Water Source and Well Field Master Plan

Prepared for:

City of Bay City

May 2021
611012.201

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Reference: 611012.201

May 04, 2021

Roy Markee, Public Works Director
City of Bay City,
PO Box 3309
Bay City, OR 97107

Subject: Water Source and Well Field Master Plan

Dear Roy Markee:

Enclosed is the Water Source and Well Field Site Master Plan for the City of Bay City. Please feel free to contact me at 541-266-9890 if you have any questions or comments.

Sincerely,
SHN

Daniel P. Graber, PE
Project Manager

DPG:dkl

Enclosure: Report

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Water Source and Well Field Master Plan

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City of Bay City
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Bay City, OR 97107

Prepared by:

275 Market Avenue
Coos Bay, OR 97420-2228
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QA/QC: RFS

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Table of Contents

Page

Appendices

List of Illustrations

Figures **Page**

Tables **Page**

Photographs **Page**

Abbreviations and Acronyms

Units of Measure

af	acre feet
cfs	cubic feet per second
mg/l	milligrams per liter
gph	gallons per hour
gpm	gallons per minute
hp	horsepower
hz	hertz
mg	milligrams
mg/l	milligrams per liter
psi	pounds per square inch
um	micron

Additional Terms

ADD	Average Daily Demand
BMP	Best Management Practice
DI	Drop Inlet
DWPA	Drinking Water Protection Area
DWS	Drinking Water Services
EPA	U.S. Environmental Protection Agency
GWUDI	Ground Water Under the Direct Influence of Surface Water
HBHRCD	Humboldt Bay Harbor, Recreation, and Conservation District
HP	Horsepower
IP	Infiltration Potential
MDD	Maximum Daily Demand
MG	Million Gallons
MMD	Maximum Monthly Demand
MPA	Microscopic Particulate Analysis
MW	Monitoring Well
OAR	Oregon Administrative Rules
ODFW	Oregon Department of Fish and Wildlife
OHA	Oregon Health Authority
OWRD	Oregon Water Resources Department
POD	Point of Diversion
RPM	Revolutions Per Minute
SWA	Source Water Assessment
TDH	Total Dynamic Head
TP	Transverse Potential
WPHA	Well Head Protection Area
WRIS	Water Resource Information System

1.0 Introduction

1.1 Authorization

SHN Consulting Engineers and Geologists, Inc. was authorized by the City of Bay City (City) to prepare this Water Source and Well field Master Plan.

1.2 Purpose

The purpose of this Water Source and Well Field Master Plan is to assess the proposed site for a new Well 3 and a future Well 4. This assessment includes a hydrologic analysis, and review of findings regarding water quality, security, and sustainability. Recommendations and alternative solutions are included for the site including upgrades to the existing facilities, and alternate locations for the new wells. An engineer's opinion of probable cost for the recommendations and alternatives for planning and budgeting purposes.

The new Well 3 will provide a much-needed backup to the existing wells which will allow for repair and or reconstruction of the existing Well 1, which is currently in disrepair.

1.3 Scope of Work

1. Assess site, perform hydrogeologic analysis, and review findings regarding water quality, security, and sustainability concerns.

2. Prepare recommendations and alternative solutions for master plan improvements at the site including repairs upgrades to existing facilities; locations for one new well (Well 3) and one future well (Well 4).

3. Prepare an Engineers Opinion of Probable Cost for the recommended master plan improvements.

4. Provide a proposed implementation schedule.

Information in this Plan was obtained from the City staff, field investigations, project drawings and as-built records, from previous planning documents, permits, and site assessment documents.

2.0 Site Assessment

The water system is registered with the Oregon Health Authority as OR41 00079 Bay City Water System and is classified as a "Community" water system. The system name has been changed from "Kilchis Water District" to "Bay City Water System". This site assessment is limited to the source supply (well field) portion of the water system.

2.1 Previous Plan Recommendations

Previous master plan recommendations, and the City's most recent Capital Improvement Plan's highest priority included improvements to the existing water supply, to both increase the supply and the reliability of this supply system.

2.2 Existing Well Field

The City utilizes two wells that are located at Dill Bar on the Kilchis River in Township 1S Range 9W Section 33. The well field site lies on a narrow strip of land approximately 13.28 acres between the Kilchis river and the Kilchis Forest Road. The Kilchis Forest Road is a gravel road with limited traffic or public exposure and extends into the heart of the Cascade Mountains where logging is the primary activity.

The perimeter of the property containing the existing well buildings, generator and chemical storage facilities are enclosed with a security fence (6-foot cyclone fence with barbed wire). The property is accessed by a gated gravel access road with a daisy chain lock and key system. Only utilities serving the site, emergency services, and the City have keys to the access road gate and the perimeter fence gate.

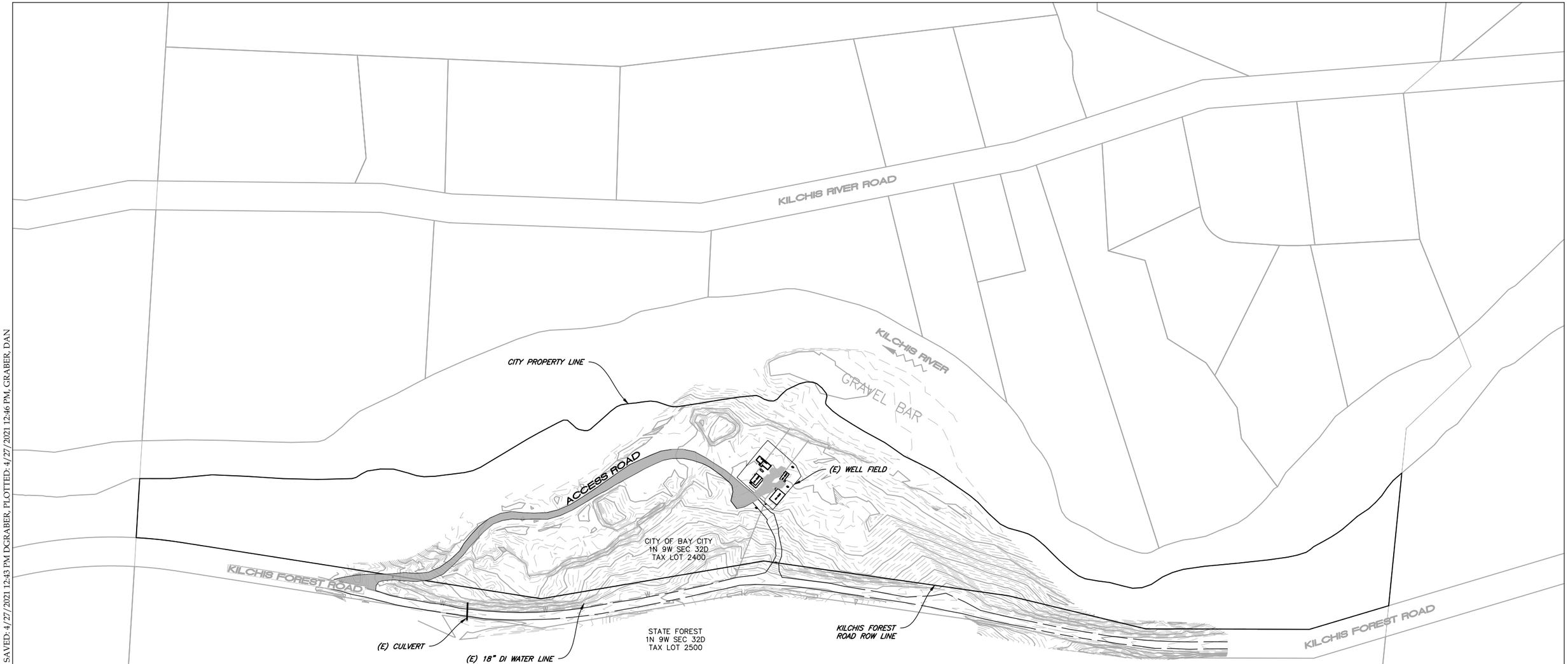
An abandoned secondary access route has a locked gate and a soil berm approximately 7-feet high constructed over the old roadbed. The abandoned access route has not been in use for many years and is covered with vegetation which adds to the security of this abandoned access. The remaining property is covered in thick coastal forest vegetation or river bar gravels.

The site terrain varies from gentle to steep slopes, with minimal space remaining for improvements within the gently sloped areas. See Figure 1 Existing Site Conditions and Figure 2 Existing Facilities.

2.3 Existing Well Construction

Well 1 was drilled in 1975 by Zent Drilling, Inc. and is fitted with a 12-inch casing from ground level to 26-feet and a 10-inch casing from 40-feet to 46.5-feet. Well 1 is screened on the interval of 26 to 40-feet. The annulus outside the well casing of Well 1 is sealed with cement to a depth of 25-feet and prevents surface water and shallow groundwater from entering the bore hole. Well 2 was constructed in 1980 by Zent Drilling, Inc. and is fitted with a 12-inch casing that extends from the surface to 21-feet. Water enters Well 2 through the well screen that runs from 20-feet to 40-feet. The annulus outside the well casing of Well 2 is sealed with cement to a depth of 20-feet and prevents surface water and shallow groundwater from gaining access to the well bore. A sanitary hazards inspection conducted by DHS Drinking Water Program staff on 03/17/1988 did not reveal any deficiencies pertaining to source water protection. A copy of the well logs for Well 1 and 2 are included in Appendix 1.

The constructed wells had good yields at 1,000 and 1,200 gpm. The installed pump rates are roughly 50% of yield rates. The wells pumping at half the potential yield, serves to reduce the stress on the aquifer and reduces the risk of potential influence of the river on the aquifer that the wells actually draw from.



PLAN
1"=100'

SHN	City of Bay City Well Field Master Plan Bay City, Oregon		Well Field Site SHN 611012.201
	April 2020	611012-201-SITE	Figure 1

(E) FENCE

(E) GENERATOR

FF= 51.96

(E) WELL #1

FF= 53.80

(E) WELL #2

FF= 51.76

MW-3

100 YEAR FLOOD PLAIN

ACCESS ROAD

PUMP CONTROL CENTER

MW-2

FF= 51.99

(E) CHEMICAL ANALYZER/ STORAGE BUILDING

MW-1

(E) 18" DI WATER LINE

1"=10'

SHN	City of Bay City Well Field Master Plan Bay City, Oregon		Well Field Existing Facilities SHN 611012.201
	March 2020	611012-201-SITE	Figure 2

New wells need to maintain sufficient separation to minimize the potential risk of an actual groundwater to surface water connection. The distance between existing wells is 60' and all new wells should be located at least 100' from other production wells on site.

2.4 Proposed Improvements

The proposed site improvements are shown in the Well 3 Site Plan (See Figure 3 on the following page). The Well 3 site improvements include: construction of a new Well 3 and well house, a graveled access with parking and turn around space at the well, additional site fencing. Buried yard piping will include: waterline connection to the existing transmission line, a discharge to waste line and floor drain line to daylight toward the river, power, control wiring, and chemical feed lines from the existing buildings on site, and improvements to re-open the existing looped access road. The Well 3 project will provide spare conduit for power, control wiring and chemical feed lines for a potential future well east of Well 3.

If findings show that the existing Well 1 cannot be rehabilitated, then a Well 4 should be installed to replace Well 1. A future 4th well will not be needed within the 20-year planning horizon but two locations have been selected for planning purposes to either replace Well 1, provide additional system redundancy, or provide for future demand. (See Figure 4 on page 7).

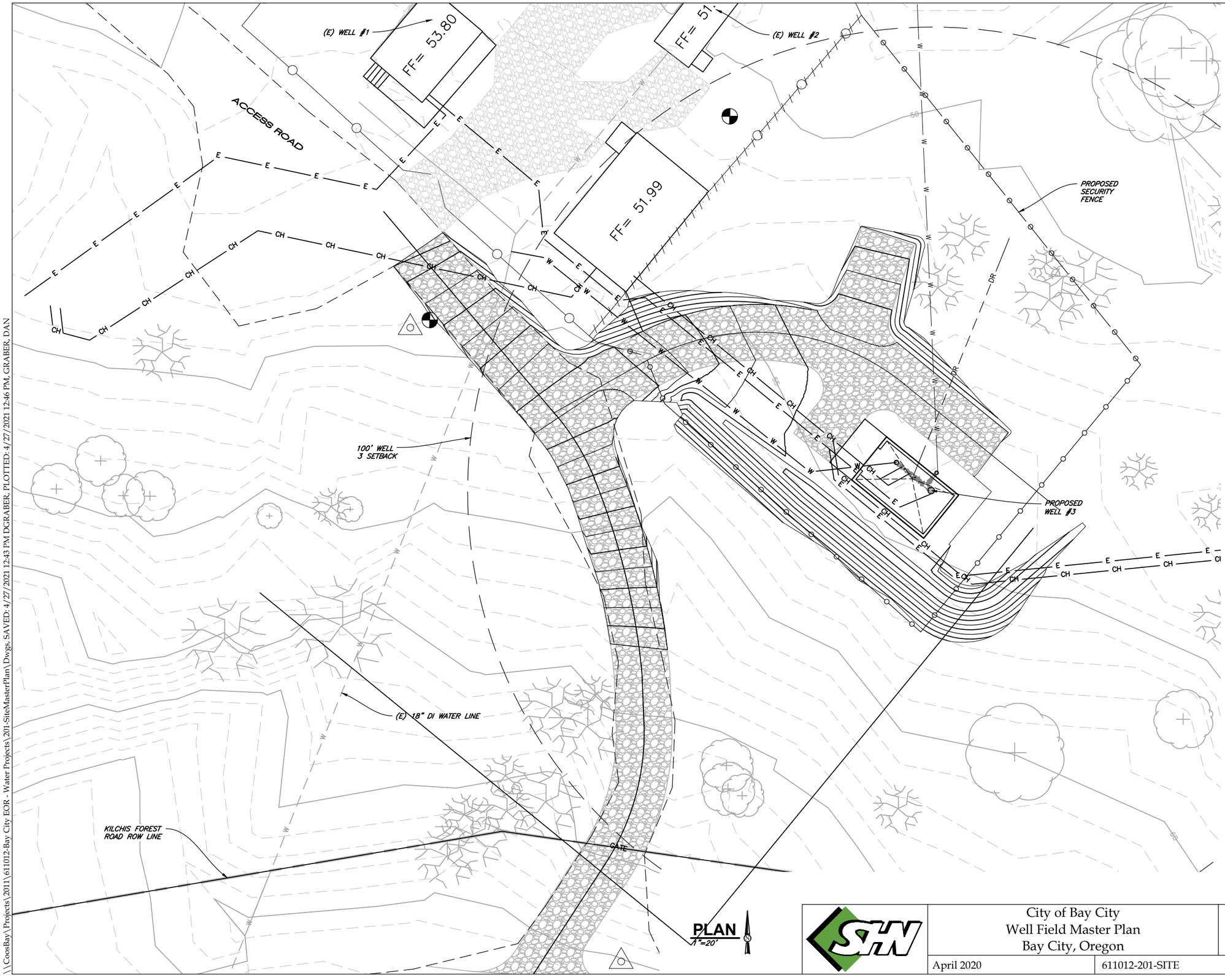
The new well locations have been selected to maintain over 100 feet from other production wells and property lines, and the looped access road will provide access during flood conditions on the river when the main access route is under water. (See Figure 1).

2.5 Source Water Assessment (Water Quality Concerns- Oregon Health Authority)

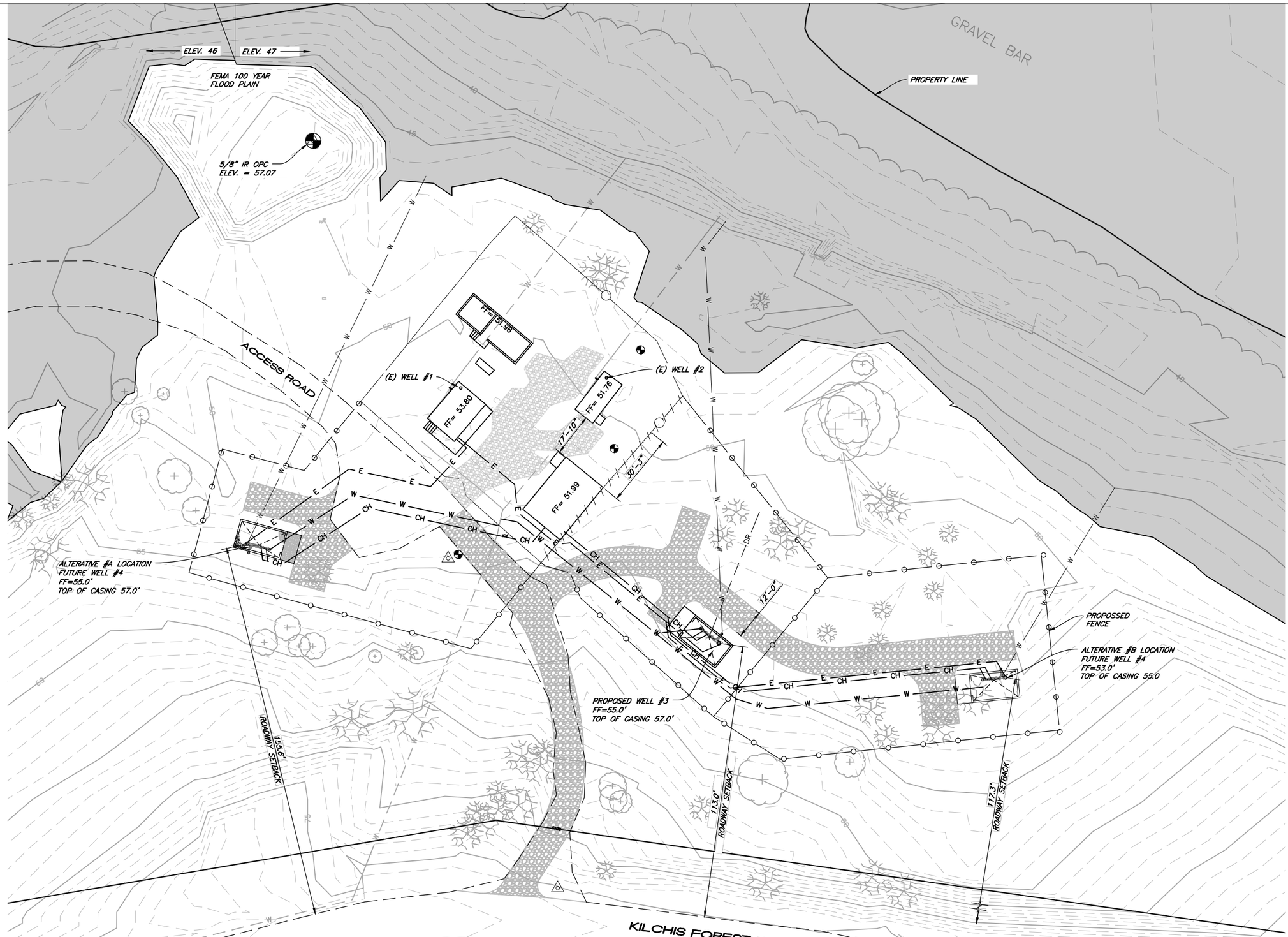
Two state agencies OHA and OWRD view the source water in different ways to perform oversite for different purposes. OWRD is concerned with the quantity of water diverted, while OHA is concerned with the quality of the water delivered.

A Source Water Assessment (SWA) program was Mandated by the 1996 Amendments to the Safe Drinking Water Act. The SWA was completed in April 2003 by The Oregon Association of Water Utilities, Groundwater Specialist in conjunction with the Oregon Health Authority (OHA) Drinking Water Services (DWS). A supplement to the assessment was completed in June 2017 by the OHA and DEQ. The full reports are attached in Appendix 2. The following is a summary of the pertinent information.

The SWA included identification of the Drinking Water Protection Area, an inventory of potential sources of contamination within the area, and an assessment of the relative threat that these potential sources pose to the water system.



	City of Bay City Well Field Master Plan Bay City, Oregon	Well Field Well 3 Site Plan SHN 611012.201
	April 2020	611012-201-SITE	Figure 3



LEGEND

- W — W — 4" DI PUMP TO WASTE LINE
- DR — DR — 4" FLOOR DRAIN
- E — E — POWER CONDUIT
- CH — CH — CHEMICAL FEED LINES
- W — W — 6" DI WATER LINE
- ⊖ — ⊖ — ∈ FENCE

PLAN
1"=40'

City of Bay City Well Field Master Plan Bay City, Oregon		Future Well 4 Options Site Plan SHN 611012.201
April 2020	611012-201-SITE	Figure 4

The 2017 update identified no new potential sources of contamination to those listed in the 2003 assessment.
The assessment included:

- System information including Construction of the Wells, the Nature and Characteristics of the Aquifer,
- Delineation of a Drinking Water Protection Area (DWPA),
- Sensitivity Analysis,
- Microscopic Particulate Analysis,
- Inventory of Potential Contaminant Sources,
- Susceptibility of the Drinking Water Source.

The 2017 SWA identified two sources of contamination as having the highest potential threat to the water source.

- surface water (the Kilchis River)
- and rural residential land uses.

The Source Water Assessment identified surface water as a primary source of potential contamination for the wells. The assessment calculated the Travers Potential (TP) and Infiltration Potential (IP) for the wellfield based entirely on the well drillers log for the two wells. In this analysis, both IP and TP scoring varies from 1 to 10, where a low TP value indicates materials above the aquifer are of low permeability and/or very thick. Conversely, a high TP value indicates high permeability and/or a thin layer of material. IP values are then calculated using the TP value and an estimate of the available water at the surface for aquifer recharge.

Figure 5A Groundwater Drinking Water Source Area

Figure 5B Groundwater Drinking Water Source Area

The DWPA sensitivity is classified as follows:

Sensitivity	Infiltration Potential (IP)
High	> 7
Moderate	≥ 4 to ≤ 7
Low	< 4

The Bay City well field was given a TP value of 7 and an IP of 9 indicating the wells are located in an area highly sensitive to contamination from infiltration.

Subsequent Microscopic Particulate Analysis (MPA) testing resulted in two low scores, suggesting that local surface water bodies do not represent a threat to drinking water quality in terms of Giardia and/or Cryptosporidium contamination. However, MPA testing alone does not rule out the potential for bacteria and viruses originating in local surface water sources, which could impact local groundwater quality near the wellfield. In addition to the potential threat of bacterial and viral contamination, any accidental chemical spill within the DWPA or upstream from the DWPA, could also impact water quality.

Since the assessment was completed in 2003 the City well field has continued to demonstrate a long history of ongoing sampling and testing which indicate under normal circumstances the aquifer is confined sufficiently from the river such that the well water and river water do not share the same chemistry or biologic organisms. While the chemistry indicates the true source of the water, the potential for contamination remains high.

While the assessment identified various potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly. Circumstances that have the greatest opportunity to increase risk include flooding of the river, and accidental chemical spills within the DWPA.

With the highest priority for source water protection being contamination from surface water, the new well will be constructed with site grading that elevates the wellhead and eliminates ponding while providing improved wellhead protection from slides, or washouts from steep upland slopes.

In addition to the SWA, City staff reported positive tests for coliform immediately after a major storm event in 2012. Steep slopes upland of the well site form small streams during heavy rains and one of these streams above the well field changed course and carried rock and debris down slope with enough material and velocity to damage the site fencing adjacent to Well 1. A positive test was traced to Well 1 and the city received water from the intertie with the City of Tillamook for a day while the well site was cleaned up.

While Well 2 was constructed in 1985, Well 1 was constructed in 1975 before the more stringent well construction standards were adopted in 1979. The well evaluations completed in 2011, identified inadequate grout in the surface grout seal for both of these wells.

The casing and surface grout seal for Well 1 was suspect in contamination associated with the 2012 storm event. In addition to the surface seal Well 1 has structural issues around the wellhead with concrete walls and floor, as well as wellhead piping all show signs of settlement. The structural forces evident in the cracked concrete and piping alignments indicate the surface grout seal may be compromised.

During flood events the groundwater and surface waters have greater opportunity to commingle due to the age and condition of the casing and surface grout seal. Also, it is assumed during flood events high flows can scour the river bottom, disturbing the silts and clays in alluvium deposits that provide a barrier between the groundwater aquifer and the surface water. A commingling of the surface water and groundwater near the river may have its greatest potential during high river flow or flood events.

