sources are shown in Figure 3.1. Photographs of the Anderson Creek sources (Photos #1-6) are located at the end of Section 3.

The North Fork (Anderson Creek) source is utilized year round and is the primary surface water source. Permitted use is 0.25 cfs (161,568 gpd). Measured minimum stream flow was 0.372 cfs (240,480 gpd) in September 1965. The North Fork dam ("Lower Dam") is a concrete structure with an intake and minimal in-stream storage. Water levels are controlled by removable wood planks. (See Photo 1, Section 3). Approximately 1060 lineal feet of main separate the intake from the junction with the transmission main from the Upper Dam (West Fork). GPS coordinates (Source: DEQ, 1999) for the intake are: 45.75396 north latitude, -123.89597 west longitude.

The West Fork (Anderson Creek) source is utilized as needed to supplement flow from the North Fork. Permitted use is 0.5 cfs (323,136 gpd). Dry season stream flow for the West Fork and Middle Fork combined is 0.124 cfs (80,000 gpd) as reported by Handforth & Larson, Inc. (1982). The West Fork dam ("Upper Dam") is a concrete structure 45 feet wide and 8 feet high. Water levels are controlled by removable wooden planks. (See Photo 3, Section 3). Approximately 1,320 lineal feet of main separate the intake from the junction with the transmission main to the water treatment plant. The line passes through a pressure reducing value just prior to the junction to adjust for the approximate 80 feet of head differential between the upper and lower dams. GPS coordinates for the intake are: 45.75219 north latitude, -123.89858 west longitude.

The Middle Fork (Anderson Creek) source is infrequently utilized. The dam washed out several years ago - the new channel is further east. Remains of the dam, and more recently constructed piping that serves as an intake and transmission main, can be seen in Photo 5, Section 3. The Original transmission main between the intake and the junction with the transmission main to the water treatment facility was 1,180 feet in length. GPS coordinates for the (former) intake are: 45.75394 north latitude, -123.89650 west longitude.

The upper and lower dams are still functional. Staff have expressed concerns about the difficulties and hazards associated with adjusting the planks used to regulate the impoundment height. The dams do not meet current standards for fish passage. Any work on the dams that requires a permit for completion will need to meet current standards.

5.3.2 Other Surface Water Sources

Other potential surface water sources, for which the City holds water rights (Table 5.1), are located on Alder Creek and Neahkanie Creek. These are no longer in use due to limited flow and reported high iron content; however, potential remains for future development, if need and economics warrant it, or for use in future negotiations to secure additional water for the City[1].

5.4 WATER AVAILABILITY

5.4.1 Capacity Assessment

The regional system has permitted access to 3.6 cfs at the well site. Current installed well capability (duplex mode) is 750 gpm (1.67 cfs). Based on Table 4.11, installed well capacity should be adequate to meet peak day demands for the next 15-20 year period; however, addition of any new communities to the system will shorten the timeline according to the size of the communities added and their need (whether it is for full water supply or only to supplement existing sources).

With Manzanita's Anderson Creek sources (0.75 cfs of water rights currently utilized), the regional system should be well positioned to serve the area needs through the next 20 year planning period under the 3% AAGR and qualifications previously discussed in Section 4.6.

5.4.2 Projected 20-year Withdrawals

Projected 20-year peak withdrawals are presented in Table 5.3. The figures are consistent with discussions and qualifications presented elsewhere in Section 5.

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[1] Water law and policies are continually evolving - it is impossible at this time to know what type of negotiations or trading may be allowed in the future; therefore, the City should maintain its rights to these currently unutilized sources.

Table 5.3: 20-year Peak Withdrawals and Permitted Capacity

Permit No.	Permitted Capacity		20-year Peak Withdrawal	
	(cfs)	(gpm)	(cfs)	(gpm)
43756	0.50	224.4	0.50	224.4
17073	0.50	224.4	0.50	224.4
G12196	3.60	1,615.7	1.67	750

Table 5.3 reflects both Manzanita's preference to use its surface water source when available and the need, at times, to operate both wells simultaneously. Other permitted sources may be utilized on occasion for non-potable municipal use; however, there are no specific plans or estimates in place.

5.5 SOURCE PROTECTION

All water sources are susceptible to contamination. Source protection involves a delineation of the area of significance surrounding the source, identification of potential risks, and contamination sources, and development of strategies to preserve source quality.

A full report *(Source Water Assessment Report)* was prepared in March 2005 for Manzanita by the Oregon Department of Environmental Quality and the Oregon Department of Human Services. Contamination potential in the 0.9 square mile catchment for the Anderson Creek sources in largely limited to natural sources of sediments/turbidity, microorganisms, and nutrients. Access to the sources is limited by their remote location and locked gates on the access road. Potential human sources of contamination could include poor forestry practices or intentional acts of vandalism/terrorism. While the Assessment Report classified the entire drinking water protection area as being sensitive to contamination, it did not offer specific recommendations to minimize contamination potential other than to recommend that the City develop and implement a Drinking Water Protection Plan.

Source protection should be taken seriously. Contaminated sources typically require expanded treatment (at best) or abandonment (at worst). Both expanded treatment and development of a new source would be very expensive for Manzanita and may result in considerable inconvenience to water users prior to construction of the needed facilities. Compliance by neighboring, or other, properties within any designated protection area will require goodwill efforts from both the City and property owners to ensure compliance with setbacks as well as other land and materials use issues that could adversely affect water quality.

5.6 ANDERSON CREEK WATER SUPPLY RECOMMENDATIONS

The two existing dam structures are functional notwithstanding reservations discussed in Section 5.3.1. Improvement recommendations are complicated by the current regulatory context which in which they are made. The existing dams could not be constructed today because they lack fish passage provisions (fish ladders). Any substantial work on the existing dams that will require permits or other regulatory oversight (or funding agency participation) is likely to trigger a regulatory response and requirement that fish passage be provided consistent with provisions of ORS 509.580 through 910 and OAR 635, Division 412. Laws requiring owners of artificial obstructions to address fish passage requirements under such circumstances have been in place since August 2001. Oregon Department of Fish and Wildlife (ODF&W) has developed fish passage guidelines.

Improvement options for the North Fork Anderson Creek (Lower Dam) and West Fork Anderson Creek (Upper Dam) include:

1) "Do nothing." Under this option, the City would only undertake work as needed to maintain the existing structures. Major improvements or modifications would be avoided so as not to trigger the regulatory requirements for provision of fish passage. The primary benefit of this option is the deferment of major expenditures on source improvement projects.

2) Provide fish passage. Construction costs for fish passage structures on small streams with an elevation change of 12 feet or less are on the order of $15,000 per vertical foot. An opinion of probable cost *for each dam*, is $200,000 for construction ($270,000 for total costs including contingencies, engineering, legal and administration). Fish passage design requires considerable involvement of ODF&W to determine and/or approve site specific design parameters and to provide review and approval of designed facilities. Other agencies (Corps of Engineers, NOAA, Oregon Water Resources, and others) may also have varying levels of involvement in design development and permitting.

   ODF&W criteria for minimum design flows (October 22, 2004) for fishways are:

   > "Low flow design should be used to assure the *Minimum Water Depth* criteria for the migration period of the fish species/stage of concern and may be either:
   >
   > - the 2-year, 7-consecutive-day low flow discharge, or

- the 95% exceedence flow"

Maintaining the minimum flow through the fishway during summer/fall low flow periods is likely to result in a reduction of flow availability (compared with that historically utilized prior to construction of the fishway). Lowest streamflows typically occur during prolonged dry weather extending into the fall season**.** Highest water consumption in Manzanita is during the Fourth of July weekend and, to a lesser extent, during the July-August peak tourist and irrigation season; consequently, the reduced flow availability from the Anderson Creek sources (resulting from fishway construction) may not adversely affect the City's ability to manage peak seasonal needs. The City may, however, need to rely on the well sources to a greater extent during these periods.

3) Construct infiltration gallery. This option involves the construction of an infiltration gallery in the stream bed upstream of the existing dams. The existing dams would be removed. Infiltration galleries consist of buried pipe and screens that collect water as the stream percolates through the overburden to the screens and is conveyed via a pipe manifold to the transmission main. Infiltration galleries require a careful assessment of site specific conditions. Failure rate is high - Washington State reports up to 50% failure with the primary cause being siltation and plugging of the screens with fines. Successful sites have sufficient slopes and hydraulics to keep fine sediments in suspension. A low loading rate also contributes to viability. An opinion of probable construction cost *for each infiltration gallery* is $200,000 ($270,000 for total costs including contingencies, engineering, legal and administration.)

There is a fourth option: to move all the Anderson Creek sources downstream, consolidate the water rights, develop a well(s) next to Anderson Creek, and pump back up to the transmission main. The result would not be significantly different than the existing situation with wells #1 and #2. The City had selected and constructed a surface water treatment facility because of citizen desires to maintain its surface water sources; consequently, this option is not further developed or recommended at this time.

The Middle Fork source currently has no constructed facilities. Permitting, design, and construction of a new dam is likely to be very costly (on the order of $1,000,000+) and require approximately 4-5 years for completion. The location appears to be susceptible to stream meandering; consequently, it may not be a good location for an infiltration gallery. Assuming the other two sources are maintained, the Middle Fork source could be used to

supplement flow to the City during the lower flow, higher demand periods of the summer and fall by construction an intake and box near the stream. Location and design would be such as to facilitate capture of low flows, to close and isolate the box during periods of higher flows to exclude materials that could damage or plug the screens, and to facilitate manual cleaning of sediments that may accumulate in the box. A preliminary opinion of probable construction cost for this work is $37,000 ($50,000 for total costs).

Another related issue is the poor condition of the AC (asbestos-cement) transmission line. The City has repaired or replaced sections of the line as a result of line failures; however, the entire remaining AC portion should be replaced. An opinion of probable cost for the replacement of 15,200 lineal feet of 8-inch AC line is $912,000 for construction ($1,231,000 for total costs including contingencies, engineering, legal, and administration). Repair or replacement on an ad hoc basis is possible; however, the ramifications of this approach will invariable be: water loss associated with leaks, inconvenience to the City - especially staff, and cost inefficiencies due to multiple mobilizations and emergency procurement of materials and services.

In addition to the three sources and the main raw water transmission line, there are connecting lines to each source (3,560 lineal feet total) that meet at a junction box. Any comprehensive approach to upgrading source and transmission facilities should include replacement of these lines and the junction box. The junction box should include pressure reducing valves (to compensate for source elevation differences, isolation values, and three flowmeters). An opinion of probable construction cost is $284,000 ($214,000 for lines, $70,000 for the junction box, valving, and flowmeters) with a total project cost of $383,000.

A summary of costs is presented in Table 5.4.

Table 5.4: Anderson Creek Source and Transmission Improvements Opinion of Probable Cost (OPC)

Item	Construction Cost
Sources	
North Fork	
Fishway or Infiltration Gallery	$200,000
West Fork	
Fishway or Infiltration Gallery	$200,000
Middle Fork	
Seasonal Intake	$37,000
Existing dam upgrade allowance	$50,000
Junction Box and Transmission Lines from Source	
Lines (3,560 LF - 8"diameter)	$214,000
Junction Box, valves, PRVs, flowmeters	$70,000
Transmission Main	
Replace 8" AC with HDPE (15,200 LF)	$912,000
Replace 8" PVC with HDPE (5,000 LF)	$300,000
Project Construction Subtotal	$1,983,000
Contingencies @ 10%	$198,000
Engineering and Construction Observation @ 20%	$397,000
Legal and Administration @ 5%	$99,000
Environmental and Permitting (allowance)	$50,000
OPC Project Total	**$2,727,000**

5.7 WELL SUPPLY RECOMMENDATIONS

Installed well capacity (1.67 cfs) will meet projected year 2020 peak day demand (Table 4.11) for the regional system under well only operation. Utilizing 0.08 cfs of surface water sources (approximately one-tenth of the existing water rights on Anderson Creek), the wells can supply peak day demand projected to year 2025. The projections are tentative and highly dependent on the rate and nature of growth the regional water system experiences. Full utilization of the existing wells (1,500 gpm, 3.34 cfs) will require new pumps, drives, and electrical. A current, order of magnitude, opinion of probable construction cost is $200,000 with a total project cost of $270,000. Full development is also likely to require transmission line improvements (either another line or a larger diameter replacement line) and/or booster pumping. These considerations are not evaluated in detail at this time.

SECTION 6: WATER QUALITY AND TREATMENT

6.1 REGULATORY OVERVIEW

The 1974 Safe Drinking Water Act (SDWA) and subsequent amendments regulate drinking water quality at the federal level. The states may utilize the minimum requirements provided for by the federal regulations or develop more stringent standards. States also have flexibility in regulating treatment technologies and design parameters to achieve or assure the minimum requirements for finished water quality.

In Oregon, the Oregon Department of Human Services (DHS), Drinking Water Program has the primary responsibility of administering federal and state regulations of public water systems. Oregon Administrative Rules (OAR) Chapter 333 includes the rules for public water systems. The complete rules are available in several formats online at http://www.dhs.state.or.us/publichealth/dwp/pwrules.cfm.

6.2 WATER QUALITY

6.2.1 Well Water Quality

Water quality associated with the two production wells is generally excellent with all chemical concentrations well within regulated maximum contaminant limits (MCLs) or established standards. Recent test results for Well #1 are presented in Table 6.1. Results for Well #2 are similar.

Table 6.1: Recent (Raw) Well #1 Water Test Results

Parameter	MCL (mg/l)[1]	Result (mg/l)	Date
Antimony	0.006	ND[2]	7/06/05
Arsenic	0.05	ND	7/06/05
Barium	2.0	ND	7/06/05
Beryllium	0.004	ND	7/06/05
Cadmium	0.005	ND	7/06/05
Chromium	0.1	ND	7/06/05
Cyanide	0.2	ND	7/06/05
Flouride	4	ND	7/06/05
Mercury	0.002	ND	7/06/05
Nickel	0.1	ND	7/06/05
Nitrate	10.0	**1.7**	7/06/05
Nitrite	1.0	ND	7/06/05
Selenium	0.05	ND	7/06/05
Sodium	-	**5.35**	7/06/05
Sulfate	-	**2.2**	7/06/05
Thallium	0.002	ND	7/06/05
pH	-	**6.3 units**	-
Total Alkalinity	-	**26**	7/06/05
SOC Regulated	(varies)	ND	3/23/04
VOC Regulated	(varies)	ND	3/23/04
Gross Apha	15 pCi/l	ND	12/5/03

1. mg/l or as noted
2. ND: "Not detected"

6.2.2 Surface Water Quality

Water quality associated with the Anderson Creek sources are generally excellent with all chemical concentrations within regulated MCLs or established standards. Recent test results are presented in Table 6.2.

Table 6.2: Recent (Raw) Anderson Creek Water Test Results

Parameter	MCL (mg/l)[1]	Result (mg/l)	Date
Antimony	0.006	ND[2]	7/06/05
Arsenic	0.05	ND	4/19/05
Asbestos	7 MFL	**0.614 MFL**	8/13/04
Barium	2.0	ND	7/06/05
Beryllium	0.004	ND	7/06/05
Cadmium	0.005	ND	7/06/05
Calcium	-	**5**	1/27/98
Chloride	-	**16**	1/27/98
Chromium	0.1	ND	7/06/05
Copper	1.3	**<10 ug/l**	1/27/98
Cyanide	0.2	ND	7/06/05
Flouride	4	ND	7/06/05
Iron	-	**0.03**	2/4/98
Lead	0.015	ND	7/06/05
Magnesium	-	**2.0**	7/12/96
Manganese	0.05	**0.08**	2/4/98
Mercury	0.002	ND	7/06/05
Nickel	0.1	ND	7/06/05
Nitrate	10.0	**0.6**	4/19/05
Nitrite	1.0	ND	7/06/05
Phosphate	-	**0.03**	1/27/98
Selenium	0.05	ND	7/06/05
Silica	-	**7.7**	1/27/98
Sodium	-	**5.93**	7/06/05
Sulfate	-	**2.0**	1/27/98
Thallium	0.002	ND	7/06/05
TOC (9 samples)	-	**0.95-1.73**	5/04-10/05
pH	-	**6.3-7.1 units**	Continuous
Temperature	-	**5-16 C**	Continuous
Total Dissolved Solids	-	**31.8**	1/27/98
Hardness	-	**25**	2/4/98
Total Alkalinity	-	**10.0**	4/16/98
Conductivity	-	**45.0 umhos/cm**	4/16/98
SOC Regulated	(varies)	ND	4/19/05
VOC Regulated	(varies)	ND	4/19/05
Gross Apha	15 pCi/l	ND	12/5/03
Radium 226/228	5 pCi/l	ND	12/5/03
Uranium	30ug/l	**0.0097 ug/l**	12/5/03

1. mg/l or as noted
2. ND: "Not detected"

6.2.3 Finished Water Quality

Selected finished water quality parameters are shown in Table 6.3. Finished water quality is generally excellent with all chemical concentrations within regulated MCLs or established standards.

Actual water quality is likely to vary somewhat according to the relative presence of well water or surface water in the Manzanita system or in those portions of the regional system that receives finished Manzanita water.

Table 6.3: Recent (Finished) Water Quality Test Results

Parameter	MCL (mg/l)[1]	Result (mg/l)	Date
Asbestos	7 MFL	0.614 MFL	8/13/04
TTHM (7 samples)	0.080	0.0025-0.0735	8/04-10/05
HAA5 (8 samples)	0.060	0.000-0.038	3/04-7/05
TOC (4 samples)	4.0	0.86-1.30	5/04-9/04
Lead (Range; 10 samples)	0.015	ND[2]-0.009	6/16/04
Lead (Avg.; 10 samples)	0.015	0.002	6/16/04
Copper (Range; 10 samples)	1.3	ND-0.55	6/16/04
Copper (Avg.; 10 samples)	1.3	0.231	6/16/04

1. mg/l or as noted.
2. ND: "Not detected"

6.3 EXISTING TREATMENT FACILITIES

6.3.1 Manzanita Micro-Filtration Treatment Facility

The existing micro-filtration membrane treatment facility is described in Section 3.1.2. Water quality is excellent and treatment, other than filtration, is limited to pH adjustment (with soda ash) and disinfection (with hypochlorite).

6.3.2 Regional System Wells

Current treatment practices are limited to pH adjustment (with soda ash) and disinfection (with hypochlorite). Overall water quality is excellent. The well related facilities are described in Section 3.1.2.

6.4 EXISTING TREATMENT - DEFICIENCIES

The treatment facilities are relatively new and there are no significant deficiencies that contribute to, or raise, water quality or reliability concerns. City staff have expressed concerns with quantities of soda ash used for pH adjustment and the need for frequent visits to the well facility to refill the tank. Staff have indicated they may try an alternative chemical for pH adjustment. A recent sanitary survey (DHS, July 21, 2004) noted no treatment deficiencies[1].

While not a treatment deficiency per se, there are times when finished water from Manzanita's reservoirs flows into the regional system transmission main, providing flow to the regional system when the wells are off-line. A portion of this water returns as influent to the treatment plant where additional corrosion control and disinfectant chemicals are added. It is then (re-)pumped up to the reservoirs. These flows are not metered; however, the problem, to the extent that it occurs, does result in higher chemical and electrical costs as well as reduce overall system hydraulic efficiency. This is discussed in Section 7.4.2.

The City did have an extensive "white water" problem for over a prolonged period (April 2004 - May 2005). Numerous investigations were conducted and every major component of the source, treatment, storage, transmission, and distribution system were reviewed as a possible source. The most probable cause of the white water was a deficiency associated with finished water transmission from the 1.6 MG reservoir. A portion of the *Air Entrainment Update* prepared by HGE and presented to the Manzanita City Council is included in Appendix 6.1. Also included in Appendix 6.1 are plan sheets showing the recommended project that was bid in November 2005 to address the problem.

6.5 RECOMMENDED IMPROVEMENTS

At this time there are no specific treatment related improvement recommendations.

[1] It did note deficiencies related to turbidimeter calibration, monitoring (Nitrate, Arsenic, and VOC's), and the need for a tracer study at the clearwell and reservoirs. The City has addressed these issues.

SECTION 7: WATER STORAGE

7.1 REGULATORY OVERVIEW

There are no specific regulatory requirements related to capacity and sizing of reservoir storage for finished water in the State of Oregon. OAR 333-061-0025 requires water systems to maintain a minimum of 20 psi pressure at all service connections in the distribution system at all times. This requirement is related to reservoir storage insofar as compliance is generally not practicable without sufficient storage to meet equalization, fire flow, and emergency reserve demands. In Oregon, system storage needs are determined in accordance with applicable general standards or specific guidelines (Section 7.2).

7.2 STORAGE DESIGN GUIDELINES

7.2.1 Capacity Guidelines (Specific)

In 1999, an interagency team made up of personnel from the Department of Environmental Quality, Oregon Economic and Community Development Department, the Health Division, the Oregon Water Resources Department, the USDA-Rural Utilities Service, Rural Community Assistance Corporation, and the Department of Land Conservation and Development developed *"Water System Usage Guidelines - Developing Target Design Numbers for Community Water System Projects."* The Guidelines were developed as part of an effort to standardize interagency policies and, specifically, to address agency concerns that many water system improvement projects appeared to be "larger than needed." Size relates to cost, and, in turn, to the demand on limited grant and low interest loan funds available through state and federal agencies. The manifest agency goal is to balance level-of-service objectives with available funds in order to maximize the benefits to a larger pool of qualified applicants.

The guidelines are not intended as absolute criteria for design; rather they are a starting point. Increased storage beyond guideline recommendations will likely require adequate justification from the perspective of potential funding agencies involved in development of the guidelines.

Storage guidelines provide for *"two and one half day's storage at average daily demand[1] plus 180,000 gallons for residential fire protection."* For purposes of the computation, a guideline average daily demand usage of 235 gpcd is indicated. The figure is based on a state-wide average and includes allowances for commercial and industrial activity. Deductions are expected for predominantly residential communities, and higher usage may be justified based on unique circumstances.

7.2.2 Capacity Guidelines (General)

As noted above, (Section 7.2.1), the agency guidelines for Oregon were developed to address perceptions and concerns that many reservoir projects provided excessive capacity. Master Plans reviewed by the author typically provide for "rule-of-thumb" reservoir capacity design of three times average daily usage plus fire flow (3xADD+FF). Fire flow storage is based on a desired flow rate multiplied by an appropriate duration. Fire flow capacity allowances incorporated in the plans vary considerably based on community characteristics, fire department recommendations, and consultant predilections. Capacity based on maximum day usage plus fire flow (MDD + FF) is also common and typically results in somewhat lower total capacity. The largest capacity recommendation the author has encountered in reviewing other consultant's work was three times maximum daily usage plus fire flow.

The rule of thumb approach, that favors either ((3 x ADD) + FF) or (MDD + FF), gain their authority primarily through established and common usage amongst consulting engineers in Oregon. The determination implicitly incorporates subjective considerations of risk and reliability. It is worth noting that some states have adopted minimum design standards that provide for considerably less storage.[2]

7.2.3 Reservoir Storage Capacity Design Considerations

Typical reservoir storage requirements can be analyzed into three components: operational (or equalization) storage, emergency storage, and fire reserve.

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[1] "Two and one half day's at average daily demand" is approximately equal to "maximum daily demand" in many communities based on peaking factor (multiplier) frequently used by consultants.

[2] Arizona is an example. The Arizona Administrative Code (R18-4-503) provides for minimum storage to equal average day demand during the peak month. For multiple well systems, the storage can be reduced by total daily production minus the largest wells production.

Operational (or equalization) storage provides for any period during a 24-hour day where water demand exceeds supply capabilities (i.e. wells or treatment facilities) or for when supply sources are off-line. Operational storage can allow treatment facilities (with adequate capacity) to be operated for a minimal and continuous period of time, thereby reducing staff demands and associated costs. For well based systems, it allows efficient cycling of well pumps.

Emergency storage provides for interruption of supply. Supply can be interrupted for many reasons including, but not limited to: mechanical failure of required treatment or pumping facilities; source contamination; electrical outage with no, or inadequate, backup power provisions; or shut-downs for maintenance or improvements. Emergency storage is not intended to provide for extended interruptions of supply associated with droughts or catastrophic system failures requiring prolonged repairs or replacement.

Fire reserve provides storage volume based on the desired fire flow rate and duration of availability. It is important to note that in many communities, there are parts, such as isolated pressure zones with relatively few connections, that may not be economically served with fire protection to the same extent as the bulk of the community. Fire reserve storage on reservoirs in these areas may be functionally nonexistent. Often, telemetry can be utilized on such reservoirs to trigger booster pumping as the reservoir level drops, and with further level drops, possibly triggering a high service pump to provide some minimal fire flows to the area.

Emergency storage and fire reserve are essentially a kind of insurance. As with any insurance, cost increases with extent of coverage and, to a large extent, the actual risks for any particular case are not fully known or quantified. Also, there are no guarantees associated with any storage recommendations that the volume will be adequate for any specific fire or emergency condition that may arise.

In general, from an emergency and fire reserve perspective, more storage is always better. For small communities, the desired fire reserve can be a major component of overall storage. However, too large a storage volume in relation to average or minimal daily demands can result in water quantity problems (i.e. bacterial re-growth) related to dissipation of disinfectant residuals. If this occurs, additional disinfection facilities will likely be needed at the reservoirs.

For small communities, detailed and accurate data is rarely available, or practicably obtainable, for a precise quantification of operational and emergency storage

requirements. Even when available, there are qualitative considerations (i.e. perceived risk) that are not easily quantified and incorporated.

The rule-of-thumb guidelines provide a reasonable basis for small community reservoir sizing and are not likely to result in water quality problems. However, additional sizing modifications may be desirable to reflect circumstances unique to the community.

7.2.4 Other Storage Related Design Considerations

In addition to storage volume, there are several other considerations involved in developing new storage facilities:

Reservoir Types and Materials.

Reservoir types include:

- Ground level, gravity flow storage is generally the most desirable storage from the standpoints of operational simplicity and cost. It requires available land at suitable elevations and within reasonable distance from the water system. This type of storage comes in various standard diameters and heights and, within the variety available, it is often possible to adjust to the occasionally varying constraints of available site elevation and desired water surface elevation. Reservoirs with a height to width ratio greater than one are referred to as standpipes. A gravity based system remains operational during power outages.

- Ground level, pumped storage is often utilized for communities with no or limited access to sites with suitable elevation for gravity flow. These systems tend to be mechanically complex and vulnerable to operational and maintenance problems. Capital and O&M costs are significantly higher than a ground level, gravity based system - although, this may be offset by cost savings associated with reduced transmission main construction and potential elimination or reduction of site acquisition and development costs.