The OHA is concerned with drinking water quality and protecting the water supply source from contamination, while at the same time the Oregon Water Resources Division (OWRD) is concerned with the appropriation of the water quantity and the judicious distribution of the limited water supply. The OHA classifies and regulates this site as a groundwater source, while the OWRD has granted the water wright as a surface water source.

Also, the OHA term; "Groundwater Under the Direct Influence of Surface Water" (GWUDI) is concerned with surface water as a source of contamination to the drinking water supply.

The OWRD term; "Interference with Surface Water" is concerned with the volume of water diverted from the surface water source in relation to the volume of flow in the Kilchis River, this concern specifically applies to Fish Persistence in the river.

The OWRD assumes the surface water permit and POD take water from the river, the OHA does not consider the wells to be GWUDI due to the ongoing bacteria testing of the water. While the source and supply concepts are in conflict, the rules and regulations are not in conflict with one another.

2.6 Permits (Water Quantity Concerns– OWRD)

The Oregon Water Resources Division (OWRD) application S-51053/permit S-43858 is a municipal surface water right. The Point of Diversion (POD) for permit S-43858 has a maximum permitted instantaneous withdrawal rate of 20.0 cfs (≈8976 gpm) from the Kilchis River. However, despite this being a surface water permit, the City has apparently always used wells located very near the Kilchis River to obtain water under this permit. In fact, the intent to use 3 wells at this POD was included in the original permit language.

An OWRD Municipal/Quasi-Municipal Extension of Time Review dated 3/20/2018 indicates the undeveloped portion of the allocation is 17.32 cfs (≈7774 gpm).

This OWRD review also indicates that both existing wells are unconfined:

> *Both existing Wells 1 and 2 are shallow (46-50 ft deep), are located less than 200 feet from the Kilchis River and obtain groundwater from recent alluvium deposited by the Kilchis River. There are no thick deposits of confining clays or silts noted on either well log, and groundwater levels in both wells are approximately coincident with the first encountered water-bearing sand and gravel deposits. These facts indicate that both Well 1 and 2 are unconfined; likewise, any number of additional shallow wells at this general location would also obtain groundwater from the same unconfined aquifer.* Per OAR 690-09-040 (1)

The POD has been evaluated by the OWRD and found to have surface water impacts that would result from the use of undeveloped portions of the groundwater permit. The POD with wells in close proximity to one another would result in coalescing cones of depression that would approximate a single large cone. The OWRD assumes the wells to be hydraulically connected to the river because they are less than ¼-mile from the river and the lack of a confining layer reported in the well logs. OAR 690-09-040 (2) (3).

Because the POD is assumed to be hydraulically connected it is also assumed to have Potential to cause Substantial Interference (PSI) with the flow in the Kilchis River.

Oregon Department of Fish and Wildlife are directed by ORS 537.230 (3)(d) and ORS 537.630 (3)(d) to provide advice to OWRD to maintain flows in streams that support fish populations at sustainable levels.

Recommended target flows have been established and a curtailment formula established to identify the percent shortfall of existing flow verses target flow.

The ODFW performed curtailment calculations based on undeveloped allocation of 18.08 cfs (≈8114 gpm) rather than the 17.32 cfs (≈7774) undeveloped allocation.

Table 1 below is an example of the curtailment calculation based on the 17.32 cfs allocation for August with a river target flow of 48.4 cfs and recommended permit diversion under various measured stream flow conditions.

Table 1. Curtailment at Various Flows[1] in August

August Target Flow (cfs)		48.4	Two Existing Wells (gpm[2])		1200
Undeveloped Water (cfs)		17.32	Developed Water (cfs)		2.68
Stream Flow Q	% Flow Target Flow Missed	Amount Curtailed	Extension Diversion	Total Permit Diversion	Comment
70	0.00	0.00	17.32	20.00	No Curtailment
60	11.82	2.05	15.27	17.95	Curtailed
50	32.48	5.63	11.69	14.38	Curtailed
40	53.14	9.20	8.12	10.80	Curtailed
35	63.47	10.99	6.33	9.01	Curtailed
30	73.80	12.78	4.54	7.22	Curtailed
25	84.13	14.57	2.75	5.43	Curtailed
20	94.46	16.36	0.96	3.64	Curtailed
15	100.00	17.32	0.00	2.68	Curtailed
10	100.00	17.32	0.00	2.68	Curtailed

1. CSF – Curtailment at Various Flows
2. gpm – gallons per minute

These curtailment calculations would limit the use of the undeveloped portion of the water right during extreme drought conditions.

2.7 Source Protection

Sources of supply must be properly developed in a manner that provides the necessary quantity of water and protection of sources and intake improvements. The State of Oregon regulates sources of water and protection for water suppliers primarily through two state agencies – the OHA and OWRD.

The OHA has developed OAR 333.61 Public Water Systems which sets certain water Quality requirements, environmental controls, and construction standards. The intent of these regulations is to ensure that the water delivered to customers by a public water system is healthful.
The OWRD has developed Oregon revised statute (ORS) 690, which among other things, set standards for constructing and maintaining water wells in Oregon. The purpose of these rules is to protect groundwater aquifers from contamination by requiring good water well construction practices.
Several of these regulations must be considered during water system planning, including the following:

- The water supplier must possess legal control of the land (with the exception of public rights-of-way) within 100-feet of a well.
- No waste shall be disposed of within the required control area.
- No water supply stores shall be permitted within 50-feet of a sanitary sewer, fuel tank, or septic tank.
- No water supply stores shall be permitted within 100-ft of a sewage Force main, pit privy, subsurface sewage disposal drain field, cesspool, solid waste disposal site, or similar public health hazard.
- Water supply sources within 100-feet of a public or private road shall be protected against contamination of surface runoff or spillage of chemicals, and they shall be secured from unauthorized access.
- In flood-prone areas, the water supply source shall be constructed to exclude flood waters that rise to 2-feet above the 100-year flood elevation. Proposed finished floor for the proposed wells will be 6 to 8-feet above the 100-year flood elevation and the well casing will extend another 2-feet above the finished floor.
- A sanitary survey conducted by the OHA may place more stringent requirements on shallow wells, in filtration Galleries, and Springs.

The existing wells 1 and 2 and proposed well 3 and 4 locations will meet the above criterion.

2.8 Treatment and Disinfection

The two Bay City wells are classified by OHA as groundwater source wells. The wells are shown as groundwater (GW) online in the following link:
https://yourwater.oregon.gov/inventory.php?pwsno=00079

This GW designation is based on a history of negative coliform sampling. The testing results are posted on-line at: https://yourwater.oregon.gov/gwudi.php?pwsno=00079

OHA completed well evaluations in 2011 and the wells seals were found to be inadequately constructed with insufficient grout to properly seal the well bore hole within 18-feet of the ground surface. Also, the existing wells are potentially sensitive to surface water due to the proximity to the river and potentially high groundwater. The nature of the aquifer and close proximity of surface water are likely to be contributing factors to any future confirmed e.coli detection.

The well evaluations (see Appendix 3) indicate that not enough material was used to seal the wells. In short, the results of these well evaluations support the need for disinfection. The well logs (drillers construction report showing the casing seal info) are identified as WELL 1 - TILL222 and WELL 2 - TILL535 in the link provided above, and Appendix 1 Well Logs.

Water treatment for the City is limited to disinfection using sodium hypochlorate and acid-alkaline (pH) balance with caustic soda. These two liquids are pumped from 55 gal drums into the water line within each well house.

The chemical pumps operate simultaneously with the well pumps and well control valve. After an initial pump to waste the well control valve directs the water to the system and the chemical feed pumps inject the chemicals through injection ports directly into the water line. Approximately 1 pound of chlorine is used per day to attain an average chlorine residual of 0.24 mg/L. In the event of a power failure, the backup generator at the well pump also powers the injection system.

The chemical dose is analyzed for chlorine residual and pH with Hawk analyzers inside the chemical storage building. A sample line delivers treated water from the transmission line just outside the site security fence, and waste sample water is discharged to the ground outside the building.

The chemical feed system is composed of the following equipment:

Caustic Soda pump
- LMI
- 120V AC 50/60 hz 1.50A
- Model # B111D90HI
- Serial # 16084200830-5
- Max GPH 1.40
- PSI 150

CL2 pumps
- LMI
- Model # AD841-A20HI
- Serial # 14013725035-1
- Max GPH .33
- PSI 250

Pursuant to OAR 333-061-0050 (5)
(b) The residual disinfectant concentration in the water entering the distribution system at the well field cannot be less than 0.2 mg/l for more than 4 hours.

Bay City has continuous monitoring and redundant chemical feed components including auxiliary power. In addition, Bay City has an auto-dialer that alerts crews whenever there is less than 0.2 mg per liter residual disinfectant in the water.

The crews are able to respond to the well field and remedy the situation within an hour of an alert or shut the well down if the situation cannot be remedied within 4 hours.

2.9 Auxiliary Power

Auxiliary power for the pumps is provided with a 135 KW 3 Phase diesel fueled generator which also operates the chlorine and pH analyzers and chemical injection pumps during power outages.

Kohler Model# 135 R O Z J, Serial # 38061, Spec # PA-189721, Engine Deere RG6081T012991

The generator is regularly maintained and automatically exercised each week and is in good working condition. The generator sits on a concrete pad with concrete walls for containment of diesel fuel from a spill or accident. The fuel supply tank is 500 gallons with a minimum ¾ full stored volume of 375 gallons of diesel maintained at all times. The generator has an estimated consumption rate of 100 gallons per day which provides an emergency operating time of nearly 4 days before refueling.

3.0 Hydrogeologic Analysis

3.1 Nature and Characteristics of the Aquifer

According to the well logs the aquifer supplying drinking water to the wellfield consists of a relatively thin alluvial aquifer composed of sandy gravel to gravelly cobbles. The alluvial deposits that make up the wellfield consist of; unconsolidated clay, silt, and sand and gravel alluvium deposited along the Kilchis River. The well logs indicate that water is drawn primary from the sand and gravel layers. The well logs report encountering water at a depth of 15 feet at Well 1 and 17 feet at Well 2, and these depths are also noted on the well log as the static water level for these wells.

The two wells were drilled in 1975 (Well 1) and 1980 (Well 2). Each well is 12 inches in diameter and 60 feet deep. During well tests, the yield of Well 1 was 1,200 gpm with a 3-feet drawdown after 24 hours and Well 2 yielded 1,000 gpm with a 3.5-feet drawdown after 24 hours.

The specific Capacity was calculated at 400 and 286 gpm/ft respectively for each well (See Table 2 on the following page). Recovery for both wells was within 30 seconds. Copies of the well logs are attached in Appendix 1.

Table 2. Original Well Pump Data

	Discharge Rate (gpm[1])	Drawdown (ft[2])	Specific Capacity (gpm/ft)	Diminished Capacity
Well 1	1200	3	400	
Well 2	1000	3.5	286	
Current Specific Capacity				Well 2 **-19%**
Well 2	580	2.5	232	

1. gpm – gallons per minute
2. ft - feet

Since construction, the reliability of each well has been consistently good, resulting in an adequate supply for the District even during low flow years on the Kilchis River. However, the current flow and drawdown data for Well 2 shows the specific capacity is diminished by roughly 19% since construction, but no change in recovery time has been observed.

It is assumed well 1, being the older well, would have similar diminished capacity, however the well is not equipped with a transducer therefore no drawdown information is available.

3.2 Aquifer Characteristics

The existing wells as originally constructed may have been equipped to measure water levels in the wells, but City staff reported this equipment had not been in place for at least the previous 16 years.

With no historic water level measurements other than well construction logs for these wells, SHN installed transducers in Well 2 together with three monitoring wells in September of 2019. A transducer was not installed in Well 1 due to the difficulties with available ports on the damaged well head.

Wells and monitoring wells are shown with relative distances from each other in Figure 6 on the following page.

Transducers were installed and water levels were recorded from November 4, 2019 through Jan 29, 2020.

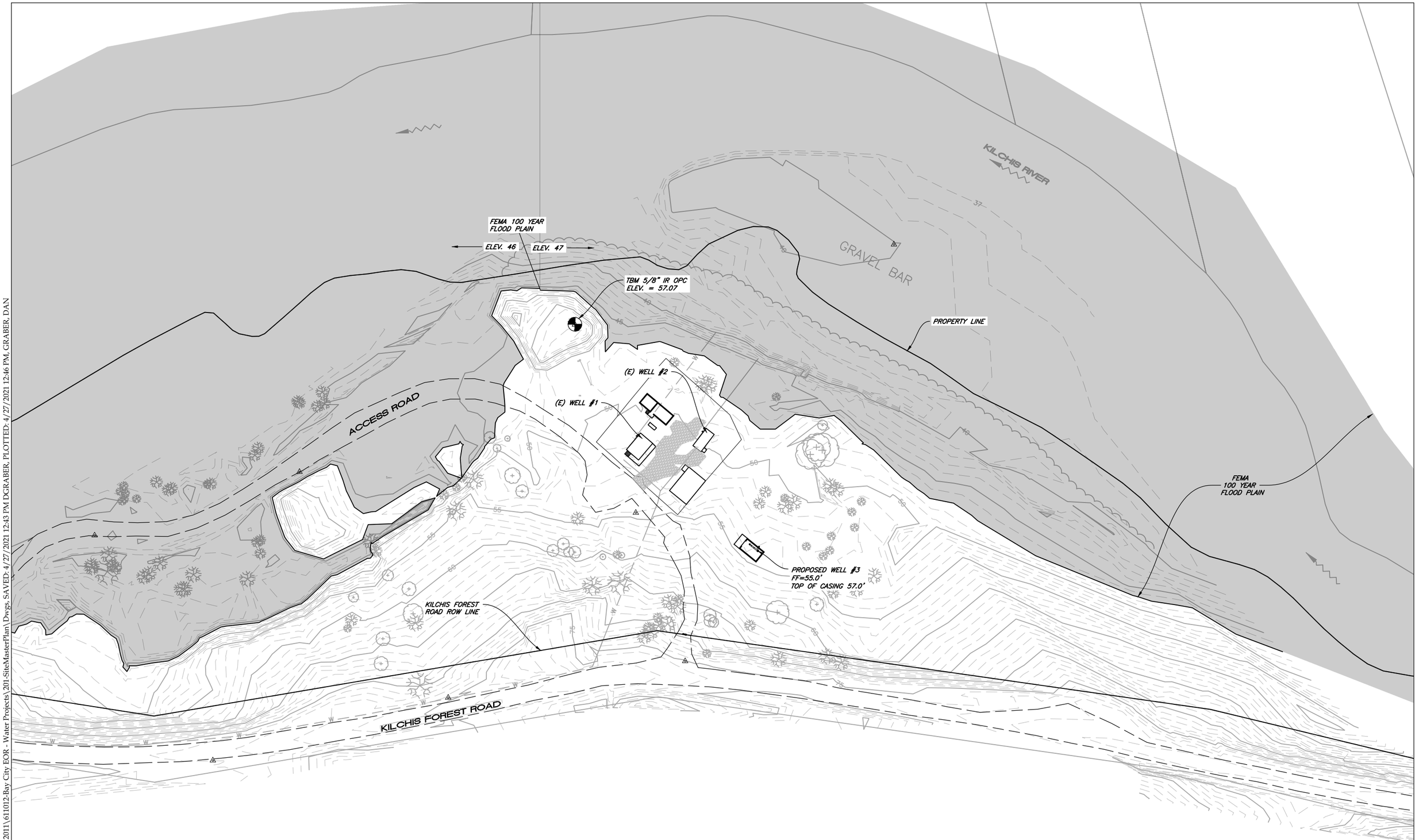
The monitoring wells are laid out nearly perpendicular to the assumed direction of water flow within the alluvial water bearing lens. MW 1 and MW 3 are located the furthest apart, approximately 113-feet. When the wells were installed November 4, 2019 and when removed March 2, 2020, the static water levels were measured as shown in Table 3 on the following page.

Table 3. Ground Water Elevations, Bay City Well Field

			NOV 4 2019			2-Mar-20	
WELL	(Approx) Distance to River (Ft[1])	Top of Casing Elev.	Depth to Water (Ft)	Water Elev.	Diff. in Water Levels (Ft)	Depth to Water (Ft)	Water Elev.
MW 1	257	53.67	19.09	34.58	0.53	18.56	35.11
WELL 1	210	55.49	21.07	34.42			
MW 2	182	50.15	15.54	34.61	0.48	15.06	35.09
WELL 2	162	51.76	17.25	34.51			
MW 3	143	48.19	13.5	34.69	0.46	13.04	35.15

1. ft - feet

The static water levels show the depth to water is about 0.11-feet difference in November and 0.06 feet difference in March. These are very minor differences given the variable terrain, the general cross slope of the area, and the proximity to the river.



PLAN
1"=80'

SHN	City of Bay City Well Field Master Plan Bay City, Oregon	Well Field Flood Plain SHN 611012.201
	April 2020 | 611012-201-SITE	Figure 6

The slight variable in water level shown in static conditions is slightly exaggerated when Well 1 is pumping. This can be seen in Figure 7 (the colored graph of the data below).

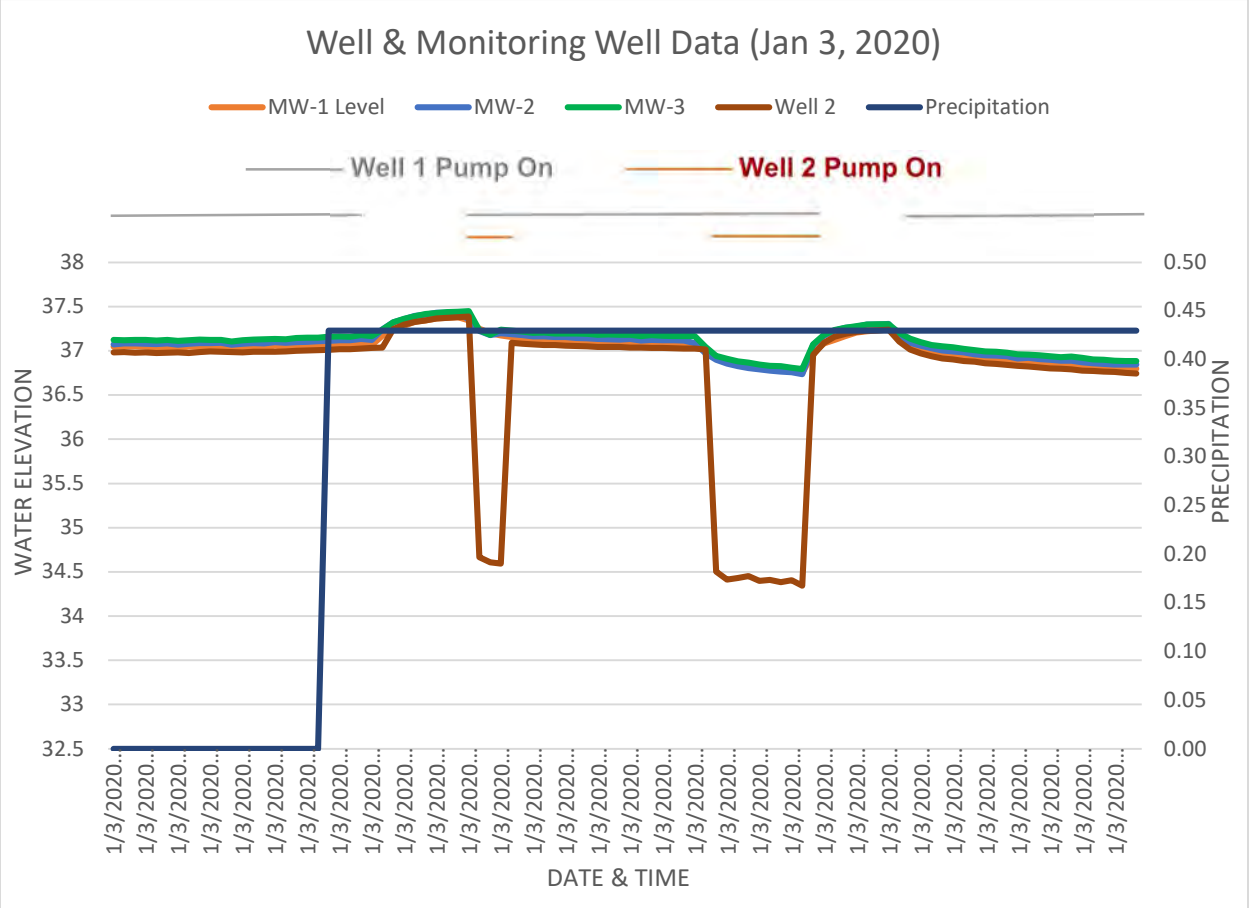


Figure 7. Well & Monitoring Data (Jan. 3, 2020)

This timeline shows Wells 1 and 2 turning off and on and running simultaneously with peaks showing when both wells are off.

When Well 1 is running, the transducer readings in Well 2 and the monitoring wells show the water level drops from 0.2 to 0.3-feet across all monitoring locations but with slightly more drop in Well 2 and less in MW 3. With Well 2 on, the drawdown in the monitoring wells is also about 0.3-feet, and the drawdown at Well 2 is about 2.5-feet. MW 3 is 18-feet away and MW 1 is 95-feet away from Well 2 and each draws down about 0.3-feet and 0.1-feet, respectively. The consistency of both the elevation and hydraulic response indicates the alluvial material is very open and permeable below the clay soils near the surface.

Monitoring data from November 4 through January 29 shows the groundwater level increasing steadily through the rainy season. See the doted trend line in Figure 8 below.

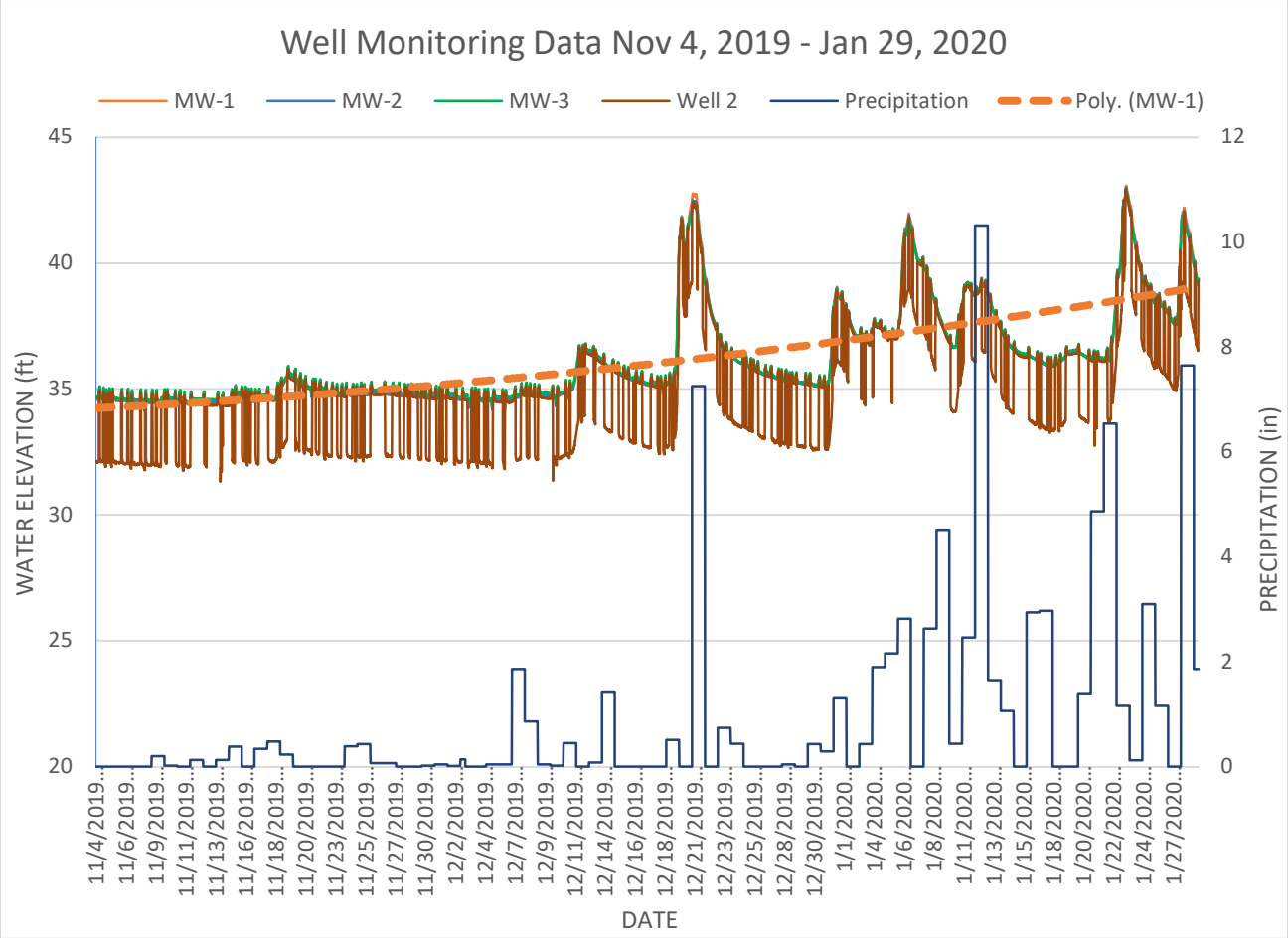


Figure 8. Well & Monitoring Data (Nov. 4, 2019 – Jan. 29, 2020)

The dotted MW-1 line is the groundwater trend as measured from MW 1 and the trend increased nearly 5-feet during the 3-month monitoring period. The data shows the relationship of water levels to storm events. The groundwater appears to jump significantly just ahead of a December 20 storm, while the January 12 storm does not show a significant water level increase. There are many factors that affect the immediate relationship of precipitation and the groundwater level readings. The timing of rain gauge readings, the distance between the rain gauge and well field, the type of storm, the size of the aquifer, the overlapping drainage basin, and the permeability of the soil within the drinking water protection area, all contribute to the immediate ambiguity of the data, but the general trend is clear, that precipitation sufficient to saturate the soil will percolate down to the water table.

This data supports the need to keep a watchful eye on activities in the groundwater protection area.

3.2 Capacity of Pump Systems

The pump rate of each well varies with pressure head which varies with groundwater elevation, system demand, and reservoir levels.

3.2.1 Well 1

Well 1 pump and motor was installed in 1975 and has been in operation for 45 years. The pump had an original pump rate of approximately 530 gpm, but this rate has seen a steady decline with a loss of roughly 70 gpm since it was installed. The cause for the loss in flow rate is not known, it could be related to the well screen, the alluvium surrounding the bore hole, iron bacteria buildup on the pump bowls or on pipe and fittings around the well head, or there could be other efficiency issues with the pump motor.

Photo 1. Iron on Well 2 Column Pipe, 2017.

The current pump rate for Well 1 varies between 450 gpm at 188 DTH (81 psi) (70 psi gauge) and 470 gpm with less pressure head in the water system, or higher groundwater in the well..

Pump 1 was rebuilt around 1996. The pump is driven by a 40Hp, 230/460 V, 60 Hz, 3-phase, 1780 rpm US Electrical Motor. Well 1 is located in a 15'x20' building which also houses the control panels for the site. Well pump 2 is located in a separate 9'x20' building. Each pump is metered with a magnetic meter.

In 2017 a contract was secured to replace the Well 1 pump and motor, however the contractor determined that the conditions of the well house including the well head and piping alignments, floor settlement, and cracks in the walls indicated the Well 1 building was in need of repair or replacement prior to installing a new pump and motor.

At that time, it was determined that the Well 2 building and pipe alignments were in good condition, but this system was approaching 40 years of service, therefore the Well 2 pump plant was replaced.

3.2.2 Well 2

Well 2 pump plant including pump column pipe and motor were replaced in 2017. The new pump operates near 590 gpm at 188 TDH (81 psi) (70 psi gauge). It has been noted by City crews that well 2 now pumps at a higher flow rate than the previous pump plant. The replacement project included a new check valve and miscellaneous fittings within the wellhouse piping.

3.2.3 Pumps

With each well running simultaneously at a normal operating pressure of 188 TDH (81 psi) the two

pumps have a combined capacity of approximately 981 gpm. A peak flow can be reached where the system pressure drops to 166 feet TDH (60 psi) and the combined capacity increases to 1,081 gpm. Dropping the pressures below this pressure head for an extended period of time would be hard on the pump motors and would not be a recommended practice.

Table 4. Peak Well Pump Capacity

System Head Pressure	188'			177'			166'		
	GPM[1]	CFS[2]	MGD[3]	GPM	CFS	MGD	GPM	CFS	MGD
Wells 1 & 2 Combined	981	2.19	1.41	1031	2.30	1.48	1081	2.41	1.56

1. GPM – gallons per minute
2. CFS – cubic feet per second
3. MGD – million gallons per day

Raw water pumping equipment should be sized to provide the design Maximum Daily Demand (MDD) with 18 hours or less of operation.

On September 8, 2020, the well pump data recorded both pumps operating continuously over a 24-hour period. The flow meters for that day showed a volume of 1.521 MG was delivered to the system equal to a constant pump rate of 1056 gpm (2.35 cfs). This volume indicates the system pressure was nearly 172 TDH through the 24 hour period.

Operation of the pumps is controlled by a telemetry system that activates the pumps based on the water level in the Willowbrook Reservoir near Bay City (see Section 4.4). The pumps can also be controlled by the SCADA system or manually at the well site.

Auxiliary power for the pumps is provided with a 27-kW diesel fueled backup generator installed in 1997, which also operates the system's chemical injection pumps (see below). The generator is regularly maintained and automatically exercised each week and is in good working condition.

4.0 Construction Standards

The new wells will be designed to comply with the Construction Standards set forth in OAR 333-061-0050 as follows:

The new well locations will be constructed with grading and drainage such that overland runoff from Kilchis Road will be directed away from the wells such that contamination will be effectively excluded. The structures and piping will be buried or made of materials with sufficient strength to protect or safely withstand all anticipated external and internal forces acting upon them.

Materials in contact with potable water will be new materials and selected to meet NSF 61 standards. Prior to construction of new facilities, plans shall be submitted to the OWRD authority for approval.

The Kilchis Forest Road is a Public roadway which is allowed within 100 feet of the wells provided the wells are protected from unauthorized access (fenced) and protected against contamination from surface runoff or hazardous liquids which may be spilled on the roadway (new well sites to be graded to drain away from the wells).
The area within 100 feet of each existing, proposed, and future wells is owned by the City or part of the Kilchis Forest Road a public right-of-way. (D) Proposed Well #3 is 110-feet from the roadway. Well #4 alternative locations are 158 and 114 feet from the roadway.

All water used in the construction, shall be potable.

The well field is located within a Voluntary Drinking Water Protection Program, and in accordance with required elements of a wellhead protection plan, OAR 340-040-0170, siting of New Public Water System Wells shall be in accordance with Health Division rules under OAR 333-061-0057 (Voluntary Drinking Water Protection Program).

4.1 Well Head Protection

Pursuant to Rule 333-061-0057(2)(g) *"Provisional delineation"* the location of the new wells will be roughly 100 feet from other wells and pumping from the same hydrogeologic water bearing lens. The Well Head Protection Area (WHPA) will be unchanged from the WHPA established for the existing wells on site.

4.2 Well Seal

New wells shall be constructed according to OAR chapter 690, division 200 "Water Supply Well Construction Standards."

The existing well logs show the well field is located in an unconsolidated formation without significant clay beds. To accommodate these conditions new wells will be constructed with a watertight, unperforated well casing extending to a minimum of eighteen feet below land surface. An an upper oversize drillhole, four inches greater in diameter than the nominal diameter of the casing, shall be constructed to a minimum depth of 18-feet, and completely filled with grout (minimum 2" thick grout seal). It is anticipated that a temporary casing will be installed to keep the drillhole open and the temporary casing will be removed as the annular space is filled with grout pursuant to section 690-210-0130.

4.3 Well Chemical Feed Systems

Currently the chemical systems including chlorine and caustic soda are maintained as separate redundant systems for each well. With new wells, chemical storage can be consolidated but individual pump systems would be retained and maintained as far ahead of the analyzers as possible.

5.0 Existing System Capacity

The existing system capacity is limited to the production capacity of the two wells plus an intertie with The City of Tillamook.

The water level in the reservoirs together with system demand will change the pressure head the wells pump against, therefore well production rates vary depending upon these system conditions. City water crews have indicated that the Well 1 pump rate varies from 450 to 470 gpm, while Well 2 rate varies from 560 to 590 gpm. When the pumps are operating simultaneously, friction head in the transmission main increases, so the efficiency and pump rate for each pump is reduced. When this friction head is added to the depth of the ground water and to the elevation head of water in the reservoirs, a system curve is developed. The pump curves for each well and the combined pump curves for the existing and proposed conditions are plotted against the system curve (Figure 9). Due to the large diameter transmission main (18-inches) the system curve is very flat, with only 1 psi difference in head pressure between one well pump running and two pumps running.

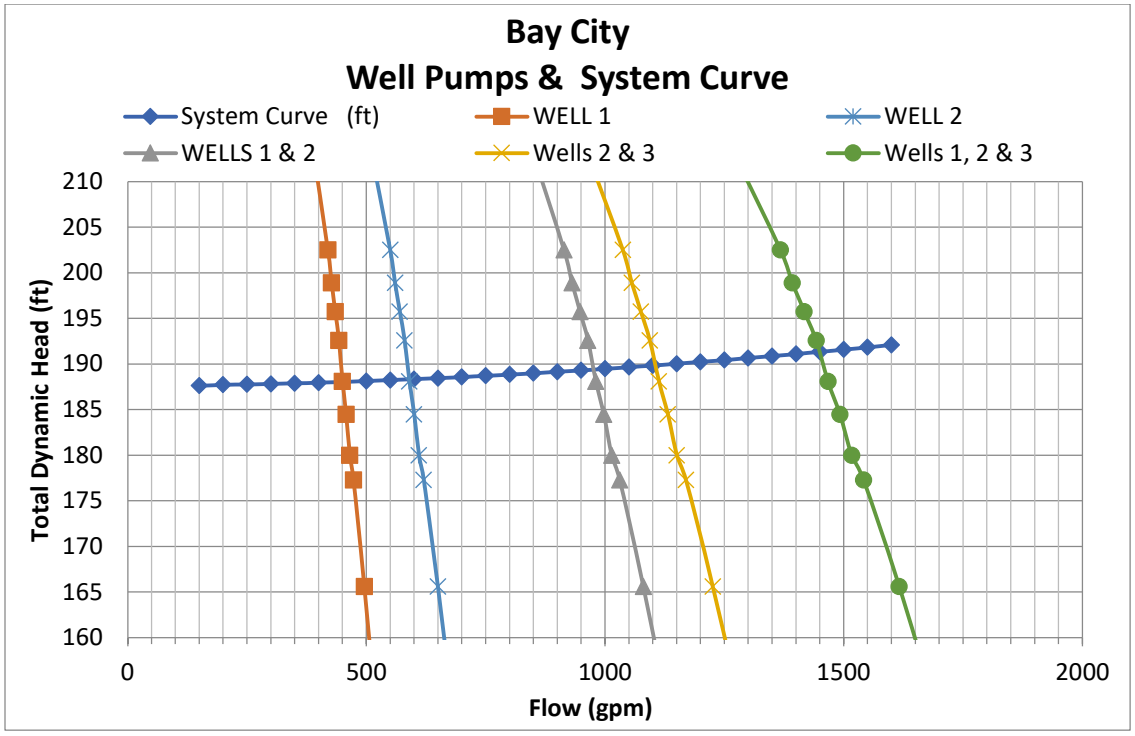


Figure 9. Well Pumps and System Curve.

With a system pressure of 188 feet (81 psi), the flow rate for Wells 1 and 2 are 450 and 590 gpm respectively and operate at a combined rate of 981 gpm (2.19 cfs). At a peak demand period with reduced head pressure of 177 feet (77 psi), the existing wells could deliver 1,031 gpm (2.30 cfs).

Table 5 Water Prediction Summary

	System Head Pressure	188'			177'			166'[1]		
		GPM[2]	CFS[3]	MGD[4]	GPM	CFS	MGD	GPM	CFS	MGD
A	Existing Well 1	450	1.003	0.648	473	1.054	0.681	496	1.105	0.714
B	Well 2	590	1.315	0.850	620	1.381	0.893	650	1.448	0.936
C	Well 3	590	1.315	0.850	620	1.381	0.893	650	1.448	0.936
D	Existing Wells 1&2	981	2.185	1.412	1,031	2.296	1.484	1,080	2.407	1.556
E	Wells 2&3	1,113	2.479	1.602	1,169	2.605	1.684	1,226	2.732	1.765
F	Wells 2 & 3 with Rebuilt Well 1	1,593	3.549	2.294	1,674	3.730	2.411	1,755	3.910	2.527
	Exceeds Benefited Use 2.68 CFS									

1. Extreme condition
2. GPM- gallons per minute
3. CFS – cubic feet per second
4. MGD – million gallons per day

It is assumed, the proposed Well 3 and new Well 1 pump plant would use the same pump curve as Well 2 and produce roughly 590 gpm, at 188 feet of head. With existing Well 2 and proposed Well 3 running against 188 feet of head the combined flow is estimated to reach 1,113 gpm (2.479 cfs). Under extreme conditions where the system dropped to near 170 feet the proposed Well 2 and 3 system could deliver 1,203 gpm (2.68 cfs) the full benefited use allocation.

The flow highlighted in blue in Table 5 exceeds the benefited use. With three wells operating under extremely low head conditions, the system is projected to deliver up to 3.91 CFS. This option would require an application to the State for additional benefited use.

Also, it is anticipated that the intertie with Tillamook can deliver up to 1,000 gpm (2.228 cfs, 1.44 MGD), in emergency situations.

6.0 Projected Growth

6.1 Population and Water Requirements

Population data was obtained from the Portland State University Population Research Center at the following link:
https://www.pdx.edu/prc/population-reports-estimates

The last census with available data was 2010 but PSU research data projections were available through 2015 and using the rate of change from 2010 to 2015 and projecting the population to 2020 the population estimate was 4 more people than population projections obtained from the City for 2020. Figure 10 (on the following page), depicts how the population growth in Bay City has been relatively steady over the last 50 years.

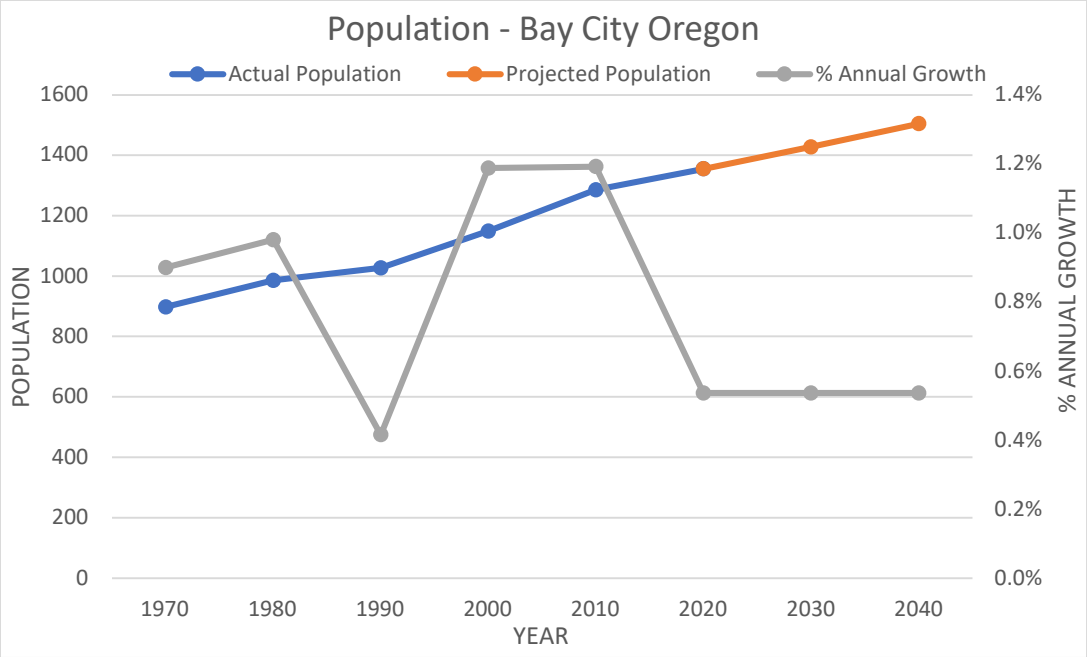


Figure 10. 50-Year Population Growth, City of Bay City

The future projections are based on the last 10 years and extended over the next 20 years. With the 2020 population estimated to be 1355 and the population in 2040 estimated to be 1504 people, a direct line should be correlated between population and water consumption. However no direct pattern with population and water use can be drawn from the data available. Most peak demand periods occurred more than 20 years ago when the population of Bay City was much smaller than it is now. The takeaway from this data is that the population will be increasing, therefore water demand should not continue to decrease, but should increase with the population.

6.2 Well Field Production

Water production data was obtained from the Oregon Water Resources Division Water Right Information Search system (WRIS), found on the following link:

https://www.oregon.gov/OWRD/programs/WaterRights/WRIS/Pages/default.aspx

Application number S51053, & permit number S43858.

A copy of the raw data is found in Appendix 5.

These water quantities are measured with magnetic meters at the water source wells and measure the volume of water produced at the source and therefore include any waste or unaccounted for water.

The meter readings are provided to the OWRD on a monthly basis and documented in the Water Rights Information System (WRIS). The total flow for the month as recorded is the difference between measurements taken on the morning of the first day of the month and the morning of the last day of the month. Due to this reporting method, the last day of the month flow readings have been missing from the total water used in the WRIS report. This volume of water would amount to a little over 3% of

the total monthly record. A correction for this amount was considered insignificant and beyond the scope of this study, so the WRIS records have been used as recorded and recognized by the State.

Also, the OWRD records a water year beginning in October and ending in September. "The water year is named for the calendar year in which it ends". So, the reading taken in October of 2020 will be found in the 2021 water year. The annual production in this report makes no correction for this reporting method.

In the process of more detailed data analysis, it is necessary to take this water year reporting into account when comparing the City Records with the WRIS records.

6.2.1 Maximum Monthly Demand

Maximum Monthly Demand (MMD) is shown in the graph below from 1989 through 2020 and projected through 2040 (Figure 11).

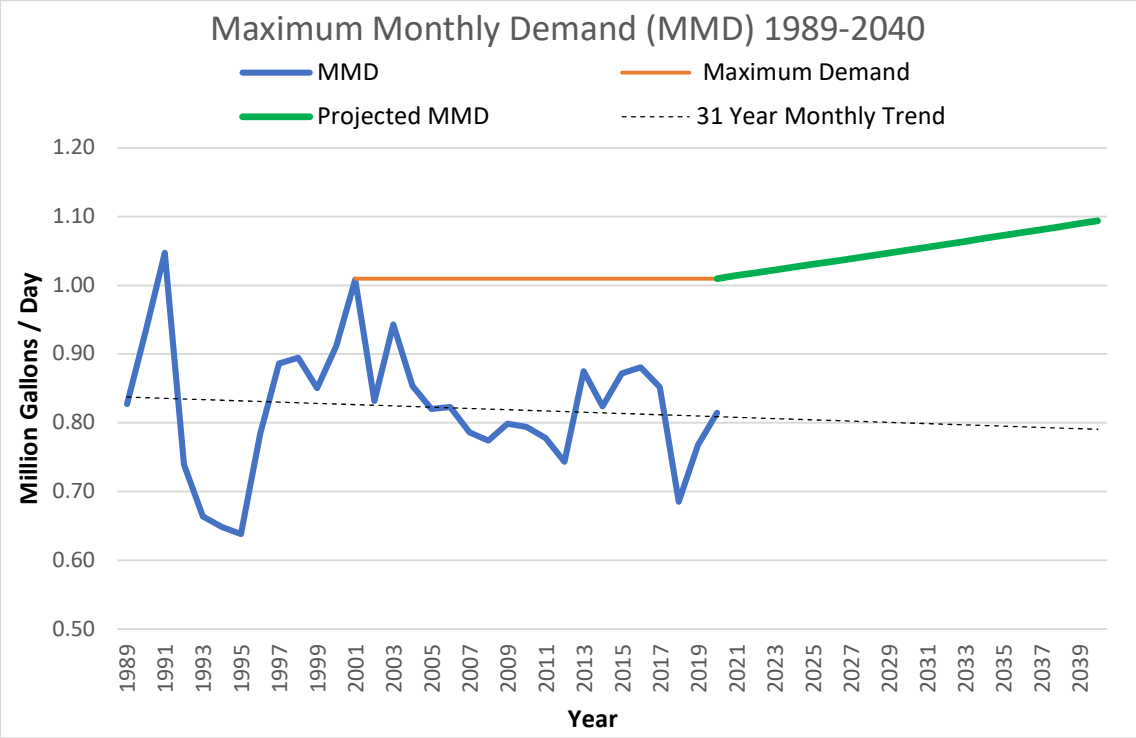


Figure 11. Maximum Monthly Demand, 1989 through 2020, projected through 2040.

The Figure 10 graph shows a linear trend dropping from a maximum month of 0.84 MGD in 1989 to roughly 0.80 MGD in 2020 For Analysis this line is extended through 2040 where the demand trends to a low of 0.79 MGD. The highest maximum monthly demand of 1.05 MGD was recorded in January 1991. January is an odd month for a peak demand that would normally take place in mid to late summer. Since this peak was over 29 years ago, for future projection purposes we used the peak demand in just the last 20 years of 1.01 MGD recorded in August of 2001. Also, rather than projecting the downward trend we used a growth rate matching the projected population growth for 2040. The MMD is estimated to be 1.13 MGD in 2040 MGD. This MMD volume would equal a constant flow of 783 gpm from the well field.

While the annual maximum month demands are shown in Figure 10, Table 6 below shows the year in which each month recorded its maximum value. All but two of the maximum monthly record values were metered after 2003. The two months of March and June reached record maximums in 2015 and 2016, respectively.

Table 6 Water Rights Summary

Month	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep
Year	2000	2000	2000	1991	1989	**2015**	2001	2001	**2016**	2003	2001	1999
Month Maximum	24.8	27.7	28.4	32.5	23.6	27.0	26.7	30.1	24.5	29.1	31.3	26.0

The mathematical trend and apparent reduction in MMD together with increased annual demand and population increase, would suggest that peaks in the past were caused by factors other than consumption or perhaps reductions in demand have occurred due to factors other than typical conservation measures. There are several operational factors that could reduce the peak water consumption per month while the annual consumption trend increases. These may include reduced water sold through the intertie connection, water tank cleaning procedures that use less water, hardening of the system to reduce main breaks, hydrant flushing scheduled during low demand months, or fire department training methods that use less water, could all be behind the reduced monthly maximums.

6.2.2 Annual Production Rates

The annual production rates are shown in Figure 12 below.