- Elevated storage is also often utilized by communities with no, or limited, access to sites with suitable elevation for ground level, gravity flow storage. This type of storage is rarely used for new

construction in Oregon because of the general availability of hillsides and the additional costs associated with structural needs to meet seismic considerations. Costs are approximately ten times greater, on a per gallon stored basis, than on comparable ground storage; nevertheless, a relatively small elevated storage facility can, when coupled with adequate ground level, pumped storage, provide numerous benefits including:

- Maintain an even and desirable system pressure without complex mechanical/pumping facilities.

- Reduce reliance on ground storage, thereby minimizing cost of pressure reducing/then pressurizing flows through the ground level storage.

- With level sensors and telemetry, the reservoir can be used to start/stop system components such as wells, treatment facilities, booster pumps, and fire pumps.

- Depending on the site selected, the reservoir may provide local flow/pressurization if a key main is offline for maintenance/repair.

The selection of reservoir type for any given community will depend on the variables involved. In the absence of any special circumstances, ground level, gravity flow reservoirs are preferable because of cost (capital and O&M) and reliability.

Reservoirs are typically constructed from steel or concrete. Steel reservoirs are generally less expensive to construct for capacities typically utilized by small communities, but are potentially more expensive to maintain because of susceptibility to corrosion. Material selection also depends on site conditions. If the reservoir is partially or completely buried, it should be constructed of concrete.

Water Surface Elevations. Water surface elevation is important for any gravity based storage facility. Typically, water surface elevations are selected to match those in existing facilities within established pressure zones. For storage replacement projects, consideration of other elevations will often be warranted to address established or anticipated system pressure problems. With adequate valving and controls (i.e. altitude value or equivalent) it is possible to have different maximum water surface elevations in different reservoirs within the same pressure zone;

however, doing so makes the system considerably more complex and vulnerable to mechanical problems and/or additional O&M requirements.

The desired water surface elevation will significantly limit reservoir site selection options if ground level storage with no booster pumping facilities is desired.

Site Location. As noted above, site elevation is a primary consideration in selecting a site for ground level storage with no booster pumping facilities. Additional considerations include:

- Whether to site additional storage adjacent to existing facilities or to distribute new storage to other locations. It is generally desirable to distribute storage to enhance system performance and reliability; however, location near existing facilities can often simplify site acquisition and reduce overall improvement costs.
- Whether a proposed site can be readily accessed at any time of year.
- Whether existing zoning and surrounding development will complicate, hinder, or prohibit development of proposed storage on any given site.
- Whether the site is suitable for constructing a reservoir. Water storage reservoirs are considered "essential structures." A geotechnical evaluation is required for any proposed site.
- Whether there are any probable environmental issues associated with the site.
- Whether the site can be kept relatively secure from vandalism or other unauthorized access.

7.3 EXISTING MANZANITA STORAGE FACILITIES

7.3.1 Storage Locations

Existing storage reservoir locations are shown on Figure 3.1 (Water System Area Map) and Figure 3.2.

7.3.2 Storage Inventory

Table 7.1 provides a summary of Manzanita's existing ground-level, water storage reservoirs. Storage totals 2,420,000 gallons.

Table 7.1: Existing Manzanita Storage Reservoirs

Reservoir Name	Associated Pressure Zone	Year Constructed	Volume (MG)	Base Elevation (ft.)	Maximum Water Elevation (ft.)	Material
WTP Clearwell	NA	2003	0.07	91.7	102.2	Concrete
Reservoir #1	Base/Upper	1979	0.50	230	258	Steel
Reservoir #2	Base	1960	0.25	222	237	Concrete
Reservoir #3	Base	1997	1.60	204	237	Steel

7.3.3 Storage Evaluation

A detailed survey and evaluation of the existing storage facilities was not included in the scope of work. Information included in this section is based on limited site visits, interviews with City staff, and written documentation by others.

The reservoirs, themselves, appear to be in good-excellent condition and well maintained. Reservoir #1 was painted in 2003. Connections and flow paths between the reservoirs and the system is fairly complex and used to result in prolonged detention of water in reservoir #3 (1.6 MG) prior to entering the distribution system. The routing was modified in 2004 to route all flow to the base level system through the 1.6 MG reservoir. The rerouting was ultimately associated with a "white water" problem. Details regarding the air entrainment problem; flow routing at, and through, the reservoirs; and related transmission and distribution deficiencies are included in Appendix 6.1. The recommended solution was expanded and modified and is currently in the bid/construction phase. Plan sheets for the project are also included in Appendix 6.1.

7.4 CAPACITY REQUIREMENTS

7.4.1 City of Manzanita

Alternate methods and results for computing total storage capacity for the City of Manzanita are indicated in Table 7.2. The three methods selected are discussed in Section 7.2.1 and 7.2.2.

Table 7.2: Alternate Storage Capacity Computations

Method	Year 2005	Year 2028
1. (235 gpcd x 2.5 days x population) + FF[1]		
Population Basis	694[2]	1281[2]
Capacity (MG)	**0.858**	**1.203**
2. (MDD + FF[1]		
MDD (MG)	0.537	1.059
Capacity (MG)	**0.987**	**1.509**
3. (3 x ADD) + FF[1]		
ADD (MG)	0.191	0.376
Capacity (MG)	**1.023**	**1.578**

[1] Fire Flows (FF): 450,000 gallons

[2] Basis: 2004 PSU population of 630 persons and 3% AAGR. (Note: the 2028 population figure is not intended as an official forecast; it is analogous to an "equivalent population" that takes into account non-residential growth.

Manzanita's existing capacity of 2.42 MG in storage exceeds by a considerable margin the computed capacity requirements indicated in Table 7.2 for all the alternatives reviewed. There is no need for storage capacity increases during the planning period based on the computations.

7.4.2 Regional System

The regional water system does not currently have its own storage facilities. Currently, when well pumps are off, water from Manzanita's system flows into the transmission main that feeds the connected communities. This arrangement was originally conceived as a way of utilizing excess storage capacity in Manzanita and keeping down overall improvement project costs. From a management perspective, however, the practice introduces several concerns:

- The water that flows from Manzanita into the regional transmission line, can, when then the wells are turned on, flow back to the water treatment facility where it is treated again for corrosion control and disinfection *and* re-pumped to the reservoirs. This increases electrical and chemical costs to the City.

- There is an appearance of more water produced by the City because of the double pumping. This, in turn, gives an appearance of a higher lost or unaccounted-for water percentage when comparing water production and (metered) water consumption figures.

Larger communities, such as Manzanita and Wheeler, have their own storage facilities for emergency supply and fire storage; however, smaller communities, such as Zaddack Creek, do not have their own storage facilities. Earlier plans[3] for the regional system called for a 2 MG reservoir. The recommendation appears to have been based on a projected (near) year 2050 peak day demand of approximately 2 mgd and the assumption that each city would also have its own reservoirs. The plan also anticipated a much larger system than currently exists or is likely to exist in the near future.

There is currently an approximate 100,000 gallon per day difference in average day water production between the regional system as a whole and Manzanita alone. Three times this figure is 300,000 gallons. A fire flow allowance, based on 1500 gpm for two hours, is 180,000 gallons. The total, 480,000 gallons, reflects current "needs" based on conventional criteria. A nominal 500,000 gallon capacity reservoir is recommended, subject to the following qualifications and observations:

- Manzanita will retain the ability to flow water back into the regional system. With provision of a regional reservoir, this flow flexibility could be controlled with valves that are normally closed.

- As the regional system expands, consideration should be given to adding an additional reservoir. A second reservoir will facilitate maintenance of the first reservoir. Timing and sizing will depend on the nature of the new connections and whether or not they have adequate storage facilities of their own.

- In addition to construction cost, too large of a reservoir could result in prolonged detention of water that could necessitate higher disinfectant additions in order to maintain adequate chlorine residuals in the distribution systems, thereby increasing operational costs. This argues against a larger reservoir at this time.

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[3] *City of Wheeler and City of Manzanita Water Facilities Master Plan Update*, Lee Engineering, October 1994.

- The intent of the regional storage is to provide equalization for efficient well operation, to allow for short periods of well maintenance, and to provide water that may assist with fire protection efforts. However, it is not the intent to provide all communities connected to the regional system with the same level of reserve storage and fire protection. Each community will need to assess its own needs and provide additional facilities in accordance with its needs and desires.

7.5 RECOMMENDED STORAGE IMPROVEMENTS

7.5.1 City of Manzanita

There are no storage capacity improvements recommendations for the City of Manzanita. Transmission main improvements associated with the 1.6 MG reservoir are discussed in Section 8.

7.5.2 Regional Water System

A new reservoir of 500,000 gallons nominal capacity is recommended to provide well equalization, limited emergency supply, and limited fire protection. A steel ground level tank is anticipated. A location as close to the junction (of the regional system 12" transmission main with the 8" transmission main to Wheeler) as practicable is preferable from the standpoint of hydraulic efficiency. Potential sites near the junction would all require excessively long transmission mains to tie-in; therefore, the most likely location will be somewhere between the wells and the above described junction. The City has identified one site on the north side of Miami Foley Road near the junction with Highway 53 (see Figure 3.1). The overflow elevation should match that of Wheeler's reservoir (239 feet). Consideration of higher overflow elevations can be made in predesign. Under the higher elevation scenario, the well pumps would pump directly to the reservoir and the regional system would be fed by gravity from the reservoir. Increasing the static head (higher overflow elevation) while decreasing the dynamic head (associated with a shorter pipeline) would allow the well pumps to experience the same total head thereby maintaining the design operating conditions. The potential site noted above could have a maximum overflow elevation of approximately 267 feet. The sustained high static pressure (116 psi at sea level) is likely to be too high for lower elevation customers without pressure reducers; consequently, any consideration of higher water-surface elevations will need to assess the impact of higher static pressures and

potential mitigation measures. City staff have noted other potential locations. A full evaluation of potential sites, site acquisition issues, and design impacts should be included in the predesign efforts. During predesign, preference should be given to a relatively short and wide reservoir design to maximize the volume of water associated with any given decline in water surface elevation. A control valve on the reservoir transmission line will allow coordination, via telemetry, with well operations to avoid overfilling the reservoir and to ensure reservoir availability when the wells are offline. Water will gravity flow from the reservoir into the regional system.

An opinion of probable cost is provided in Table 7.3.

Table 7.3: New 500,000 Gallon Reservoir Opinion of Probable Cost

Item	Preliminary Opinion of Probable Cost
Steel Tank (500,000 gallon); Installed and Painted	$400,000
Concrete Foundation	$75,000
Site Piping, Transmission, and Valving	$150,000
Excavation and Backfill	$50,000
Other Sitework (access, fencing, etc.)	$20,000
Telemetry	$35,000
Subtotal Construction Costs	**$730,000**
Engineering and Construction Observation	$146,000
Legal and Administrative	$37,000
Site Survey	$10,000
Site Acquisition (Allowance)	$100,000
Soil (Foundation and Seismic) Evaluation	$20,000
Contingency (10% Construction Cost)	$73,000
Total Capital Costs	**$1,116,000**

SECTION 8: WATER TRANSMISSION AND DISTRIBUTION

8.1 GENERAL

This section includes considerations of Manzanita's transmission and distribution system and those portions of the regional system that directly impact the City of Manzanita

8.2 EXISTING SYSTEM

Section 3 includes a general description and mapping of the City's existing transmission and distribution system.

8.2.1 Distribution Pipelines

The 1990 Master Plan identified 76,630 lineal feet of 2" - 10" diameter main in Manzanita of which 44.2 percent was asbestos-cement (AC) pipe. AC pipe has relatively short life in corrosive environments like the Oregon Coast. AC was commonly used in the 1960's and early 1970's. Longevity of AC pipe is variable, but a rule of thumb figure of 30 years in an environment such as Manzanita's is reasonable. Manzanita's AC pipe is currently 30-40 years old and is therefore at the end of its anticipated design life. AC pipe is also fairly brittle; consequently, even a relatively minor earthquake in Manzanita could result in widespread main breakage. Appendix 8.1 shows the general location of AC mains in Manzanita's distribution system.

The 1990 Master Plan notes a total of 11,360 lineal feet of 2" diameter main. 2" mains are commonly used for joint service lines serving a relative few customers; however, in Manzanita they frequently appear as distribution mains with more than a few customers connected.

Newer construction (predominantly in the southeast quadrant of the City) is primarily 6"- 8" diameter PVC. Older construction (in other parts of the City) is primarily 4"-6" diameter.

8.2.2 Distribution System Booster Pumping and Pressure Zones

Manzanita does not currently have any distribution system booster pumping facilities. Finished water from the treatment plant is pumped directly to the reservoirs; both

upper and lower level pressure zones are served by gravity from the reservoirs. The two pressure zones are operated independently with no active connections between the two zones. If necessary, closed valves between the two pressure zones can be opened to effect an interconnection.

8.2.3 Finished Water Transmission

Finished water is conveyed via approximately 3,000 lineal feet of 8" diameter AC main from the treatment plant to the reservoirs. Installed pumping capacity at the treatment plant is 350 gpm (504,000 gpd).

Appendix 6.1 includes a detailed description of water transmission from the reservoirs to the distribution system. It also describes concerns with reliability and system hydraulics as it pertains to reservoir transmission, and it includes plan sheets for the recently bid improvement project to address the problem.

8.2.4 Anderson Creek Raw Water Transmission

The transmission main is briefly discussed in Section 3.13 and Section 5.6; it is shown in Figure 3.1.

8.2.5 Regional System Well Water Transmission

The 12" transmission main was recently constructed in 2002. See Section 3.1.3 for a brief description and Figure 3.1 for approximate location and routing.

8.3 CRITERIA FOR DISTRIBUTION NETWORK EVALUATIONS AND DESIGN

Pressure. DHS requires that a minimum pressure of 20 psi be maintained throughout the system. However, most household waste-using appliances require pressures of 40 psi to operate properly. Maximum daily pressures should not exceed 90-100 psi. Variations in pressure throughout the system are related to piping size and arrangement, local fluctuations in demand, and, especially for static pressures, elevation. Generally, the lowest elevation users have the highest average system pressure.

Flow. Water mains are generally designed to provide the greater of either peak hour demand or maximum day demand plus fire flow. As is typical for small communities, fire flow is considerably more significant in the determination of main diameter.

Generally, it is desired to size pipes large enough to keep frictional energy loss to less than

5 feet of loss per 1000 feet of line length (equivalent to 2.2 psi of pressure loss per 1000 feet of line) during normal flows. This helps keep residual water pressures at acceptable levels and conserves electrical costs that otherwise might be needed for pumping (to boost pressures).

Another general guideline is that water velocities in pipe lines should be less than 5 feet per second. This helps keep momentum forces (due to changes in flow directions) at fittings such as elbows at acceptable levels. It may be acceptable to exceed these limits during emergency conditions such as a fire. However, in certain cases it is important to maintain velocities much lower than 5 fps (especially if it is a condition that occurs frequently, such as pumping from the water treatment plant) to minimize pressure surges and water hammer. For normal operating conditions it is recommended that pipe line velocity be kept at less than 2.5 fps.

Flow capacity of various size mains are tabulated below for the recommended maximum velocity of 5 fps for flow in one direction, and for flow arriving from two directions. The latter would reflect flow at a hydrant off a looped line. The table highlights why 8" lines are often specified as the minimum size desirable for municipal service.

Line Diameter	Flow at 5 fps	
	In One Direction (gpm)	From Two Direction (gpm)
4"	196	392
6"	441	881
8"	783	1,567
10"	1,224	2,448
12"	1,762	3,525

Layout. Main construction should be tied into the system to form or complete loops wherever possible. In general, such construction will enhance the hydraulic performance of the system. A comparison of looped distribution versus branching (also known as tree or dendritic) distribution is presented below. A looped system is desired because:

A. Water is carried by many interconnected pipes, which significantly increases the hydraulic capacity of the system.

B. Increased factor of safety. If a pipe is out of service, water can still be fed to

customers from a different direction (pipeline).

C. Decreased line flushing.

Branching distribution systems are not desirable, if economics, land ownership, and geography allow a looped system, since:

A. Water is carried through single pipes which restricts the hydraulic capacity of the system.

B. If branched pipeline is out of service, customers are without water.

C. Sediments tend to settle out in dead end lines, which leads to the need for line flushing and, due to decaying chlorine residual, increases the potential of bacterial contamination.

Hydrants should be located at intersections, midway along blocks, and in general 500 feet or less from the nearest hydrant or user. Spacing can very according to land use and main layout. Placement at the end of dead end lines facilitates flushing and maintenance.

8.4 DISTRIBUTION SYSTEM ASSESSMENT

Manzanita has an ageing distribution system with many lines of substandard dimension (2" diameter) and a central core, primarily between Laneda Avenue and Ocean Avenue, that is predominantly comprised of old (30-40 years) AC mains that have reached the end of their anticipated design life (See Appendix 8.1 for approximate AC main locations in Manzanita). AC lines are prone to breakage under stress and degradation by acidic chemical action. Ostensibly, for these reasons, some consultants recommend their approval and replacement. Given the potential costs involved and the need for the City to prioritize its expenses, replacement of the AC lines should be considered relatively low priority; however, individual AC lines, if defects are sufficiently manifest, should be replaced. Consideration should also be given to replacing AC lines associated with any future street improvement project. This latter consideration extends as well to other substandard mains.

Most of Manzanita's system is looped; however, portions of the system are more dendritic in layout. These areas include the high level pressure zone and in the southwest part of the City. Looping in these areas in largely impracticable.

A large diameter (8"-10" diameter) loop serving most of the City is achievable by replacing the existing 3600 lineal feet of 6" AC main that runs along Laneda Avenue, just east of

Division Street, then east along Highway 100 to the existing transition from 6" - 8".

All reservoir flows are currently routed to the existing 10" AC main at Ocean Avenue and Nutmeg Street. This is currently being modified by construction of a 10" line down Division Street to North Avenue where it will connect to existing 4" and 6" lines. To enhance overall system reliability and hydraulic performance, the 10" line should be extended down Division Street to Laneda Avenue.

City Staff have indicated a standardization on 4" and 6" lines to meet local distribution needs. This is somewhat smaller than the 6" - 8" lines typically recommended. Given the City's intent to remain a predominantly residential community, its provision of larger diameter service in the central business district, and its experience with fire protection issues in the City[1], the recommended improvement projects do not include increases in line size except for: replacement of 2" lines (use 4" or 6") and major transmission or distribution lines.

8.5 RECOMMENDED TRANSMISSION AND DISTRIBUTION IMPROVEMENTS

8.5.1 Main Improvements

Specific recommended main improvements are shown in Figures 8.1 and 8.2. Project descriptions and opinions of probable cost are presented in Table 8.1. Table 8.1 also provides a preliminary prioritization of improvements. Project numbers are provided to identify projects on Figures 8.1 and 8.2 with corresponding descriptions in Table 8.1. Project numbers do not imply project priority. Anderson Creek raw water transmission line improvements are discussed in Section 5.6.

[1] According to the City hydrant map, there are only nine hydrants with flows of less than 500 gpm.

Table 8.1: Proposed Distribution and Transmission Improvements
Preliminary Opinion of Probable Cost (OPC)

Project No.	Project Description	New Dia. (in.)	Length (LF)	Unit Cost	Const. Cost	Total Project Cost[2]	Distribution Priority
1	New 6" line to complete loop from west end of College Ave. to north end of Cherry Lane.	6"	200	70	$14,000	$18,900	II
2	Replaces existing 4" line which is largely unserviceable because of burial depth (10-12 ft.) along Cherry Lane to Cherry Street.	6"	580	70	$40,600	$54,810	I
3	Replace existing 2" line along Elm Street between College Ave. and High Ave.	4"	420	60	$25,200	$34,020	II
4	Replace existing 2" line along Elm Street from High Ave. south to end.	4"	340	60	$20,400	$27,540	II
5	New 10" transmission main from 1.6 MG Reservoir. Route along Oak Street southwest to Poysky Ave., then southeast along Poysky Ave. to Ocean Ave. Connect to existing 10" line at Poysky Ave. and Ocean Ave.	10"	850	75	$63,750	$86,062	I
6	New 8" line from Poysky Ave. and North Ave. east along North Ave, then south along Classic Street to Fir Avenue.	8"	200	70	$14,000	$18,900	II
7	Replace existing 2" line along Classic Street from Fir Street, south to end of existing 4" line (mid-way between Fir Ave. and Pine Ave.)	8"	160	70	$11,200	$15,120	II

[2] Total project cost = construction cost x 1.35. Results presented reflect simple multiplication of quantities and unit costs and are not intended to reflect the precision of the OPC.

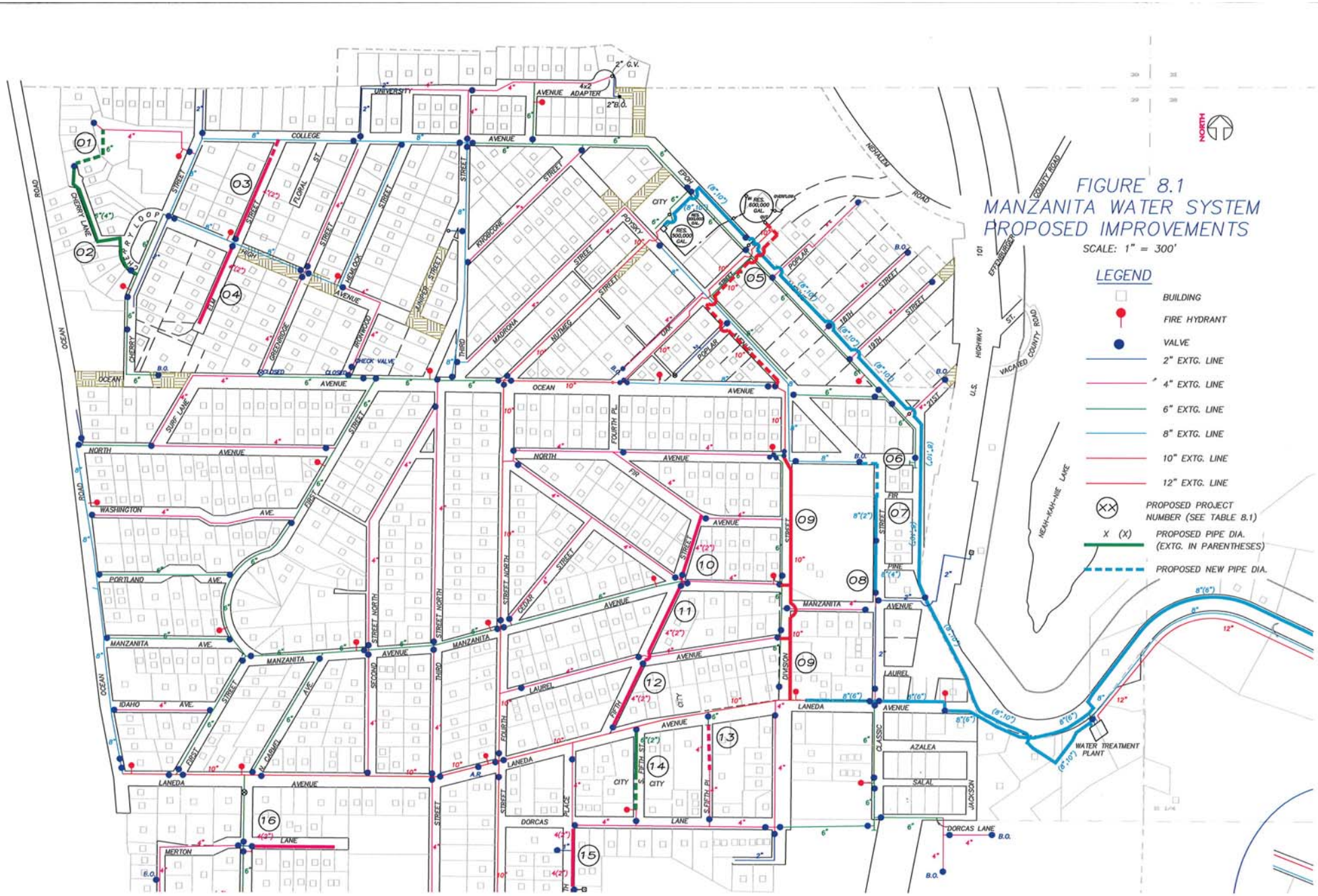


FIGURE 8.1
MANZANITA WATER SYSTEM
PROPOSED IMPROVEMENTS
SCALE: 1" = 300'
LEGEND
BUILDING
FIRE HYDRANT
VALVE
2" EXTG. LINE
4" EXTG. LINE
6" EXTG. LINE
8" EXTG. LINE
10" EXTG. LINE
12" EXTG. LINE
XX PROPOSED PROJECT NUMBER (SEE TABLE 8.1)
X (X) PROPOSED PIPE DIA. (EXTG. IN PARENTHESES)
PROPOSED NEW PIPE DIA.
NORTH
OCEAN
NEHALEM ROAD
HIGHWAY 101
U.S.
COUNTY ROAD
VACATED
NEAH-KAH-NIE LAKE
WATER TREATMENT PLANT
RES. 600,000 GAL.
RES. 900,000 GAL.
OVERFLOW
CHECK VALVE
PROPOSED CLOSURE
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
COLLEGE AVENUE
UNIVERSITY AVENUE
OCEAN AVENUE
NORTH AVENUE
WASHINGTON AVE.
PORTLAND AVE.
MANZANITA AVE.
IDAHO AVE.
LANEDA AVENUE
DORCAS LANE
MERTON LANE
CHERRY LANE
SURF LANE
LOOP DRIVE
FIRST STREET
SECOND STREET
THIRD STREET
FOURTH PL.
FIFTH STREET
SIXTH PL.
CEDAR STREET
FIR STREET
PINE STREET
ALDER STREET
POPLAR STREET
MADRONA STREET
NUTMEG STREET
OAK STREET
KNOBCONE STREET
POTOSKY STREET
LARCH STREET
HEMLOCK STREET
FLORAL ST.
EL CAMINO AVE.
LAUREL
DIVISION
CLASSIC
AZALEA
SALAL
JACKSON
A.R. PLACE
S. FIFTH ST.
S. FIFTH PL.
CITY
2" G.V.
4x2 ADAPTER
2" B.O.
B.O.
4"(2")
6"(4")
8"(2")
8"(6")
8"(10")
10"(8")
10"(10")
12"(10")