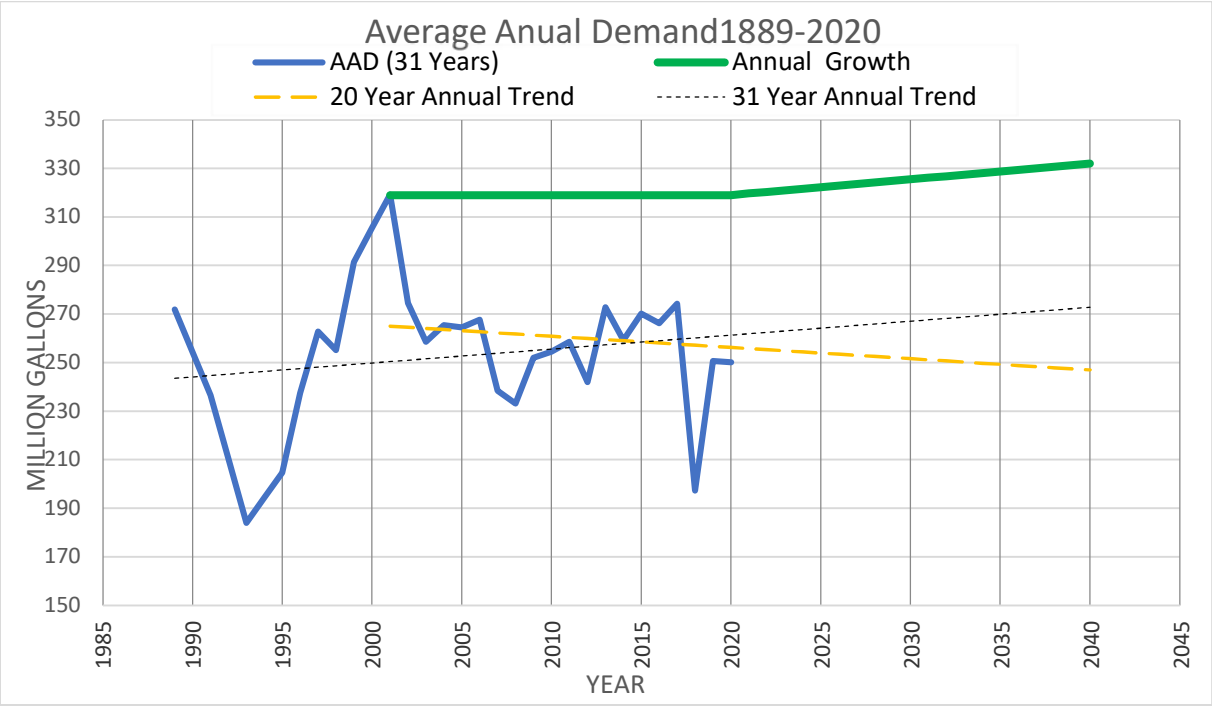


Figure 12. Annual Water Production, 1889-2020.

The lowest annual demand of 184 MG was recorded in 1993 while the highest demand was measured in the year 2001, at 319 MG. Over the 31 years of data a total of six months reached their peak in the year 2001. The differential between the low in 1993 and the high in 2001 is 58%. These two extremes skew the trend lines such that annual production shows a trend toward increased production over the 31 years of record. However, when only the last 20 years is graphed, the trend shows a decline in production over the last 20 years.

A growth rate is projected at 4% consistent with the population projection. Based on these assumptions the maximum annual production is projected to be 332 MG in 2040. This annual production information is presented to demonstrate a mathematical need for increased production to support potential growth, in agreement with the population trend.

6.2.3 Maximum Daily Demand

The maximum daily water production over the last 5 years is summarized in Table 7 on the following page.

Table 7. Water Production Summary

	Water Demand (MGD)[1]			Peaking Factor		
	Average	Maximum	Maximum			
Year	Daily ADD[2]	Monthly MMD[3]	Daily MDD[4]	MDD PF[5]	MDD GPM[6]	MDD CFS[7]
2016	0.762	0.910	1.525	2	1059	2.35
2017	0.785	0.852	1.571[8]	2	1091	2.43
2018	0.567	0.685	1.135	2	788	1.76
2019	0.719	0.767	1.437	2	998	2.22
2020	0.717	0.814	1.434	2	996	2.22
Average	0.710	0.806	1.420	2	986	2.20

1. MGD – million gallons per day
2. ADD – average daily demand
3. MMD – maximum monthly demand
4. MDD – maximum daily demand
5. MDD PF –
6. MDD GPM – maximum daily demand gallons per minute
7. MDD CFS – maximum daily demand cubic feet per second
8. A maximum daily demand of 1,571 equals a constant pump rate of 1,091 gpm.

A maximum daily demand (MDD) can be calculated based on the Average Daily Demand (ADD) times a peaking factor. A peaking factor of 2 was calculated using the peak day demand recorded on September 9, 2020, divided by the average demand for that month. This peaking value was established from a limited review of data, but was the highest peak value found over the last 5 years during the 4 months of peak flows evaluated. This MDD peaking factor was used to calculate an MDD through the 31 years of record data as shown in Figure 13 (on the following page).

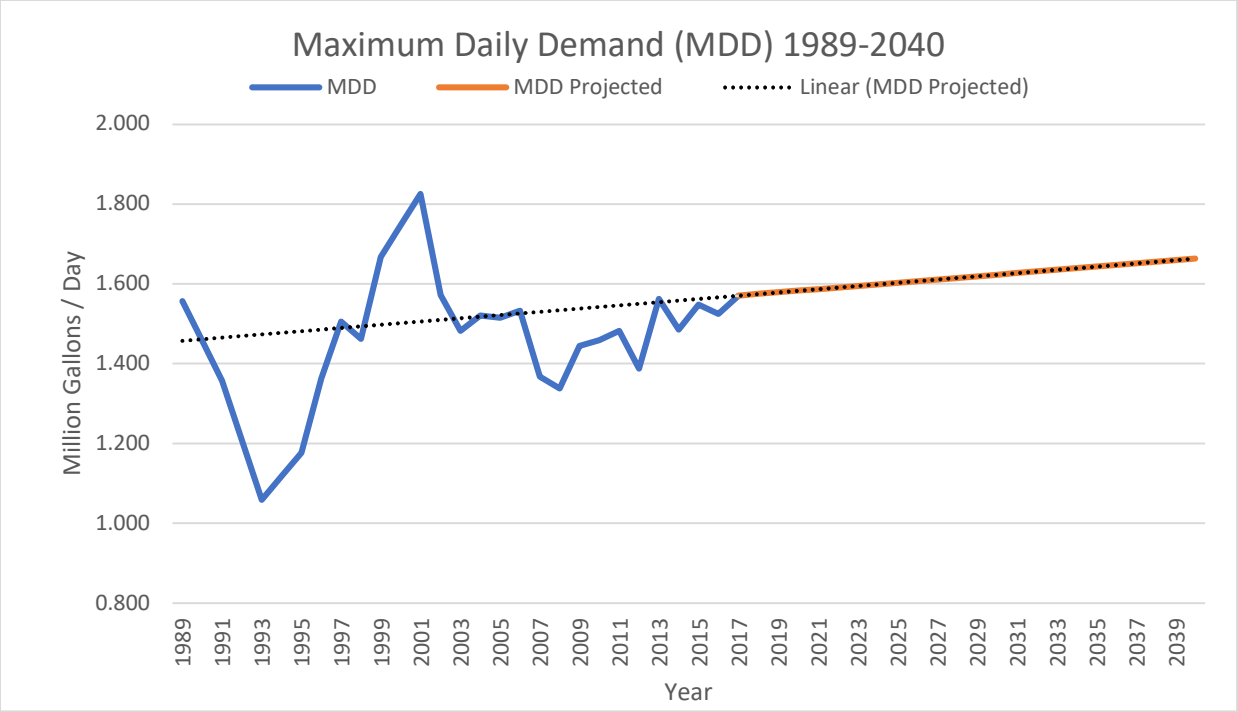


Figure 13. Maximum Daily Demand (MDD) 1889-2040.

The MDD in the last 20 years of 1.571 MGD was projected out to the design year 2040 using a growth rate matching the trend line over the record period. This demand is equal to 1,091 gpm pumping continuously over a 24-hour period.

This calculated MDD rate is slightly higher than the peak daily flow measured with flow meters at the production wells equal to 1.52 MGD for the same September 9, 2020 date. This measured flow rate of 1.52 MGD was recorded together with records that show both well pumps were operating for 24 hours on this day. Based on the pump curves shown in Figure 8 the two existing pumps can provide a combined flow 1,056 gpm at a TDH of 172 feet and this matches the measured flow.

7.0 Existing System Deficiencies

7.1 Aging Infrastructure

The capacity of the existing water supply is limited to the capacity of the two existing wells. These wells are now 40 and 45 years old.

The site has an existing chemical storage building that houses chlorine and pH analyzers but is otherwise underutilized. The chemical storage and feed systems are located within each well building creating crowded working conditions. With the construction of Well 3 the chemical storage and chemical feed pumps should be relocated to the chemical storage building intended for this purpose. The system flow production deficiencies are detailed in Section 6.2. In summary, the system requires

two pumps running to meet demand and there are no backup or redundant systems. There have been isolated instances where the two pumps ran over the 18-hour design maximum and at least two days when the wells ran continuously for 24 hours.

7.2 Well 1

Well 1, pumps at a rate of 450 gpm with a gauge reading of 71 psi in the yard piping at Well 2.
Well 1 is the oldest well, has a number of structural issues related to settlement or loss of backfill under the elevated concrete floor slab near the well casing. The floating slab has settled about 5-inches in the NE corner of the well house and adjacent to the well head equipment pad. The equipment pad and or pipe penetrations through the floor have created a misalignment of discharge piping in the well building and a flexible joint has been employed to make up the difference in alignment. There are also cracks in the masonry walls visible from inside and outside the building.

Cracks in the masonry walls do not extend through the foundation where the stem wall has nearly 3-feet of exposure near this corner of the building. This indicates the settlement is confined to the floating slab floor not the perimeter foundation. The cracks in the walls, while large, do not appear to be related to the foundation of the building or cause for immediate concern.

It is uncertain if the soil under the floor slab and resultant floor settlement issues are related to unconsolidated fill material, leaking floor drain, high groundwater during a river flooding event, or other unknown factors.

The piping alignment may be related to pressure on the pipe penetration through the floor slab or the well head itself involving the casing surface grout seal and concrete equipment pad supporting the pump plant. Either way something has settled or shifted significantly enough such that piping is out of alignment inside the building. The piping connected to the wellhead has been equipped with a flexible rubber expansion joint to make up the difference in pipe alignments.

Installing a new Well 3 will allow Well 1 to be taken out of service for evaluation and repair or replacement. Evaluation would involve removing the floor slab to find the cause of settlement. Repair would include stabilizing system components to prevent any further settlement if possible.

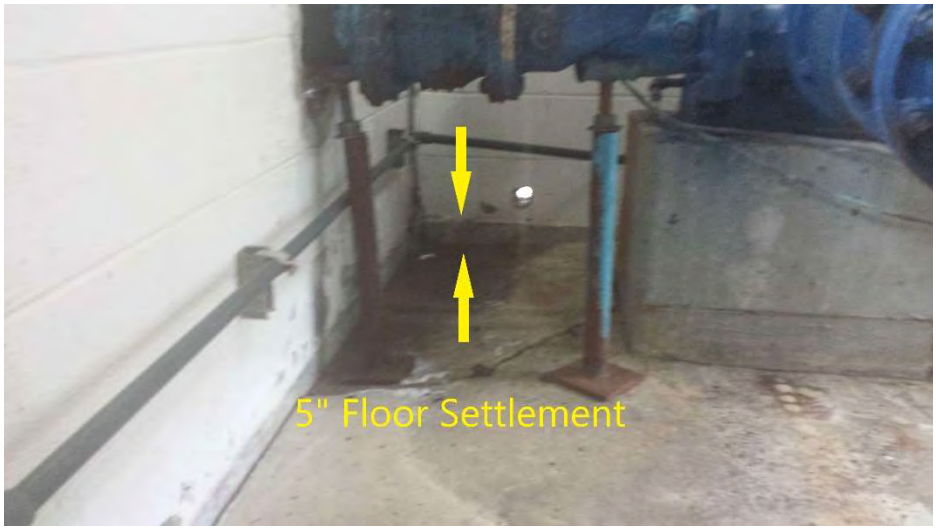


Photo 2. Well 1 Floor Settlement.

7.3 Well 2

The Well 2 building and facilities appear to be in good condition and functioning normally. The Well 2 pumping plant was replaced in 2017 with a new line shaft turbine pump and motor. The pump is a DWT-Line shaft Turbine Pump, Open Line Shaft, 8FDHC/9-Stage, VIT-DITM. The motor is US Motors VHS 40 HP 1800 RPM.

The Well 2 pump plant has a design operating point of 535 gpm at 207 TDH. The pump flow continuously varies with fluctuations in system demand, groundwater elevations, and stored water levels. Under normal operating conditions the pump delivers 590 gpm with the gauge on the discharge pipe measuring 71 psi (164-ft of head).

7.4 Demand verses Production Capacity

The calculated MDD of 1.571 exceeded the measured 1.52 MDD when both pumps were found to be running 24 hours in one day September 8, 2020. This high flow event indicates there were low water levels in the reservoirs for an extended period of time and demonstrates the need for improving the system capacity. The current two well system does not have the capacity to meet existing or future demands at normal reservoir levels. The replacement of Well 1 with Well 3 would meet the current calculated MDD in 24 hours of run time but will not be sufficient to provide these demands within the recommended 18 hours of run time and will not meet the 2040 design year MDD of 1.664 MGD.

Table 8, on the following page, shows that 3 wells, operating at low but reasonable reservoir levels, will meet the design year flows within 18 hours of operation.

Table 8. Design Flows

System Head Pressure		188'	177'	166'
		MGD	MGD	MGD
Wells 1&2	18 hours	1.059	1.113	1.167
	24 hours	1.412	1.484	1.556
Wells 2&3	18 hours	1.202	1.263	1.324
	24 hours	1.602	1.684	1.765
3 Wells	**18 hours**	1.584	**1.665**	1.745
	24 hours	2.112	2.220	2.327
Measured MDD		1.520		
Current Calculated MDD		1.571		
Future Calculated MDD		1.664		
Benefited use MDD		1.732		

1. MGD – million gallons per day
2. MDD – maximum daily demand

8.0 Existing Water Rights

The City of Bay City has a total of three water right permits, which include two surface rights and one reservoir right. A summary of these water rights is presented in Table 9. Copies of water right permits, certificates, and orders are found in appendices.

Table 9. Water Right Summary, City of Bay City

Source	Permit	Cert.	Priority Date	Permitted Rate
Kilchis River	S 43858	---	8/10/1973	20.0 cfs[1] (8,977 gpm[2])
Patterson Creek	R 1287	21584	12/6/1951	3.3 af[3] (1.1 MG[4] Storage)
Patterson Creek	S 20895	21585	5/9/1991	1.0 cfs (449 gpm)

1. cfs – cubic feet per second
2. gpm – gallons per minute
3. af – acre feet
4. MG – million gallons

The point of diversion for Patterson Creek is located about 1/3 mile east north east the corner of 9th and Ocean Streets. This water permit and certificate are for construction of a dam on the creek that would store 1.1 million gallons of water and deliver a peak flow of 449 gpm. Construction of a dam on the creek is in direct conflict with the Patterson Creek fish passage project. See Patterson Creek Water Right with preliminary design plan and profile in Appendix 4.

It is assumed that the Patterson Creek water rights are de facto forfeited to the fish passage project and the only viable option for the City is the Kilchis River.

Currently the City only utilizes the water right on the Kilchis River, however, the full use of this water right has not been certified by the OWRD. The Kilchis River water right permit originally had an October 1, 1981 deadline for full beneficial use; however, this deadline has been extended several times, and the OWRD rules allow for extensions of 40 years or longer.

Current Certificate date is Oct. 1, 2000, and the fish persistence rule was promulgated June 29, 2005. The undeveloped portion of this allocation is 17.32 cfs (~7774 gpm), or a benefited use of 2.68 cfs (1203 gpm). The benefited use appears to be based on two wells pumping at 50% of the well pump test capacity, or 600 gpm per well (2x600=±2.68 cfs).

Wells 1 and 2 were constructed in 1975 and 1981 and the fish persistence rule came into effect in 1999 or 24 years after the City had been utilizing two wells at the same time with an instantaneous peak demand estimated by OWRD to be 2.68 cfs (1203 gpm). This rate is very high but may match what the two wells could do in emergency situations with high groundwater and the system head pressures reduced via high demand and depleted reservoir levels.

See OWRD Extension of Time Review, dated 3/20/2018. "The undeveloped portion of this allocation is 17.32 cfs (~7,774 gpm) or benefited use equal to 2.68 cfs (1,203 gpm).

Table 10. Water Rights Allocation

	(cfs[1])	(gpm[2])	MGD[3]
Permit Allocation	20.0	8,976	12.93
Undeveloped Portion	17.32	7,773	11.19
Benefited Use	**2.68**	**1,203**	**1.73**
Existing Wells 1 & 2 (Combined Flow with Extreme Low System Pressures = 166')	2.41	1,080	1.56
Proposed Wells 2 and 3 (Combined Flow with Low System Pressures = 177')	2.61	1,169	1.68
Proposed Wells 1, 2 and 3 (Combined Flow with Extreme Low System Pressures = 166')	3.91	1,755	2.53
Exceeds Benefited Use			

1. cfs – cubic feet per second
2. gpm – gallons per minute
3. MGD – million gallons per day

Table 10 shows the existing well combined flow of 2.41 cfs during extremely low-pressure conditions is less than the existing water right. Well 2 together with proposed Well 3 will operate under the Benefited Use for all but extreme low-pressure conditions. All three wells running will exceed the Benefited Use portion of the water right under all system conditions (shaded area Table 10 and Table 5). The proposed Well 3 improvement project proposes to operate with Wells 2 and 3 and will be less than the Benefited Use except in these extreme low pressure or emergency situations. Well 1 will be analyzed for repair and used as a backup well for system in stressed or emergency situations.

9.0 Conclusions and Recommendations

Currently the system capacity has been able to keep up with system demand but with periodic undo stress on the system. Two days in a row within the last 5 years the system operated with both wells running over the 18-hour recommended maximum. Operating both existing wells for 24 hours and

21.5 hours the following day, is beyond a safe operating level. While the system should be designed to provide water through reasonable system emergencies and scenarios rather than extreme worst-case scenarios, this recorded incident is an event that the system needs to handle with a reasonable safety factor and keeping pace with demand growth.

As previously noted, intake pumps should be capable of meeting the MDD within 18 hours or less of operation, so improvements to the system need to accommodate the known MDD design scenario and the 20-year projection of that demand, or 1.664 MGD within 18 hours (see Figure 12).

Based on calculations shown in Figure 12 the MDD for the design year over the last 20-years is 1.571 MGD and the projected MDD for the design year is 1.66 MGD.

As a minimum a backup pump is needed as no two wells will be able to produce 1.66 MGD in 18 hours. The two existing well pumps have a combined capacity of approximately 981 gpm (1.06 MGD in 18 hours) under normal pumping conditions.

It is important that the supply system can provide sufficient water to the system during peak demand without tapping into its storage reservoirs. This design year MDD can be met in less than 18-hours of operation with 3 wells running under normal water levels.

10. Alternatives

Two alternatives are considered to increase the capacity of the existing water supply:

Alternative 1 – Develop a New Well 3 and Rehab Well 1

Engineer's Opinion of Probable Cost

	Engineering	Construction	Subtotal
Well 3, Phase 1 Well Casing Installation	$24,400.00	$104,736.00	$129,136.00
Well 3, Phase 2 Well Pump Plant & Site Improvements	$56,400.00	$346,501.25	$402,901.25
Well 1 - Rehabilitation *	$30,000.00	$138,125.00	$168,125.00
Total	$110,800.00	$589,362.25	**$700,162.25**

This alternative will require the following steps for implementation:

a. Submit site plan and elevation views to Tillamook County for land use approval.

b. Complete contract documents for construction of the phase 1 well casing and bid the project.

c. Complete and flow test the new Well 3 to determine the capacity of the new well.

d. Based on capacity of new well, complete the Well 3 phase 2 design for electrical, plumbing, and chemical feed systems and incorporate any comments from Tillamook County in the final plan.

e. Complete Construction contract documents and bid the project for construction.

f. After Well 3 is fully operational, remove collapsed floor around Well 1casing and determine cause of failure if possible.

g. Remove pump and motor and video existing casing to verify no issues with well casing.

h. Evaluate pump plant and casing to determine the cause for gradual loss of flow.

i. If needed, rehabilitate well casing with Hydropuls Technology or other rehab methods.

j. Make necessary repairs to restore floor and piping alignments within well house.

k. Install new pump plant and document new pump flow parameters.
(Note: items a. and b. above can be completed concurrently,
items f.- i. are to be determined through investigation.

Should investigation of Well 1 indicate rehab is not feasible, then consider options or proceed with Alternative 2.

<u>Alternative 2 – Develop New Wells 3 and 4 and Abandon Well 1</u>

Engineer's Opinion of Probable Cost

	Engineering	Construction	Subtotal
Well 3, Phase 1 Well Casing Installation	$24,400.00	$104,736.00	$129,136.00
Well 3, Phase 2 Well Pump Plant & Site Improvements	$56,400.00	$346,501.25	$402,901.25
Well 4	$25,000.00	$451,237.25	$476,237.25
Abandon, Demo Well 1	$1,000.00	$10,000.00	$11,000.00
Total	$106,800.00	$912,474.50	**$1,019,274.50**

This alternative will require the following steps for implementation:

a. Submit Well 4 site plan and elevation views to Tillamook County for land use approval.

b. Complete contract documents for construction of the phase 1 well casing and bid the project.

c. Complete and flow test the new Well 4 to determine the capacity of the new well.

d. Based on capacity of new well, complete the Well 4 phase 2 design for electrical, plumbing, and chemical feed systems and incorporate any comments from Tillamook County in the final plan.

e. Complete Construction contract documents and bid the Well 4 project for construction.

f. After completion of Well 3 and 4 abandon Well 1 as appropriate with the findings of the investigation.

(note items a. and b. above can be completed concurrently)

1

Well Logs

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

TILL 222

State Well No. 1N/9W-33

State Permit No.

RECEIVED
OCT 13 1975
WATER RESOURCES DEPT.
SALEM, OREGON

(1) OWNER:
Name City of Bay City
Address Bay City, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
12 " Diam. from plus 2 ft. to 0 ft. Gage .375
12 " Diam. from 0 ft. to 26 ft. Gage
10 " Diam. from 40 ft. to 46½ ft. Gage .250

(6) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Johnson
Type low carbon steel Model No.
Diam. 10 Slot size 100 Set from 20 ft. to 40 ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller
Yield: 1200 gal./min. with 3 ft. drawdown after 24 hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used cement grout
Well sealed from land surface to 25 ft.
Diameter of well bore to bottom of seal 16 in.
Diameter of well bore below seal 12 in.
Number of sacks of cement used in well seal 6 sack mix sacks
Number of sacks of bentonite used in well seal 0 sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Tillamook Driller's well number
SW ¼ SW ¼ Section 33 T. 1N R. 9W W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 17 ft.
Static level 17 ft. below land surface. Date 9/23/75
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing
Depth drilled 60 ft. Depth of completed well 46½ ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
clay gravel soil brown	0	3	12
sandy gravel gray brown	3	19	12
sand gravel water gray	19	35½	17
clay brown	35½	38½	17
rocky clay brown	38½	42	42
brown weathered rock	42	60	42
hard rock	60	60½	

Work started 9/15/75 19 Completed 9/27/75 19
Date well drilling machine moved off of well 9/27/75 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date 9-30, 1975
Drilling Machine Operator's License No. 213

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Zent Drilling, Inc. (Person, firm or corporation) (Type or print)
Address 7310 St. Johns Vancouver, Wash. 98665
[Signed] (Water Well Contractor)
Contractor's License No. 228 Date 9/30/75, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
SEP 08 1980
WATER RESOURCES DEPT
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

TILL 535

State Well No. 1S/9W-33CC

State Permit No.