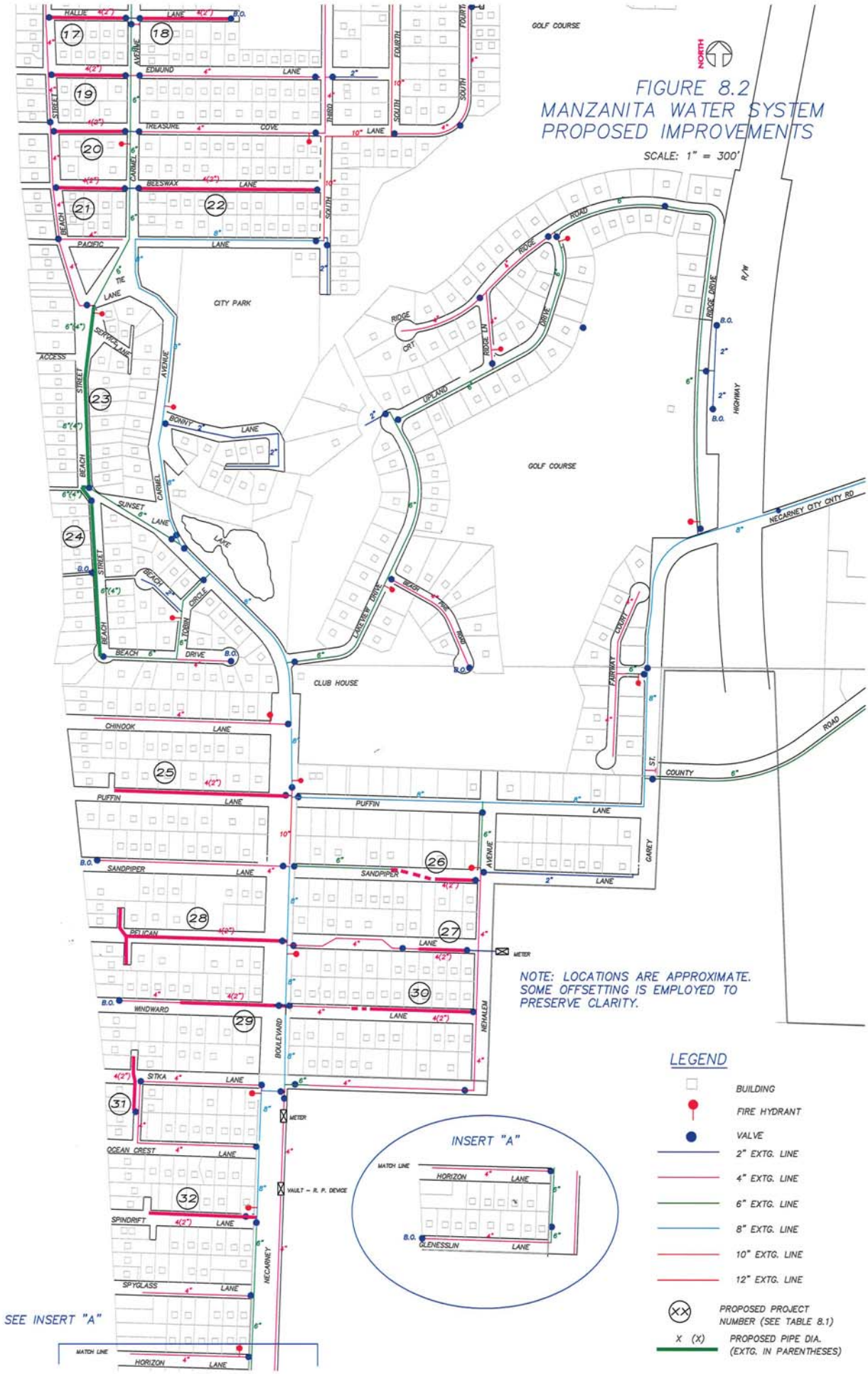


FIGURE 8.2
MANZANITA WATER SYSTEM
PROPOSED IMPROVEMENTS
SCALE: 1" = 300'
NORTH
GOLF COURSE
CITY PARK
CLUB HOUSE
NECARNEY CITY CNTY RD
COUNTY ROAD
HIGHWAY
R/W
NOTE: LOCATIONS ARE APPROXIMATE. SOME OFFSETTING IS EMPLOYED TO PRESERVE CLARITY.
SEE INSERT "A"
INSERT "A"
LEGEND
BUILDING
FIRE HYDRANT
VALVE
2" EXTG. LINE
4" EXTG. LINE
6" EXTG. LINE
8" EXTG. LINE
10" EXTG. LINE
12" EXTG. LINE
PROPOSED PROJECT NUMBER (SEE TABLE 8.1)
X (X) PROPOSED PIPE DIA. (EXTG. IN PARENTHESES)

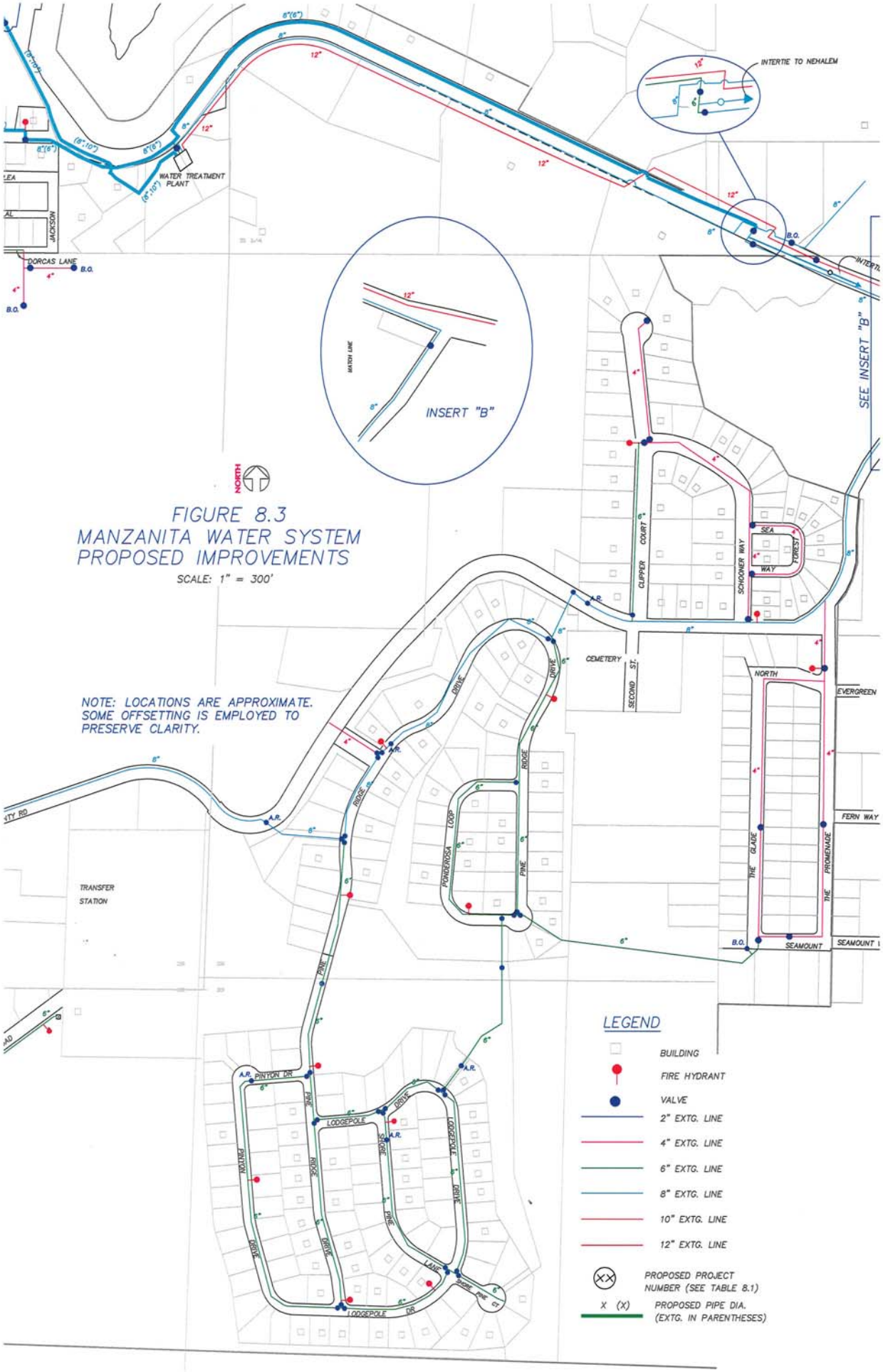


FIGURE 8.3
MANZANITA WATER SYSTEM
PROPOSED IMPROVEMENTS
SCALE: 1" = 300'

Project No.	Project Description	New Dia. (in.)	Length (LF)	Unit Cost	Const. Cost	Total Project Cost[1]	Distribution Priority
8	Replace existing 4" line along Classic Street from end of Project 07 to Manzanita Ave.	8"	200	70	$14,000	$18,900	II
9	New 10" transmission main along Division Street between North Ave. and Laneda Ave. Connect to existing 10" lines at both ends. Extend 8" lines across Division Street at Manzanita Ave. and at Laurel Ave. and connect to existing system.	10" 8"	950 80	80 75	$76,000 $6,000	$110,700	I
10	Replace existing 2" line along Fifth Street with between Manzanita Ave. and Fir Ave. Revise piping and valving at intersection of Manzanita Ave. and Fifth Street.	4"	250	70	$17,500	$23,625	I
11	Replace existing 2" line along Fifth Street from end of Project 10 to Laurel Ave. Connect to ex. east-west 4" line at Laurel Ave.	4"	300	60	$18,000	$24,300	I
12	Replace existing 2" line along Fifth Street between Laurel Ave. and Laneda Ave.	4"	300	60	$18,000	$24,300	I
13	New 4" line along S. Fifth Place from Laneda Ave to north end of existing 4" line (midway between Dorcas Lane and Laneda Ave.)	4"	180	60	$10,800	$14,580	II
14	Replace existing 2" line along S. Fifth St. between Laneda Ave. and Dorcas Ln.	6"	300	65	$19,500	$26,325	II

Project No.	Project Description	New Dia. (in.)	Length (LF)	Unit Cost	Const. Cost	Total Project Cost[1]	Distribution Priority
15	Replace existing 2" line along S. Fourth Place from Dorcas Lane south approximately 250 feet to existing 4" line.	4"	250	60	$15,000	$20,250	II
16	Replace existing 2" line along Merton Lane from Carmel Ave. to east end.	4"	340	60	$20,400	$27,540	II
17	Replace existing 2" line along Hallie Lane between Beach St. and Carmel Ave.	4"	300	60	$18,000	$24,300	II
18	Replace existing 2" line along Hallie Lane line from Carmel Ave. to east end.	4"	350	60	$21,000	$28,350	II
19	Replace existing 2" line along Edmund Lane with between Beach St. and Carmel Ave.	4"	300	60	$18,000	$24,300	II
20	Replace existing 2" line along Treasure Cove Lane between Beach St. and Carmel Ave.	4"	290	60	$17,400	$23,490	II
21	Replace existing 2" line along Beeswax Lane between Beach St. and Carmel Ave.	4"	280	60	$16,800	$22,680	II
22	Replace existing 2" line along Beeswax Lane between Carmel Ave. and S. Third Street.	4"	690	60	$41,400	$55,890	II
23	Replace existing 4" line along Beach St. between Tie Lane and Sunset Lane.	6"	700	65	$45,500	$61,425	II
24	Replace existing 4" line along Beach St. between Sunset Lane and Beach Drive.	6"	600	65	$39,000	$52,650	II

Project No.	Project Description	New Dia. (in.)	Length (LF)	Unit Cost	Const. Cost	Total Project Cost[1]	Distribution Priority
25	Replace existing 2" line along Puffin Lane from Necarney Boulevard west to end.	4"	650	60	$39,000	$52,650	II
26	Replace existing 2" line along Sandpiper Lane from Nehalem Ave. to west. Extend new 4" line west and connect to existing 6" line.	4"	330	60	$19,800	$26,730	II
27	Replace existing 2" line along Pelican Lane from Nehalem Ave. west to end.	4"	220	60	$13,200	$17,820	II
28	Replace all existing 2" lines along, or at the end of, Pelican Lane from NeCarney Boulevard west to end.	4"	800	60	$48,000	$64,800	II
29	Replace existing 2" line along Windward Lane from Necarney Boulevard west to end.	4"	380	60	$22,800	$30,780	II
30	Replace existing 2" line along Windward Lane from Nehalem Ave to west end and extend to existing 4" line.	4"	450	60	$27,000	$36,450	II
31	Replace existing 2" line (north-south) at the westmost end of Sitka Lane.	4"	200	60	$12,000	$16,200	II
32	Replace existing 2" line along Spindrift Lane with 4" line from Necarney Boulevard to west end.	4"	380	60	$22,800	$30,780	II

Project No.	Project Description	New Dia. (in.)	Length (LF)	Unit Cost	Const. Cost	Total Project Cost[1]	Distribution Priority
33	Replace existing 6" line along Laneda Ave. just east of Division Street, then east along Highway 101 to existing transition from 6" to 8". Intent is to complete a large diameter loop serving most of Manzanita.	8"	3600	$75	$270,000	$364,500	I
34	Replace existing 8" AC transmission main from WTP to reservoirs	10"	3,000	$75	$225,000	$303,750	I
Distribution I Subtotal					$734,850	$992,047	
Distribution II Subtotal					$586,200	$791,370	
Total					**$1,321,050**	**$1,783,417**	

Distribution I improvements are associated with general hydraulic improvements (as opposed to a highly localized benefit) and/or enhancing system reliability and efficiency.

Distribution II improvements are associated with more localized benefits. Many of the projects are upgrades of existing 2" lines to 4" or 6" lines.

Distribution I and II total project costs (Table 8.1) are $1,783,000.

In addition to the projects described in Table 8.1, there is a general allowance for AC main replacement. Appendix 8.1 includes a reduced scale water system map with AC mains highlighted. The map shows the general location of AC mains as identified in the City's Service Profile Database. Excluding projects #23, 24, 33, and 34, which are AC line replacements identified in Table 8.1, the remaining AC line totals identified in Appendix 8.1 are listed in Table 8.2 along with replacement costs.

Table 8.2: AC Lines and Replacement Costs (OPC)
(Quantities based on mains identified in Appendix 8.1)

Diameter (in.)	Total Length (LF)	Replacement Cost (per LF)	Construction Costs (OPC)	Total Project Costs (OPC)
4"	15,230	$60	$913,800	$1,233,630
6"	6,050	$65	$393,250	$530,888
8"	3,330	$70	$233,100	$314,685
10"	2,680	$80	$214,400	$289,440
Total	**27,290**	**-**	**$1,754,550**	**$2,368,643**

The AC line replacements should be considered as Distribution Priority II or III unless otherwise designated. City staff are very knowledgeable regarding the relative condition of mains in Manzanita based on experience with repairs or other activities. With regard to specific mains or projects, City staff are in the best position to assess and determine the relative urgency of any specific project. Public works should be consulted prior to implementing any particular recommendations in the Master Plan to ensure that priorities have not changed.

All these priority groups reflect current or near-term needs and could, therefore, be grouped together as a single project if financially and politically practicable; however, it is likely that financial and political realities are such as to require a more gradual implementation. In general, larger projects introduce construction cost efficiencies; consequently, clustering selected improvements into larger

comprehensive projects will provide a better value to the City.

8.5.2 Booster Pumping Improvements

A booster pumping facility located near the water treatment plant will allow efficient conveyance of regional water system (well) water to Manzanita's distribution system. Currently, well water when utilized, is routed through the treatment facility. Bypassing the treatment facility would allow the City to provide flow in excess of the 350 gpm plant capacity, as needed, during periods of high system demand. The booster pump station could direct flow directly to the distribution system via the existing 6" main (or upgraded 8" main - Table 8.1, project #3). Since the pressure differential between the two systems is nominal and can vary in either direction depending on reservoir levels, the pumps would be relatively small and of low horsepower. A two pump system should be adequate. No emergency power will need to be provided since the existing reservoirs provide adequate reserves. Location near the existing treatment facility would facilitate connections with the lines involved and facilitate connection to the control/monitoring center at the treatment facility. A capacity of approximately 325 gpm would, with existing plant capacity of 350 gpm, provide for projected year 2025 peak day requirements. Actual usage would be relatively infrequent, especially in the early years of operation. Anticipated usage, based on flow projections in Table 4.12 and current plant capacity of 350 gpm, is approximately 1-2 weeks in year 2010 to 2-3 months in year 2025. An opnion of probable construction cost (including pump station, pumps, controls/electrical/telemetry, and pipe interconnections) is $120,000 with a total project cost, (including construction costs, contingencies, engineering, legal, and administration) of $162,000.

As an alternative, the City could install a third finished water pump in the treatment facility. Under this scenario, additional well water would be routed to the facilities clearwell and pumped, along with processed water, to the City's reservoirs. Advantages of this approach include: lower cost and complexity - the facility was designed to accommodate a third pump, and routing flow to reservoirs - thereby enhancing cycling of water through the reservoirs. Disadvantages of this approach include: relatively high inefficiency - water is discharged to atmospheric pressure at the clearwell, then repressurized and pumped to the highest pressure zone; additional corrosion control and disinfectant chemicals would likely be used because of the difficulty in monitoring levels and adjusting chemical feeds to the varying levels of chemicals present in the clearwell (associated with the fraction of well water present); and additional operational costs associated with the inefficiencies. An opinion of probable construction cost is $50,000 with total project cost of $68,000.

SECTION 9: SUMMARY OF NEAR-TERM IMPROVEMENT RECOMMENDATION

9.1 INTRODUCTION

A Manzanita City Council Workshop was held on February 22, 2006 to discuss the draft Water Master Plan, issues, improvement options, and costs. From the discussion, it became clear that the City, while concerned for the continued use and viability of its Anderson Creek sources, nevertheless understands that conformance with fish passage requirements will result in less than historical water availability from these sources. In addition, wells from the regional system, providing an alternate source, mitigate the need to immediately correct deficiencies associated with the Anderson Creek sources and transmission mains. It does, however, increase the need for improvements associated with the reliability of the regional system.

Council also understood and appreciated the need for the approximately $8,300,000 in recommended improvements; however, they also expressed concern for recent rate increases associated with the new treatment plant and regional system construction and the palatability to the public of additional rate increases at this time. Accordingly, the Council believed the $8.3 million figure was impracticable at this time. A figure of approximately $3 million was discussed, along with a phased implementation of approximately $1 million per year. The City has approximately $1.7 million in available construction funds. The balance ($1.3 million) will have to come from other sources.

The Council tasked the Public Works Staff and Engineer to develop a prioritization for project implementation in accordance with the concerns, priorities, and limitations expressed in the meeting.

9.2 GENERAL IMPROVEMENT PRIORITIES

From a master planning perspective, improvement recommendations for Manzanita reflect a concern primarily with elements of the system that bear on the overall health, operation, and reliability of the water utility as a whole. In contrast, local improvements, such as a replacement of an undersized line, may have tangible benefits for the relative few customers locally connected, but are unlikely to significantly improve overall system performance to the extent that the City can justify the allocation of the limited funds identified as practicable under current economic and political realities. Accordingly, a broad categorization of priorities for Manzanita includes the following:

- Priority 1 Improvements: address capability and reliability of meeting peak day water supply requirements for the City of Manzanita under circumstances when the Anderson Creek sources are not available.

- Priority 2 Improvements: address reliability and enhanced transmission (to and from the City's finished water reservoirs).

- Priority 3 Improvements: address distribution improvements that both replace mains with known deficiencies and enhance overall distribution system hydraulics.

- Priority 4 Improvements: address distribution improvements that either replace mains with significant deficiencies or replace undersized mains. Benefits are generally more localized than is the case for priority 3 improvements.

9.3 SPECIFIC IMPROVEMENT PRIORITIES

At times, certain projects, which would otherwise be considered relatively low priority, are elevated to a higher priority by virtue of the extent of deficiencies present. Where these have been identified by staff, they have been included with a higher prioritization. In addition, prioritization for implementation can change as circumstances change or opportunities present themselves. For example, a planned street project can include replacement of mains at a significantly lower cost than if the mains were replaced as an independent project. Because of this, the City should be open to reshuffling priorities as opportunities arise. Prioritization should be viewed as an ongoing, dynamic process.

9.4 NEAR-TERM CAPITAL IMPROVEMENTS

Recommended near-term improvements and budgets by priority are listed below:

Priority 1 Improvements[1]*:*

a) New 500,000 gallon reservoir. $1,116,000

This project benefits the regional system by providing well equalization, limited emergency supply, and limited fire protection.

[1] Budget cost includes contingencies, engineering, legal and administrative costs (typically 1.35 x construction costs) plus additional costs such as geotechnical and site acquisition.

It is also essential if Manzanita adds a third pump at the treatment plant.

Priority 2 Improvements:

a)	New (3rd) pump at treatment plant.	$68,000
b)	Replace existing 8" AC transmission main from treatment plant to reservoirs. (See project #34, Table 8.1.) Replace with 8" or 10" line. Evaluate and size along with project 1b noted above.	$68,000
c)	New 10" transmission main along Division Street between North Ave. and Laneda Ave. (See project #9, Table 8.1.)	$111,000
d)	New 10" transmission main from 1.6 MG reservoir to Poysky Ave. and Ocean Ave. (See project #5, Table 8.1.)	$86,000

Priority 3 Improvements:

a)	Replace existing 6" AC line along Laneda Ave. and Highway 101. (See project #34, Table 8.1.)	$365,000
b)	Project #10 (See Table 8.1)	$24,000
c)	Project #11 (See Table 8.1)	$24,000
d)	Project #12 (See Table 8.1)	$24,000
e)	Project #2 (See Table 8.1)	$55,000

Priority 4 Improvements:

a)	All Distribution Priority II main improvements (See Table 8.1).	$791,000

Priority 1 Subtotal	$1,116,000
Priority 2 Subtotal	$569,000
Priority 3 Subtotal	$492,000
Priority 4 Subtotal	$791,000
Near-term Improvements Total	$2,968,000

SECTION 10: WATER RATES AND FINANCING

10.1 WATER FUND BUDGET

Table 10.1 includes a summary of recent Water Operating Fund budgets.

Table 10.1: Recent Water Operating Fund Budgets

Description	Actual FY 01-02	Actual FY 02-03	Actual FY 03-04	Actual FY 04-05
Revenue:				
Beginning Fund Balance	$244,969	$210,369	$140,578	$282,330
Water Rate Revenue	$519,260	$543,101	$606,589	$688,572
Other	$11,146	$11,406	$16,301	$25,722
Revenue Total:	*$775,375*	*$764,876*	*$763,468*	*$996,624*
Expenses:				
Personal Services	$199,180	$215,386	$221,421	$227,885
Materials and Services	$67,698	$97,098	$270,842	$160,806
Capital Outlay	$1,928	$21,614	$10,481	$0
Debt Service[1]	-	-	-	$0
Transfers (net)	$296,200	$290,200	($21,606)	$10,200
Expenses Total:	*$565,006*	*$624,298*	*$481,138*	*$398,891*
Revenue Minus Expenses:	**$210,369**	**$140,578**	**$282,330**	**$597,733**

[1] Annual debt service of $185,251 begins in FY 05-06.

Reference to Table 9.1 is made is sections that follow.

10.2 WATER SYSTEM REVENUE

10.2.1 Current Water Rates

Current water rates were established in October 2003. Current rate structure and fees are presented in Table 10.2.

Table 10.2: Current (2003) Monthly Water Rates

Customer Type	Location	Meter Size	Minimum Monthly Rate (per unit)	Gallons included in minimum monthly rate	Cost per 1000 gallons over minimum
Residential	Inside City	Per Unit	$34.50	6,000	$1.50
	Outside City	Per Unit	$45.50	6,000	$2.25
Commercial	Inside City	3/4 inch	$25.50	-0-	$1.50
		1 inch	$34.00	-0-	$1.50
		2 inch	$142.00	-0-	$1.50
	Outside City	3/4 inch	$32.00	-0-	$2.25
		1 inch	$43.00	-0-	$2.25
		2 inch	$178.00	-0-	$2.25

10.2.2 Current Rate Revenue

Current annual rate revenue is approximately $700,000. Total annual receipts are likely to increase at a rate comparable to overall system growth. There are no large commercial or industrial customers that would adversely affect total receipts if the business closed. Rate revenue in excess of the budget is carried over to the next year as part of the beginning fund balance.

10.2.3 Equivalent Dwelling Units (EDUs)

In general, funding agencies have recommended or required that water rates reflect or incorporate consideration of dwelling units for residential customers and equivalent dwelling units (EDUs) for non-residential customers. Definitions for an EDU can vary, but in general refer to that amount of metered water used by one residential unit - a single family house, manufactured home, or a single unit of a multifamily building (duplex, apartment, etc.). For non-residential customers, the total water used divided by the average usage per residential dwelling unit yields the number of "equivalent dwelling units" associated with the non-residential customers. Add the residential and non-residential customer components yields the total number of EDUs associated with the water system. Consultants and funding agencies use the EDU total to determine what the average monthly bill will be by dividing the annual revenue required by the total number of EDUs and 12 months per year.

Manzanita and Wheeler determine and coordinate annual EDU estimates as a basis for allocating costs associated with the regional system. Based on a City EDU Summary dated March 16, 2005, recent EDU totals are:

Manzanita:	1512.5 EDUs
Wheeler:	285.5 EDUs

10.2.4 Average Monthly Rate per EDU

Average monthly rate per EDU is $37.94 based on the FY 04-05 rate revenue of $688,572 and the EDU total of 1512.5. This is slightly higher than the residential base rate of $34.50; but consistent if overage and base rate variations (Table 10.2) are considered.

10.2.5 Property Taxes

Currently, water system revenue includes no property tax component.

10.2.6 "Other" Revenue

"Other" revenue noted in Table 10.1 includes: meter installations, interest, and miscellaneous. The last item is a category with nominal sums, typically $0-$100. These sources typically contribute a relatively small portion of overall revenue.

10.3 WATER SYSTEM EXPENSES

10.3.1 Debt Service

Manzanita recently constructed major improvements to the water system, including a new water filtration plant for treatment of water from Anderson Creek, development of wells adjacent to the Nehalem River, and transmission piping from the well field to the City's existing water system. The developed facilities were intended to provide service to the City of Wheeler, and capacity was provided for the Zaddack Creek Water Cooperative water system. A loan of $3,290,410 is the City's share of the total project cost of approximately $6 million dollars. (Remainder of total cost was provided by Federal grants from the Rural Utilities Service, a branch of the USDA.)

The cities of Manzanita and Wheeler developed an intergovernmental agreement for construction of the new well system adjacent to the Nehalem River, and for

transmission piping to serve each water system, The agreement provides that each entity will pay for their fair and proportionate share of operation the well system and transmission line, and for the City of Manzanita to repay the loan to Rural Utilities. The water revenue bonds carry a 4.75% interest rate and a 40-year term. Loan payments commence in FY 05-06 with annual payments of $185,251 through FY 2043-2044. A final payment of $183,977 is due in FY 2044-45.

10.3.2 Operations and Maintenance (O&M)

Operations, maintenance, and administrative costs are summarized in Table 10.1. Actual annual expenditures are significantly less than current annual revenues.

10.4 CURRENT RATES - ANALYSIS AND RECOMMENDATIONS

A simple formula for budget viability is: *Revenue - Expenses* $\geq$ *0.* In reviewing recent budgets, it is apparent that rate revenues have more than kept pace with expenditures. Debt service payments commence is FY 05-06. There is no current basis for increasing water rates at this time. Future rate increases may be needed if the utility budget costs (due to inflation) exceed revenues associated with an expanded customer base (system growth). Capital improvement projects, depending on overall cost and funding sources, may require rate increases to meet debt service requirements.

10.5 CAPITAL IMPROVEMENTS PLAN

10.5.1 Capital Improvement Summary

Near-term capital improvements are discussed in Section 9. A detailed listing of near-term projects and costs in included in Section 9.4. The near-term improvements total is $2,968,000. The projects include a new 500,000 gallon (regional system) reservoir, a third clearwell pump installed at the water treatment plant, and miscellaneous distribution and transmission improvements.

Long-term improvements include:

Anderson Creek source and transmission improvements	$2,727,000
Well upgrades	$270,000
General AC line replacement	$2,369,000
Total	$5,366,000

10.5.2 Capital Improvement Implementation

Near-term improvements have been identified for construction over the next three years. In accordance with the discussion at the February 22, 2006 Manzanita City Council Workshop, the near-term projects total approximately $3,000,000 and could be phased and constructed over the next three years. The regional reservoir is the highest priority improvement; however, it is the most complex and includes issues (land/easement acquisition, environmental review, geotechnical site evaluation, and County approval) that may take significant time to address and resolve. It is recommended that the Priority 1, 2, and 3 improvements (Section 9.4), with a total cost of $2,177,000, be addressed concurrently with the intent of construction the projects in 2007-2008. This would allow ample time to address reservoir issues while maintaining the allowance of approximately $1,000,000 per year for the next three years. Priority 4 improvements could next be addressed after assessing the costs of completing the first projects (Priority 1, 2, and 3) determining the remaining budget, and identifying source(s) of funds.

Long-term improvements do not have a specific timeline. Anderson Creek improvements (source and transmission) will be addressed on an as needed basis with the intent of relying on the regional system as a backup supply. Implementation of well related improvements will depend on their actual system growth that occurs and the ability of the regional reservoir to meet peak diurnal demands. Replacement of old AC lines will depend on budget availability, construction opportunities, and perceived need. From a general planning standpoint, the City should anticipate addressing all of these issues and improvements within the next 20 years.

10.5.3 Financing

For the budget year ending June 30, 2005, the City's Water Construction Fund had net assets of $1,723,098. During the same budget year, the City received $148,300 in systems development charges and $35,794 in interest income. It is quite likely that the Construction Fund will have sufficient monies to construct the Priority 1, 2, and 3 improvements without incurring debt or requiring a rate increase. Construction of the Priority 4 improvements ($791,000) are likely to require some outside funding agency participation or other funding source.

A general discussion of financing options is presented in Appendix 9.1. Probable financing is limited to loans (based on project scope, cost, impact on rates, and City eligibility). Loans can be obtained from either Rural Development (RD) or Oregon Economic and Community Development (OECDD). RD has a longer term (40 years

vs. 20 years), but a lower interest rate (4.5% versus 6.5%). RD tends to have more complicated application and environmental reporting requirements.

After a selection of the initial project scope, the City should contact OECDD to schedule a one stop meeting with available state and federal funding agencies, to discuss project needs. When the project is presented to all the funding agencies, each agency will evaluate their programs potential to assist with financing the needed water improvements.

The following potential funding scenarios are based on loan only awards. These are examples only, interest rates and program guidelines are subject to change and will likely do so prior to agency application and acceptance.

Project (Priority 4 Improvements) Total Cost: $791,000

Alternative I

RD Loan:	$791,000 (4.5% Interest; 40 year term)
Annual Payment (including 10% Reserve):	$47,284
EDUs:	1,512.5
Monthly Debt Service per EDU	$2.61

Alternative II:

OECDD Loan:	$791,000 (6.5% Interest; 20 year term)
Annual Payment:	$71,788
EDUs:	1,512.5
Monthly Debt Service per EDU:	$3.96

10.5.4 Water Rate Impacts

Implementation of the Priority 1, 2, and 3 improvements are not anticipated to result

in water rate increases based on utilizing existing and anticipated cash reserves. Funding of the Priority 4 improvements with loan funds (only) is likely to result in rate increases of $2.61-$3.96.

10.6 SYSTEMS DEVELOPMENT CHARGES (SDCs)

System Development Charges (SDCs) can be charged to all users of transportation, water, sewer, storm drainage, and parks and recreation facilities. The fee is usually charged as each piece of property is developed in the future and goes into a capital construction fund to pay for improvements required by growth in the community. The Oregon System Development Charges Act, House Bill 3224, became effective in 1991. Legislation requires that capital improvement plans be developed, and that methodology used to compute SDCs be documented and reviewed by the community before SDCs can be charged.

The Oregon System Development Charges Act permits two types of charges: 1) a reimbursable fee, and 2) an improvement charge. A reimbursable fee is a charge for unused capacity in existing capital improvements. An improvement charge is a fee associated with capital improvements to be constructed. Improvement fees are generally more popular than reimbursement fees, due to the complexity of computing reimbursable fees for infrastructure constructed sometime in the past.

SDCs charged before construction will be considered improvement fees. After construction the charges will be considered reimbursement fees. The cost estimate should be modified to reflect actual cost of construction and recomputed SDCs. To insure that new development is not charged twice through system development charges and user fees, the revenue generated from reimbursement fees is typically used to pay back existing loans for improvements. Legislation requires that the methodology for establishing fees be available for public inspection.

The City adopted a Capital Improvements Plan and SDC Methodology in December 1995. The report provides for periodic updates to account for inflation according to the ENR Construction Cost Index. SDCs were last updated and adopted by Resolution No. 04.10 on September 8, 2004. The current water system SDC is $3,425.00.

10.6.1 SDC Recommendations

It has been 10 years since SCDs were last evaluated for the system. While the City has adjusted the fees, there has been no inclusion of work completed since the original study (such as the treatment plant, wells, and transmission main). SDCs should be updated to reflect new construction and recommended improvements

associated with this Master Plan.

APPENDIX 2.1
CITY OF MANZANITA, OREGON
SELECTED U.S. CENSUS BUREAU DATA, CENSUS 2000

Table DP-1. Profile of General Demographic Characteristics: 2000

Geographic Area: Manzanita city, Oregon

[For information on confidentiality protection, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total population	**564**	**100.0**
SEX AND AGE		
Male	259	45.9
Female	305	54.1
Under 5 years	11	2.0
5 to 9 years	14	2.5
10 to 14 years	16	2.8
15 to 19 years	28	5.0
20 to 24 years	16	2.8
25 to 34 years	40	7.1
35 to 44 years	41	7.3
45 to 54 years	91	16.1
55 to 59 years	64	11.3
60 to 64 years	48	8.5
65 to 74 years	107	19.0
75 to 84 years	59	10.5
85 years and over	29	5.1
Median age (years)	57.2	(X)
18 years and over	503	89.2
Male	229	40.6
Female	274	48.6
21 years and over	489	86.7
62 years and over	227	40.2
65 years and over	195	34.6
Male	86	15.2
Female	109	19.3
RACE		
One race	552	97.9
White	544	96.5
Black or African American	-	-
American Indian and Alaska Native	3	0.5
Asian	-	-
Asian Indian	-	-
Chinese	-	-
Filipino	-	-
Japanese	-	-
Korean	-	-
Vietnamese	-	-
Other Asian [1]	-	-
Native Hawaiian and Other Pacific Islander	-	-
Native Hawaiian	-	-
Guamanian or Chamorro	-	-
Samoan	-	-
Other Pacific Islander [2]	-	-
Some other race	5	0.9
Two or more races	12	2.1
Race alone or in combination with one or more other races: [3]		
White	556	98.6
Black or African American	4	0.7
American Indian and Alaska Native	11	2.0
Asian	1	0.2
Native Hawaiian and Other Pacific Islander	2	0.4
Some other race	5	0.9

Subject	Number	Percent
HISPANIC OR LATINO AND RACE		
Total population	**564**	**100.0**
Hispanic or Latino (of any race)	9	1.6
Mexican	7	1.2
Puerto Rican	-	-
Cuban	1	0.2
Other Hispanic or Latino	1	0.2
Not Hispanic or Latino	555	98.4
White alone	540	95.7
RELATIONSHIP		
Total population	**564**	**100.0**
In households	564	100.0
Householder	307	54.4
Spouse	157	27.8
Child	70	12.4
Own child under 18 years	53	9.4
Other relatives	9	1.6
Under 18 years	2	0.4
Nonrelatives	21	3.7
Unmarried partner	10	1.8
In group quarters	-	-
Institutionalized population	-	-
Noninstitutionalized population	-	-
HOUSEHOLD BY TYPE		
Total households	**307**	**100.0**
Family households (families)	177	57.7
With own children under 18 years	29	9.4
Married-couple family	157	51.1
With own children under 18 years	19	6.2
Female householder, no husband present	14	4.6
With own children under 18 years	6	2.0
Nonfamily households	130	42.3
Householder living alone	119	38.8
Householder 65 years and over	57	18.6
Households with individuals under 18 years	32	10.4
Households with individuals 65 years and over	136	44.3
Average household size	1.84	(X)
Average family size	2.33	(X)
HOUSING OCCUPANCY		
Total housing units	**1,078**	**100.0**
Occupied housing units	307	28.5
Vacant housing units	771	71.5
For seasonal, recreational, or occasional use	723	67.1
Homeowner vacancy rate (percent)	9.2	(X)
Rental vacancy rate (percent)	20.6	(X)
HOUSING TENURE		
Occupied housing units	**307**	**100.0**
Owner-occupied housing units	226	73.6
Renter-occupied housing units	81	26.4
Average household size of owner-occupied units	1.83	(X)
Average household size of renter-occupied units	1.85	(X)

- Represents zero or rounds to zero. (X) Not applicable.

[1] Other Asian alone, or two or more Asian categories.

[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.

[3] In combination with one or more of the other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau, Census 2000.

Table DP-2. Profile of Selected Social Characteristics: 2000

Geographic area: Manzanita city, Oregon

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
SCHOOL ENROLLMENT		
Population 3 years and over enrolled in school	**52**	**100.0**
Nursery school, preschool	-	-
Kindergarten	4	7.7
Elementary school (grades 1-8)	28	53.8
High school (grades 9-12)	18	34.6
College or graduate school	2	3.8
EDUCATIONAL ATTAINMENT		
Population 25 years and over	**427**	**100.0**
Less than 9th grade	-	-
9th to 12th grade, no diploma	28	6.6
High school graduate (includes equivalency)	74	17.3
Some college, no degree	100	23.4
Associate degree	24	5.6
Bachelor's degree	109	25.5
Graduate or professional degree	92	21.5
Percent high school graduate or higher	93.4	(X)
Percent bachelor's degree or higher	47.1	(X)
MARITAL STATUS		
Population 15 years and over	**460**	**100.0**
Never married	67	14.6
Now married, except separated	279	60.7
Separated	7	1.5
Widowed	48	10.4
Female	43	9.3
Divorced	59	12.8
Female	39	8.5
GRANDPARENTS AS CAREGIVERS		
Grandparent living in household with one or more own grandchildren under 18 years	**3**	**100.0**
Grandparent responsible for grandchildren	-	-
VETERAN STATUS		
Civilian population 18 years and over	**446**	**100.0**
Civilian veterans	94	21.1
DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION		
Population 5 to 20 years	**52**	**100.0**
With a disability	4	7.7
Population 21 to 64 years	**269**	**100.0**
With a disability	52	19.3
Percent employed	84.6	(X)
No disability	217	80.7
Percent employed	74.2	(X)
Population 65 years and over	**171**	**100.0**
With a disability	38	22.2
RESIDENCE IN 1995		
Population 5 years and over	**492**	**100.0**
Same house in 1995	228	46.3
Different house in the U.S. in 1995	252	51.2
Same county	92	18.7
Different county	160	32.5
Same state	72	14.6
Different state	88	17.9
Elsewhere in 1995	12	2.4

Subject	Number	Percent
NATIVITY AND PLACE OF BIRTH		
Total population	**501**	**100.0**
Native	476	95.0
Born in United States	473	94.4
State of residence	205	40.9
Different state	268	53.5
Born outside United States	3	0.6
Foreign born	25	5.0
Entered 1990 to March 2000	2	0.4
Naturalized citizen	18	3.6
Not a citizen	7	1.4
REGION OF BIRTH OF FOREIGN BORN		
Total (excluding born at sea)	**25**	**100.0**
Europe	10	40.0
Asia	-	-
Africa	-	-
Oceania	-	-
Latin America	2	8.0
Northern America	13	52.0
LANGUAGE SPOKEN AT HOME		
Population 5 years and over	**492**	**100.0**
English only	478	97.2
Language other than English	14	2.8
Speak English less than "very well"	6	1.2
Spanish	5	1.0
Speak English less than "very well"	2	0.4
Other Indo-European languages	5	1.0
Speak English less than "very well"	2	0.4
Asian and Pacific Island languages	4	0.8
Speak English less than "very well"	2	0.4
ANCESTRY (single or multiple)		
Total population	**501**	**100.0**
Total ancestries reported	*549*	*109.6*
Arab	-	-
Czech[1]	3	0.6
Danish	10	2.0
Dutch	12	2.4
English	63	12.6
French (except Basque)[1]	23	4.6
French Canadian[1]	6	1.2
German	104	20.8
Greek	2	0.4
Hungarian	-	-
Irish[1]	58	11.6
Italian	35	7.0
Lithuanian	-	-
Norwegian	30	6.0
Polish	5	1.0
Portuguese	3	0.6
Russian	2	0.4
Scotch-Irish	28	5.6
Scottish	26	5.2
Slovak	3	0.6
Subsaharan African	-	-
Swedish	10	2.0
Swiss	23	4.6
Ukrainian	10	2.0
United States or American	37	7.4
Welsh	13	2.6
West Indian (excluding Hispanic groups)	-	-
Other ancestries	43	8.6

-Represents zero or rounds to zero. (X) Not applicable.

[1]The data represent a combination of two ancestries shown separately in Summary File 3. Czech includes Czechoslovakian. French includes Alsatian. French Canadian includes Acadian/Cajun. Irish includes Celtic.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-3. Profile of Selected Economic Characteristics: 2000

Geographic area: Manzanita city, Oregon

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**455**	**100.0**
In labor force	239	52.5
Civilian labor force	239	52.5
Employed	233	51.2
Unemployed	6	1.3
Percent of civilian labor force	2.5	(X)
Armed Forces	-	-
Not in labor force	216	47.5
Females 16 years and over	**246**	**100.0**
In labor force	113	45.9
Civilian labor force	113	45.9
Employed	109	44.3
Own children under 6 years	**11**	**100.0**
All parents in family in labor force	11	100.0
COMMUTING TO WORK		
Workers 16 years and over	**228**	**100.0**
Car, truck, or van - - drove alone	153	67.1
Car, truck, or van - - carpooled	20	8.8
Public transportation (including taxicab)	-	-
Walked	11	4.8
Other means	-	-
Worked at home	44	19.3
Mean travel time to work (minutes)[1]	17.9	(X)
Employed civilian population 16 years and over	**233**	**100.0**
OCCUPATION		
Management, professional, and related occupations	103	44.2
Service occupations	25	10.7
Sales and office occupations	61	26.2
Farming, fishing, and forestry occupations	-	-
Construction, extraction, and maintenance occupations	39	16.7
Production, transportation, and material moving occupations	5	2.1
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	6	2.6
Construction	41	17.6
Manufacturing	7	3.0
Wholesale trade	-	-
Retail trade	29	12.4
Transportation and warehousing, and utilities	8	3.4
Information	10	4.3
Finance, insurance, real estate, and rental and leasing	27	11.6
Professional, scientific, management, administrative, and waste management services	21	9.0
Educational, health and social services	51	21.9
Arts, entertainment, recreation, accommodation and food services	26	11.2
Other services (except public administration)	3	1.3
Public administration	4	1.7
CLASS OF WORKER		
Private wage and salary workers	144	61.8
Government workers	37	15.9
Self-employed workers in own not incorporated business	52	22.3
Unpaid family workers	-	-

Subject	Number	Percent
INCOME IN 1999		
Households	**280**	**100.0**
Less than $10,000	10	3.6
$10,000 to $14,999	8	2.9
$15,000 to $24,999	51	18.2
$25,000 to $34,999	54	19.3
$35,000 to $49,999	60	21.4
$50,000 to $74,999	62	22.1
$75,000 to $99,999	15	5.4
$100,000 to $149,999	10	3.6
$150,000 to $199,999	10	3.6
$200,000 or more	-	-
Median household income (dollars)	38,750	(X)
With earnings	175	62.5
Mean earnings (dollars)[1]	41,416	(X)
With Social Security income	124	44.3
Mean Social Security income (dollars)[1]	14,354	(X)
With Supplemental Security Income	6	2.1
Mean Supplemental Security Income (dollars)[1]	2,133	(X)
With public assistance income	5	1.8
Mean public assistance income (dollars)[1]	2,460	(X)
With retirement income	101	36.1
Mean retirement income (dollars)[1]	18,515	(X)
Families	**162**	**100.0**
Less than $10,000	2	1.2
$10,000 to $14,999	7	4.3
$15,000 to $24,999	19	11.7
$25,000 to $34,999	28	17.3
$35,000 to $49,999	41	25.3
$50,000 to $74,999	37	22.8
$75,000 to $99,999	13	8.0
$100,000 to $149,999	8	4.9
$150,000 to $199,999	7	4.3
$200,000 or more	-	-
Median family income (dollars)	43,958	(X)
Per capita income (dollars)[1]	26,428	(X)
Median earnings (dollars):		
Male full-time, year-round workers	30,000	(X)
Female full-time, year-round workers	25,833	(X)

Subject	Number below poverty level	Percent below poverty level
POVERTY STATUS IN 1999		
Families	**8**	**4.9**
With related children under 18 years	6	18.8
With related children under 5 years	3	33.3
Families with female householder, no husband present	**3**	**15.0**
With related children under 18 years	3	25.0
With related children under 5 years	3	100.0
Individuals	**36**	**7.2**
18 years and over	21	4.7
65 years and over	8	4.7
Related children under 18 years	11	22.4
Related children 5 to 17 years	8	19.0
Unrelated individuals 15 years and over	12	8.6

-Represents zero or rounds to zero. (X) Not applicable.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator. See text.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-4. Profile of Selected Housing Characteristics: 2000

Geographic area: Manzanita city, Oregon

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total housing units	**1,074**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	1,015	94.5
1-unit, attached	22	2.0
2 units	24	2.2
3 or 4 units	9	0.8
5 to 9 units	2	0.2
10 to 19 units	2	0.2
20 or more units	-	-
Mobile home	-	-
Boat, RV, van, etc	-	-
YEAR STRUCTURE BUILT		
1999 to March 2000	54	5.0
1995 to 1998	139	12.9
1990 to 1994	171	15.9
1980 to 1989	293	27.3
1970 to 1979	163	15.2
1960 to 1969	74	6.9
1940 to 1959	106	9.9
1939 or earlier	74	6.9
ROOMS		
1 room	3	0.3
2 rooms	13	1.2
3 rooms	76	7.1
4 rooms	197	18.3
5 rooms	330	30.7
6 rooms	244	22.7
7 rooms	120	11.2
8 rooms	67	6.2
9 or more rooms	24	2.2
Median (rooms)	5.3	(X)
Occupied housing units	**283**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	56	19.8
1995 to 1998	81	28.6
1990 to 1994	61	21.6
1980 to 1989	54	19.1
1970 to 1979	20	7.1
1969 or earlier	11	3.9
VEHICLES AVAILABLE		
None	11	3.9
1	124	43.8
2	134	47.3
3 or more	14	4.9
HOUSE HEATING FUEL		
Utility gas	1	0.4
Bottled, tank, or LP gas	6	2.1
Electricity	227	80.2
Fuel oil, kerosene, etc	3	1.1
Coal or coke	-	-
Wood	46	16.3
Solar energy	-	-
Other fuel	-	-
No fuel used	-	-
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	4	1.4
Lacking complete kitchen facilities	8	2.8
No telephone service	7	2.5

Subject	Number	Percent
OCCUPANTS PER ROOM		
Occupied housing units	**283**	**100.0**
1.00 or less	280	98.9
1.01 to 1.50	3	1.1
1.51 or more	-	-
Specified owner-occupied units	**201**	**100.0**
VALUE		
Less than $50,000	-	-
$50,000 to $99,999	7	3.5
$100,000 to $149,999	20	10.0
$150,000 to $199,999	43	21.4
$200,000 to $299,999	85	42.3
$300,000 to $499,999	39	19.4
$500,000 to $999,999	7	3.5
$1,000,000 or more	-	-
Median (dollars)	234,700	(X)
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
With a mortgage	74	36.8
Less than $300	2	1.0
$300 to $499	5	2.5
$500 to $699	6	3.0
$700 to $999	25	12.4
$1,000 to $1,499	15	7.5
$1,500 to $1,999	19	9.5
$2,000 or more	2	1.0
Median (dollars)	980	(X)
Not mortgaged	127	63.2
Median (dollars)	328	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	111	55.2
15.0 to 19.9 percent	20	10.0
20.0 to 24.9 percent	20	10.0
25.0 to 29.9 percent	9	4.5
30.0 to 34.9 percent	8	4.0
35.0 percent or more	33	16.4
Not computed	-	-
Specified renter-occupied units	**67**	**100.0**
GROSS RENT		
Less than $200	-	-
$200 to $299	1	1.5
$300 to $499	10	14.9
$500 to $749	36	53.7
$750 to $999	13	19.4
$1,000 to $1,499	3	4.5
$1,500 or more	-	-
No cash rent	4	6.0
Median (dollars)	657	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	8	11.9
15.0 to 19.9 percent	11	16.4
20.0 to 24.9 percent	8	11.9
25.0 to 29.9 percent	14	20.9
30.0 to 34.9 percent	5	7.5
35.0 percent or more	17	25.4
Not computed	4	6.0

-Represents zero or rounds to zero. (X) Not applicable.

Source: U.S. Bureau of the Census, Census 2000.

APPENDIX 2.2
CITY OF WHEELER, OREGON
SELECTED U.S. CENSUS BUREAU DATA, CENSUS 2000

Table DP-1. Profile of General Demographic Characteristics: 2000

Geographic Area: Wheeler city, Oregon

[For information on confidentiality protection, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total population	**391**	**100.0**
SEX AND AGE		
Male	185	47.3
Female	206	52.7
Under 5 years	11	2.8
5 to 9 years	17	4.3
10 to 14 years	21	5.4
15 to 19 years	9	2.3
20 to 24 years	23	5.9
25 to 34 years	26	6.6
35 to 44 years	52	13.3
45 to 54 years	74	18.9
55 to 59 years	18	4.6
60 to 64 years	32	8.2
65 to 74 years	47	12.0
75 to 84 years	28	7.2
85 years and over	33	8.4
Median age (years)	50.0	(X)
18 years and over	335	85.7
Male	160	40.9
Female	175	44.8
21 years and over	329	84.1
62 years and over	117	29.9
65 years and over	108	27.6
Male	43	11.0
Female	65	16.6
RACE		
One race	381	97.4
White	364	93.1
Black or African American	-	-
American Indian and Alaska Native	3	0.8
Asian	7	1.8
Asian Indian	-	-
Chinese	-	-
Filipino	3	0.8
Japanese	1	0.3
Korean	3	0.8
Vietnamese	-	-
Other Asian [1]	-	-
Native Hawaiian and Other Pacific Islander	-	-
Native Hawaiian	-	-
Guamanian or Chamorro	-	-
Samoan	-	-
Other Pacific Islander [2]	-	-
Some other race	7	1.8
Two or more races	10	2.6
Race alone or in combination with one or more other races: [3]		
White	374	95.7
Black or African American	1	0.3
American Indian and Alaska Native	8	2.0
Asian	13	3.3
Native Hawaiian and Other Pacific Islander	1	0.3
Some other race	7	1.8

Subject	Number	Percent
HISPANIC OR LATINO AND RACE		
Total population	**391**	**100.0**
Hispanic or Latino (of any race)	11	2.8
Mexican	8	2.0
Puerto Rican	1	0.3
Cuban	-	-
Other Hispanic or Latino	2	0.5
Not Hispanic or Latino	380	97.2
White alone	360	92.1
RELATIONSHIP		
Total population	**391**	**100.0**
In households	349	89.3
Householder	176	45.0
Spouse	79	20.2
Child	59	15.1
Own child under 18 years	49	12.5
Other relatives	7	1.8
Under 18 years	3	0.8
Nonrelatives	28	7.2
Unmarried partner	19	4.9
In group quarters	42	10.7
Institutionalized population	42	10.7
Noninstitutionalized population	-	-
HOUSEHOLD BY TYPE		
Total households	**176**	**100.0**
Family households (families)	94	53.4
With own children under 18 years	29	16.5
Married-couple family	79	44.9
With own children under 18 years	18	10.2
Female householder, no husband present	12	6.8
With own children under 18 years	10	5.7
Nonfamily households	82	46.6
Householder living alone	63	35.8
Householder 65 years and over	23	13.1
Households with individuals under 18 years	32	18.2
Households with individuals 65 years and over	49	27.8
Average household size	1.98	(X)
Average family size	2.54	(X)
HOUSING OCCUPANCY		
Total housing units	**244**	**100.0**
Occupied housing units	176	72.1
Vacant housing units	68	27.9
For seasonal, recreational, or occasional use	52	21.3
Homeowner vacancy rate (percent)	3.6	(X)
Rental vacancy rate (percent)	13.9	(X)
HOUSING TENURE		
Occupied housing units	**176**	**100.0**
Owner-occupied housing units	108	61.4
Renter-occupied housing units	68	38.6
Average household size of owner-occupied units	2.02	(X)
Average household size of renter-occupied units	1.93	(X)

- Represents zero or rounds to zero. (X) Not applicable.

[1] Other Asian alone, or two or more Asian categories.

[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.

[3] In combination with one or more of the other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau, Census 2000.