(1) OWNER:
Name City of Bay City
Address Bay City, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
( ) ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
12 " Diam. from plus 2 ft. to 21 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Johnson
Type stainless Model No.
Diam. 10"PS Slot size 100 Set from 20 ft. to 40 ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller
Yield: 1000 gal./min. with 3.5 ft. drawdown after 24 hrs.
" " " "
" " " "
iler test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
mperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used cement
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal 16 in.
Diameter of well bore below seal 10 in.
Number of sacks of cement used in well seal 6 sack mix sacks
How was cement grout placed? tremie pipe
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Tillamook Driller's well number
SW ¼ SW ¼ Section 33 T. 1S R. 9 W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 15 ft.
Static level 15 ft. below land surface. Date 5/12/80
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 10
Depth drilled 50 ft. Depth of completed well 50 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
clay sand brown	0	7	0
clay gravel cobbles gray	7	18	15
sand gravel water gray	18	29	15
clay gravel cobbles brown	29	36	15
sand gravel water brown	36	41	15
clay brown	41	43	15
clay gravel brown	43	50	15

RECEIVED
AUG 05 1980
WATER RESOURCES DEPT
SALEM, OREGON

Work started 4/28/80 19 Completed 5/9/80 19
Date well drilling machine moved off of well 5/12/80 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date 5/12/, 19 80
Drilling Machine Operator's License No. 574

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Zent Drilling, Inc. (Person, firm or corporation) (Type or print)
Address 7310 St. Johns Vancouver, Wn. 98665
[Signed] (Water Well Contractor)
Contractor's License No. 228 Date 5/13/80, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

Source Water Assessment

2

Public Health Division
Drinking Water Program
Kate Brown, Governor

Oregon Health Authority

444 A St
Springfield, OR 97477
Phone: (541) 726-2587
Fax: (541) 726-2596

Source Water Assessment Update

To: Kilchis Regional Water Dist
Brian Bettis
PO Box 3309
Bay City, OR 97107

Date: June 27, 2017

Re: Source Water Assessment update: PWS # 4100079 – Kilchis Regional Water Dist

Dear Brian Bettis

The drinking water protection staff of the Oregon Health Authority (OHA) and the Oregon Department of Environmental Quality (DEQ) are pleased to provide you with supplemental Source Water Assessment (SWA) data. Our goal is to provide you and your customers the basic information and resources needed to develop strategies that reduce drinking water contamination risk. Advanced mapping tools and databases were used to identify current land use practices and potential contaminant sources within your mapped Drinking Water Source Area(s). Additional resources are provided to help you identify and implement contamination risk-reduction strategies. OHA staff assembled these materials after a site visit to review potential contaminant sources and obtain feedback regarding the potential contaminant sources of greatest concern to the water system. Based on that visit, we believe the higher priority potential contaminant sources within your drinking water source area are:

- Surface water
- Rural residential land uses

Management Strategies for reducing risks associated with each of these potential contaminant sources are listed in the table immediately following this letter. These include strategies that can be put to use right away. This report also contains:

- A regional map of nearby drinking water source areas that includes other water systems which may have similar potential contaminant source concerns.
- A zoomed in aerial photo basemap of your drinking water source area(s).
- A map showing land ownership/use and potential contaminant sources within your source area(s). We encourage you to use this map to identify nearby land use

authorities and associated potential contaminant sources, as few public water systems have legal jurisdiction over their entire source area(s).
- An inventory table listing the potential contaminant sources (PCSs) identified inside your drinking water source area(s). Using this table in conjunction with the maps will help identify additional potential contaminant sources for risk-reduction strategies.

The appendices include the following drinking water source protection resources:

- **Appendix 1,** a guide for developing and implementing source water protection strategies;
- **Appendix 2,** notes and a key to the Maps and PCS Inventory Table;
- **Appendix 3,** a resource list for water quality, including links to fact sheets;
- **Appendix 4,** funding sources and free or low-cost technical assistance.

This report can be used as a standalone document for drinking water source protection or in conjunction with Source Water Assessment reports previously completed by OHA and DEQ between 1998 and 2005. If available, we encourage you to use the original Source Water Assessment report which contains additional information characterizing well/spring construction, the drinking water source area(s), and susceptibility to potential contaminant sources. Contact OHA at (541) 726-2587 to receive the original SWA Report, or to request a new SWA Report if one was not previously completed.

To further support protection efforts, a statewide Drinking Water Source Protection Resource Guide for groundwater systems is available at: http://www.oregon.gov/deq/wq/programs/Pages/DWP-Source.aspx. For additional assistance regarding drinking water source protection, please contact Tom Pattee at OHA (541) 726-2587 ext.24.

Sincerely,

Gregg Baird
OHA Drinking Water Services

cc: Electronic Source Water Assessment file, Springfield

Management Strategies for High Priority Potential Sources of Pollutants Identified in Kilchis Regional Water Dist Drinking Water Source Area

Contact Drinking Water Protection Staff with questions or for assistance with any potential sources of contamination not identified in this document.

Potential Pollutant Type	***Potential Impact***	***Pollutant Reduction and Outreach Ideas***
Residential lands – private urban or private rural homes	Spills, leaks, or improper handling of chemicals, fuels, wastewater, and other materials may impact drinking water; infiltration containing pesticides or fertilizers may impact drinking water *(Moderate potential risk)*	□ Contact residents (see DEQ drinking water website for example letter) and provide information on their location within your drinking water source area. Outreach can be done through local media or via utility bills. Send (or refer to) relevant fact sheets and web resources from list below. **Fact Sheets/Resources** *DEQ DWP website for Residential/Rural Land Uses (under Management Strategies by Land Use): http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Source.aspx *Groundwater Basics: http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/GroundwaterBasics.pdf *Healthy Lawn, Healthy Environment: https://www.epa.gov/sites/production/files/2014-04/documents/healthy_lawn_healthy_environment.pdf *What is Household Hazardous Waste?: http://www.deq.state.or.us/lq/pubs/docs/sw/hhw/WhatisHHW.pdf *Household Hazardous Waste Program: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/hhw.aspx *Household Pharmaceutical Waste Disposal: http://www.deq.state.or.us/lq/pubs/factsheets/sw/HouseholdPharmaceuticalWasteDisposal.pdf *Groundwater Friendly Gardening Tips: http://wellwater.engr.oregonstate.edu/groundwater-friendly-gardening Additional measures may include: □ Establish ongoing educational program on household hazardous waste and proper disposal of pharmaceuticals, lawn and landscaping, septic system maintenance.
Surface water - Rivers, streams, lakes, ponds, and wetlands in close proximity to wells	Infiltration of surface water into groundwater may carry contaminants such as bacteria, nitrates, metals, or	□ Verify that wells and springs with surface water present within the 2-year Time-of-Travel Zone for wells or within Zone 1 for springs maintain low turbidity and remain e.coli free during and immediately following high rainfall events. □ Consider strategies to improve/protect surface water quality especially within the 2-year Time-of-Travel / Zone 1 area based on aquifer sensitivity and degree of hazard. Strategies may include increased setbacks for

Potential Pollutant Type	*Potential Impact*	*Pollutant Reduction and Outreach Ideas*
	synthetic chemicals to drinking water supply. Water bodies with known impairments/threats are listed on Oregon's 303(d) list available from DEQ. Localized contaminants to surface water / groundwater such as turbidity, bacteria, fuels, pesticides or other chemicals may not be identified by DEQ. *(Higher potential risk)*	chemical use/storage, riparian (river bank) protections to limit turbidity and overland flow, Integrated Pest Management (http://npic.orst.edu/pest/ipm.html), review of septic system operation and maintenance practices, review of recreational activity impacts (i.e. boating, campgrounds, etc.), and review of road maintenance practices. □ Contact DEQ's basin coordinator (http://www.deq.state.or.us/wq/tmdls/docs/basincoordinators.pdf) to inquire about water quality data and the quality of the surface water body. Drinking water protection staff (http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Contacts.aspx) can also help with relevant protection strategies. **Fact Sheets/Resources** *Clean Boater Guide (OSMB): http://www.oregon.gov/OSMB/boater-info/Documents/2015_osmb_clean_boater_guide_forweb.pdf *Clean Marina Program (OSMB): http://www.oregon.gov/OSMB/boater-info/Pages/Clean-Marinas.aspx * DEQ water quality assessment: http://www.oregon.gov/DEQ/wq/Pages/WQ-Assessment.aspx *Riparian Protection (DEQ): https://www.epa.gov/nps/national-management-measures-protect-and-restore-wetlands-and-riparian-areas-abatement-nonpoint *Chemical Storage/Safety and Spill Prevention (EPA) http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_ChemUseSmallQ.pdf If present, see also BMPs for "Septic systems"; "Stormwater Runoff"

Figures List:

Key to Figures[1]

Figure 1: Drinking Water Source Area and Vicinity Map[2]

Figure 2: Drinking Water Source Area Map[3]

Figure 3: Drinking Water Source Area with Land Ownership/Use and Potential Sources of Contaminants Map[4]

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[1] The Key provides legend symbols for the accompanying Figures. More detailed information regarding the Key is also provided in Appendix 2.

[2] The purpose of Figure 1, the Drinking Water Source Area and Vicinity Map, is to show other nearby water systems that may be addressing similar concerns with potential contaminant sources. It is often advantageous for water systems with similar concerns to work together when addressing those concerns.

[3] The purpose of Figure 2, the Drinking Water Source Area Map, is to show an up close map of the drinking water source area for the water system overlain on an aerial photo. The aerial photo can be used to help identify general land use practices such as agriculture, forestry, residential, and/or commercial/industrial areas.

[4]The purpose of Figure 3, Drinking Water Source Area with Land Ownership/Use and Potential Sources of Contaminants Map, is to show the location of potential contaminant sources and land ownership/use within the drinking water source area. Many water systems do not own or have management authority over large portions of their mapped drinking water source area. Therefore, when considering effective drinking water protection measures, it is advantageous to work with private land owners and/or agencies that are responsible for managing land use practices within the drinking water source area.

Additional Drinking Water Source Area Maps with more detail or other mapped features are also available upon request by contacting OHA (541) 726-2587. Detailed or expanded maps may be especially useful in areas where a high density of potential contaminant sources are present.

Key to Figures
Source Water Assessment Update
for public water systems using groundwater

General Legend:

- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source
- City limits (ODOT, 2013)
- County Boundary

Transportation:

- Interstate
- U.S. Routes
- Oregon Routes
- Roads (BLM)
- Railways (USGS - 2009)

Land Ownership/Use:

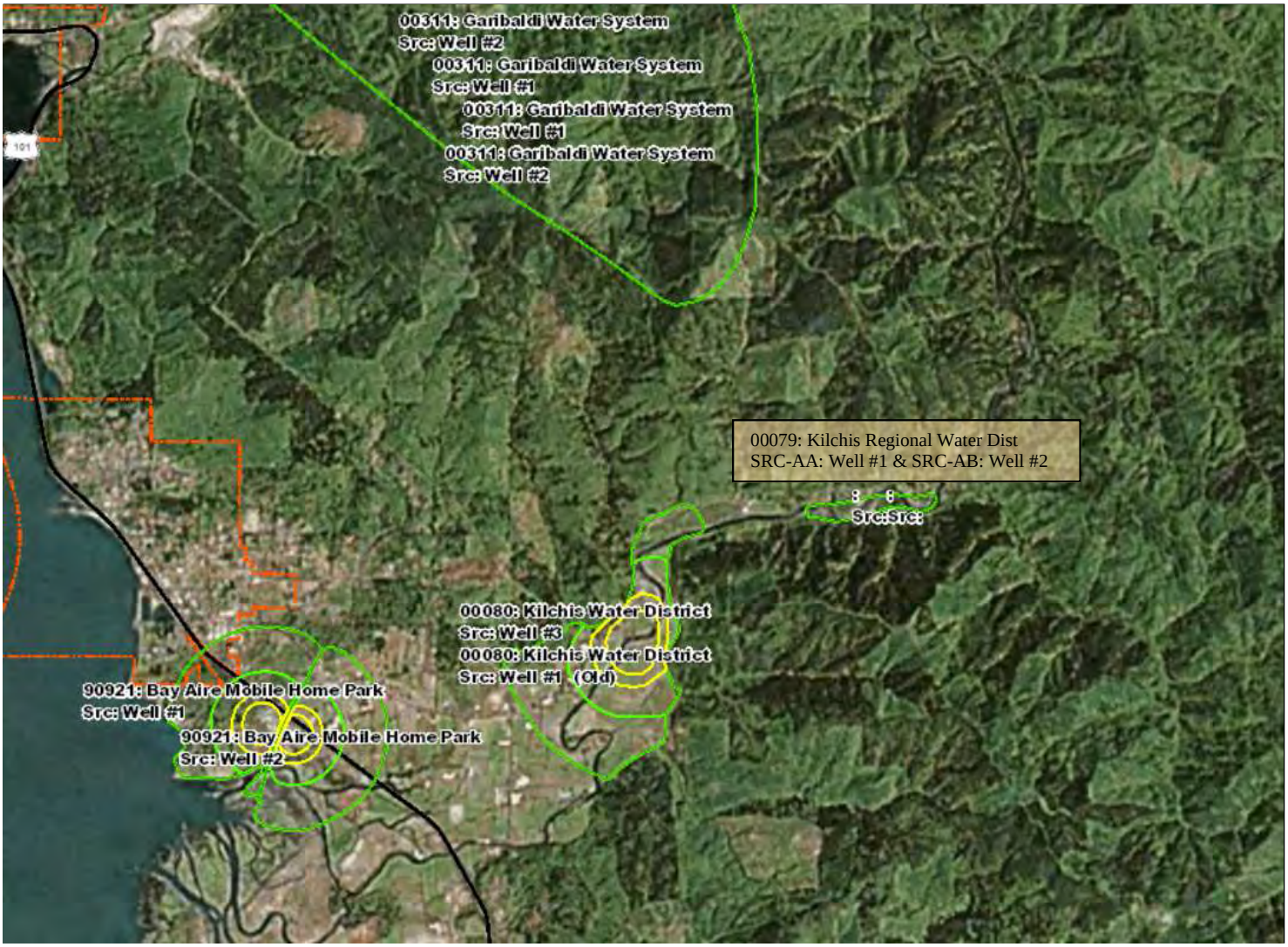
- Private Urban Lands (within city limits)
- Private Rural Lands (private non-industrial outside city limits)
- Agriculture (Ag Zoning (BLM) and NASS 2013)
- Private Industrial Forests (ODF data); Lands Managed by Private Industry (BLM)
- Local Government
- State Dept. of Forestry
- State - Other
- Bureau of Land Management
- U.S. Forest Service
- Federal - Other
- Bonneville Power
- Bureau of Indian
- Undetermined
- Water

Potential Sources of Pollutants identified in State and Federal Regulatory Databases:

- Confined Animal Feeding Operations (ODA as of 2016)
- Dry Cleaner, Active (DEQ as of 2015)
- Dry Cleaner, Dry Store (DEQ as of 2015)
- Dry Cleaner, Closed (DEQ as of 2015)
- Dry Cleaner, Inactive (DEQ as of 2015)
- Dry Cleaner, Solvent Supplier (DEQ as of 2015)
- Environmental cleanup site with known contamination (DEQ as of 01/2016)
- Environmental cleanup site No Further Action required or otherwise lower risk (DEQ as of 01/2016)
- Hazardous Material Large Quantity Generator (DEQ - HW as of 1/02/2016)
- Hazardous Material Small Quantity or Conditionally Exempt Generator (DEQ - HW as of 1/02/2016)
- Hazardous Material Transport, Storage, and Disposal sites (DEQ - HW as of 1/2016)
- Hazardous Substance Information System (OSFM as of 2009)
- Hazardous Substance Information System - AST (OSFM as of 2009)
- Leaking underground storage tank - Confirmed (DEQ as of 9/2012) (Locaton will likely need verification.)
- Leaking underground storage tank with No Further Action required or otherwise lower risk (DEQ as of 9/2015) (Location will likely need verification.)
- Mining permits (DOGAMI as of 1/16/2014)
- Oil and Gas wells (permitted only) (DOGAMI as of 7/2016)
- Original Source Water Assessment Potential Contaminant Source - Area-wide source (DEQ as of 2005)
- Original Source Water Assessment Potential Contaminant Source - Point source (DEQ as of 2005)
- Other Source Water Assessment Potential Contaminant Source - SWA Update (OHA/DEQ as of 2016)
- School Locations OR (DHS as of 2015)
- Solid Waste sites (DEQ - SW as of 1/25/2016)
- Underground Injection Control - Stormwater (UIC - DEQ as of 91/12/2016)
- Underground Injection Control - Non-stormwater (UIC - DEQ as of 91/12/2016)
- Underground Storage Tanks (DEQ as of 1/25/2016) (Location will likely need verificaton.)
- Water Quality domestic wastewater treatment sites (DEQ - SIS as of 1/25/2016)
- Water Quality permits (DEQ - SIS as of 1/25/2016)

Potential sources of pollution: The inventory of potential sources of pollution is based on readily-available state and federal regulatory databases. The primary intent is to identify and locate significant potential sources of contaminants of concern. Non-regulated and non-point sources such as areas with agricultural, septic systems, or managed forests are generally not identified in the regulated databases but are presented in the figures as a factor of land ownership/use. It is important to remember that the sites and areas identified are only potential sources of contamination to the drinking water. Water quality impacts are not likely to occur when contaminants are used and managed properly and land use activities occur in such a way as to minimize contaminant releases. It is highly recommended that the community "enhance" or refine the delineation of the sensitive areas and the identification of the potential contamination sources through further research and local input. If there were no potential sources of contamination identified during the review of regulatory databases or community's enhanced inventory, the water system and community should consider the potential for future development to impact the source water.

Figure 1
Kilchis Regional Water Dist, (PWS #4100079)
Drinking Water Source Area and Vicinity



This map is provided to assist public water systems and their communities identify other local water systems that may have common concerns. It may be beneficial for communities with similar risks or concerns to develop place-based planning with collaborative partnerships to implement priority actions for risk reduction.

Legend

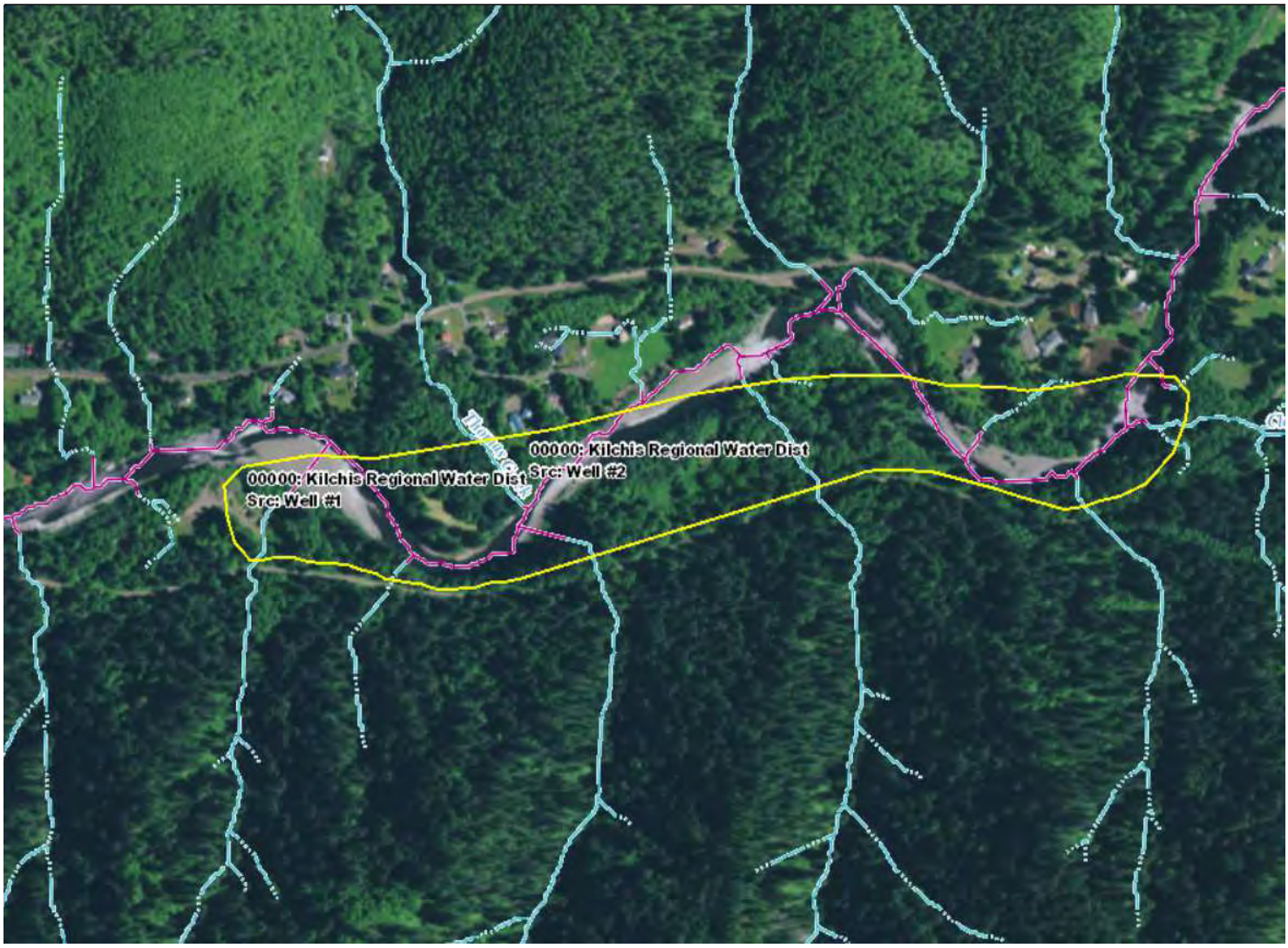
- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source Area
- Surface Water Drinking Water Source Area
- City limits (ODOT, 2013)
- County Boundary

N
W E
S

This product is for informational purposes and may not have be prepared for, or be suitable for legal, engineering or surveying purposes. Users of this information should review of consult the primary data and information sources to ascertain the usability of the information.

Prepared by: Gregg Baird – 6/29/2017

Figure 2
Kilchis Regional Water Dist, (PWS #4100079)
Drinking Water Source Area



Legend

- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source Area
- City limits (ODOT, 2013)
- Streams
- Waterbodies

See original Source Water Assessment for information on delineation method and aquifer/well parameters. If a copy of the Source Water Assessment is needed contact Oregon Health Authority Drinking Water Services at (541) 726-2587.

N
W E
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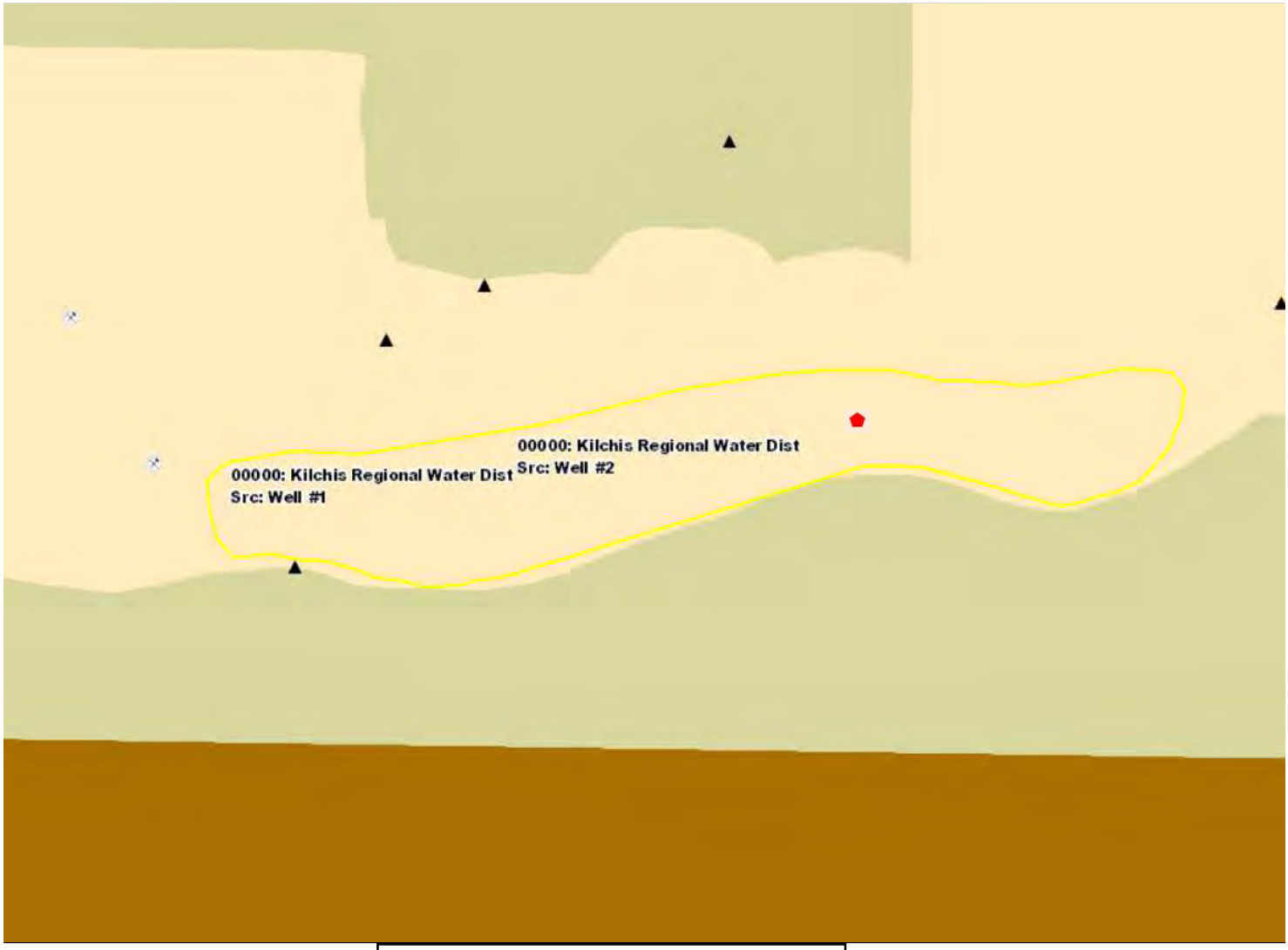
This product is for informational purposes and may not have be prepared for, or be suitable for legal, engineering or surveying purposes. Users of this information should review of consult the primary data and information sources to ascertain the usability of the information.