Table DP-2. Profile of Selected Social Characteristics: 2000

Geographic area: Wheeler city, Oregon

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
SCHOOL ENROLLMENT		
Population 3 years and over enrolled in school	**76**	**100.0**
Nursery school, preschool	-	-
Kindergarten	5	6.6
Elementary school (grades 1-8)	54	71.1
High school (grades 9-12)	12	15.8
College or graduate school	5	6.6
EDUCATIONAL ATTAINMENT		
Population 25 years and over	**313**	**100.0**
Less than 9th grade	15	4.8
9th to 12th grade, no diploma	49	15.7
High school graduate (includes equivalency)	77	24.6
Some college, no degree	61	19.5
Associate degree	29	9.3
Bachelor's degree	45	14.4
Graduate or professional degree	37	11.8
Percent high school graduate or higher	79.6	(X)
Percent bachelor's degree or higher	26.2	(X)
MARITAL STATUS		
Population 15 years and over	**350**	**100.0**
Never married	58	16.6
Now married, except separated	190	54.3
Separated	9	2.6
Widowed	52	14.9
Female	39	11.1
Divorced	41	11.7
Female	24	6.9
GRANDPARENTS AS CAREGIVERS		
Grandparent living in household with one or more own grandchildren under 18 years	**3**	**100.0**
Grandparent responsible for grandchildren	3	100.0
VETERAN STATUS		
Civilian population 18 years and over	**338**	**100.0**
Civilian veterans	48	14.2
DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION		
Population 5 to 20 years	**86**	**100.0**
With a disability	6	7.0
Population 21 to 64 years	**221**	**100.0**
With a disability	50	22.6
Percent employed	46.0	(X)
No disability	171	77.4
Percent employed	75.4	(X)
Population 65 years and over	**64**	**100.0**
With a disability	18	28.1
RESIDENCE IN 1995		
Population 5 years and over	**414**	**100.0**
Same house in 1995	167	40.3
Different house in the U.S. in 1995	247	59.7
Same county	110	26.6
Different county	137	33.1
Same state	92	22.2
Different state	45	10.9
Elsewhere in 1995	-	-

Subject	Number	Percent
NATIVITY AND PLACE OF BIRTH		
Total population	**425**	**100.0**
Native	409	96.2
Born in United States	399	93.9
State of residence	182	42.8
Different state	217	51.1
Born outside United States	10	2.4
Foreign born	16	3.8
Entered 1990 to March 2000	5	1.2
Naturalized citizen	7	1.6
Not a citizen	9	2.1
REGION OF BIRTH OF FOREIGN BORN		
Total (excluding born at sea)	**16**	**100.0**
Europe	9	56.3
Asia	-	-
Africa	1	6.3
Oceania	-	-
Latin America	6	37.5
Northern America	-	-
LANGUAGE SPOKEN AT HOME		
Population 5 years and over	**414**	**100.0**
English only	404	97.6
Language other than English	10	2.4
Speak English less than "very well"	5	1.2
Spanish	8	1.9
Speak English less than "very well"	4	1.0
Other Indo-European languages	2	0.5
Speak English less than "very well"	1	0.2
Asian and Pacific Island languages	-	-
Speak English less than "very well"	-	-
ANCESTRY (single or multiple)		
Total population	**425**	**100.0**
Total ancestries reported	*471*	*110.8*
Arab	1	0.2
Czech[1]	2	0.5
Danish	20	4.7
Dutch	30	7.1
English	100	23.5
French (except Basque)[1]	25	5.9
French Canadian[1]	2	0.5
German	66	15.5
Greek	-	-
Hungarian	-	-
Irish[1]	44	10.4
Italian	18	4.2
Lithuanian	1	0.2
Norwegian	9	2.1
Polish	2	0.5
Portuguese	-	-
Russian	-	-
Scotch-Irish	9	2.1
Scottish	17	4.0
Slovak	-	-
Subsaharan African	-	-
Swedish	7	1.6
Swiss	3	0.7
Ukrainian	-	-
United States or American	60	14.1
Welsh	1	0.2
West Indian (excluding Hispanic groups)	-	-
Other ancestries	54	12.7

-Represents zero or rounds to zero. (X) Not applicable.

[1]The data represent a combination of two ancestries shown separately in Summary File 3. Czech includes Czechoslovakian. French includes Alsatian. French Canadian includes Acadian/Cajun. Irish includes Celtic.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-3. Profile of Selected Economic Characteristics: 2000

Geographic area: Wheeler city, Oregon

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**347**	**100.0**
In labor force	166	47.8
Civilian labor force	166	47.8
Employed	163	47.0
Unemployed	3	0.9
Percent of civilian labor force	1.8	(X)
Armed Forces	-	-
Not in labor force	181	52.2
Females 16 years and over	**195**	**100.0**
In labor force	76	39.0
Civilian labor force	76	39.0
Employed	74	37.9
Own children under 6 years	**10**	**100.0**
All parents in family in labor force	3	30.0
COMMUTING TO WORK		
Workers 16 years and over	**152**	**100.0**
Car, truck, or van - - drove alone	110	72.4
Car, truck, or van - - carpooled	24	15.8
Public transportation (including taxicab)	-	-
Walked	14	9.2
Other means	-	-
Worked at home	4	2.6
Mean travel time to work (minutes)[1]	20.2	(X)
Employed civilian population 16 years and over	**163**	**100.0**
OCCUPATION		
Management, professional, and related occupations	58	35.6
Service occupations	37	22.7
Sales and office occupations	27	16.6
Farming, fishing, and forestry occupations	2	1.2
Construction, extraction, and maintenance occupations	22	13.5
Production, transportation, and material moving occupations	17	10.4
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	2	1.2
Construction	14	8.6
Manufacturing	11	6.7
Wholesale trade	-	-
Retail trade	13	8.0
Transportation and warehousing, and utilities	8	4.9
Information	2	1.2
Finance, insurance, real estate, and rental and leasing	3	1.8
Professional, scientific, management, administrative, and waste management services	20	12.3
Educational, health and social services	43	26.4
Arts, entertainment, recreation, accommodation and food services	37	22.7
Other services (except public administration)	6	3.7
Public administration	4	2.5
CLASS OF WORKER		
Private wage and salary workers	97	59.5
Government workers	47	28.8
Self-employed workers in own not incorporated business	18	11.0
Unpaid family workers	1	0.6

Subject	Number	Percent
INCOME IN 1999		
Households	**168**	**100.0**
Less than $10,000	20	11.9
$10,000 to $14,999	14	8.3
$15,000 to $24,999	37	22.0
$25,000 to $34,999	35	20.8
$35,000 to $49,999	34	20.2
$50,000 to $74,999	15	8.9
$75,000 to $99,999	9	5.4
$100,000 to $149,999	2	1.2
$150,000 to $199,999	-	-
$200,000 or more	2	1.2
Median household income (dollars)	29,000	(X)
With earnings	125	74.4
Mean earnings (dollars)[1]	27,607	(X)
With Social Security income	53	31.5
Mean Social Security income (dollars)[1]	11,620	(X)
With Supplemental Security Income	12	7.1
Mean Supplemental Security Income (dollars)[1]	5,583	(X)
With public assistance income	6	3.6
Mean public assistance income (dollars)[1]	1,433	(X)
With retirement income	39	23.2
Mean retirement income (dollars)[1]	21,501	(X)
Families	**101**	**100.0**
Less than $10,000	11	10.9
$10,000 to $14,999	5	5.0
$15,000 to $24,999	24	23.8
$25,000 to $34,999	21	20.8
$35,000 to $49,999	21	20.8
$50,000 to $74,999	10	9.9
$75,000 to $99,999	6	5.9
$100,000 to $149,999	2	2.0
$150,000 to $199,999	-	-
$200,000 or more	1	1.0
Median family income (dollars)	31,161	(X)
Per capita income (dollars)[1]	16,535	(X)
Median earnings (dollars):		
Male full-time, year-round workers	26,364	(X)
Female full-time, year-round workers	21,429	(X)

Subject	Number below poverty level	Percent below poverty level
POVERTY STATUS IN 1999		
Families	**11**	**10.9**
With related children under 18 years	10	21.7
With related children under 5 years	7	53.8
Families with female householder, no husband present	**3**	**20.0**
With related children under 18 years	3	25.0
With related children under 5 years	-	-
Individuals	**62**	**16.2**
18 years and over	45	15.3
65 years and over	-	-
Related children under 18 years	11	13.6
Related children 5 to 17 years	6	8.6
Unrelated individuals 15 years and over	33	30.8

-Represents zero or rounds to zero. (X) Not applicable.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator. See text.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-4. Profile of Selected Housing Characteristics: 2000

Geographic area: Wheeler city, Oregon

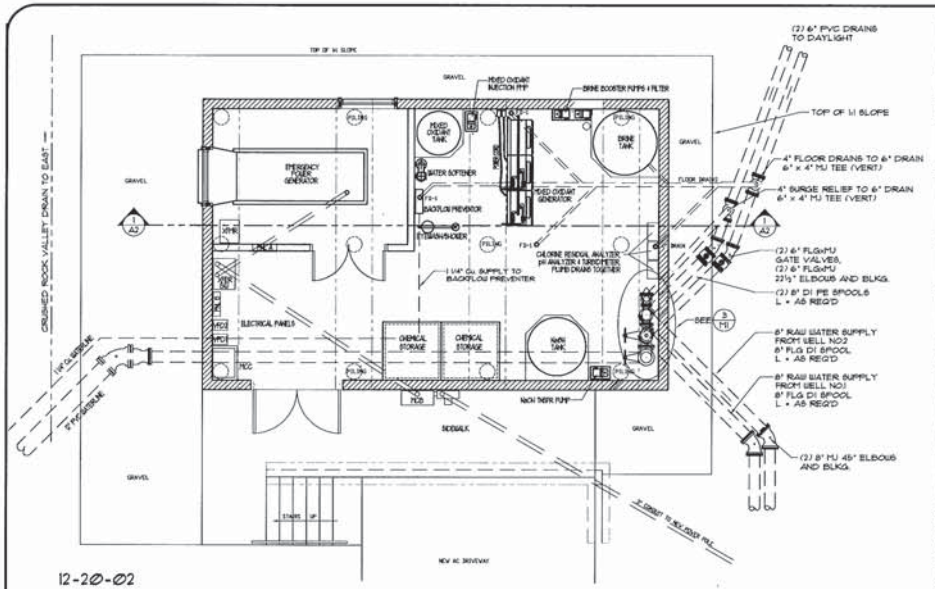
[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent	Subject	Number	Percent
Total housing units	**244**	**100.0**	**OCCUPANTS PER ROOM**		
UNITS IN STRUCTURE			**Occupied housing units**	**180**	**100.0**
1-unit, detached	174	71.3	1.00 or less	175	97.2
1-unit, attached	10	4.1	1.01 to 1.50	5	2.8
2 units	9	3.7	1.51 or more	-	-
3 or 4 units	8	3.3			
5 to 9 units	19	7.8	**Specified owner-occupied units**	**99**	**100.0**
10 to 19 units	4	1.6	**VALUE**		
20 or more units	-	-	Less than $50,000	5	5.1
Mobile home	15	6.1	$50,000 to $99,999	17	17.2
Boat, RV, van, etc	5	2.0	$100,000 to $149,999	34	34.3
			$150,000 to $199,999	24	24.2
YEAR STRUCTURE BUILT			$200,000 to $299,999	14	14.1
1999 to March 2000	2	0.8	$300,000 to $499,999	2	2.0
1995 to 1998	10	4.1	$500,000 to $999,999	3	3.0
1990 to 1994	20	8.2	$1,000,000 or more	-	-
1980 to 1989	35	14.3	Median (dollars)	144,400	(X)
1970 to 1979	32	13.1			
1960 to 1969	16	6.6	**MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS**		
1940 to 1959	53	21.7			
1939 or earlier	76	31.1	With a mortgage	54	54.5
			Less than $300	-	-
ROOMS			$300 to $499	-	-
1 room	8	3.3	$500 to $699	9	9.1
2 rooms	13	5.3	$700 to $999	15	15.2
3 rooms	19	7.8	$1,000 to $1,499	23	23.2
4 rooms	43	17.6	$1,500 to $1,999	7	7.1
5 rooms	64	26.2	$2,000 or more	-	-
6 rooms	69	28.3	Median (dollars)	1,039	(X)
7 rooms	16	6.6	Not mortgaged	45	45.5
8 rooms	10	4.1	Median (dollars)	321	(X)
9 or more rooms	2	0.8			
Median (rooms)	5.1	(X)	**SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999**		
Occupied housing units	**180**	**100.0**			
YEAR HOUSEHOLDER MOVED INTO UNIT			Less than 15.0 percent	41	41.4
1999 to March 2000	32	17.8	15.0 to 19.9 percent	17	17.2
1995 to 1998	55	30.6	20.0 to 24.9 percent	4	4.0
1990 to 1994	36	20.0	25.0 to 29.9 percent	8	8.1
1980 to 1989	18	10.0	30.0 to 34.9 percent	6	6.1
1970 to 1979	28	15.6	35.0 percent or more	21	21.2
1969 or earlier	11	6.1	Not computed	2	2.0
VEHICLES AVAILABLE			**Specified renter-occupied units**	**60**	**100.0**
None	10	5.6	**GROSS RENT**		
1	82	45.6	Less than $200	-	-
2	64	35.6	$200 to $299	3	5.0
3 or more	24	13.3	$300 to $499	29	48.3
			$500 to $749	16	26.7
HOUSE HEATING FUEL			$750 to $999	7	11.7
Utility gas	-	-	$1,000 to $1,499	-	-
Bottled, tank, or LP gas	8	4.4	$1,500 or more	-	-
Electricity	134	74.4	No cash rent	5	8.3
Fuel oil, kerosene, etc	10	5.6	Median (dollars)	455	(X)
Coal or coke	-	-			
Wood	23	12.8	**GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999**		
Solar energy	-	-			
Other fuel	5	2.8	Less than 15.0 percent	2	3.3
No fuel used	-	-	15.0 to 19.9 percent	3	5.0
			20.0 to 24.9 percent	10	16.7
SELECTED CHARACTERISTICS			25.0 to 29.9 percent	12	20.0
Lacking complete plumbing facilities	-	-	30.0 to 34.9 percent	4	6.7
Lacking complete kitchen facilities	-	-	35.0 percent or more	23	38.3
No telephone service	8	4.4	Not computed	6	10.0

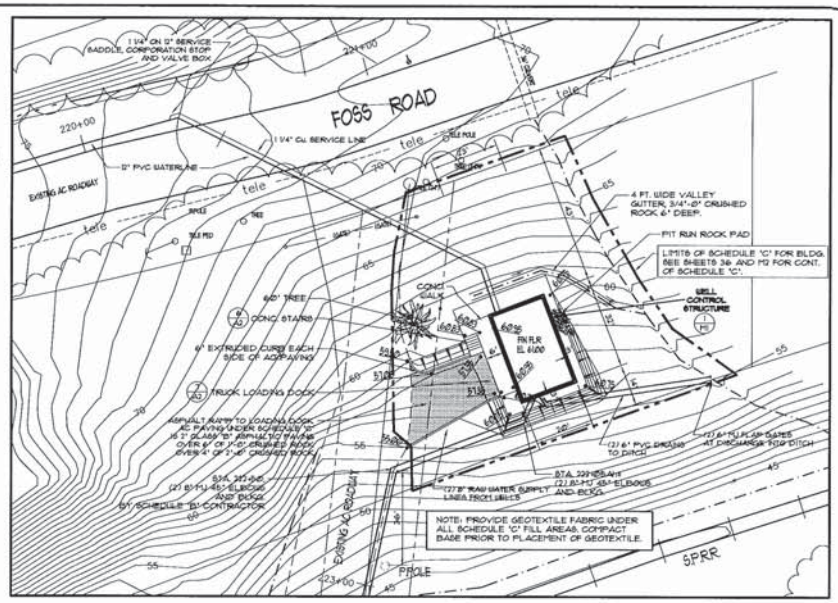
-Represents zero or rounds to zero. (X) Not applicable.

Source: U.S. Bureau of the Census, Census 2000.

APPENDIX 3.1
SELECTED PLAN SHEETS FROM
CITY OF MANZANITA 2001 WATER SYSTEM IMPROVEMENTS
(HGE, Inc., Architects, Engineers, Surveyors & Planners, 2001)



1 M1 MECHANICAL FLOOR PLAN
SCALE: ¼" = 1'-0"

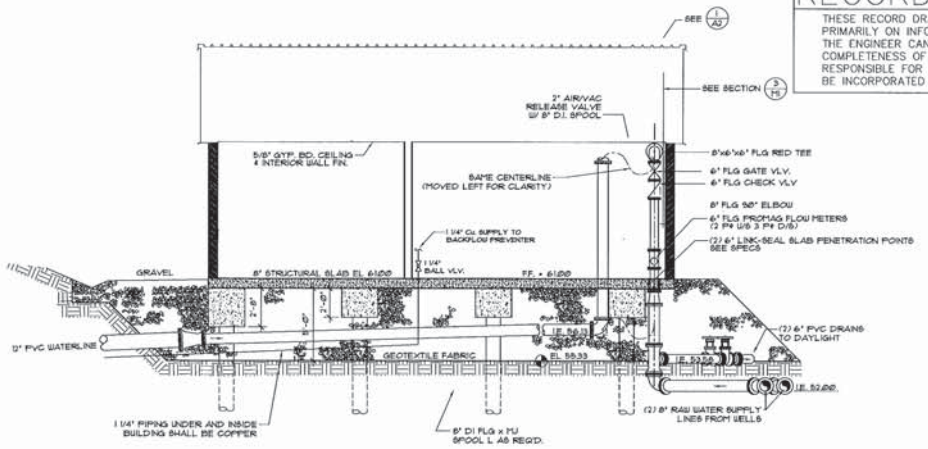


4 M1 CONTROL STRUCTURE MECH. SITE PLAN
SCALE: 1" = 40'

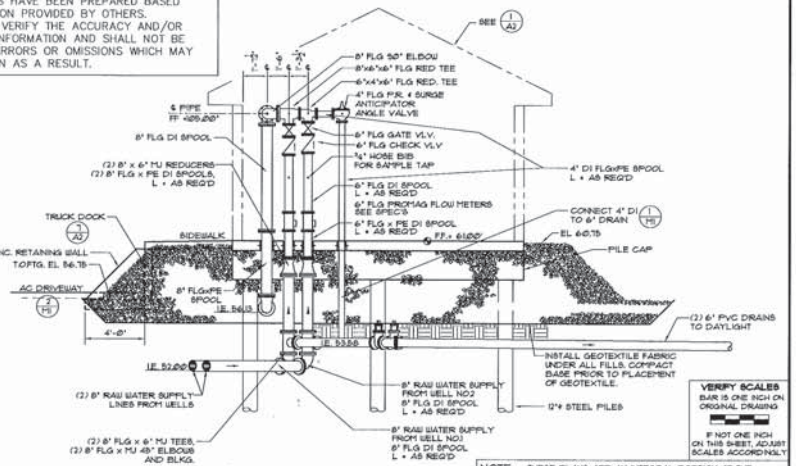
NOTE:
FOR DETAILED WELL LOCATIONS SEE 1/M6

RECORD DWG. DATE: 12-20-02

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED PRIMARILY ON INFORMATION PROVIDED BY OTHERS. THE ENGINEER CAN NOT VERIFY THE ACCURACY AND/OR COMPLETENESS OF ALL INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.



2 M1 MECHANICAL SECTION
SCALE: ¼" = 1'-0"



3 M1 MECHANICAL SECTION
SCALE: ¼" = 1'-0"

NOTE: THESE PLANS ARE AN INTEGRAL PORTION OF THE CONTRACT DOCUMENTS, SEPARATE WRITTEN SPECIFICATIONS FOR THE WORK ARE PROVIDED.

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

R.A.B.

HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS

SHEET TITLE: MECHANICAL FLOOR PLAN & BLDG SECTIONS

PROJECT: CITY OF MANZANITA WATER IMPROVEMENTS TILLAMOOK COUNTY, OREGON

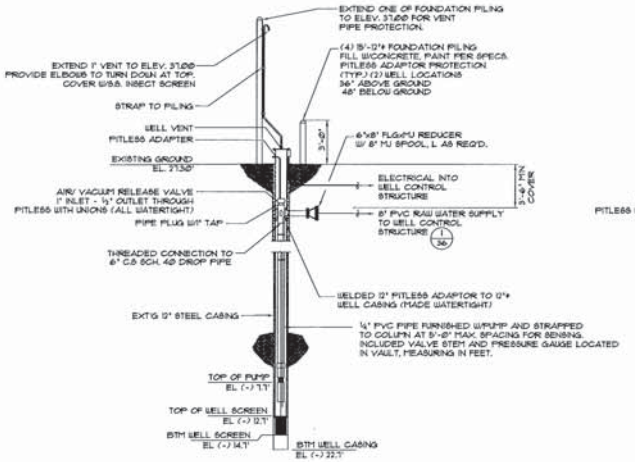
REGISTERED PROFESSIONAL ENGINEER 6489 OREGON JULY 11, 1986 RICHARD B. BOYD RENEWS: 6-30-04

PROJECT NO. 0036

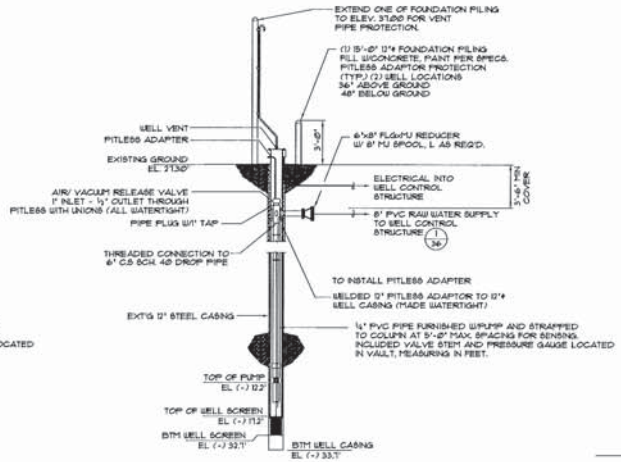
DATE: OCTOBER, 2001

REVISIONS	
DATE	
2-1-02	RB

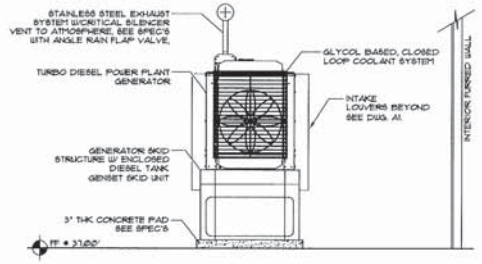
SHEET NO. M1



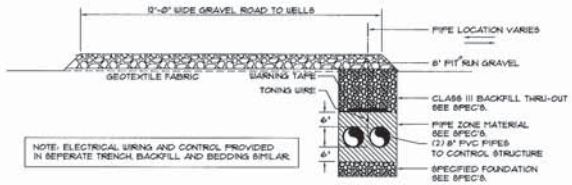
1 M2 WELL NO.1 & PUMP SECTION
SCALE: ½"=1'-0"



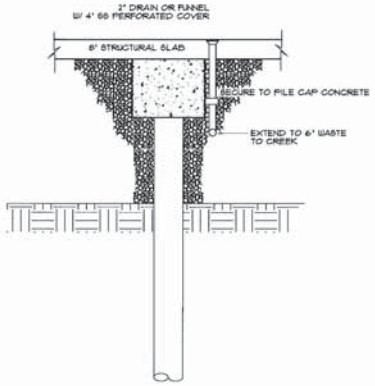
2 M2 WELL NO.2 & PUMP SECTION
SCALE: ½"=1'-0"



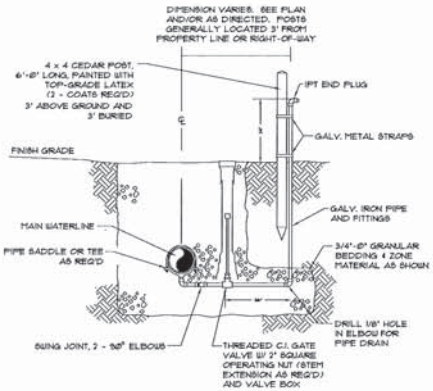
3 M2 EMERGENCY GENERATOR
SCALE: ¼" = 1'-0"



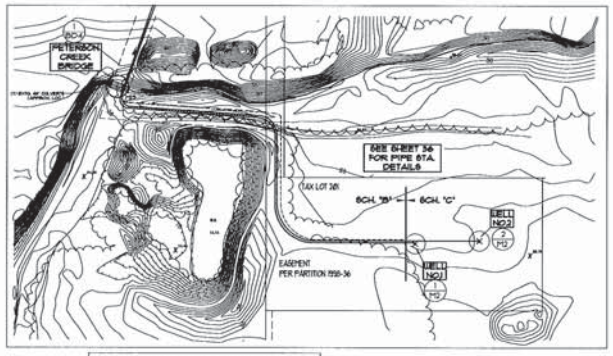
4 M2 TYPICAL ROAD/PIPE TRENCH SECTION
SCALE: NONE



5 M2 FLOOR DRAINS
SCALE: ½" = 1'-0"



6 M2 TYPICAL BLOWOFF
TYPICAL HGE DETAIL. SEE SPECIFICATIONS FOR SITE SPECIFIC REQUIREMENTS



NOTE: ELECTRICAL TO WELLS TO BE PROVIDED IN ENTIRETY BY SCHEDULE 'C' CONTRACTOR.

7 M1 WELL SITE AREA MAP
SCALE: 1"=300'

RECORD DWG. DEC 03
THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED PRIMARILY ON INFORMATION PROVIDED BY OTHERS. THE ENGINEER CAN NOT VERIFY THE ACCURACY AND/OR COMPLETENESS OF ALL INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

VERIFY SCALES
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

NOTE: THESE PLANS ARE AN INTEGRAL PORTION OF THE CONTRACT DOCUMENTS, SEPARATE WRITTEN SPECIFICATIONS FOR THE WORK ARE PROVIDED.

HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
375 W. 4th Avenue/Suite 204, Oregon 97401 (541) 359-3166
171 S.W. 10th Avenue/Suite C, Oregon 97080 (503) 223-6617

SHEET TITLE: MECHANICAL EQUIPMENT DETAILS & SECTIONS

PROJECT: CITY OF MANZANITA WATER IMPROVEMENTS TILLAMOOK COUNTY, OREGON

REGISTERED PROFESSIONAL ENGINEER 6489 OREGON JULY 11, 1980 RICHARD S. ROSS EXPIRES: 12-31-04

PROJECT NO. 0036

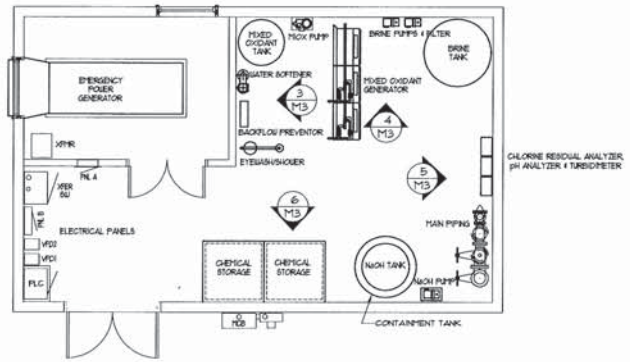
DATE: OCTOBER, 2001

REVISIONS

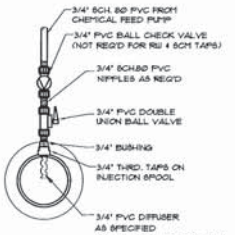
DATE	
2-1-02	RB

R.A.S.

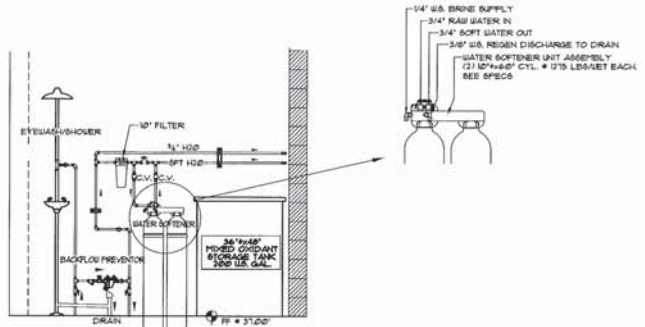
SHEET NO. M2



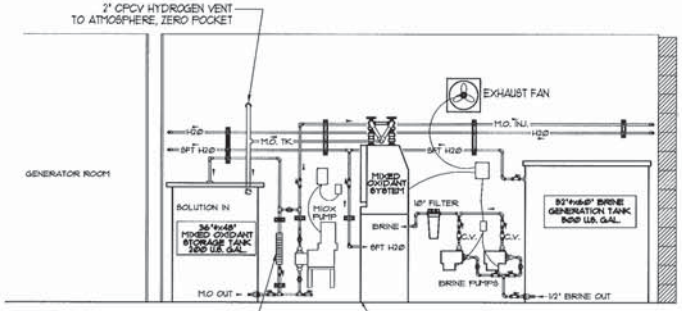
1 M3 MECHANICAL FLOOR PLAN
SCALE: NONE



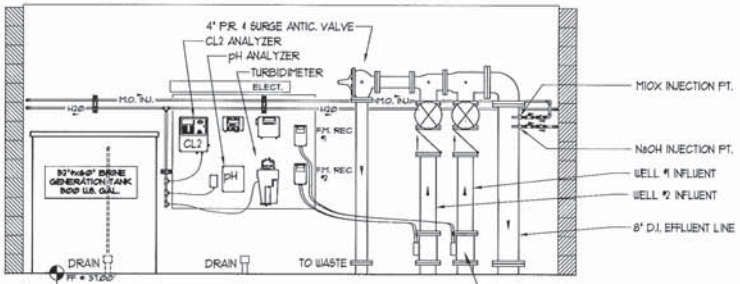
2 M3 CHEMICAL INJECTION PORT WATER SUPPLY TAP
N.T.S.



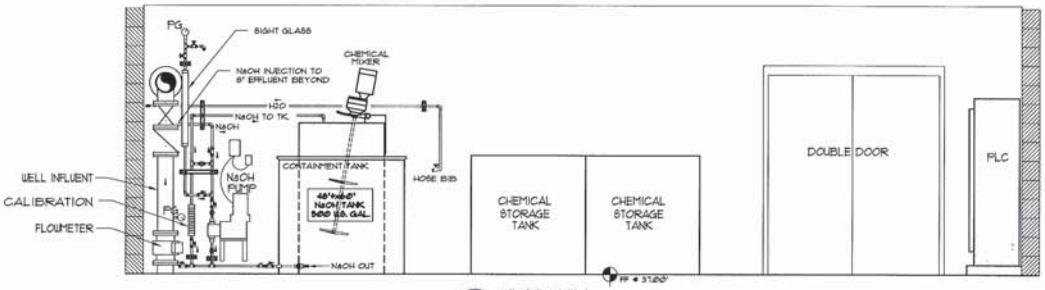
3 M3 INTERIOR WALL - NORTH
SCALE: 1/2" = 1'-0"



4 M3 EAST WALL
SCALE: 1/4" = 1'-0"



5 M3 SOUTH WALL
SCALE: 1/4" = 1'-0"



6 M3 WEST WALL
SCALE: 1/4" = 1'-0"

RECORD DWG. DATE: AUGUST 03

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED PRIMARILY ON INFORMATION PROVIDED BY OTHERS. THE ENGINEER CAN NOT VERIFY THE ACCURACY AND/OR COMPLETENESS OF ALL INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
373 Park Avenue/Coos Bay, Oregon 97420/(541) 269-1166
19 N.W. Fifth Avenue/Portland, Oregon 97209/(503) 223-1687

SHEET TITLE: MECHANICAL ELEVATIONS AND DETAILS

PROJECT: CITY OF MANZANITA WATER IMPROVEMENTS TILLAMOOK COUNTY, OREGON

REGISTERED PROFESSIONAL ENGINEER 6409 OREGON JULY 11, 1995 RICHARD S. KOCH EXPIRES: 12-31-04

PROJECT NO. 0036

DATE: OCTOBER, 2001

REVISIONS	
DATE	
AUG 03	RS
R.A.S.	

SHEET NO. M3

APPENDIX 3.2
SELECTED PLAN SHEETS FROM CITY OF MANZANITA WATER TREATMENT PLANT IMPROVEMENTS
(HGE, Inc., Architects, Engineers, Surveyors & Planners, 2000)

DESIGN CRITERIA

DESCRIPTION	CRITERIA
PLANT CAPACITY	
INITIAL:	350 GALLONS / MINUTE
FUTURE:	690 GALLONS / MINUTE
MICROFILTRATION UNIT	
INITIAL:	
UNITS TYPE:	30M 10C
NUMBER OF UNITS:	2
MODULE PER UNIT:	30
TOTAL MODULES:	60
FUTURE: (ADDITIONAL MODULES TO INITIAL UNITS)	
UNIT TYPE:	48M 10C
NUMBER OF UNITS:	2
MODULE PER UNIT:	48
TOTAL MODULES:	96
RAW WATER PUMPS	
INITIAL:	
PUMP TYPE:	VARIABLE SPEED VERTICAL TURBINE
AVERAGE FEED RATE:	371 GALLONS / MINUTE
BACKWASH FEED RATE:	756 GALLONS / MINUTE
FUTURE:	
PUMP TYPE:	VARIABLE SPEED VERTICAL TURBINE
AVERAGE FEED RATE:	736 GALLONS / MINUTE
BACKWASH FEED RATE:	1223 GALLONS / MINUTE
PREFILTERS	
CAPACITY	700 GALLONS / MINUTE
BACKWASH	
INITIAL:	
DURATION:	140 SECONDS
FREQUENCY:	30 MINUTES
BACKWASH AS % OF FEED:	5.13%
FLOW RATE DURING BACKWASH	756 GALLONS / MINUTE
AVERAGE BACKWASH FLOW RATE:	213 GALLONS / MINUTE
FUTURE:	
DURATION:	150 SECONDS
FREQUENCY:	30 MINUTE
BACKWASH AS % OF FEED:	4.64%
FLOW RATE DURING BACKWASH	1223 GALLONS / MINUTE
AVERAGE BACKWASH FLOW RATE:	33.6 GALLONS / MINUTE
BACKWASH EQUALIZATION TANK:	
CAPACITY:	1,150 GALLONS
BACKWASH STORAGE BASIN:	
CAPACITY:	82,500 GALLONS
DEPTH:	11.5 FT
GALLONS/FT:	7,180 GALLONS/FT
BACKWASH PUMPS:	2 PUMPS
CAPACITY PER PUMP:	40 GALLONS/MINUTES
RAW WATER BASIN:	
CAPACITY:	29,500 GALLONS
DEPTH:	11.5 FT
GALLON/FT OF DEPTH:	2,565

DESCRIPTION	UNITS	CRITERIA
TREATED WATER BASIN		
CAPACITY:		69,350 GALLONS
DEPTH:		10.5 FT
GALLON/FT. :		6,600 GALLONS/FT.
DETENTION TIME: (350 GAL/MIN)		198 MINUTES
CHLORINATION SYSTEM:		
MIXED - OXIDANT GENERATION EQUIPMENT:		20 POUNDS PER DAY OF CHLORINE PLUS 4 POUND PER DAY OF CHLORINE EQUIVALENT OXIDANTS
DOSAGE: (AVG.)		2 mg/l
MIXED - OXIDANT STORAGE TANK:		500 GALLONS
FEED PUMPS:		2 PUMPS
CAPACITY PER PUMP:		60 GALLON/HOUR
SODA ASH SYSTEM:		
STORAGE TANK:		500 GALLONS
DOSAGE: (AVG.)		12 mg/l
FEED PUMP		1 PUMP
PUMP CAPACITY:		11.3

MEMCOR MICROFILTRATION SYSTEM SPECIFICATIONS

MEMBRANE	
MATERIAL OF CONSTRUCTION:	POLYPROPYLENE
PORE SIZE:	0.2 MICRONS (NOMINAL)
VALIDATION:	PRESSURE DECAY TEST
CONFIGURATION:	HOLLOW FIBER (CAPILLARY)
MODULE	
TYPE:	M10C
LENGTH:	1 METER
MEMBRANE SURFACE AREA:	15 SQUARE METERS (INSIDE OF FIBER)
ORIENTATION	VERTICAL
SYSTEM	
FEED CONFIGURATION:	DIRECT FLOW
OPERATING PRESSURE:	30 - 35 psi (NOMINAL)
TRANSMEMBRANE:	7 TO 22 psid
PRESSURE DIFFERENTIAL	-
MEMBRANE SYSTEM:	5 psid (PIPE LOSS ALLOWANCE)
BACKWASH	
MEDIUM:	REVERSE FLOW COMPRESSED AIR (95 psi)
-	WITH RAW WATER SWEEP
INTERVAL:	22 - 60 MINUTES
DURATION:	2 1/2 MINUTES
VOLUME:	5 TO 10% (TYPICAL)
GENERAL	
MAXIMUM FEED PRESSURE:	100 psi
MAXIMUM CONTINUOUS:	-
OPERATING RANGE:	50 psi
DESIGN TEMPERATURE:	32°F - 104°F (0° - 40° C)
	0°C (32°F)
pH RANGE	0.5 TO 14
COMPRESSED AIR:	100 psi MINIMUM PRESSURE
	LESS THAN 0.01 ppm OF OIL
	37.5 SCF/MODULE MAX. INSTANT. DELIVERY (TYPICAL)
	APPROX. 7.5 SCFM/MODULE USED PER BACKWASH (TYP.)

MEMCOR - REQUIREMENTS

1) WATER TO MEMCOR UNITS MUST BE UNCHLORINATED.

2) WATER TO MEMCOR UNIT MUST BE PREFILTERED TO 500 MICRONS.

VERIFY SCALES
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RECORD DWG. DATE: JAN 04
THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED PRIMARILY ON INFORMATION PROVIDED BY OTHERS. THE ENGINEER CAN NOT VERIFY THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
777 High Avenue/Coos Bay, Oregon 97420/(541) 269-1166
975 N.W. 16th Avenue/Portland, Oregon 97209/(503) 222-1687

SHEET TITLE: GENERAL DESIGN CRITERIA

PROJECT: CITY OF MANZANITA
WATER TREATMENT PLANT
MANZANITA, OREGON

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 11, 1975
RICHARD D. WHITE
EXPIRES: 12-31-04

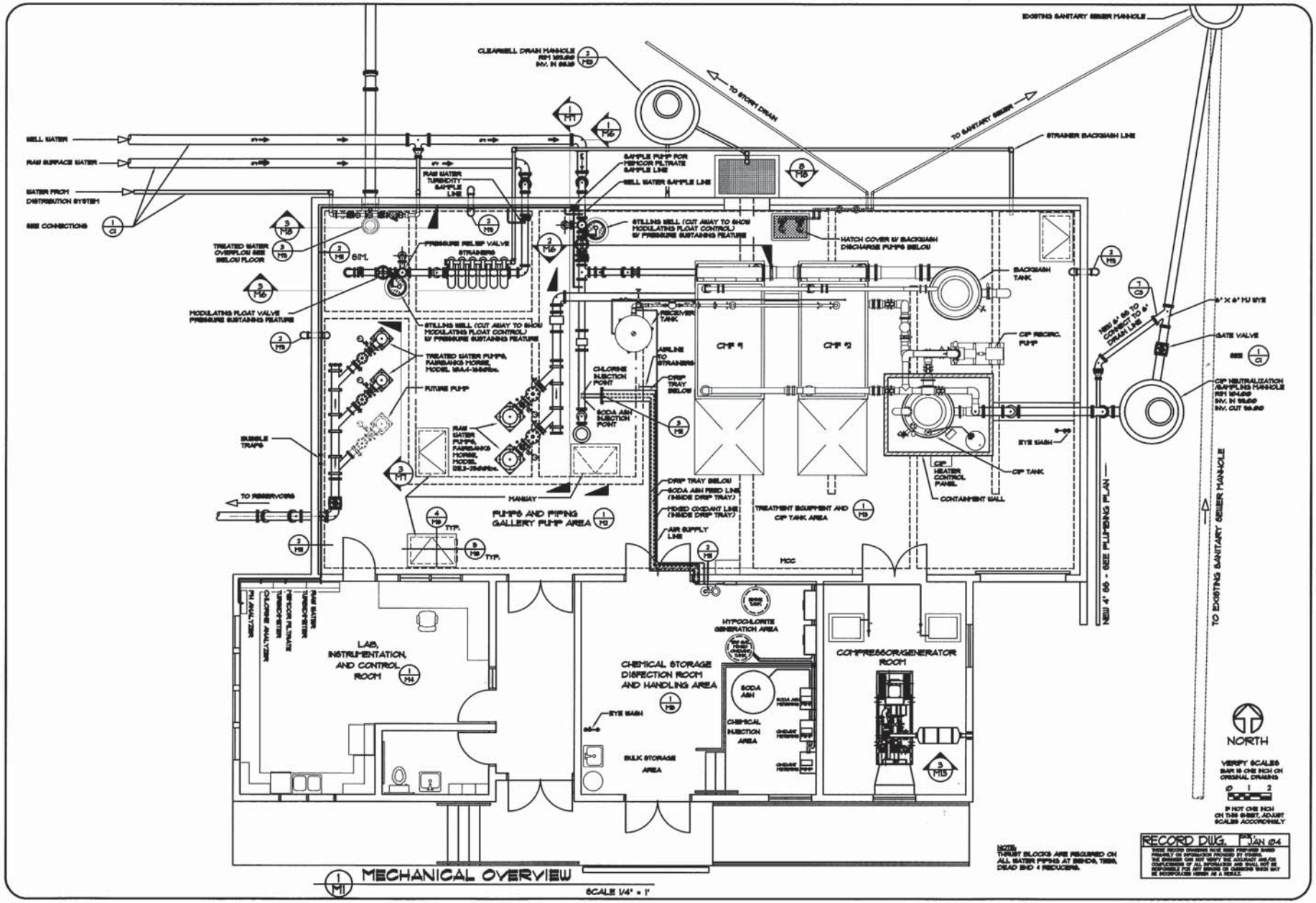
PROJECT NO. 9913.1

DATE: MAY 2000

REVISIONS

DATE	BY

SHEET NO. G2



MECHANICAL OVERVIEW

SCALE 1/4" = 1'

HGE
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
375 Park Avenue/Coos Bay, Oregon 97420 (541) 269-1166
19 N. W. Fifth Avenue/Portland, Oregon 97209 (503) 223-1687

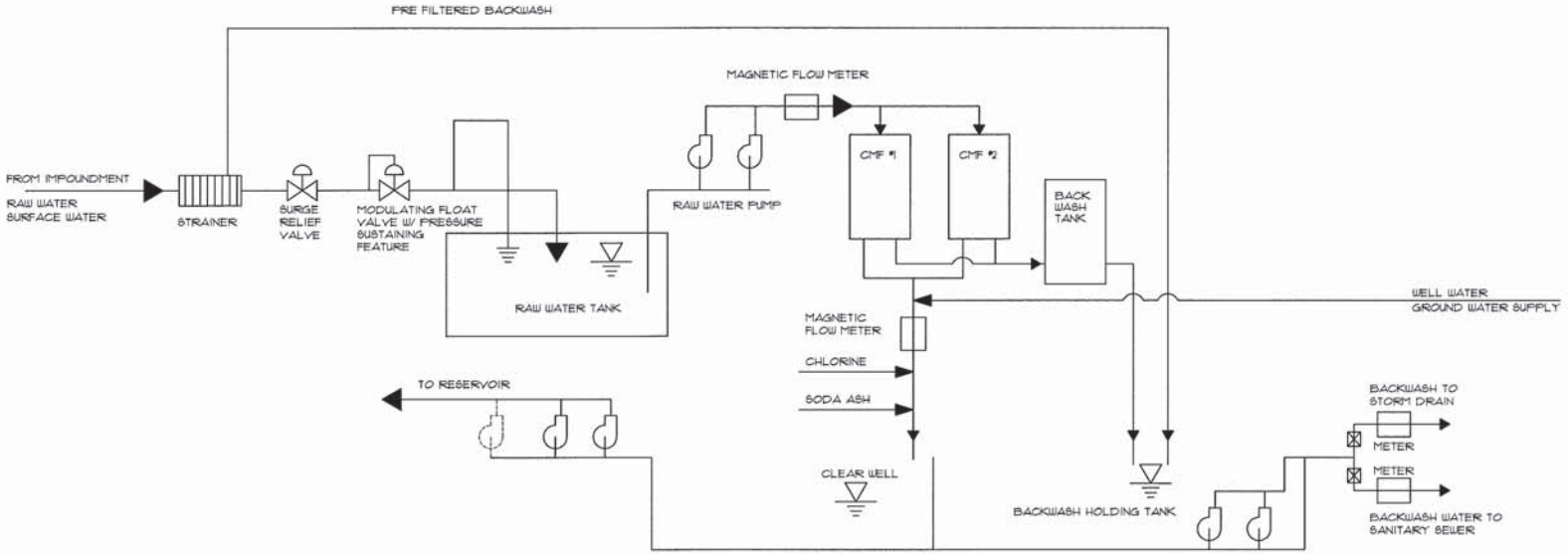
SHEET TITLE:
MECHANICAL
MECHANICAL FLOOR PLAN

PROJECT:
CITY OF MANZANITA
WATER TREATMENT PLANT
MANZANITA, OREGON

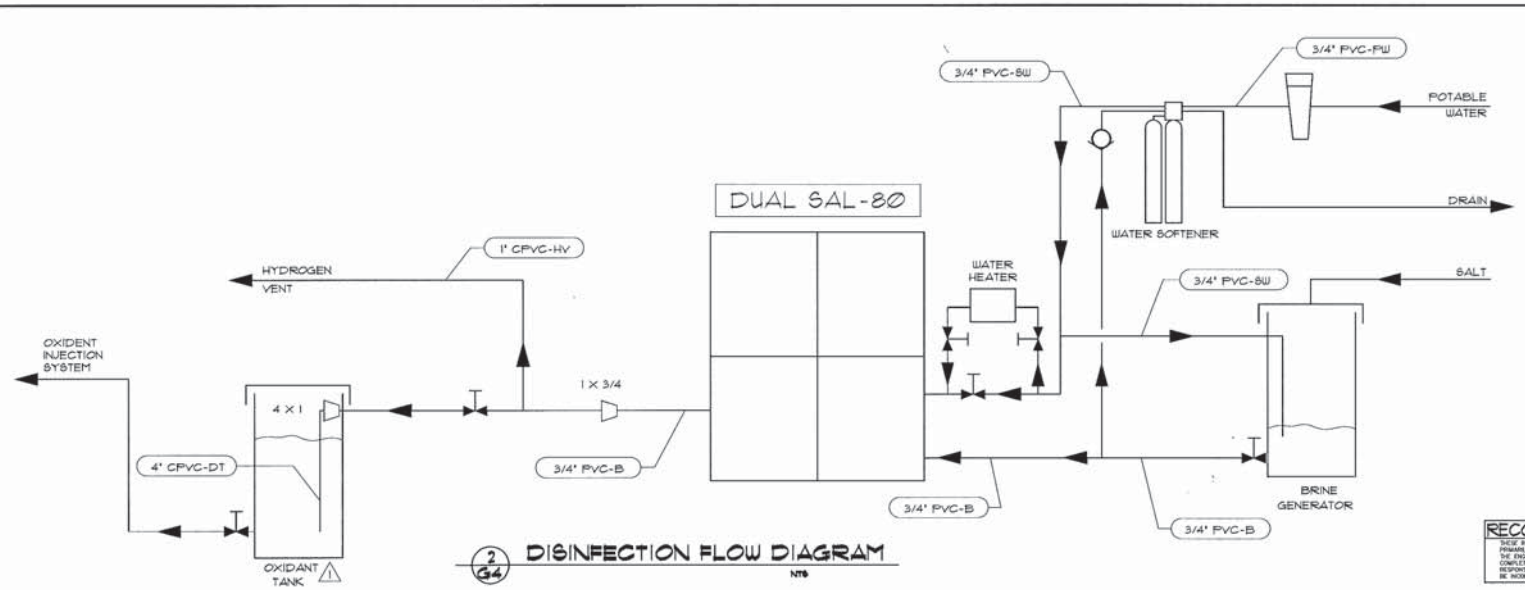
REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 11, 1986
DONALD B. HOGE
EXPIRES: 12-31-04

PROJECT 9813.1
DATE: MAY 2000

SHEET NO.
M1



1/G4 TREATMENT PROCESS FLOW DIAGRAM
NTS



2/G4 DISINFECTION FLOW DIAGRAM
NTS

VERIFY SCALES
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RECORD DWG. DATE: JAN 04
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HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
Grants Pass, Oregon 97526 (541) 479-3121
Klamath Falls, Oregon 97601 (541) 882-4021

SHEET TITLE: CATEGORY PROCESS & DISINFECTION FLOW DIAGRAMS

PROJECT: CITY OF MANZANITA WATER TREATMENT PLANT MANZANITA, OREGON

REGISTERED PROFESSIONAL ENGINEER 6489 OREGON JULY 11, 1980 RICHARD S. HOBES EXPIRES 12-31-04

PROJECT NO. 9813.1

DATE: MAY 2000

REVISIONS

DATE	BY

SHEET NO. G4

APPENDIX 5.1
WATER RIGHT CERTIFICATES
Note: Classic Lake Creek = Neahkanie Creek
Lange Creek = Alder Creek
Beniteau Creek = Anderson Creek

Application No. 57745 Permit No. 48758

RECEIVED
DEC 15 1978
WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for Permit to Appropriate Surface Water

I, City of Manzanita
(Name of Applicant)

of P.O. Box C Manzanita, (City)
(Mailing Address)

State of Oregon, 97130 Phone No. 368-5343 do hereby
(Zip Code)

make application for a permit to appropriate the following described waters of the State of Oregon:

1. The source of the proposed appropriation is West Fork, Anderson Creek aka Beniteau Cr., a tributary of N. Fork, Nehalem River

2. The point of diversion is to be located 322.84 ft. S52°34'W (N. or S.) and 238.78 ft. N66°-26'E (E. or W.) and 85.61ft N89°-48'W from the ¼ corner of common to Sections 10 & 15, T3N, R10W, W.M.
(Public Land Survey Corner)

(If there is more than one point of diversion, each must be described)
450 ft S ∈ 780 ft W from the

being within the NE ¼ of the NW ¼ of Sec. 15 Tp. 3N (N. or S.) R. 10W (E. or W.), W. M., in the county of Tillamook

3. Location of area to be irrigated, or place of use if other than irrigation.

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated
3N	10W	29	Entire Sec. to Ocean	474) not irrigated;
3N	10W	32	Entire Sec to Ocean	429) comprises urban servi
3N	10W	28	SW 1/4	134) area City of
3N	10W	33	NW¼ NW¼ NE¼ NW¼ SW¼	141) Manzanita
			NW¼ plus Ptn SE¼	
			NW¼	

Form 690-1-0-1-77

4. *The amount of water which the applicant intends to apply to beneficial use is* 0.5

cubic feet per second

(If water is to be used from more than one source, give quantity from each)

5. *The use to which the water is to be applied is* Municipal

6. *DESCRIPTION OF WORKS*

Include dimensions and type of construction of diversion dam and headgate, length and dimensions of supply ditch or pipeline, size and type of pump and motor, type of irrigation system to adequately describe the proposed distribution system.

Reinf Conc. Diversion Dam 8' high 45' long @top, 15 ft long at bottom with timber flashboards 8' long; 6" pipeline 1377 ft long connecting to existing 8" supply line to City just below existing main diversion dam.

If for domestic use state number of families to be supplied

7. *Construction work will begin on or before* August 1, 1979

8. *Construction work will be completed on or before* October 1, 1979

9. *The water will be completely applied to the proposed use on or before* July 1985

Application No. 57745 *Permit No.* 43756

Remarks:.....

.....

.....

.....

.....

.....

.....

.....

.....

City of Monmouth
Signature of Applicant
by Howard Wilson City Manager

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for.....

.....

In order to retain its priority, this application must be returned to the Water Resources Director with corrections on or before ....., *19*.....

WITNESS my hand this ..... *day of*....., *19*.....

.....*Water Resources Director*

By .....

This instrument was first received in the office of the Water Resources Director at Salem, Oregon, on the 4th *day of* August, *19* 78, *at* 8 *o'clock* A *M.*

Application No. 57745 *Permit No.* 43756

Application No. 57145 Permit No. 43756

Permit to Appropriate the Public Waters of the State of Oregon

This is to certify that I have examined the foregoing application and do hereby grant the same SUBJECT TO EXISTING RIGHTS INCLUDING THE EXISTING FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 0.5 *cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from* West Fork Anderson Creek.

The use to which this water is to be applied is Mumicipal

If for irrigation, this appropriation shall be limited to ..... *of one cubic foot per second or its equivalent for each acre irrigated*

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is December 15, 1978

Actual construction work shall begin on or before January 10, 1980 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*80

Extended to October 1, 1988 Extended to October 1, 199?

*Complete application of the water to the proposed use shall be made on or before October 1, 198*1

Extended to October 1, 1988 Extended to October 1, 1993

WITNESS my hand this 10th *day of* January, *1979*

James E. Sexson

Water Resources Director

Reservoir—150—3-51

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF MANZANITA

of Manzanita, State of Oregon, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to store the waters of Classic Lake Creek & Lange Creek, tributaries of Nehalem River, to be appropriated under App. No. 25124, Per. No. 21913

for the purposes of

municipal use

under Reservoir Permit No. R-1455 of the State Engineer, and that said right to store said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from June 12, 1951

that the amount of water entitled to be stored each year under such right, for the purposes aforesaid, shall not exceed 1.23 acre-feet.