Prepared by: Gregg Baird – 6/29/2017

Figure 3
Kilchis Regional Water Dist, (PWS #4100079)
Drinking Water Source Area with Land Ownership/Use and Potential Sources of Contamination



Legend:

- Groundwater drinking water source area 2-year time-of-travel (Zone 1 for springs)
- Groundwater drinking water source area
- City limits (ODOT, 2016)
- County Boundary
- Interstate
- U.S. Routes
- Oregon Routes
- Roads (BLM)
- Railways (USGS - 2009)
- Potential Contaminant Source - 2016 Site Visit (see Table 1)

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Key to land ownership/use. Not all may be present in mapped area:

- Private Urban Lands (within city limits)
- Private Rural Lands (private non-industrial outside city limits)
- Agriculture (Ag Zoning (BLM) and NASS 2013)
- Private Industrial Forests (ODF data); Lands Managed by Private Industry (BLM)
- Local Government
- State Dept. of Forestry
- State - Other
- Bureau of Land Management
- U.S. Forest Service
- Federal - Other
- Bonneville Power
- Bureau of Indian
- Undetermined
- Water

N W E S

Notes:

See Key for Figures for symbol key to potential sources of pollution identified on regulatory databases. Additional information also provided in Appendix 2.

Due to limitations for locational data, some mapped locations will need further research to verify presence and location.

Additional detailed maps can be provided for areas where a high density of potential contaminant sources are present.

This product is for informational purposes and may not have be prepared for, or be suitable for legal, engineering or surveying purposes. Users of this information should review of consult the primary data and information sources to ascertain the usability of the information.

	Table 1: Inventory of Potential Sources of Pollution as identified in readily accessible state and federal databases and GIS layers **Source Water Assessment Addendum** *see Appendix 2 for Key to Tables for Notes and Descriptions of Acronyms*	**PWS Name:**	**Kilchis Regional Water Dist**
		PWS Number:	**4100079**

This information supplements the Original Source Water Assessment Inventory dated between 1998 and 2005 and should be used in conjunction with the original inventory to provide a more detailed analysis of potential sources of pollution. Note that due to limitations for locational data in state databases, some locations will need further research to verify presence and location.

Primary Land Ownership/Use(s)	**Data Source**
Private Rural Lands (private non-industrial outside city limits)	Land use map - Figure 3

Other potential sources of pollution identified based on aerial photographs, topographic maps or local knowledge.

Name	Address/location	City	County	Data Source
Surface water (Kilchis River)	Throughout DWSA	Tillamook	Tillamook	Aerial photo

Regulatory Database Results - State and Federal

Database Identifier (DB_ID)	Site Identifier (Site_ID)	Status	Common Name	Address	City	County	Retrieval Date (RET_DATE)	Data Source
None identified								

Appendix #1

Developing Strategies For Drinking Water Protection

The Oregon Health Authority has implemented measures that will provide Source Water Assessment updates to many groundwater systems. Our top priority are new Community and Non-Transient Non-Community water systems and systems that have added a new water source since their original source water assessment was completed. These updates provide more up to date information on the potential contaminant sources and land use practices within the drinking water source area(s) that supply their drinking water. Public water systems and local communities can use the information contained in the Source Water Assessment update to voluntarily develop and implement drinking water protection strategies.

Public water system monitoring and treatment requirements help assure safe drinking water however, all water systems are susceptible to potential contamination. **Developing local strategies designed to protect against potential contamination is one of the best ways to ensure safe drinking water and minimize future treatment costs**. Strategy development adds a margin of safety, raises community awareness of drinking water contamination risks, and provides information about how communities and local land owners can help protect their drinking water sources.

Using Place-Based Planning to Develop Protection Strategies

The drinking water source area for most communities lies partially, if not entirely, outside of their jurisdiction and may include several different governing agencies as well as a diverse mix of landowners, businesses, and residents. When developing protection strategies, DEQ and OHA highly recommend that the water system and community involve potentially affected stakeholders early in the process to foster stakeholder awareness and trust in the resulting strategies.

Oregon adopted an "Integrated Water Resources Strategy (IWRS)" in 2012 that provides recommendations for how to do a place-based and integrated approach to water resources planning. This approach helps communities achieve the level of coordination and collaboration to successfully address local water quality and water quantity challenges, such as developing and implementing strategies to protect their drinking water sources. The IWRS Place-Based Planning guidelines describe elements to consider for building a collaborative process, characterizing water-related issues, quantifying existing and future water needs, developing a suite of solutions, and adopting and implementing the plan. More information about the process can be found in this Water Resources Department document:
http://www.oregon.gov/owrd/LAW/docs/IWRS/2015_February_Draft_Place_Based_Guidelines.pdf

Strategies to Achieve Risk Reduction

The primary goal of any drinking water protection strategy should be to reduce or minimize the risk of source water contamination. It is unlikely that one can eliminate all risks in an area, but by applying one or more protection strategies, a community can reduce the likelihood of pollutants affecting the water supply in the future. Potential strategies include both general management practices such as conservation or efficiency measures that would apply to the entire drinking water source area and specific management practices that can be applied most appropriately by land-use category (commercial/industrial, agricultural/rural, forestry, residential/municipal, and miscellaneous). The following list provides some of the most common management options as an example to public water systems and their communities:

Oregon Health Authority
Drinking Water Services
444 A Street
Springfield, OR 97477
Phone: (541) 726-2587
Fax: (541) 726-2596
Contact: Tom Pattee

State of Oregon
Department of Environmental Quality

Environmental Solutions Division
Drinking Water Protection
811 SW 6th Ave.
Portland, OR 97204
Phone: (503) 229-5413
(800) 452-4011
Fax: (503) 229-5408
Contact: Sheree Stewart
http://www.oregon.gov/DEQ/wq/programs/Pages/DWP.aspx

Alternative formats
Alternative formats of this document can be made available. Contact OHA DWS, Springfield, at (541) 726-2587

Last Updated 1/25/17
By: Tom Pattee

Example Strategies for Drinking Water Protection

Non-Regulatory Options
Notify and Educate the Public: Contact property owners within the protection area so they are aware of the need for protection measures. Let them know this is voluntary. Focus educational efforts on basic information about the source water and the relationship between surface activities and the water quality; familiarity with the location of the protected area; basic information on sources of contamination; and effective strategies for safe management of all potential contaminants. Public education/notification can be accomplished using local news media outlets, letters to residents, letters to land owners/operators, and bill stuffers/customer mailings. Information signs could be placed adjacent to roadways entering the protection area. Include on the sign the name of the water system/jurisdiction and a phone number where callers can obtain more information or report spills.
Use Technical Assistance Resources: Work with local or state providers of technical assistance (e.g., DEQ's regional offices, Soil and Water Conservation Districts, OSU Extension) to encourage the use of best management practices for pollution prevention and waste reduction. Apply for grants or funding to provide financial incentives such as pollution prevention tax credits, low-interest loans or direct subsidies/cost sharing. Provide recognition for environmental friendly businesses and operations (e.g., green awards, plaques/door signs).
Sponsor Hazardous Waste/Unused Chemical Collection: Establishing a permanent location or holding one-day events to collect hazardous wastes from community residents (including households and small businesses) is an effective way to reduce risks posed by storing hazardous wastes or other chemicals within the protection area. Hold an amnesty (free disposal) event for unused business or agricultural chemicals stored in the protection area. Set up a local materials exchange program (or publicize existing programs).
Develop Spill Response Plans: Encourage and assist your local fire department and transportation department with spill response planning. Jurisdictions within protection areas could develop specific spill response procedures to allow quicker response and notifications should a hazardous material spill or release occur. These can be integrated into your county's Emergency Management Plan. Contact the Oregon Department of Transportation (ODOT) for state highways.
Acquire Land or Rights to Development: Community ownership and management of as much of the critical land areas within the protection area for water quality protection provides some of the best assurance of long-term protection of the public water supply. Protection could be provided by ownership accomplished through methods such as capital or bond fund programs, or through easements and deed restrictions. Private non-profit land conservation organizations or local land trusts in your area can assist you in acquiring land within your protection area by conveyance to a trust, seeking donations, or direct land purchases for conservation.
Local Regulatory Options
Existing Regulations and Permits: Take advantage of opportunities to provide public comment and input when existing regulatory programs are reviewing permits or programs which affect the siting, design, construction, operation or closure of facilities within your protection area. Ensure you are included on regulatory agency contact lists so that you receive announcements for public involvement opportunities. Consider participating in advisory group meetings for specific topics of interest. Ensure that the regulatory programs are aware of your protection area and request that compliance inspections or technical assistance is prioritized in critical areas.
Land Use Controls (Zoning/Health Ordinances): There are many different types of zoning tools. Your community can identify the protection area with an overlay map and enact specific requirements for land uses and development within these boundaries in order to protect public health. Ordinances applying to sites that pose a risk to water quality within the overlay area may include prohibition of various land uses (such as landfills or underground fuel storage tanks); subdivision controls (such as limiting density or requiring larger lot sizes); special permitting or siting requirements (i.e. placing limitations on the use of toxic and hazardous materials, pesticides, salts); and performance standards (i.e. requiring secondary containment for petroleum or chemical storage over a certain volume).

How do communities use the Updated Source Water Assessments?

The updated Source Water Assessment data provides additional information for developing local protection strategies. The Update includes details characterizing the drinking water source area and potential source water risks. When used in combination with a Source Water Assessment Report, it also provides key information that will allow the community to focus limited resources on highly sensitive areas within the drinking water source area(s). The information contained in both reports should be supplemented with local knowledge of the water system and community. The water system and community can refine the drinking water source area(s) and potential contaminant source inventory through further research, local input, and coordination with state and local agencies.

Characterization of the drinking water source area(s) should be reviewed to clarify the presence, location, operational practices, and actual risks of the identified facilities and land-use activities. Additional potential contaminant sources or sensitive areas may also be added based on local knowledge or additional research. Potential contaminant sources with low or no risk (such as land owners who have already incorporated best management practices into their operations to protect your drinking water source) can be screened out or selected for low priority outreach or technical assistance. Local and state resources can then be directed to the highest priority potential problems in the drinking water source area.

This information is also useful in developing a water system Contingency Plan. Contingency planning focuses on potential threats to the drinking water supply (such as mechanical problems, chemical detections, chemical spills, or natural disasters) and the development of procedures to be followed should these events occur. Guidance for preparing a contingency plan and examples are available from OHA. Many contingency plan elements may have already been completed by public water systems as part of their required Emergency Response Plan. Additional elements can be added as drinking water source protection strategies are developed.

Public water systems may also find it necessary, as a result of either existing or projected increased demand, to explore the development of additional drinking water sources. Drinking water source protection provides a mechanism that can be used to help select the best site and identify areas that could be protected so they will provide quality drinking water in the future. Additionally, development of a new groundwater source in the vicinity of an existing source may change the movement of groundwater in the subsurface, triggering a needed modification changing the shape and orientation of existing drinking water source areas. Evaluation of the significance of those changes should be addressed in the protection planning process to ensure the management strategy in place will continue to protect the community's drinking water supply.

Need assistance?

Drinking water source protection is already at work in Oregon. A number of Oregon communities are currently developing and implementing strategies to protect their drinking water source areas. Successful drinking water protection plans developed in Oregon are available to communities as templates or examples. Staff members at OHA and DEQ are available to provide assistance, and extensive written materials are available to local community groups or consultants to assist in developing drinking water protection plans or strategies.

Detailed information about developing drinking water source protection strategies can be found on DEQ's Drinking Water Protection Program website. The website also includes Updated Source Water Assessment methods and results, sample Drinking Water Protection Plans, information for schools, and links to many other useful sites:
http://www.oregon.gov/DEQ/wq/programs/Pages/DWP.aspx

The OHA – Drinking Water Program website includes system characteristics, monitoring data, contacts for all public water systems in Oregon, drinking water standards, fact sheets on contaminants, information on the Safe Drinking Water Revolving Loan Fund and Drinking Water Source Protection Grants, Consumer Confidence Reports, and more: http://www.healthoregon.org/dwp

Water systems or community members interested in developing drinking water protection strategies should contact the respective DEQ and OHA coordinators. Those systems using surface water sources should initially contact Sheree Stewart, Drinking Water Protection Program Coordinator, DEQ, Portland, (503) 229-5413. Groundwater-based water systems should initially contact Tom Pattee, Groundwater Coordinator, OHA, Springfield, (541) 726-2587 x24. As the state moves further into the protection phase of the Oregon program, DEQ and OHA will be able to direct individual requests for assistance to specific staff trained and experienced in that area, both within the state agencies and in other partner organizations.

Appendix # 2

Notes for Figures and Tables
Source Water Assessment Update

Land Ownership/Use

The dataset is a combination of multiple datasets and was developed by DEQ in 02/2015. The primary dataset is from Bureau of Land Management BLM (OWNERSHIP_POLY.shp dated 06/20/2013) obtained from BLM at: http://www.blm.gov/or/gis/data-details.php?id=425. Publication date: 20130718. The dataset has been modified by grouping land owner categories in order to simplify data display on the map and using geospatial techniques to add additional data to capture the following land uses:

- agricultural land using a combination of the National Agricultural Statistics Service (NASS) data from Natural Resource Conservation Service (2007 " cdl_awifs_r_or_2007.tif") and agricultural land zoning from OR Dept. of Land Conservation and Development (note that public water systems may obtain more detailed information on potential crop types using the US Department of Agriculture National Agricultural Statistics Service "CropScape-cropland data layer." Available at https://nassgeodata.gmu.edu/CropScape/),
- private industrial forests using Oregon Dept. of Forestry's (ODF) "Private_Industrial_2006_ORLambert.shp" last updated in 2013,
- local government land combined from BLM ownership, tax lot ownership information from local county tax lot data and "OR Map" on-line application: http://www.ormap.net/, and
- all other categories (BLM, USFS, State, etc) from BLM 06202013 data. Note that Private Non-Industrial/Urban includes residential, municipal, commercial, industrial, and rural residential land uses.

Because of the nature of combining multiple datasets, minor discrepancies will be seen in some maps especially at larger scales. Public water systems and communities could use tax lot data available from the counties or other datasets to further refine the analysis if higher accuracy is needed.

Inventory of Potential Sources of Pollution

This information is intended to supplement the original Source Water Assessment completed for most water systems between 1998 and 2005 by DEQ and Oregon Health Authority. **This update should be used in conjunction with the original inventory.** DEQ and OHA can provide more information on potential impact, risk and status as the public water system moves into developing protection strategies.

The inventory of potential sources of pollution is based on the readily-available state and federal regulatory databases listed below and general categories of land use/ownership. The primary intent is to identify and locate significant potential sources of contaminants of concern. Non-regulated and non-point sources such as areas with agricultural, septic systems, or managed forests are generally not identified in the regulated databases but are presented in the figures as a factor of land ownership/use.

It is important to remember that the sites and areas identified are only potential sources of contamination to the drinking water. Water quality impacts are not likely to occur when contaminants are used and managed properly and land use activities occur in such a way as to minimize erosion and contaminant releases.

It is highly recommended that the community "enhance" or refine the delineation of the sensitive areas and the identification of the potential contamination sources through further research and local input. If there were no potential sources of contamination identified during the review of regulatory databases or community's enhanced inventory, the water system and community should consider the potential for future development to impact the source water.

Appendix # 2

Notes for Figures and Tables
Source Water Assessment Update

Table 1 Header	Description
Database Identifier (DB_ID)	Database Type and site name for identified potential pollutant
Site Identifier (Site ID)	Program specific identifier. This is the number or name used to look the site up in the programs regulatory database.
Status	Select information on the site that helps to evaluate potential risk to water quality
Common Name, Address, City	Common Name, Address, and City as listed in the regulatory database. Note that some sites may have addresses associated with responsible party, not the physical location of the site.
County	County site is located in
Retrieval Date (Ret_Date)	Date the information was retrieved from the individual programs regulatory database
Data Source	Source for geographic information system (GIS) data
State and Federal Regulatory Database Information	
CAFO 	Oregon Department of Agriculture's Confined Animal Feeding Operation database of livestock owners. Includes permitted, non-permitted, and applications. Status indicates facility designation and animal type. Permits typically address conditions for animal waste management. More information at http://www.oregon.gov/ODA/programs/NaturalResources/Pages/CAFO.aspx
DC  Active  Dry Store  Closed  Inactive  Solvent Supplier	DEQ Dry Cleaner: Status indicates Facility type and information on historic and current solvent use: Facility Type: *Dry Cleaner* - currently active *Dry Store*: current 'dry store': pickup and drop off point that does not have a dry cleaning machine on site. These sites may still pose a risk as the industry has consolidated over past decades, so many of these used to be dry cleaners and may have contamination. *Closed site:* There is no longer a dry cleaner or dry store on site, and the site has not opted to stay in the program as 'inactive'. Note that when a site changes ownership, the old Dry Cleaner ID (DCID) may be identified as Closed and a new dry cleaner record may be added for the new owner resulting in the potential for an address to have more than one status *Listed Inactive:* Site is no longer a dry cleaner or dry store but the property owner or former operator has opted to continue paying dry cleaner program fees in order to maintain their liability protection & cleanup coverage. *Solvent Supplier:* This may be a chemical supply businesses or individual dry cleaner that imports their own solvent from out-of-state SolventBefore1998: true if dry cleaning solvent was used at this site prior to spill prevention regulations that came in around 1998. If this field is true, there's a higher likelihood that there may be contamination on site. PercUseOngoing: true if perchloroethylene solvent is currently used at the site.
DOGAMI 	Oregon Department of Geology and Mineral Industries list of mining sites. Status includes permit status and primary material extracted.
DWP-PCSs  area wide  point source	Potential sources of contamination (PCS) identified by the DEQ and Oregon Health Authority drinking water protection (DWP) program in the original source water assessments completed between 1998 and 2005. Status includes DEQ's potential contaminant source Code (i.e. M31 or R15), Source type (P= point source, A=Area wide source) and a description of the land use type. Note that sources classified as "Area-wide" were marked at a point on the map closest to the intake, well or spring. Additional detailed maps can be provided upon request for source areas where DWP PCSs are not shown on maps to improve map clarity.
DWP-PCS (update) 	Potential sources of contamination (PCS) identified by the OHA or DEQ in the Source Water Assessment updates completed in 2016 and 2017. May include information from interviews with public water system operators, field visits, aerial photograph or topographic map review.
ECSI 	DEQ Environmental Cleanup Site Information database. Includes the U.S. EPA National Priorities List (NPL) and the U.S. EPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLA) list. Includes sites where further assessment or action is needed. More information available at http://www.oregon.gov/DEQ/Hazards-and-Cleanup/env-cleanup/Pages/ecsi.aspx

Appendix # 2

Notes for Figures and Tables
Source Water Assessment Update

ECSI-NFA 	DEQ Environmental Cleanup Site Information database site where no further action (NFA) is required. Public water system may consider verifying with DEQ that standards used during site investigation were protective of drinking water.
HW  LQG  SQG or CEG	DEQ Hazardous Waste generators that submit an annual report to DEQ. This list includes active facilities in HazWaste.NET (http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/HW-Reporting.aspx). Status includes information on generator size including LQG (Large Quantity Generator), SQG (Small Quantity Generator), CEG (Conditionally Exempt Generator), and Unknown (may be used oil or universal waste activities or old generators that require further assessment.
HW/TSD 	DEQ Hazardous Waste Program registered sites that treat, store or dispose of hazardous waste. Includes both active and inactive sites in the process of closing or in post-closure care that are registered in HazWaste.NET (http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/HW-Reporting.aspx).
LUST 	DEQ leaking underground storage tank (LUST) list - includes sites that have reported releases from petroleum-containing underground storage tanks, including residential heating oil tanks, regulated tanks at gas stations and other commercial facilities, and non-regulated tanks.
LUST-NFA 	DEQ leaking underground storage tank (LUST) list where no further action (NFA) is required or cleanup is completed. PWS may consider verifying with DEQ that standards used during site investigation were protective of drinking water. Additional detailed maps can be provided upon request for source areas where DWP PCSs are not shown on maps to improve map clarity.
Oil & Gas Well	Oil and Gas wells from OR Department of Geology and Mineral Industries. Only includes wells with a status of "permitted".
HSIS-AST 	Aboveground storage tank(s) as identified in the State Fire Marshall Hazardous Material Information System (HMIS) site list. Aboveground tanks storing gas products were not included since gaseous compounds rarely pose a threat to surface water or groundwater. Additional information on material stored and tank size is available upon request.
SFM (HSIS) 	State Fire Marshall Hazardous Material Information System (HMIS) site list. Status indicates site type (based on NAICS North American Industry Classification System code) and number of different chemicals stored on site. A full list of chemicals with information on storage type and a range of amounts is available on request. Information on materials in a gas-form was not included in the chemical counts since gaseous compounds rarely pose a threat to surface water or groundwater.
School 	School as identified by Department of Human Services. Further evaluation may be needed to identify if school has onsite/septic system, pesticide use, chemistry lab, vehicle maintenance, or other potential contaminant sources.
SW 	DEQ Active Solid Waste Disposal Permits list. Status includes permit type and activity (active, terminated, closure, pending). May include the following facility types: landfill, solidwaste treatment, transfer station/material recovery, composting, incineration, conversion tech., and energy recovery.
UIC – Stormwater 	DEQ Underground Injection Control (UIC) list of facilities with registered underground injection control systems that manage Stormwater. Status includes type and number of UIC wells registered.
UIC – Non-Stormwater 	DEQ Underground Injection Control (UIC) list of facilities with registered underground injection control systems that do not manage stormwater. Includes type and number of UIC wells registered.
UST 	DEQ registered underground storage tank (UST) list. Details on number of tanks that are upgraded to current standards, decommissioned, and with unknown status that require further assessment.
WQ SIS 	DEQ Site Information System (SIS) which includes Water Pollution Control Facility (WPCF) permits where discharge to surface water is not allowed and National Pollutant Discharge Elimination System (NPDES) permits for "point source" discharges into surface water. Includes both individual permits (site specific) and general permits covering a category of similar discharges
WQ SIS-WWTP 	Subset of water quality Site Information System (SIS) for domestic wastewater treatment plants that discharge to surface water
Transportation Sources	
Interstate/Highway Interstate U.S. Roads Oregon Routes	Oregon Department of Transportation interstate, highway, road, or route identified in the Integrated Transportation Information System database.
Roads	Oregon Department of Transportation 2012 Roads layer - note roads are usually mapped by section so there will be many duplications of road names.
Railways	Railways

Appendix #3

Technical Information and Factsheets for Water Quality

PLEASE NOTE: The Internet URL Addresses listed in this document were included as a convenience for the users of this document. All URL Addresses were functional at the time this publication was last updated (January 2017). For active links, this list is located at http://www.oregon.gov/deq/wq/programs/Pages/DWP-Source.aspx