The reservoir is located in Section 21 (NW¼SE¼), Tp. 3 N., R. 10 W., W.M.

WITNESS the signature of the State Engineer, affixed this 28th day of November, 1956.

LEWIS A. STANLEY
State Engineer.

Recorded in State Record of Water Right Certificates, Volume 16, page 21708.

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF MANZANITA

of Manzanita, State of Oregon, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of Classic Lake Creek and Lange Creek & reservoir constructed under App. No. R-26028, Perm. No. R-1455 for the purpose of municipal

tributary of Nehalem River

under Permit No. 21913 of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from August 14, 1950;

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1.3 cubic feet per second, being 0.433 c.f.s. from Lange Creek and 0.867 c.f.s. from Classic Lake Creek,

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the $NW\frac{1}{4}SW\frac{1}{4}$, Section 16 on Classic Lake Creek, and $NW\frac{1}{4}SE\frac{1}{4}$, Section 21 on Lange Creek, Township 3 North, Range 10 West, W. M.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to _ _ _ _ _ _ _ _ of one cubic foot per second per acre,

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

$S\frac{1}{2}NE\frac{1}{4}$
Lot #2 – $(SE\frac{1}{4}NW\frac{1}{4})$
Lot #3 – $(NE\frac{1}{4}SW\frac{1}{4})$
Lot #4 – $(SE\frac{1}{4}SW\frac{1}{4})$
$SE\frac{1}{4}$
Section 29
$N\frac{1}{2}NE\frac{1}{4}$
Lot #1 – $(NE\frac{1}{4}NW\frac{1}{4})$
Section 32
Township 3 North, Range 10 West, W. M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the State Engineer, affixed this 28th day of November, 1956.

LEWIS A. STANLEY
State Engineer

Recorded in State Record of Water Right Certificates, Volume 16, page 21707.

Permit A-1—1500—3-56 State Printing 82192

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF MANZANITA

of Manzanita, State of Oregon, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of Lange Creek a tributary of Nehalem Bay for the purpose of municipal under Permit No. 18634 of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from September 14, 1948;

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.50 cubic foot per second

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NW¼ SE¼, Section 21, Township 3 North, Range 10 West, W.M.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to - - - - - - - - - of one cubic foot per second per acre,

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

S½ NE¼
Lot #2 (SE¼ NW¼)
Lot #3 (NE¼ SW¼)
Lot #4 (SE¼ SW¼)
SE¼
Section 29
N½ NE¼
Lot #1 (NE¼ NW¼)
Section 32
Township 3 North, Range 10 West, W.M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the State Engineer, affixed this 21st day of September, 1956.

LEWIS A. STANLEY
State Engineer

Recorded in State Record of Water Right Certificates, Volume 16, page 21684

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF MANZANITA

of Manzanita, State of Oregon, 97130, has made proof to the satisfaction of the Water Resources Director, of a right to the use of the waters of Beniteau Creek and an unnamed stream

a tributary of North Fork Nehalem River for the purpose of municipal

under Permit No. 17073 and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from December 10, 1945

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.5 cubic foot per second, being 0.25 c.f.s. from each source

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NW¼ NE¼, Section 15, T. 3 N., R. 10 W., W. M., 200 feet South and 3400 feet East; 300 feet South and 3100 feet East, both from the SW Corner, Section 10

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to ——————of one cubic foot per second per acre,

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

All
Section 29
NE¼
E½ SW¼
SE¼
Section 32
SW¼ NE¼
S½ NW¼
SW¼
Section 33
T. 3 N., R. 10 W., W. M.

N½ NW¼
Section 4
N½ NE¼
NE¼ NW¼
Section 5
T. 2 N., R. 10 W., W. M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described and is subject to the existing minimum flow policies established by the Water Policy Review Board.

WITNESS the signature of the Water Resources Director, affixed this date. September 12, 1977

James E. Sexton
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 36, page 4775

APPENDIX 5.2
WELL LOGS FOR WELL #1 and WELL #2

RECEIVED AUG 20 1996 WATER RESOURCES DEPT. SALEM, OREGON

Till 50076

STATE OF OREGON WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01906 (START CARD) # 89998

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number 1
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[XX] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [XX] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [XX] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [XX] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [XX] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	59 SACKS

How was seal placed: Method [ ] A [ ] B [XX] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material SAND & BENT. CHIPS
Gravel placed from 35 ft. to 55 ft. Size of gravel PEA ROCK

(6) CASING/LINER: 55 63 DRAIN ROCK

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	43	.250	XX		XX	
	12	50	55		XX		XX	
Liner:								

Final location of shoe(s) NONE

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[XX] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
43	53	100		12" p/s		XX	

(8) WELL TESTS: Minimum testing time is 1 hour

[XX] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1012	3.5		24

Temperature of water 49 Depth Artesian Flow Found
Was a water analysis done? [XX] Yes By whom AGI TECHNOLOGIES
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude ____ Longitude ____
Township 2N N or S Range 9W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address)
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-24-96
Artesian pressure 0 lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 9'

From	To	Estimated Flow Rate	SWL
9	16	15	
16	23	50	14
42.5	50	500	14

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
SAND GREY LOOSE (overbank dep)	0	2	
SAND GREY SILTY	2	9	
SAND & GRAVEL MED SILTY	9	11	
SAND & GARVEL COURSE SILTY	11	16	
SAND GRAVEL COBBLES 10"MINUS	16		
BRN LOOSE (semi clean)		23	
COBBLES SAND & GRAVEL 10"	23		
MINUS PACKED BRN SOME SILT	BRN	27	
SILT BROWN GRAVELY	27	28	
SAND & GRAVEL SILTY BRN 5"	28		
MINUS SOME COBBLES		31	
GRAVEL BRN COURSE TO FINE	31		
SOME SAND SEMI LOOSE		32.5	
SAND GRAVEL COBBLES 10"	32.5		
MINUS PACKED BRN		34.5	
GRAVEL & COBBLES 8" MINUS	34.5		
BROWN LESS SAND		39	
SAND GRAVEL COBBLES BRN 8"	39		
MINUS MORE SAND SEMI TIGHT		42.5	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed ____ Date 7-29-96

(Bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688

RECEIVED

AUG 2 0 1996

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01906

(START CARD) # 89998

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

XX New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:

☐ Rotary Air ☐ Rotary Mud XX Cable ☐ Auger

☐ Other

(4) PROPOSED USE:

☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Livestock XX Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Well ____ ft.

Explosives used ☐ Yes ☐ No Type ____ Amount ____

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☐ Other

Backfill placed from ____ ft. to ____ ft. Material ____

Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water ____ Depth Artesian Flow Found ____

Was a water analysis done? ☐ Yes By whom ____

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ____

Depth of strata: ____

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude ____ Longitude ____

Township 2N N or S Range 9W E or W. WM.

Section 5 ____ 1/4 ____ 1/4

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address)

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

____ ft. below land surface. Date ____

Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:

Depth at which water was first found ____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation ____

Material	From	To	SWL
GRAVEL GREY 6" MINUS CLEAN	42.5		
SOME SAND		50	
GRAVEL 8" MINUS BRN SANDY	50		
PACKED		54	
SILT BROWN GRAVELY	54	55	
GRAVEL BRN SILTY 6" MINUS	55	59.5	
BED ROCK BLUE GREY SOFT	50.5		
BROKEN WEATHERED		63	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Studebaker Date 7-29-96

Till
50077

AUG 20 1996
WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D.# L01907 (START CARD) # 90000

(1) OWNER: Well Number #2
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [X] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	42 SACKS

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material BENT. CHIPS & SAND
Gravel placed from 35 ft. to 63 ft. Size of gravel PEA ROCK

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	45	.250	[X]	[ ]	[X]	[ ]
	12	60	63	.250	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[X] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
45	60	100		12p/s		[X]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1025	3.5		24 HOUR

Temperature of water 49° Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude ____ Longitude ____
Township 2N N or S Range 4W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address)
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-28-96
Artesian pressure ____ lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 16'

From	To	Estimated Flow Rate	SWL
16	32.5	< 15 GPM	14
32.5	44.5	< 100 GPM	14
44.5	63	> 400 GPM	14

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
SAND GREY LOOSE FLOOD DEPOSIT	0	2	
SAND GREY SILTY	2	7	
SAND & GRAVEL SILTY	7	9	
SAND & GRAVEL LESS SILT	9	16	
GRAVEL GREY BRN RED W/SILT	16		
BROWN		19	
GRAVEL & SAND SOME COBBLES	19	26	
GREY BRN 2" MINUS PACKED	26		
GRAVEL BROWN SILTY		30	
GRAVEL COURSE BRN 8" MINUS	30		
SOME SILT SOME SAND		32.5	
GRAVEL RED BRN SEMI CLEAN	32.5	44.5	
GRAVEL GREY BRN 6" MINUS	44.5		
CLEAN LOOSE SOME SAND		50.5	
GRAVEL GREY COURSE 10"	50.5		
MINUS CLEAN LOOSE SOME SAND		58.5	
GRAVEL GREY COURSE TRACE OF	58.5		
SILT		59.0	
GRAVEL GREY COURSE 10" MINUS	59.0		
SEMI LOOSE MORE SAND		63.0	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688
Signed ____ Date 7-29-96

RECEIVED 1111 rg 2 of 2
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AUG 20 1996

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01907

(START CARD) # 90000

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger

[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.

Explosives used [ ] Yes [X] No Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[ ] Other

Backfill placed from _____ ft. to _____ ft. Material _____

Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[ ] Perforations Method

[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water _____ Depth Artesian Flow Found _____

Was a water analysis done? [ ] Yes By whom _____

Did any strata contain water not suitable for intended use? [ ] Too little

[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other _____

Depth of strata: _____

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude _____ Longitude _____

Township 2N N or S Range 4W E or W. WM.

Section 5 _____ 1/4 _____ 1/4

Tax Lot _____ Lot _____ Block _____ Subdivision _____

Street Address of Well (or nearest address)

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

_____ ft. below land surface. Date _____

Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation _____

Material	From	To	SWL
ROCK BROKEN WEATHERED BLUE	63		
GREY		?	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed _____ Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Stadeli Date 7-29-96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

APPENDIX 6.1
PORTIONS OF:
• *Air Entrainment Update*, HGE, Inc., Architects, Engineers, Surveyors & Planners, May 11 2005
•*Ocean Avenue & Division Street Waterline Improvement* (Plan Sheets) HGE, Inc.,Architects, Engineers, Surveyors & Planners, Nov 2005

AIR ENTRAINMENT UPDATE
City of Manzanita
May 11, 2005

Prepared by: William M. Pavlich, P.E.
HGE, Inc. Architects, Engineers, Surveyors & Planners

INTRODUCTION

We have recently made significant progress in identifying the source and possible solutions to the City's air entrainment problem. Last week, operational changes were implemented that resulted in a sharp drop in dissolved oxygen concentrations. Most water customers that had problems should have clear water now; however, the operational changes are only a temporary solution. This update describes some of the recent efforts and some near-term improvements intended to address significant deficiencies in the distribution system. We believe these deficiencies are either the source, or a contributing factor, of the air entrainment problem.

RECENT EFFORTS

Recent efforts have focused on water system operational changes that were implemented around the same time as the Laneda Project. Table 1 (attached) provides a general timeline for the period prior to the first recorded customer complaint dated April 9, 2004. The timeline is based on operational logs and interviews with City staff. Reservoir modifications and operational changes paralleled the Laneda Project. The first incident of air in the system was not recorded. Verbal reports of problems were made prior to April 9th - possibly as early as late January 2004.

Figure 1 (attached) shows the water flow path prior to the isolation of Reservoir #2. Water was routed primarily through Reservoir #1 to Reservoir #2 and then to the lower level distribution system. The secondary flow path through Reservoir #3 is believed to have not been very efficient - resulting in most water being delivered to the system via Reservoir #2.

Figure 2 (attached) shows the modified flow path. All water to the lower level system is delivered via Reservoir #3 with Reservoir #2 just floating on the system.

Reservoir locations can be found on Figure 3 (attached).

The reservoirs are all at atmospheric pressure and all dissolved oxygen (D.O.) measurements at the reservoirs have shown levels of less than 100 percent saturation. Increases in system D.O. is therefore due to changes occurring within the system itself. In examining the line from Reservoir #3 to its connection with the 10" line from Reservoir #2 (at Ocean Avenue and Nutmeg Street) we note:

- The line from Reservoir #3 is 10" diameter. This is much smaller than would be anticipated given the size and modernity of the reservoir. A more typical size would be 16". The larger size allows greater flow and reduces frictional losses thereby enhancing system fire flows. The 10" line extends 916 feet.
- At Oak Street and Ocean Avenue, the 10" line enters a tee and transitions to an 8" line that extends approximately 440 feet.
- Near Ocean Avenue and Nutmeg Street, the 8" line transitions to 6" - or, at least, passes through a reducer and 6" valve prior to the connection with the 10" line from Reservoir #2. The size of the 6" valve was verified by counting the number of turns to open or close to the valve.
- The nature of the connection with the 10" line is not known. Based on the probable location of the 10" line in relation to the valve, it is likely to be a 6" tee connection; however, other types or sizes of connection are possible.

The final necking down of the 10" line to 6" may act like a nozzle to accelerate flow. The effect could create a vacuum that pulls air in via a defect. This would be somewhat analogous to situations described in engineering literature of transmission lines pulling in air through defective air release valves or pumps entraining air through defective suction seals. In this particular case, the nature of the connection is not known so its potential as an air source is just inferred at this time. The location in the system is relatively high in elevation; consequently there is less internal static pressure for a vacuum to overcome. Sampling of D.O. concentrations in town over the past year consistently showed the highest levels in the city to be in the vicinity of this connection.

As a partial test of this hypothesis, City staff closed the 6" valve at Ocean Avenue and Nutmeg Street and routed flow to the lower level system via reservoir #1 and Reservoir #2. Reservoir #3 is essentially off-line, feeding only the few active connections along Ocean Avenue. The modifications were implemented on Tuesday, May 5th. By the next day, D.O. levels were at less than 100% saturation at the various test locations. The only location showing high D.O. levels was on the isolated part of the system where there are few active connections. City staff will be flushing this isolated part of the system to draw in fresh water from Reservoir #3. It is expected that D.O. levels will drop accordingly. At some time in the near future, the 6" valve will be opened and the City's leak detection equipment used to listen for abnormal sounds at key features including the 6" valve at Nutmeg Street and at the existing air release valve at Poysky Street and Ocean Avenue. This last test will introduce some air back into the system for the duration of the test.

OTHER CONSIDERATIONS

The current "fix" is a temporary arrangement; Reservoir #3 needs to be brought back online. Going back to the old mode of operation is not recommended since the changes that were made at that time addressed other system deficiencies and concerns.

Circulation in reservoirs is also important to minimize the formation of disinfection by-products and loss of chlorine residuals.

The existing connection at Ocean Avenue and Nutmeg Street also constitutes a serious risk to system reliability. If the connection failed, the reservoirs would be essentially off-line. Flow could still be available by opening connections to the upper-zone system; however, this could over-pressurize the lower system and could cause breaks. The city would be most at risk during a prolonged fire flow situation both from the stresses placed on the connection and from the lack of water for fire flow if a break should occur.

A second line connecting Reservoir #3 to the lower level system is recommended to alleviate the risk of having a single connection, to improve system flow capabilities, and to reduce higher flow velocities that could be contributing to the air problem.

RECOMMENDATIONS

At this time, we are recommending two small improvement projects that should alleviate, or eliminate the air entrainment problem, and address the system reliability issues. Figure 3 shows project locations. Annotated photographs showing the existing water system and proposed improvements are referenced on Figure 3 and shown on the Photo Plate 1 (attached). The projects include:

- Ocean and Nutmeg Project - Provides a 10" tee connection, 10" valve, and 10" line to replace the existing 6" configuration. Eventually, the City could replace the 8" line to the connection at Oak Street. This would provide a continuous 10" connection to Reservoir #3.
- Ocean and Division Project - Provides a new connection to the City's distribution system. The 10" line size will allow the City, in the future, to extend a second 10" line from Reservoir #3 down to the existing 10" line on Laneda.

An opinion of probable cost for the recommended projects is approximately $50,000, including construction, contingencies, engineering, legal, and administration (see Table 2 attached).

The projects can and should be implemented immediately.

CONTEXT

The recent findings and recommendations are made in the context of prior efforts and research to determine the source, or sources, of the air entrainment problem. Earliest efforts focused on possible construction related sources associated with the Laneda project. "White Water" is commonly associated with waterline construction. Lines were flushed and air release valves checked, but no notable improvement occurred. Dissolved oxygen (D.O.) levels were sampled at many locations. Elevated D.O. levels were found

at all locations except the wells, water treatment plant, reservoirs, and upper level distribution system. Changing from surface water to well water resulted in some reduction of D.O. levels; however, levels were still above saturation. Pressure reduction devices were installed in some test locations with limited benefit. Chemical additions for corrosion control (soda ash) and disinfection (MIOX) were reviewed as possible sources. Isolation tests at the wells and water treatment plant of various durations and combinations of water, disinfectant, and corrosion control showed elevated D.O. levels only with prolonged (two week) detention and the presence of either, or both, the disinfectant and soda ash. The City's reservoirs have excess capacity - in fact, water is held approximately two weeks, during the winter, prior to entering the distribution system. An association of time and chemical effects was suspected, but no clear theoretical support for the association has been found. Further review and understanding of the water system as part of the ongoing master planning process contributed to the recent focus on reservoir routing as the probable source.

We now believe the air problem is primarily associated with the nature of the connection of Reservoir #3 to the lower level distribution system; however, until the problem is permanently solved, we cannot fully rule out other sources or contributing factors. We believe some of the observations associated with the air entrainment problem can be explained as follows:

- Flows to the upper level system are not fed by water from the lower level system; therefore, there are no elevated D.O. levels.
- Water in Reservoir #2 floats on the system and is fed via Reservoir #3. D.O. levels in Reservoir #2 are less than saturated because it is vented and open to atmospheric pressure.
- During high flow conditions, the water level in Reservoir #2 drops faster than in Reservoir #3 because of the higher frictional effects associated with the transmission line from Reservoir #3. Water entering the system from Reservoir #2 would not have the high D.O. levels; therefore, there might be some short lived and local reprieve from "white water" until the hydraulic conditions return to normal. This was observed during early City efforts to flush the lines.
- D.O. levels in town were approximately 100-120 percent of saturation. Supersaturated water will not necessarily form "white water" when poured into a glass. Formation of air bubbles can be effected by temperature changes, manipulation of local pressures and turbulence (through the manipulation of valves and selection of faucet aerators), chemical interactions with service pipes and fixtures, and the extent to which the D.O. is dissolved (as a result of extended time and increased system pressure). Elevated D.O. levels can also increase corrosional effects. Changing temperature, pressure, and material contact can affect pH and drive chemical equilibrium reactions in directions that favor any given constituent. Generation of micro-particulate phases can provide seed particles for bubble formation. Without going into all the details, these

considerations can explain why some customers have the problem and some do not; why some can clear the white water by just running the tap for a short time; why changing a faucet aerator may make a difference; and why one neighbor may have a problem while another does not.

Table 1: Timeline

(March 2003 - April 9, 2004)

Date	Reservoir Projects	Laneda Project	Air Complaints	Comments
March 2003				WTP and wells online.
Oct. 31, 2003	Reservoir #1 drained for painting and modifications.			
Dec. 15-20, 2003	Reservoir #1 disinfect and fill.			
Dec. 20, 2003	Reservoir #1 online.			
Jan. 7, 2004		Filled and flushed new pipelines (Ocean Rd to 3rd St.).		Flush using a hose connection-not via open hydrant.
Jan. 12-13, 2004		Transfer 20 services and 7 main laterals.		
Jan. 16-18, 2004 (approximate; date not known)	Reservoir #2 isolated for cleaning.			All water fed to lower level system via Reservoir #3.
(Between Reservoir #2 drain and fill dates.)				Staff had concerns with possible vacuum creation in old 10" line due to the isolation of Reservoir #2.
Jan. 22, 2004	Reservoir #2 connection to system resumed.			Routing of all water to lower level system via Reservoir #3 maintained.

Date	Reservoir Projects	Laneda Project	Air Complaints	Comments
End of Feb. 2004 (very approx.)	Removed Cla-valves.			
Mar. 3-4, 2004		Filled and flushed new lines (3rd to Division).		
Mar. 18-19, 2004		Service and lateral transfers.		
Mar. 29, 2004		Install 10" valves.		
Apr. 9, 2004			First official (recorded) air complaint.	Verbal air complaints occurred before April 9th - possibly as early as late January.

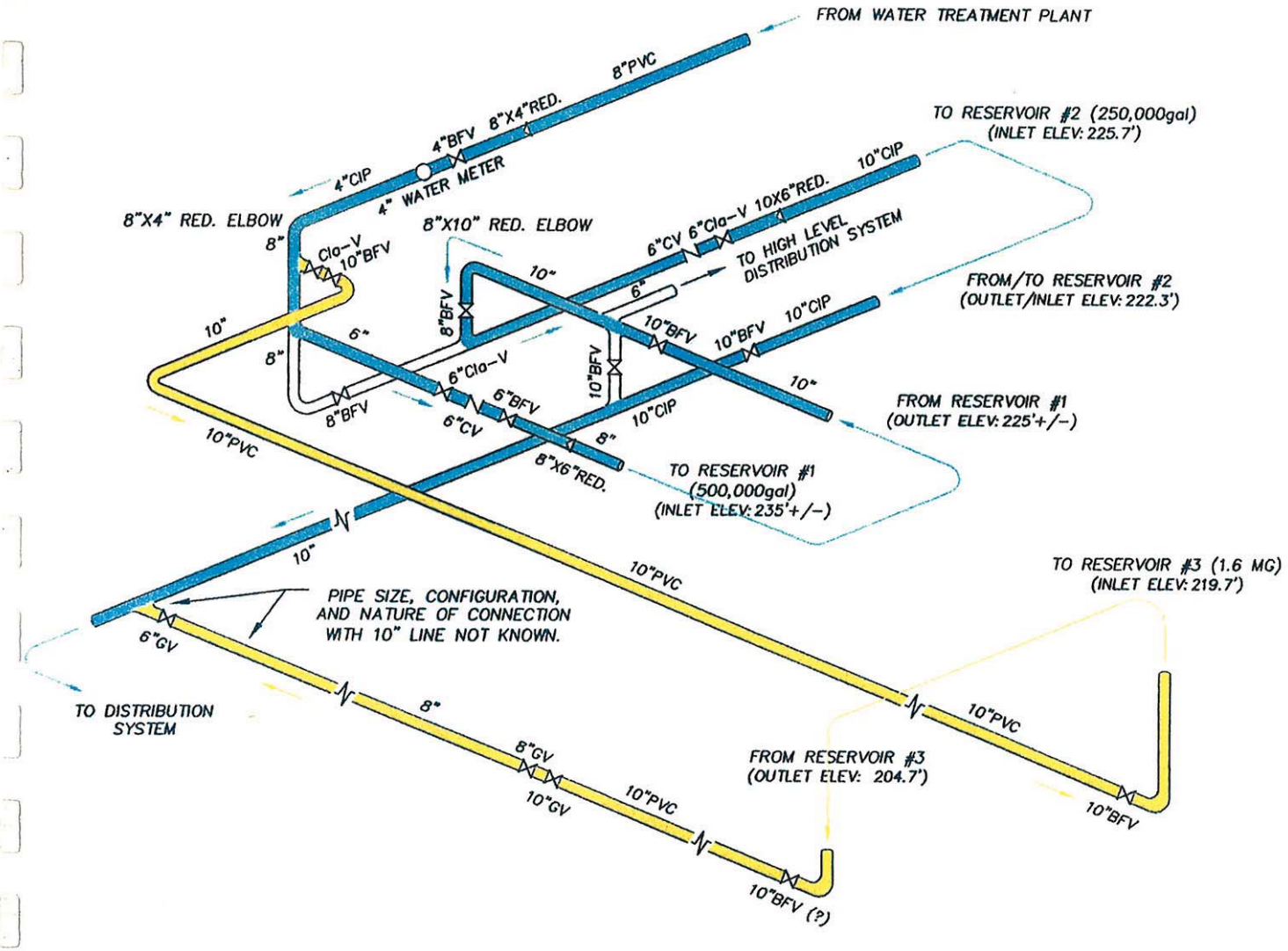

FIGURE 1: Piping Gallery and Reservoir Connections; Water Flow from WTP to Lower Level Distribution System (Pre–Jan 16, 2004 Flow Configuration)

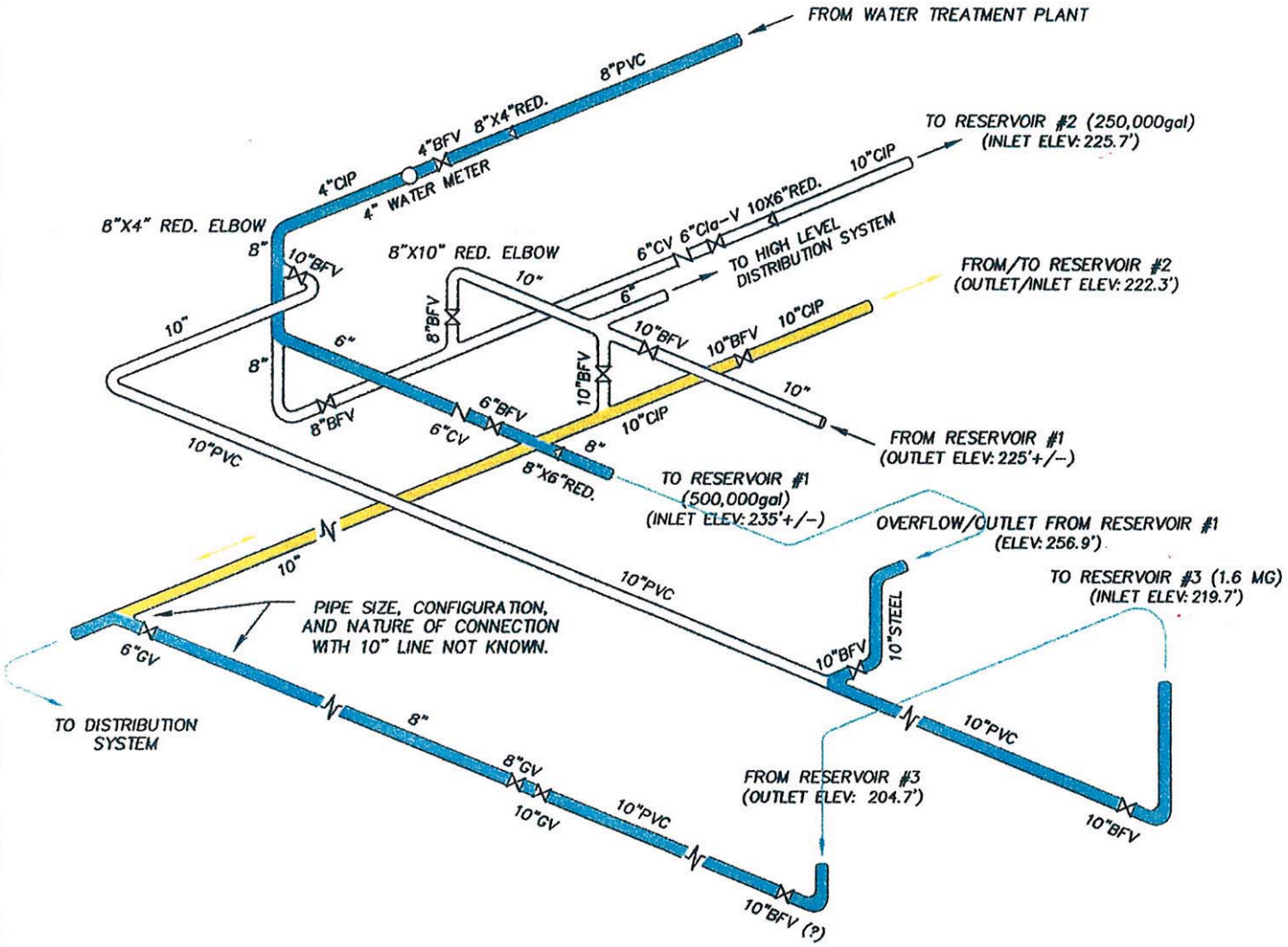

FIGURE 2: Piping Gallery and Reservoir Connections; Water Flow from WTP to Lower Level Distribution System (Post–Jan 16, 2004 Flow Configuration)

APPENDIX 8.1
MANZANITA AC MAIN LOCATIONS
(Based on Manzanita Service Profiles database)

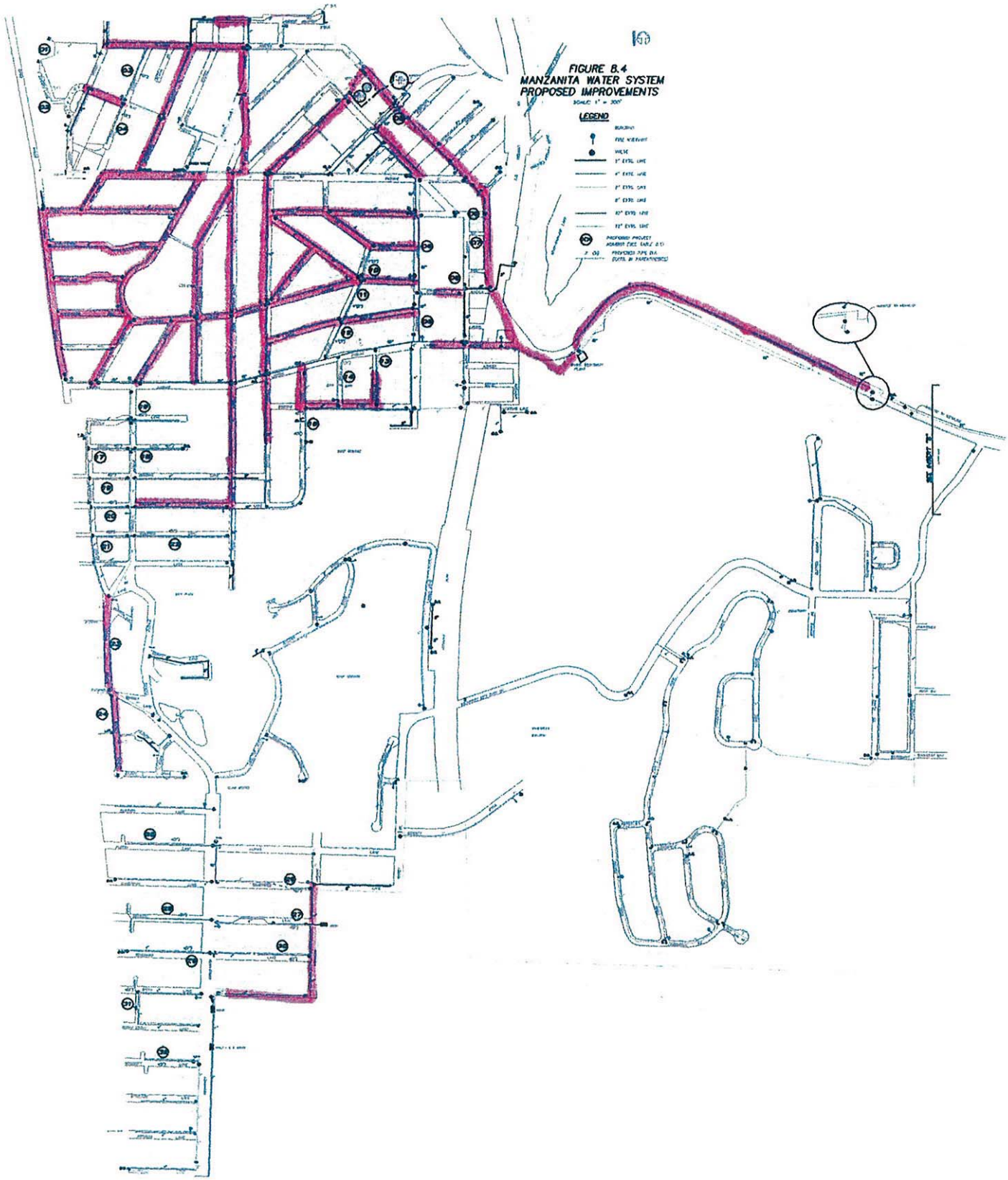
FIGURE B.4
MANZANITA WATER SYSTEM
PROPOSED IMPROVEMENTS
LEGEND

APPENDIX 10.1
FINANCE OPTIONS

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FINANCE OPTIONS

A10.1 INTRODUCTION

The funding of needed water improvements for the City of Manzanita may utilize one or more of the following sources:

- Sale of Bonds by Acquiring Federal or State Grants and/or Loans
- Special Assessments
- Local Improvement Districts
- Serial Levies
- Capital Improvements (Sinking) Funds
- Systems Development Charges

The most successful financing plans utilize state or federal grants and/or loans that best address the characteristics of needed improvements. It is difficult to finance improvements with grant funding alone. Some level of local funding or borrowing from available loan programs is usually necessary. Funding programs vary in terms of their economic impact on the community. Some programs are available to create and retain jobs or benefit areas of low to moderate income families. Other programs provide for specific types of infrastructure improvements, such as improvements to address water related compliance issues.

A thorough consideration of applicable state and federal funding programs, in addition to a potential means of securing local funding, is needed to minimize the long-term cost of water system improvements, while providing quality construction.

If the City decides to pursue agency funding for any of the recommended projects, it should contact the Oregon Economic and Community Development Department (OECDD) for information and scheduling of a one-stop meeting. One-stop meetings are held in Salem (and several other locations). These meetings bring together staff from the various agencies that could potentially contribute funds and representatives of the community to discuss the project and funding needs.

This section is intended to provide a general overview of recently available programs. **Agency and program policies are continually evolving and specifics are likely to have changed since development of this section.**

A10.2 PUBLIC WORKS FINANCING PROGRAMS

Four grant programs and five loan/bond sale programs, which have the potential to accommodate the City, are listed below.

Grants

Federal	• Economic Development Administration • Rural Development
Federal Administered by State	• Oregon Community Development Block Grants
State	• Special Public Works Fund • Water/Wastewater Financing Program

Loans/Bond Sales

Federal	• Rural Development
State	• Special Public Works Fund • Water/Wastewater Financing Program • Safe Drinking Water Revolving Loan Fund • Small Scale Energy Loan Program

Each of the available grant and loan programs varies in terms of the extent and complexity of the application process. In all cases, it is extremely important to communicate the program needs to the funding agency at the earliest possible date. A close working relationship with the potential grantor or lending agency can optimize the timing and amount of the grant and/or loan assistance. A brief overview of potential public works financing programs and an assessment of their availability follows.

A10.2.1 Economic Development Administration

The emphasis of the Economic Development Administration (*EDA*) grant program is on projects which create permanent jobs, especially in economically depressed areas. Results from a survey of businesses must demonstrate that the creation of jobs will occur, in sufficient number, by virtue of building the improvements. There is a higher chance of receiving the grant if the community can demonstrate that the existing system is at capacity; for example, if there is a moratorium on new connections.

Grants require a local match, usually between the 40% to 50% range of the project cost, although local match can be as low as 20%.

A10.2.2 Rural Development

The Water and Wastewater Disposal Grants and Loans program is under the administration of U.S. Department of Agriculture, Rural Development (RD), under the old guidelines of Farmers Home Administration (FmHA). The program is limited to rural communities which have a population of less than 10,000 people; community population must not be likely to decline in the foreseeable future. The City meets this criteria.

RD Grant Program
RD utilizes "MEDIAN HOUSEHOLD INCOME" (MHI) in their computations for determining eligibility. This allows for single-person households to count as family-type households.

RD is currently basing its grant and loan determination on 2000 census data. Availability of grants from the RD is dependent on the (MHI); projects are competitive with one another on the basis of community need.

Maximum grant availability based on MHI from 1990 census data is as follows:

Less than $32,984 . . . . . 75% maximum grant
Between $32,984 and $41,230 . . . . . Up to 45% maximum grant
Greater than $41,230 . . . . . Ineligible for grant

The City of Manzatita has a MHI (2000 Census) of $38,750 that could potentially qualify it for up to 45% grant funding. In addition, RD has a limited amount of grant funding available at the state and federal levels and requirements of the Safe Drinking Water Act and Clean Water Act have dramatically increased the current number of applications from Oregon communities. RD also requires eligible communities to finance the project with loans up to the extent of the communities ability to pay; the grant is then available to cover the remainder. The actual formula to determine the maximum burden per household is quite complicated, and costs for commercial users are typically higher. RD determines the debt burden required in each case.

RD Loan Program
The City falls within the established criteria for loans. Please note that this is an

excellent financial assistance program. Items which determine a borrower's eligibility are listed below.

- Unable to obtain needed funds from other sources at reasonable rates and terms.
- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs, including costs that pertain to operation and maintenance. Furthermore, it must be shown that debts will be retired and financial reserves maintained.

RD loans currently have a 4.5 % interest rate: The maximum term for all loans to cities is 40 years. However, no repayment period can exceed any local statutory limitation on obligations.

A10.2.3 Community Development Block Grant Program

The State of Oregon Economic and Community Development Department administers the Community Development Block Grant (OCDBG) program. This program is funded by the U.S. Department of Housing and Urban Development. Funds allocated under the heading of this grant program are provided for projects designed specifically to improve the conditions of low and moderate income housing areas. The maximum grant for a project is $1,000,000 which includes planning, engineering and construction.

To qualify for an OCDBG, the project must meet at least one of the following three national objectives of the federal OCDBG program. The primary national objective is one that limits OCDBG assistance to projects that principally benefit low and moderate income persons. OCDBG funds may be used to develop projects that are needed to benefit current residents, however, they must be built to include sufficient capacity for future development.

The current policy is that at least 51% of a city's population must have low and moderate incomes to be eligible. Grant awards will be based on the 2000 Census

data or an OECDD recognized income survey. Manzanita's low to moderate percentage, based on OECDD information, is 27.5% At present, the City does not qualify for OCDGB Funding.

A10.2.4 Special Public Works Fund (SPWF)

The State of Oregon Economic and Community Development Department (OECDD) administers the Oregon Special Public Works Fund (SPWF) program. The SPWF program is capitalized through biennial appropriations from the Oregon Lottery Economic Development Fund, through Oregon Bond Bank Fund sales for dedicated project funds, through loan repayments and other interest earnings. Applications may be submitted throughout the year. Loans and grants may be made available for infrastructure construction projects related to economic development and for the retention or creation of jobs.

Projects must build public infrastructure to assist a business expanding, thus creating jobs, or build needed infrastructure capacity for future economic growth in the community. OECDD has separated the program into three categories:

1.1 Firm business commitment for permanent job creation
1.2 Capacity building, high probability of job creation or retention.
1.3 Capacity building for severely affected communities

Revenue bonds are limited obligations of the state of Oregon payable solely from, and secured by, the loan repayments and other revenue pursuant to agreements between the state of Oregon acting by and through its OECDD, and specific benefitted municipalities. The Oregon Bond Bank Fund pools municipal loans into one bond issue and provides small communities affordable access to the financial markets. Bonds are repaid by local revenues and at interest rates lower than what is available to most Oregon communities. The Oregon Bond Bank Fund also pays the cost of issuance and funds the debt service reserve.

The Oregon Bond Bank Fund substantially increases funds available through the SPWF program to assist Oregon municipalities, and offers communities a viable financing alternative. Revenue bonds sold through the Oregon Bond Bank Fund are not subject to the State Treasurer's moratorium on the issuance of new general obligation or certificates of participation debt. OECDD expects to regularly issue bonds to provide permanent financing for SPWF program applicants. Interest rates are anticipated to range from 5% to 6.5%. For bond-funded projects, the interest rate is often estimated at 6.5% with actual interest passed on to the applicant at the time

of the bond sale.

OECDD plans to pass the exact interest rate allotted to the state for this program directly to borrowers. The state will pay for all debt reserve costs, bond issuance costs and attorneys fees. This is a loan program that the City could acquire funding directly from the state without the necessity for revenue or general obligation bonding.

SPWF has loans to $15,000,000 and grants up to $500,000 for severely affected communities. Communities are able to apply for grants from this fund even if they don't have a waiting business that needs the infrastructure. This will give communities who are seeking to attract business growth the chance to prepare in advance for these opportunities.

Manzanita would need to demonstrate that this project is necessary to create and/or retain jobs in the industrial sector. SPWF staff emphasize that the program is primarily a loan program and that applicants should not be overly optimistic about securing maximum grant dollars.

A10.2.5 Water/Wastewater Financing Program

The 1993 State Legislature created a Water Fund through Senate Bill 81 to provide financing to local governments to construct and improve public drinking water systems and public waste collection systems. The legislation was primarily intended to assist local governments meet regulations for the Safe Drinking Water Act and the Clean Water Act. In that respect, the Water/Wastewater Fund may assist both municipal drinking water projects and municipal water collection and treatment projects. Program eligibility is limited to projects necessary to ensure that municipal water and water systems comply with the requirements of the following:

1. Current drinking water quality standards administered by the Department of Human Services (DHS), previously known as the Oregon Health Division(OHD).

2. Water quality statues, rules, orders, or permits administered by the Oregon Department of Environmental Quality (DEQ).

The Water/Wastewater Fund is capitalized through a biennial appropriation from the Oregon Lottery Economic Development fund, bond sales for dedicated project funds, loan repayments, and interest earnings. The Fund is administered by the OECDD,

Community Development Programs Section.

Loans and grants may be awarded for eligible projects. Loans will be based on a reasonable and prudent expectation of the local government's ability to repay the loan.

Grants may be awarded only if a loan is not feasible due to the following:

1. Financial hardship to the local government as determined by OECDD.

2. Special circumstances of the project.

Loans up to $15,000,000 and grants up to $750,000 (includes non-cash grants for issuance costs and debt service reserve) are available to projects financed with bond funds. Loan term is 20 years at a 5% - 6.5% interest rate.

A10.2.6 Safe Drinking Water Revolving Loan Fund

The Safe Drinking Water Revolving Loan Fund (SDWRLF) was created in 1996 by Congress to assist community and non-profit non-community drinking water system plan, design, and construct drinking water facilities needed to correct non-compliance with current or future drinking water standards. The program is administered by the Oregon Economic and Community Development and is funded by annual grants from the U.S. Environmental Protection Agency and 20% matching funds through a biennial appropriation from the Oregon State Legislature and/or through bond sales for dedicated project funds.

Highlights of the program include 1% financing (30 year term) for disadvantaged communities. A disadvantaged community is one whose average water cost for a residential customer is at least the state "average" and also meet two of the following criteria:

- For water system only communities, there is a per capita water system debt of at least $250. For communities with both water and sewer systems, the combined water and sewer system debt must be at least $500 per capita.

- At least 15% low and moderate income persons.

- Documented financial burden due to a national or state declared

disaster that occurred within the past two years.

Interested applicants submit an initial "Letter of Interest". Projects are then ranked by the Department of Human Services (DHS) and OECDD to form a Project Priority List. Projects are ranked based on existing or potential noncompliance with Safe Drinking Water Act (SDWA) provisions. This program is notable in providing ranking "points" for systems that may be close but not actually in violation of SDWA requirements. Top ranking applicants will be invited to submit a final application. The cut-off for any given year will vary according to the nature of competing projects and the availability of funds.

A10.2.7 Oregon Department of Energy - Small Scale Energy Loan Program

Funds could be made available under this program as a demonstration project or as a conventional energy savings or conservation program. The Department of Energy's Small Scale Energy Loan Program (SELP) offers help to anyone who wants to save money on energy costs. SELP was created by Oregon voters in 1980, and has financed more than $150 million in projects since that time. This is a self supporting program that operates without tax funds. A finished project must at least break even in power costs with the pre-study and improvement program. The predesign phase would be utilized to generate data that would show power savings or creation for recommended improvements. This is a loan program repayable at 8% interest over a 15-year repayment period. A fee of one-tenth of one percent of the loan request is required at the time of application. Loan closing costs and fees vary.

A10.3 LOCAL FUNDING SOURCES

A significant portion of a project may need to be financed with local funding sources. Local funding sources are listed below:

General Obligation Bonds
Revenue Bonds
Improvement Bonds (Local Improvement District)
Serial Levies
Sinking Funds
Ad Valorem Tax
System User Fees
Assessments
System Development Charges (SDC's)

The 1991 legislature clarified and defined the impact of Ballot Measure 5 on municipal finance in several special ways. Cities, counties, and special districts need to clearly

understand, and follow these rules, when they consider bonding for the financing of needed improvements.

The following information was provided in part by Howard A. Rankin, Expert Bond Counsel:

1. Chapters 287 and 288 of the Oregon Revised Statutes describe the borrowing and bonding of counties, cities, and special districts, generally.

2. The advance sheets of the Laws of 1991 indicate that the general bond limitations of ORS 287.004 are still in force. Except with regard to the old 3% limitation on all issued and outstanding bonds, of true-cash value of all taxable property within the city's boundaries, has been changed to a 3% limitation on "real market value" as determined by the County Assessor.

3. The above limitation still does not apply to bonds issued for water, sanitary or storm sewers, sewage disposal plants; nor to bonds issued to pay assessments for improvements in installments under statutory or charter authority (i.e. revenue bonds).

4. All cities and districts should be careful to check their current charters for any additional impacts or limitations on bonding capabilities.

A description of each of the preceding listed funding sources follows.

A10.3.1 General Obligation Bonds

Financing of water improvements by General Obligation (G.O.) Bonds is accomplished by the following procedures:

1. The Consulting Engineer prepares a detailed cost estimate to determine the total monies required for construction.

2. An election is held.

3. When voter approval is granted (by a majority of the registered voters), bonds are offered for sale. The money for detailed planning and construction is obtained prior to preparation of final engineering plans and the start of project construction unless interim financing has been developed.

G.O. bonds are backed by the full credit of the issuer and authorize the issuer to levy

ad valorem taxes. The issuer can make the required payments on the bonds solely from the new tax levy or may instead use revenue from assessment, user charges, or some other source.

Oregon Revised Statutes limit the maximum term of G.O. bonds to 40 years for cities and 25 years for sanitary districts. Except in the event that RD purchases the bonds, the realistic term for which general obligation bonds would be issued is 15 to 20 years.

Ballot Measure 5 has limited the ability of communities to levy property taxes. Capital improvement projects, such as the proposed water system improvements, are exempt from property tax limitations if an election is held and new public hearing requirements are met.

Cities, counties and special districts (all non-school taxing entities) must be very careful when seeking approval from the voters for a general obligation bond, new tax base, annual budget levy, or special levy. The current law now requires that all non-school taxing entities, including cities, counties, and special districts, hold a special public hearing more than 30 days before filing the election statement with the County Clerk. Notice of this special public hearing must be sent to all other non-school taxing entities with overlapping taxing jurisdictions no later than 10 days before the special public hearing. This special public hearing offers the opportunity for all overlapping taxing entities to determine the compaction impact of the proposed election on their respective assessment capability. Effectively, the municipality proposing the election measure must be thoroughly prepared with notice of special public hearing published no later than 41 days before a final public hearing and filing of the election statement.

If the special public hearing procedures are not followed, and no certificate is included in the filing that attests that the special public hearing was conducted pursuant to law, the County Clerk is required to reject the filing for an election. This results in additional unnecessary delays. Consideration should be given to hiring a competent Bond Counsel before proceeding with a General Bond Election. This action will insure that all requirements of current law are met.

Since bonding requirements are very stringent, most recent municipal improvements have been financed with either revenue bonds or one of the state financing programs which can be accomplished outside of bonding requirements.

A10.3.2 Revenue Bonds

A revenue bond is one that is payable solely from charges made for the services

provided. Such bonds cannot be paid from tax levies or special assessments, and their only security is the borrower's promise to operate the water system in a way that will provide sufficient net revenue to meet the obligations of the bond issue. Revenue bonds are most commonly retired with revenue from user fees.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Normally there are no legal limitations on the amount of revenue bonds to be issued, but excessive bond issue amounts are generally unattractive to bond buyers because they represent high investment risk. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods for billing and collection, rate structures, and the degree to which forecasts of net revenues are realistic. RD will fund revenue bonds in which user rates are committed for the repayment of the bonds.

Under the provisions of the Oregon Uniform Revenue Bond Act (ORS 288.805-288.945), municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate. In this case, certain notice and posting requirements must be met including a mandatory 60-day waiting period. A petition signed by 5% of the municipalities' registered voters may cause the issue to be referred to an election.

Laws enacted by the 1991 legislature have eliminated the limitation on revenue bonds. The law formally required that the revenues pledged for payment of the bonds have a direct relationship to the services financed by the bonds. Current law now allows revenue bonds to be paid with any revenue pledged for "any public purpose," without the relationship restriction.

A10.3.3 Improvement Bonds (Local Improvement District)

Improvement bonds may be issued to assess certain portions of water improvements directly against the parties being benefitted. An equitable means of distributing the assessed cost must be utilized so that all property, whether developed or undeveloped, receives the assessment on an equal basis. Cities are limited to improvement bonds not exceeding 3% of true cash value. For a particular improvement, all property within the assessment area is assessed on an equal basis, regardless of whether it is developed or undeveloped.

Improvement bond financing requires that an improvement district be formed, the boundaries be established, and the benefitted properties and property owners are determined. The engineer usually determines an approximate assessment based on a square-foot, a front-foot basis, or a combined basis. Property owners are then given an opportunity to remonstrate against the project. The assessment against the

properties is usually not levied until the actual total cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. It is common practice to issue warrants, which are paid when the project is completed, to cover debts.

The primary disadvantages to this source of revenue (improvement bonds) are described below:

1. The property to be assessed must have a true cash valuation at least equal to 50% of the total assessments to be levied. This may require a substantial cash payment by owners of undeveloped property.

2. An assessment district is very cumbersome and expensive when facilities for an entire community are contemplated.

3. The project is impacted by Measure 5 tax limitations because the improvement bonds are backed or guaranteed by the city's authority to raise revenue via taxation. If the city is in compaction, then a general election (same procedures as for a general obligation bond) is required. If the city's property taxes are not under compaction, then the city can proceed with a L.I.D. as in the past; however, the project cost will count against the $10.00 limitation for non-school taxes.

This program should not be considered for improvements to satisfy the City's needs in general, but could be a definite consideration for future expansions to annexations or property developments.

A10.3.4 Serial Levies

Under Oregon Revised Statutes, if approved by the voters, the City can levy taxes for a fixed period of time to construct new facilities and maintain existing facilities. Generally, when a serial levy is presented to the voters, it is based upon a specific program and listing of planned improvements.

Since the time frame required for construction of the needed water improvements is quite limited, it is doubtful that residents could afford a serial levy of sufficient size to provide for needed construction revenues.

A10.3.5 Sinking Funds

Sinking funds can be established by budget for a particular capital improvement need. Budgeted amounts, from each annual budget, are carried in a sinking fund until sufficient revenue is available for the needed project. Funds can also be developed with revenue derived from system development charges or serial levies. Again, the City's water system financial needs cannot be met with a sinking fund because of the limited time in which improvements must be completed.

A10.3.6 Ad Valorem Tax

Many communities utilize an ad valorem tax as the basis for repaying general obligation bonds for system expansions, and supplement them with additional water use charges. This means of financing reaches all property to be ultimately benefitted by the water system, whether the property is presently developed or not. Construction costs are more equally distributed among all property owners and the program does not impose a penalty on existing residential or business development.

A10.3.7 System User Fees

Monthly charges are made to all residences, businesses, etc., that are connected to the water system. Water use charges are established by resolution, and can be modified as needed to serve increased or decreased operating costs. Rates are established depending on the various classes of users and the metered demand through their connection. By establishment of proper use charges, the City could repay the local share of bond amortization without imposition of property taxes. This appears to be most favorable; however, a proposal to substantially increase monthly use charges might meet resistance from citizens with low or fixed incomes who would otherwise gain some financial advantage from repayment via taxation.

A10.3.8 Assessments

In some cases the beneficiary of a public works improvement can simply be assessed for the cost of the project. It is not uncommon for an industrial or commercial developer to provide up-front capital to pay for a community administered improvement which serves the development.

A10.3.9 System Development Charges

System Development Charges (SDC's) are charges assessed against new development to recover the costs incurred by local government who provide the capital facilities required to serve the new development. SDC's apply to new developments that

generate revenue for the expansion or construction of facilities located outside the boundaries of new development When capital improvements increase usage, SDC's can be billed for water, water, drainage and flood control, transportation, and parks or recreational facilities.

A10.4 PROPOSED FINANCIAL PROGRAM

To the extent that supplemental funding is needed or desired, RD funding may be the most applicable since there are no outstanding compliance issues, or anticipated commercial growth that will result in family wage jobs. Funding is likely to be predominantly loan. OECDD may also be a good source of funds.

The City should first attempt to educate area residents and businesses about the project, and collect public input. After selection of the initial project scope, the city should contact the OECDD to schedule a one stop meeting with available state and federal funding agencies, to discuss project needs. When the project is presented to all funding agencies, each agency will evaluate their program's potential to assist with financing the needed water improvements.