General Water Quality Information	
Handbook for Developing Watershed Plans to Restore and Protect Our Waters (EPA)	https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/handbook-developing-watershed-plans-restore-and-protect
Water Quality Model Code and Guidebook (DLCD)	http://www.oregon.gov/LCD/pages/waterqualitygb.aspx
DEQ Toxics Reduction Strategy	http://www.deq.state.or.us/toxics/docs/ToxicsStrategyNov28.pdf
Oregon's Groundwater Protection Program – who does what? (DEQ)	http://www.oregon.gov/DEQ/wq/programs/Pages/GWP-about.aspx
Groundwater Basics for Drinking Water Protection (DEQ)	http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/GroundwaterBasics.pdf
Protecting Oregon's Groundwater from Contamination (OSU)	http://groundwater.orst.edu/groundwater/
Oregon Climate Change Research Institute	http://occri.net/
Climate Impacts in the Northwest (EPA)	http://www3.epa.gov/climatechange/impacts/northwest.html
Climate science, data, tools, and information (NOAA)	http://www.noaa.gov/climate.html
Harmful Algae Blooms (OHA) FAQs, guidelines for lake managers and outreach materials	https://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/index.aspx
Harmful Algal Blooms (DEQ) - agency strategy, actions to control/eliminate & prevention	http://www.oregon.gov/DEQ/wq/Pages/Harmful-Algal-Blooms.aspx
Residential Areas, Parks and Golf Courses	
Domestic Well Safety Program (OHA) – Resources and contacts for domestic/private wells	http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/SourceWater/DomesticWellSafety/Pages/index.aspx
Well Water Program (OSU)- tech. assistance for domestic/private wells & septic systems	http://wellwater.oregonstate.edu/
Oregon's Domestic Well Testing Program for Real Estate Transactions	http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/SourceWater/DomesticWellSafety/Pages/Testing-Regulations.aspx
After You Buy: Wells, Septic Systems, and a Healthy Homesite (NRCS)	http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_042403.pdf
Household Hazardous Waste Program website (DEQ)	http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/hhw.aspx
Household Hazardous Waste - locally-sponsored and county collection programs	http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/HHW-Events.aspx and http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/HHW-by-County.aspx

Residential Areas, Parks and Golf Courses (cont.)	
Household Pharmaceutical Waste Disposal (OHA)	https://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/SourceWater/Pages/takeback.aspx
Household Hazardous Wastes (EPA)	https://www.epa.gov/hw/household-hazardous-waste-hhw
Recycle Used Motor Oil Resources (EPA)	https://www.epa.gov/recycle/managing-reusing-and-recycling-used-oil
Frequently Asked Questions About Heating Oil Tanks (DEQ)	http://www.oregon.gov/DEQ/tanks/Pages/hot.aspx
Proper Care/Maintenance of Heating Oil and Other Unregulated Tank Systems	http://www.deq.state.or.us/lq/pubs/factsheets/tanks/hot/ProperCareMaintenance.pdf
Oregon resources for on-site septic systems (DEQ)	http://www.oregon.gov/deq/Residential/Pages/Septic-Smart.aspx
Oregon's Onsite Wastewater Management Program (Septic Systems) (DEQ)	http://www.oregon.gov/DEQ/Residential/Pages/Onsite.aspx
Local Outreach Toolkit for Septic Systems (EPA)	https://www.epa.gov/septic/septic-systems-outreach-toolkit
A Homeowners Guide to Septic Systems (EPA)	http://www.nesc.wvu.edu/pdf/ww/septic/epa_septic_guide.pdf
Septic Tank Maintenance (DEQ)	http://www.deq.state.or.us/wq/pubs/factsheets/onsite/septictankmaint.pdf
Septic Systems OSU Extension website (OSU)	http://wellwater.oregonstate.edu/septic-systems-0
Groundwater protection and your septic system (National Small Flows Clearinghouse)	http://www.nesc.wvu.edu/pdf/ww/septic/septic_tank3.pdf
Combating Illegal Dumping (DEQ)	http://www.oregon.gov/DEQ/mm/Pages/Illegal-Dumping.aspx and http://www.oregon.gov/DEQ/mm/Pages/Illegal-Dumping-Clean-Up.aspx
Water Well Owner's Handbook & other related guidance documents (WRD)	http://www.oregon.gov/owrd/pages/pubs/index.aspx
Oregon Water Resources Department	http://egov.oregon.gov/OWRD/
Disposal of Chlorinated Water from Swimming Pools and Hot Tubs (DEQ)	http://www.deq.state.or.us/wq/pubs/factsheets/wastewater/bmpchlorwaterdisp.pdf
Source Water Protection Publications (EPA) for managing various including: Septic Systems Turfgrass and Garden Fertilizer Application Small-Scale Application of Pesticides Small Quantity Chemical Use Pet and Wildlife Waste Storm Water Runoff	http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Pubs.aspx
Integrated Plant Protection Center (OSU)	http://ipmnet.org/
National Pesticide Information Center	http://npic.orst.edu/
Integrated Pest Management and Pesticide Safety for Schools (OSU)	http://www.ipmnet.org/Tim/PSEP_home.htm
Golf Course Integrated Pest Management (IPM) tool and BMP Generator	http://www.greengolfusa.com/tiki-index.php
EcoBiz Certified Landscapers and Auto Repair Shops	http://ecobiz.org/find-an-ecobiz/

Agriculture/Forestry Land Uses	
Tips for Small Acreages in Oregon (NRCS) - Fact Sheets on wells, septic systems, animals, crops, weeds, streamside erosion protection. Includes specific factsheets for Eastern and Western Oregon.	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/?cid=nrcs142p2_046062
Source Water Protection Pubs (EPA) for managing various activities including: Agricultural Fertilizer Application Large-Scale and Small-Scale Application of Pesticides Livestock, Poultry and Horse Waste Above Ground and Underground Storage Tanks Small Quantity Chemical Use Turfgrass and Garden Fertilizer Application	http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Pubs.aspx
Oregon Small Farms (OSU Extension) Information on Crops, Grains, Livestock, Pastures, and Soils (see tabs at top of page for multiple resources)	http://smallfarms.oregonstate.edu/
Oregon Pesticide Stewardship Partnerships and Waste Pesticide Collection Events	http://www.oregon.gov/oda/programs/pesticides/water/pages/pesticidestewardship.aspx
Managing Waste Pesticide (DEQ)	http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/Miscellaneous-Industries.aspx
Oregon Department of Agriculture (ODA) – resources for reducing impacts	http://www.oregon.gov/oda/Pages/default.aspx
Soil and Water Conservation Districts (OACD) – technical assistance for rural landowners, family forests and growers	http://oacd.org/conservation-districts/directory
Natural Resources Conservation Service, Oregon (NRCS)	http://www.or.nrcs.usda.gov/
NRCS Financial Assistance Programs	http://www.nrcs.usda.gov/wps/portal/nrcs/main/or/programs/financial/
Oregon Department of Fish and Wildlife Hatchery Information (ODFW)	http://www.dfw.state.or.us/fish/hatchery/
Animal Care and Handling Facilities (from California stormwater program)	https://www.casqa.org/sites/default/files/BMPHandbooks/BMP_IndComm_Appendix_D.pdf
Managing Small-acreage Horse Farms (OSU)	https://catalog.extension.oregonstate.edu/ec1558/viewfile
Irrigation well use and maintenance	See resources for domestic wells under Information for Residential Areas
Oregon State University Forestry & Natural Resources Extension Program	http://extensionweb.forestry.oregonstate.edu/
Oregon Department of Forestry Stewardship Foresters	http://www.oregon.gov/ODF/Working/Pages/FindAForester.aspx
Oregon Department of Forestry Grants and Incentives	http://www.oregon.gov/ODF/AboutODF/Pages/GrantsIncentives.aspx
US Department of Agriculture Pacific Northwest Research Station	http://www.fs.fed.us/pnw/
US Department of Agriculture Forest Incentive Programs Available in Oregon	http://www.srs.fs.usda.gov/econ/data/forestincentives/or.htm
US Forest Service State & Private Forestry–Cooperative Forestry, Forest Health Protection, Sustainable Development & Urban/ Community Forestry	http://www.fs.fed.us/spf/
Water quality impacts information from US Forest Service - Part III: Chapter 10: Forest Management; Chapter 13: Pesticides and Part IV: Chapter 14-16 Animals	http://www.srs.fs.fed.us/pubs/gtr/gtr_srs039/

Agriculture/Forestry Land Uses (cont.)	
National Management Measures to Control Nonpoint Source Pollution from Forestry (EPA)	http://water.epa.gov/polwaste/nps/forestry/forestrymgmt_index.cfm
Managing Nonpoint Source Pollution from Forestry (EPA)	https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/forestry-additional-resources
Oregon Forest Practices Act	https://www.oregon.gov/ODF/Working/Pages/FPA.aspx
Forest Practices Board Manual (Washington Dept. of Natural Resources)	http://www.dnr.wa.gov/about/boards-and-councils/forest-practices-board/rules-and-guidelines/forest-practices-board-manual
Sustainable Forest Management Programs/Certifications: American Tree Farm Systems (ATFS) Forest Stewardship Council (FSC) Sustainable Forestry Initiative (SFI) Dovetail Partners, Inc.	https://www.oregon.gov/ODF/Documents/AboutODF/ForestCertificationFactsheet.pdf https://www.treefarmsystem.org/ https://us.fsc.org/en-us/certification http://www.oregonsfi.org/ http://www.dovetailinc.org/
Commercial/Industrial/Municipal Land Uses	
Drinking Water Protection Strategies for Commercial & Industrial Land Uses (DEQ)	http://www.deq.state.or.us/wq/dwp/docs/DWPStrategiesCommercialIndustrial.pdf
Business and Industry tips for reducing water quality impacts (DEQ)	http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/busindtips.pdf
Source Water Protection Publications (EPA) for managing various including: Above Ground and Underground Storage Tanks Aircraft and Airfield Deicing Operations Highway Deicing Operations Vehicle Washing Pet and Wildlife Waste Small Quantity Chemical Use Storm Water Runoff	http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Pubs.aspx
Free Assistance from DEQ's Toxics Use and Waste Reduction Assistance Program	http://www.deq.state.or.us/lq/pubs/docs/hw/TABrochure.pdf
Managing Used Computers and Other Electronic Equipment (DEQ)	http://www.deq.state.or.us/lq/pubs/factsheets/ManagingUsedComputers.pdf
Computer and Electronic Equipment Recyclers (DEQ)	http://www.deq.state.or.us/lq/pubs/factsheets/OregonECyclesConsumers.pdf
Underground Injection Control (UIC) Program (DEQ)	http://staging.apps.oregon.gov/DEQ/wq/wqpermits/Pages/UIC.aspx
Industrial Stormwater Best Management Practices Manual (DEQ)	http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf
Best Mgmt Practices for Industrial Activity Storm Water Discharges (DEQ)	http://www.deq.state.or.us/wq/stormwater/docs/nwr/indbmps.pdf
Construction Stormwater Best Management Practices Manual (DEQ)	http://www.deq.state.or.us/wq/wqpermit/docs/general/npdes1200c/BMPManual.pdf

Commercial/Industrial/Municipal Land Uses (cont.)	
Illicit Discharge and Source Tracing Guidance Manual (Washington Stormwater Center)	http://www.wastormwatercenter.org/illicit-connection-illicit-discharge
Low Impact Development O&M guidance (Washington Stormwater Center)	http://www.wastormwatercenter.org/lid-mando/
Water quality impacts information from USFS - Part V: Chapter 18-20 Mining and Oil/Gas	http://www.srs.fs.fed.us/pubs/gtr/gtr_srs039/
Dam Safety Publications and Resources FEMA website	https://www.fema.gov/dam-safety-publications-resources
Healthcare: Pollution Prevention & Best Management Practices (EPA)	http://www3.epa.gov/region9/waste/p2/hospart.html
Boating/Marinas/Recreation Areas	
Oregon Clean Boater Program (OSMB)	http://www.oregon.gov/OSMB/boater-info/Pages/Clean-Boater.aspx
Clean Boater Guide (OSMB)	http://www.oregon.gov/OSMB/boater-info/Documents/2015_osmb_clean_boater_guide_forweb.pdf
Best Management Practices for Oregon's Marinas (DEQ)	http://www.deq.state.or.us/wq/pubs/bmps/marinas.pdf
Clean Marina Program (OSMB)	http://www.oregon.gov/OSMB/boater-info/Pages/Clean-Marinas.aspx
Clean Marina Guidebook (OSMB)	http://www.oregon.gov/OSMB/forms-library/Documents/Environmental/entire_clean_marina_guidebook.pdf
Marine Sewage and Wastewater Disposal (DEQ)	http://www.oregon.gov/OSMB/Pages/Pumpout-and-Dump-Stations.aspx
Water quality impacts information from US Forest Service - Part II: Chapters 7-8: Recreation; Chapter 5: Dams and Chapter 9: Roads	http://www.srs.fs.fed.us/pubs/gtr/gtr_srs039/

Appendix #4

FUNDS AND RESOURCES for Drinking Water Source Protection

This section provides brief descriptions and contact information for resources available to public water systems, including grants and loans to fund drinking water infrastructure and source protection projects. ***PLEASE NOTE:*** *The Internet URL Addresses listed in this document were included as a convenience for the users of this document. All URL Addresses were functional at the time this publication was last updated (July 2016). For active links, this list will be placed on DEQ's Water Quality and Drinking Water Protection web pages under "Funds and Resources…". Link:* http://www.oregon.gov/DEQ/WQ/pages/index.aspx

Oregon Health Authority (OHA)

Drinking Water Services - **Phone:** 971-673-0405; **Website**: www.healthoregon.org/dwp

The Oregon Health Authority (OHA) is the primacy agency for the implementation of the federal Safe Drinking Water Act (SWDA) in Oregon. ORS 338.277 authorizes the OHA to administer the federal Safe Drinking Water Act in Oregon as the Primacy Agency in agreement with the federal government. ORS 448.131 further authorizes the adoption of standards necessary to protect public health through insuring safe drinking water within a water system. Standards in OAR 333-061 outlines requirements for systems to meet MCLs, submit to periodic inspections, and meet enforcement requirements as administered by OHA. As the primacy agency, OHA also approves drinking water treatment plans and sets construction standards, operator certification standards, and enforces rules to ensure safe drinking water. The OHA website above has extensive information on drinking water treatment requirements.
In order to assist systems in complying with standards, OHA also provides technical assistance and oversight of grants and loans from the Safe Drinking Water Act for public water system operation and improvements. *For those Safe Drinking Water Act loans and grant funds, the* ***Oregon Health Authority partners with Oregon Infrastructure Finance Authority to provide the financial services*** *(see below).*

Business Oregon - Infrastructure Finance Authority (IFA)

Phone: (503) 986-0123; ***Website:*** www.orinfrastructure.org

IFA is a division of Business Oregon that provides funding for municipally owned infrastructure projects. IFA manages federal infrastructure funds for agencies such as Oregon Health Authority and Housing and Urban Development. IFA is not a regulatory agency but collaborates and supports our state and federal partners with financing programs and technical assistance. Available funding programs that are most applicable for groundwater source protection include: the Safe Drinking Water Revolving Loan Fund (SDWRLF), Drinking Water Source Protection Fund (DWSP), and Special Public Works Fund (SPWF).

Safe Drinking Water Revolving Loan Fund (SDWRLF)

This loan program funds drinking water system improvements needed to maintain compliance with the Federal Safe Drinking Water Act. The Safe Drinking Water Fund is funded by annual grants from the U.S. Environmental Protection Agency (EPA) and matched with funds from the state Water/Wastewater Financing Program. The program is managed by the Oregon Health Authority (OHA), Drinking Water Services. The loans are managed by the Oregon Infrastructure Finance Authority (IFA).
The Safe Drinking Water Revolving Loan Fund (SDWRLF) is designed for water source, treatment, distribution, storage and related infrastructure projects. Funding is available for all sizes of water systems, although 15 percent of the funds are reserved for systems serving a population of fewer than 10,000. Eligible applicants can be owners of water systems that provide service to at least 25 year-round

residents or systems that have 15 or more connections (or a nonprofit with 25 or more regular users). Owners can be a nonprofit, private party or municipality, but systems cannot be federally owned or operated.
To be eligible for funding, a project must solve an existing or potential health hazard or noncompliance issue under federal/state water quality standards.
To apply, the municipality should first submit a Letter of Interest to Oregon Health Authority where it will be rated and ranked. Call Oregon OHA Drinking Water Services at 971-673-0422 or go to the OHA website: www.healthoregon.org/srf.
Projects placed on the Project Priority List will be invited to apply through IFA for funding. Contact your IFA Regional Coordinator for assistance and more information. Call IFA at 503-986-0123 or http://www.orinfrastructure.org/

Drinking Water Source Protection Fund (DWSP)

From the Safe Drinking Water Act, loans and grants are also available for drinking water protection projects: low interest *loans up to a maximum of $100,000 per project*, and *grant funds up to $30,000 per water system*. Eligible systems include any public or privately-owned Community and Nonprofit Non-Community water systems with a completed Source Water Assessment that are able to demonstrate a direct link between the proposed project and maintaining or improving drinking water quality. Eligible activities include those that lead to risk reduction within the delineated source water area or would contribute to a reduction in contaminant concentration within the drinking water source. Projects can take either a local or regional approach and may involve multiple communities and/or water systems attempting to address a common source water issue or group of issues.
Categories for eligible projects for DW Source Protection funding for groundwater include:

- ***Refined Delineation:*** OHA and DEQ have completed delineations for most drinking water source areas (DWSA) for the community and non-community public water systems. DWSAs include aquifer recharge areas for groundwater sources. DW Source Protection funding can be used to complete, update, or refine DWSA delineations using new or additional site-specific information as part of a more comprehensive protection strategy.
- ***Enhanced Assessment:***
  - ***Inventory*** – Projects that improve upon (e.g. update or expand) existing potential contaminant source inventories available from the DEQ database, Geographic Information System, and Assessment Reports prepared by OHA/DEQ.
  - ***Evaluation*** – Water quality monitoring projects to evaluate existing and potential threats. This could include evaluating and prioritizing these threats (or protection activities) based upon new or more detailed information.
- ***Source Protection Planning:***
  Projects designed to identify appropriate protection measures, including development of a comprehensive DW Source Protection plan, educational projects, implementation of Best Management Practices (BMPs), development of local DW Source Protection ordinances, development of restoration, or conservation plans.
- ***Implementation:***
  Funds can be used to implement many types of protection strategies in drinking water source areas. This can include implementation of any *eligible activities that will reduce risks within the source water area or would contribute to a reduction of contaminant concentration within the drinking water source(s).*

For the source water protection funds, contact OHA regarding the letter of interest submittal schedule. Call Oregon OHA Drinking Water Services at 971-673-0422 or go to the OHA website: www.healthoregon.org/srf or contact IFA at 503-986-0123; www.orinfrastructure.org

Other IFA Funding Programs

IFA administers a number of other funding programs for communities that support the design and construction of public infrastructure and economic and community development. These funding programs include the Water/Wastewater Funding Program, the Special Public Works Fund (SPWF) Community Development Block Grant (CDBG), and the Port Revolving Loan Fund (PRLF). More information and allowable funded project activities are available on IFA's website.

Oregon Department of Environmental Quality (DEQ)

Clean Water State Revolving Fund: 503-229-6412; ***Website:***
http://www.oregon.gov/DEQ/wq/cwsrf/Pages/default.aspx

Clean Water State Revolving Fund (CWSRF)

Low-cost loans for planning, design, and construction projects to attain and maintain water quality standards, and necessary to protect beneficial uses such as drinking water sources, irrigation, and recreation. Eligible borrowers are public entities, such as cities and counties, Indian tribal governments, sanitary districts, soil and water conservation districts, irrigation districts, various special districts, and some intergovernmental entities. Applications are accepted year round with scheduled review and ranking in the first week of January, May, and September. Contact DEQ for a list of CWSRF project officers: http://www.oregon.gov/DEQ/wq/cwsrf/Pages/default.aspx.
Financial incentives make CWSRF loans worth exploring. Principle forgiveness is available for communities meeting affordability criteria, or for meeting green project criteria. Implement a non-planning nonpoint source project *and* a traditional point source wastewater treatment project through the same application to reduce your interest rate on the combined two projects to as low as 1%. This combined application is called a sponsorship option.

CWSRF Pollution Reduction Funding

The Clean Water State Revolving Fund loan program provides low-cost loans to public entities for the planning, design or construction of both point source and nonpoint source projects that *prevent or mitigate water pollution*. CWSRF offers a Local Community Loan, which allows the borrower to make loans to private entities like home owners and farmers. The Local Community Loans fund the repair and replacement of failing decentralized systems. This loan type can also fund nonpoint source agricultural best management practices and a variety of nonpoint source watershed improvement projects.
More information on DEQ's Clean Water State Revolving Fund program can be found here: http://www.oregon.gov/DEQ/wq/cwsrf/Pages/default.aspx. For specific information on the Sponsorship Option, Planning Loans, Nonpoint Source Loans, or Local Community Loans, see http://www.oregon.gov/DEQ/wq/cwsrf/Pages/CWSRF-Application.aspx. The application requirements for CWSRF loans may take some lead-time to develop and may require out-of-pocket expense to prepare. Prospective CWSRF applicants should discuss any questions about the required content of these items with a regional DEQ CWSRF Project Officer at the earliest opportunity (http://www.oregon.gov/DEQ/wq/cwsrf/Pages/CWSRF-Contacts.aspx)

Supplemental Environmental Projects (SEPs)

Supplemental Environmental Projects are administered by DEQ's Office of Compliance and Enforcement. When DEQ assesses civil penalties for environmental law violations, violators can offset up to 80% of their monetary penalty by agreeing to pay for a Supplemental Environmental Project that improves Oregon's environment. SEPs can be for pollution prevention or reduction, public health protection, environmental restoration and protection as long as it is a project that the respondent is not already required to do by law or where the project would be financially self-serving for the respondent. The work can be completed by a third-party like a local government, watershed council, non-profit or private entity. Community

organizations with proposed projects are also free to contact respondents on their own initiative. The enforcement case does not necessarily have to be in the same area (watershed/county, etc.) as the environmental project or even address the same media (i.e. air/water/land). Interested parties can sign up for DEQ's public notifications via email at http://www.oregon.gov/deq/Pages/publicnotice.aspx - when signing up, select types of information (select "enforcement actions") and which counties or subbasins are of interest.

Oregon Water Resources Department (WRD)

Website: http://www.oregon.gov/OWRD/pages/index.aspx

The Water Resources Department is the state agency charged with administration of the laws governing surface and ground water resources. The Department's core functions are to protect existing water rights, facilitate voluntary streamflow restoration, increase the understanding of the demands on the state's water resources, provide accurate and accessible water resource data, and facilitate water supply solutions. WRD carries out the water management policies and rules set by the Water Resources Commission and oversees enforcement of Oregon's water laws. By law, all surface and ground water in Oregon belongs to the public.

WRD developed *Oregon's 2012 Integrated Water Resources Strategy* to help individuals and communities address instream and out-of-stream needs now and into the future, including water quantity, water quality, and ecosystem needs. Funding to support groundwater-related planning, feasibility studies, and implementation of water projects includes: Feasibility Study Grants, Water Project Grants and Loans (formerly Water Supply Development Grants and Loans), and Place-based Planning Grants. **For more information on the criteria for these grants, visit:**
http://www.oregon.gov/OWRD/pages/Water_Resources_Development_Program.aspx

Municipal Water Management and Conservation Planning

Municipal water management and conservation planning provides a process through which cities and other municipal water suppliers estimate long-range water supply needs and identify alternatives, including water conservation programs, to meet those needs. The Department requires many municipal water suppliers to prepare plans as conditions of their water use permits or permit extensions.

Water Rights and Well Construction/Abandonment

Watermasters respond to complaints from water users and determine in times of water shortage, which generally occur every year, who has the right to use water. Watermasters can also provide information on the potential risks and proper abandonment of unused wells. "Watermaster" offices across the state offer excellent local information: http://www.oregon.gov/owrd/pages/offices.aspx.

Oregon Department of Forestry (ODF)

Website: http://www.oregon.gov/ODF/Pages/index.aspx

The Oregon Department of Forestry manages and regulates activities on non-federal forestland in Oregon. There are three main divisions under ODF-- Fire Protection, Private Forests, and State Forests. The Private Forests Division administers the Forest Practices Act and various forestry incentive programs and employs the use of about 50 Stewardship Foresters who work closely with landowners and operators. The State Forests Division is responsible for forest management to provide economic, environmental, and social benefits to Oregonians.

Financial incentive programs are aimed at encouraging and assisting landowners in managing their resources and meeting their objectives. Typical forestry projects can be aimed at protecting the landowner's resources/investment from fire or insect and disease infestation, to increasing its monetary

and environmental value in the future. Information about all ODF and federal forestry-related grants and incentive programs can be found at:
http://www.oregon.gov/ODF/AboutODF/Pages/GrantsIncentives.aspx

Department of Agriculture - Natural Resources Program

Phone: 503-986-4700; ***Website:*** http://www.oregon.gov/ODA/programs/NaturalResources

The Oregon Department of Agriculture (ODA) is responsible for developing plans to prevent and control water pollution from agricultural activities and soil erosion on rural lands. Through the actions below, ODA's Natural Resources Program aims to conserve, protect, and develop natural resources on public and private lands to ensure that agriculture will continue to be productive and economically viable in Oregon:

- Address water quality and natural resource conservation on agricultural lands
- Ensure proper and legal sale, use, and distribution of pesticide products
- Assist local soil and water conservation districts as they help landowners properly manage Oregon's natural resources

More information on the Agricultural Plan Areas, Regulations, local management plans and your area's ODA Water Quality Specialist can be found at:
http://www.oregon.gov/ODA/programs/NaturalResources/AgWQ/Pages/AgWQPlans.aspx
More information on the regulation and use of pesticides can be found at:
http://www.oregon.gov/ODA/programs/Pesticides/Pages/default.aspx

Department of Agriculture - Pesticide Analytical and Response Center (PARC)

Website: http://www.oregon.gov/ODA/programs/Pesticides/Pages/PARC.aspx

The Pesticide Analytical and Response Center (PARC) was created by executive order in 1978. The program was reauthorized under the Oregon Department of Agriculture (ODA) as ORS 634.550, in 1991.

PARC is mandated to perform the following activities with regard to pesticide-related incidents in Oregon that have suspected health or environmental effects: collect incident information, mobilize expertise for investigations, identify trends and patterns of problems, make policy or other recommendations for action, report results of investigations, and prepare activity reports for each legislative session.

PARC does not have regulatory authority. Their primary function is to coordinate investigations to collect and analyze information about reported incidents.

To report a pesticide incident that has impacted people, animals, or the environment, contact:
Theodore Bunch Jr., PARC Coordination Team Leader at 503-986-6470 or toll-free at 844-688-7272, PARC@oda.state.or.us or Christina Higby, Citizen Advocate Liaison at 503-986-5105, chigby@oda.state.or.us

Department of Agriculture - Soil and Water Conservation Districts

Website: http://www.oregon.gov/ODA/SWCD/

SWCD Program and Water Quality Program Manager: John Byers, 503-986-4718
The Soil and Water Conservation District (SWCD) Program provides services to the 45 Soil and Water Conservation Districts throughout Oregon (list current as of 6/16). SWCDs are local government entities that have authorities to address soil, erosion, and water quality issues.

Source Water Collaborative – led by U.S. Environmental Protection Agency

Technical assistance and lists of resources and contacts are available from this national network that has worked to promote drinking water protection for several years. The Source Water Collaborative is a network of federal, state, and local organizations led by US EPA. Some of the key Source Water Collaborative members include the US EPA, US Department of Agriculture, AWWA, American Planning Association, ASDWA, ACWA, National Rural Water Association, Groundwater Protection Council, National Association of Counties, and The Trust for Public Land. Resources can be found here:
http://sourcewatercollaborative.org/

U.S. Environmental Protection Agency
Catalog of Federal Funding Sources for Watershed Protection

Website: https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1

This is an online, free searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund a variety of watershed protection projects.

U.S. Environmental Protection Agency - Environmental Finance Centers

Website: https://www.epa.gov/envirofinance

Free technical assistance is available through EPA's Environmental Finance Centers. There is currently no Environmental Finance Center for US EPA Region 10, but the resources are still available through the US EPA website. The program mission is to provide help to those facing the "how to pay" challenges of environmental protection. EFC is committed to helping the regulated community build and improve the technical, managerial, and financial capabilities needed to comply with federal and state environmental protection laws.

U.S. Department of Agriculture, Farm Service Agency
Conservation Programs

Website: http://www.fsa.usda.gov/programs-and-services/conservation-programs/index

USDA Farm Service Agency oversees a number of voluntary conservation-related programs. These programs work to address a large number of farming and ranching related conservation issues including: drinking water protection, reducing soil erosion, wildlife habitat preservation, preservation and restoration of forests and wetlands, and aiding farmers whose farms are damaged by natural disasters.

Source Water Protection Program (SWPP)

The SWPP is designed to protect surface and ground water used as drinking water by rural residents. Through a partnership with the National Rural Water Association, local teams are formed to develop plans to reduce pollutant impacts in rural areas.
http://www.fsa.usda.gov/programs-and-services/conservation-programs/source-water-protection/index

Conservation Reserve Program (CRP)

In exchange for a yearly rental payment, farmers enrolled in the program agree to remove sensitive land from agricultural production and plant species that will improve environmental health and quality. Contracts for land enrolled in CRP are 10-15 years in length. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.
http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

Conservation Reserve Enhancement Program (CREP)
The CREP, an offshoot of CRP, targets high-priority conservation issues identified by local, state, or tribal governments or non-governmental organizations. In exchange for removing environmentally sensitive land from production and introducing conservation practices, farmers, ranchers, and agricultural land owners are paid an annual rental rate. Participation is voluntary, and the contract period is typically 10–15 years, along with other federal and state incentives as applicable per each CREP agreement.
http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index

Emergency Conservation Program (ECP)
The ECP provides funding and technical assistance for farmers and ranchers to restore farmland damaged by natural disasters and for emergency water conservation measures in severe droughts. The ECP helps farmers and ranchers to repair damage to farmlands caused by natural disasters and to help. The ECP also provides funding and assistance to help ranchers and farmers install water conservation measures during severe drought.
http://www.fsa.usda.gov/programs-and-services/conservation-programs/emergency-conservation/index

U.S. Department of Agriculture, Natural Resources Conservation Service

NRCS provides farmers, ranchers and forest managers with free technical assistance, or advice, for their land. Common technical assistance includes: resource assessment, practice design, and resource monitoring. The conservation planner will help you determine if financial assistance is right for you. Technical assistance is also available online through Conservation Client Gateway. For more information about NRCS, visit their home page: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/about/.
Several key funding opportunities for best management practices and conservation on private, non-industrial forestland and agricultural lands may provide assistance in groundwater source areas include:

Environmental Quality Incentives Program (EQIP)
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/ and

Conservation Stewardship Program (CSP)
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/

Agricultural Conservation Easements Program (ACEP)
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/home/?cid=stelprdb1249312

Emergency Watershed Protection (EWP)
http://www.nrcs.usda.gov/wps/portal/nrcs/main/or/programs/financial/ewp/

Anyone applying for EQIP or any of the other NRCS grants for the first time should schedule a meeting with NRCS to discuss their options before moving forward.

U.S. Department of Agriculture, Rural Development
Water and Waste Disposal Direct Loans and Grants

Eligible Projects: Pre-construction and construction associated with building, repairing, or improving drinking water, solid waste facilities and wastewater facilities
Eligible Applicants:
-Cities or towns with fewer than 10,000 population
-Counties, special purpose districts, non-profit corporations or tribes unable to get funds from other sources at reasonable rates and terms
Funding Available: Loans (40-year term), grants in some cases, interest rates vary (currently 2.125 – 3.5%)
How To Apply: Applications accepted year-round on a fund-available basis. https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program

U.S. Environmental Protection Agency
Community Action for a Renewed Environment (CARE) Grants

Eligible Projects: Prevention of human exposure to harmful pollution; improve water quality. Form community-based collaborative partnerships; identifying and developing an understanding of the many local sources of risk from toxic pollutants and environmental concerns; and setting priorities for the reduction of the identified risks and concerns of the community.
Eligible Applicants: Local, public non-profit institution/organizations, federally-recognized Indian tribal government, Native American organizations, private non-profit institution/organization, quasi-public nonprofit institution/organization both interstate and intrastate, local government, colleges, and universities.
Funding Available: $75,000 to $100,000 with an average project funding of about $90,000.
How To Apply: www.epa.gov/care

U.S. Department of Commerce
Community Development Block Grant Planning Program

Phone: (206) 220-5101; http://portal.hud.gov/hudportal/HUD?src=/states/washington/offices
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs
Eligible Projects: Comprehensive plans, Infrastructure plans, Feasibility studies, Community action plans, Low-income housing assessments.
Eligible Applicants: Projects must principally benefit low- to moderate-income people in non-entitlement cities (under 50,000 people) and counties (under 200,000 people).
Funding Available: Grants
· Up to $24,000 for a single jurisdiction,
· Up to $35,000 for single jurisdiction projects that address urgent public health and safety needs,
· Up to $40,000 for multiple jurisdictions/joint application.
How To Apply: http://portal.hud.gov/hudportal/HUD?src=/states/washington/offices

Rural Community Assistance Corporation (RCAC)

Website: www.rcac.org; **National contact:** Josh Griff, 720-951-2163, jgriff@rcac.org
Oregon contacts: Chris Marko, Rural Development Specialist 503- 228-1780; cmarko@rcac.org and
RosAnna Noval, Rural Development Specialist 503-308-0207; rnoval@rcac.org
At the national level, RCAC has a variety of loans for water and/or wastewater planning, environmental work, and other work to assist in developing an application for infrastructure improvements.
Eligible Applicants: Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if guaranteed by USDA Rural Development financing.
Funding Available:

- Maximum $50,000 for feasibility loan,
- Maximum $350,000 for pre-development loan,
- 1 year term with 5.5% interest rate.

How To Apply: Applications accepted anytime. www.rcac.org

Water Research Foundation - Source Water Protection Cost-Benefit Tool

Website: http://www.swptool.org/index.cfm

This is a free, online suite of tools designed to assist in evaluating the triple bottom-line costs and benefits of different source water protection options. Cost/benefit calculations help evaluate, prioritize, justify, and ultimately implement source water protection initiatives.

LAND TRUSTS

Resources to assist in locating a land trust: http://findalandtrust.org/states/oregon41

Coalition of Oregon Land Trusts

Phone: 503-719-4732 ***Website:*** http://oregonlandtrusts.org/

The Coalition of Oregon Land Trusts (COLT) is a newly formed nonprofit representing and serving Oregon's land trusts. Its mission is to serve and strengthen the land trust community in Oregon. Oregon's land trust community is working at local, regional, and statewide scales with landowners, communities, public agencies, and other partners to maintain the state's natural heritage and the economies it supports. COLT will accomplish its mission by strengthening public policies and programs that are supportive of land conservation, helping to build capacity within and across land trusts, and communicating to key audiences about the role of land trusts in conserving Oregon's natural heritage and healthy human communities that depend on it. There are currently 18 land trusts that are members of COLT.

Land Trust Alliance

Phone: (971) 202-1483 ***Website:*** http://www.landtrustalliance.org/

The Land Trust Alliance is a national conservation organization that works to preserve land through conservation and easements, so land and natural resources are protected. The Alliance is based in Washington, D.C., and has several regional offices.

Individual land trusts which may be of assistance include:

The Trust for Public Land http://www.tpl.org/services/conservation-transactions

The Nature Conservancy http://www.nature.org/

FOUNDATIONS

The National Groundwater Association

Eligible Projects: USA Groundwater Fund was established by the National Ground Water Research and Educational Foundation (NGWREF) to help fund water supply projects as well as education and training projects within the United States of America.

- Education and training program projects for groundwater development, wellhead protection, well pumping systems, and/or maintenance of wells and pumping systems
- Groundwater supply projects that serve the general public in a community setting.

Eligible Applicants: Applicant should have a history of not less than three years of demonstrated success in projects for groundwater water supply. Applicant should provide with its application documentation of its successful completion of these projects, preferably from a third party, not affiliated with the grant seeking organization that can attest to the completed work.

Funding Available: Small grants, total of $10,000 available per year nationwide.

Contact: http://www.ngwa.org/Foundation/Pages/USA-Groundwater-Fund.aspx

The Collins Foundation

Eligible Projects: land acquisitions; grants are for projects that directly benefit the residents of Oregon

Eligible Applicants: nonprofits with tax-exempt status under Section 501(c)(3) / agencies that have current registration with the offices of the Oregon State Attorney General and the Secretary of State.

Funding Available: varies; grants may range from $3000 to $150,000

Contact: www.collinsfoundation.org

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SOURCE WATER ASSESSMENT REPORT

Kilchis Regional Water District
Bay City, Oregon
Tillamook County
PWS #4100079

April,2003

Prepared

by

Oregon Association of Water Utilities
Groundwater Specialist

in conjunction with

Oregon Department of Human Services
Health Services
Drinking Water Program

and the

Oregon Department of Environmental Quality
Water Quality Division
Drinking Water Protection Program

DHS oregon department of human services

DEQ State of Oregon Department of Environmental Quality

Available in Alternate Formats by contacting the DHS DWP at (541) 726-2587

Table of Contents

Kilchis Regional Water District:
Source Water Assessment Report

Summary

The Source Water Assessment Program, mandated by the 1996 Amendments to the Safe Drinking Water Act, requires that states provide the information needed by public water systems to develop drinking water protection plans if they choose. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Drinking Water Protection Area, an inventory of potential sources of contamination within the Drinking Water Protection Area, and an assessment of the relative threat that these potential sources pose to the water system.

This report is intended to provide Kilchis Regional Water District with our conclusions regarding the source water assessment analysis. It is our hope that the information provided will be used as a basis for reducing the risk of contamination to your water source through the development of a voluntary Drinking Water Protection Plan (DWPP). Should you decided to proceed with the development of a DWPP, a comprehensive assessment analysis can be made available to you by contacting either the OAWU Groundwater Specialist or the DHS Drinking Water Program Groundwater Coordinator. The comprehensive analysis includes a more in-depth description of the local hydrogeology and the parameters and assumptions used in the model.

The Drinking Water Protection Area for Kilchis Regional Water District is identified as the area at the surface overlying the critical portion of the aquifer that supplies groundwater to the well(s) or spring(s). The primary aquifer supplying drinking water to the Kilchis Regional Water Districts Wellfield has been identified as the Kilchis River Alluvium. According to a detailed site investigation, the primary geologic unit present at the site are alluvial deposits made up of unconsolidated clay, silt, sand and gravel deposited along the Kilchis River. (Wells, Snavely, Macleod, 1994). The wells draw water primarly from the sands and gravels.

The shallow unconfined nature of the aquifer is considered highly sensitive due to a high aquifer Traverse Potential and Infiltration Potential scores at the Wellfield site. The nitrate concentrations, age of well#1, presence of moderately permeable soils within the DWPA, and close proximity of surface water to the Kilchis Regional Water District's Wellfield contributes to the overall sensitivity of the drinking water supply. Approximately 5 other wells are present in the same section containing the Kilchis Regional Water District Wellfield and are not believed to pose a significant risk to local water quality.

An inventory of potential contamination sources was performed within the alluvial aquifer boundary of the Kilchis Regional Water District's drinking water protection area. The primary intent of this inventory was to identify and locate significant potential contaminate sources of

concern. The inventory was conducted by reviewing applicable state and federal regulatory databases and land use maps, interviewing persons knowledgeable of the area, and conducting a windshield survey by driving through the drinking water protection area to field locate and verify as many of the potential contaminant source activities as possible. It is important to remember the sites and areas identified are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

Two potential contaminant source was identified within the delineated alluvial aquifer boundary Of the potential contaminant sources identified pose a relatively moderate risk to the drinking water supply. The Kilchis Regional Water District's wells are "in hydraulic connection" with the Kilchis River. This inventory addresses only the groundwater portion of the delineation. The water system and community should "enhance" this inventory by identifying potential contaminant sources and evaluating risk within the Kilchis River watershed upstream of the wells.

Well #1, and the aquifer contribute to overall water system susceptibility. **Under a "worst-case" scenario, our susceptibility analysis suggests that although any Drinking Water Protection Plan should address all moderate and high risk contaminate sources inside the DWPA, activities within one mile upstream of the Kilchis Regional Water District's Wellfield appear to present the greatest risk to drinking water quality.**

The entire DWPA for Kilchis Regional Water District is shown in Figure 5 (Appendix B). A delineation of the alluvial aquifer contributing water to the Wellfield is shown in Figure 1 (Appendix B). A 2-year time-of-travel zone is usually shown on the delineation map to indicate a conservative area in which viral contaminate sources could impact drinking water quality. However, 2-year TOT area was not identified by the contractor due to the fact that the entire DWPA falls with in the one year time of travel. **Based on assessment results, the aquifer is considered to be sensitive to microbial contamination. Given that viral contaminate sources have been identified within one year time of travel, we also consider the drinking water supply to be susceptible to viral contamination.** Therefore, to reduce the potential for future contamination, it is important for the water system to comply with all Oregon Department of Human Services setback standards related to public drinking water sources.

The costs associated with contaminated drinking water are high. Developing an approach to protect that resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Drinking Water Protection Area) and have identified potential sources of contamination within that area. In addition, we provide you with recommendations, i.e., Best Management Practices, regarding the proper use and practices associated with some common potential contamination sources. We believe public awareness is a powerful tool for

protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality.

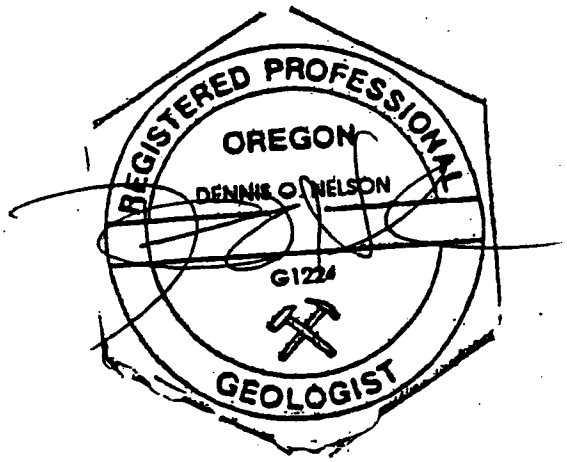
If you have any questions regarding the information contained in this report or are interested in developing a Drinking Water Protection Plan please contact one of the following people:

Mike Hayes
Groundwater Specialist
12312 Silverton Rd
Silverton, OR 97381

Phone (503) 873-8353

Dennis Nelson
Drinking Water Program Groundwater Coordinator
442 A St.
Springfield, OR 97477

Phone (541) 726-2588 Ext. 21



1. Introduction

1.1 Source Water Assessment Project

Traditionally, water systems have relied on proper water system management, water quality monitoring and, if necessary, water treatment to ensure that the water they serve meets drinking water standards. In spite of the best of these efforts, drinking water contamination still occurs. The costs, both tangible and intangible, to a water system contending with a contaminated water supply are significant. At a minimum, there is the cost of increased monitoring that will be required to make certain that the water does not pose a significant health risk. At contaminant concentrations exceeding a drinking water standard, the system may be dealing with the cost of installing and maintaining treatment, the loss of the drinking water source, i.e., a well, and most assuredly, a concerned and often frightened public.

Beginning with the 1986 Amendments to the Safe Drinking Water Act, an additional "barrier to contamination" was recognized at the federal level. A shift from the "reactive" approach of water treatment to a "proactive" approach of prevention began to occur. Although water treatment may be necessary in some cases, it is much more cost effective to prevent the contamination from happening in the first place. The Oregon Department of Environmental Quality (DEQ) and the Department of Human Services (DHS) Drinking Water Program recently compared the estimated cost of prevention (less than $15 per resident) to the actual cost of investigation and treatment (more than $1500 per resident) in a small Oregon community (population 330) impacted by a volatile organic contaminant that exceeded the drinking water standard.

Oregon has a Drinking Water Protection Program in place for groundwater systems, i.e., wells and springs. In order to protect a drinking water resource, a water system must know where the drinking water comes from, what potential sources of pollution exist and what level of threat each presents to the system's drinking water. Until recently, the costs associated with acquiring this information were the responsibility of the water system, a financial burden that even the most proactive water systems found difficult to meet. The 1996 Amendments to the Safe Drinking Water Act lifted that burden from water systems by requiring that the states conduct Source Water Assessments for federally recognized public water systems that fall under state regulative authority. The purpose of the Assessment is to provide the water systems with the information that they need to develop a strategy to protect their source of drinking water if they choose.

As mandated by the 1996 Amendments, a Source Water Assessment consists of the following:

1. The identification of the area that directly overlies that part of the aquifer supplying drinking water to the well or spring,

2. An inventory of potential sources of contamination within that area, and

3. The evaluation of water system susceptibility to contamination from those sources.

Funding for assessments was provided to the states through the Act as part of the state's Drinking Water Revolving Loan Fund.

The DEQ and DHS worked with a citizen's advisory committee and with the DHS Drinking Water Advisory Committee to design a program that would meet the needs of Oregon's public water systems. The Environmental Protection Agency (EPA) has certified that Oregon's plan meets the requirements of the Safe Drinking Water Act. Within the program, DHS has the responsibility of working with groundwater systems and the DEQ works with surface water systems and conducts all potential contaminant inventories.

Within this report, you will find general descriptions of the various elements of the Source Water Assessment Program, as well as specific information identifying the Drinking Water Protection Area for your water system and an inventory of the potential threats to your drinking water quality. Although developing a Drinking Water Protection Plan is voluntary in Oregon, we hope that the information provided in the Source Water Assessment Report will be used as a basis for reducing the risk of contamination to your water supply. Risk reduction can be accomplished by correcting intake construction and/or set back deficiencies that contribute to water system susceptibility and by implementing Best Management Practices for identified potential contaminate sources. The bulk of our risk reduction recommendations center on developing a "state certified" Drinking Water Protection Plan, and providing information to those residences, agricultural operations, businesses, etc., that live or operate within the identified protection area.

A more comprehensive description of the assessment analysis can be made available to you should you decide to proceed with the development of a drinking water protection plan. This comprehensive description will include a more in-depth discussion of the local hydrogeology and the parameters and assumptions used in the model. Resources are not available for the DHS Drinking Water Program to gather new information, however the incorporation of new data discovered by the system or its contractors will be considered as time permits.

1.2 Groundwater Basics

In order to protect a groundwater source of drinking water, it is important to understand how the groundwater system works, e.g., where groundwater comes from, how it occurs in the subsurface, how it moves and how it can become contaminated. Included in Appendix G of this report is a Fact Sheet about groundwater that you can use to help increase the awareness of others regarding groundwater and its susceptibility to contamination.

When a well is drilled, the drilling equipment first passes through the vadose zone until it encounters the water-table. Within the vadose zone, the open pore spaces between soil and

sediment particles and/or the open fractures within the bedrock material are only partially filled with water. Most of the open pore/fracture space is filled with air, therefore, little if any water can be obtained from the vadose zone. The water-table marks the top of the saturated zone, where the open pore/fracture spaces are, for the most part, completely saturated (full) with groundwater. It should be understood that within the saturated zone, groundwater does not occur as underground rivers, lakes, or veins. An aquifer is any geologic material located below the water-table (and is therefore water saturated) that can yield an adequate water supply to a well. Geologic materials that tend to yield large quantities of water to wells include sand and gravel deposits, porous lava flows, and fractured bedrock.

Groundwater is part of the hydrologic cycle which controls the distribution of water throughout the earth. Groundwater is therefore linked to other water sources, notably surface water such as streams, rivers and lakes. Virtually without exception, groundwater originates as precipitation at the earth's surface which sinks through the soil and percolates down to the water-table. The fact that groundwater originates at the surface is what makes it vulnerable to contamination. As recharging groundwater moves downward through the soil and vadose zone, it comes in contact not only with the geologic materials present, but also with any contaminates contained within the soil and/or vadose zone. Therefore, recharging groundwater can carry contaminants downward to the aquifer. Likewise liquid chemicals, if present in large enough quantities, can enter the aquifer by following the same path as recharging groundwater.

The direction and speed with which groundwater moves is controlled by the slope of the water-table and aquifer permeability. The slope of the water-table often mimics, in a subdued sense, the earth's surface with groundwater moving from high areas to low areas. Aquifer permeability is a measure of how easy it is for groundwater to move through the geologic material that makes up the aquifer. Geologic materials with greater permeability allow groundwater to move with less restriction. In general, groundwater movement is measured in terms of a few inches to a few feet per day. The speed and direction of groundwater movement can be significantly influenced by a pumping well, drawing the water-table down in its' vicinity, thus creating a water-table depression. As the well continues to pump, the depression in the water-table continues to expand out into the aquifer which leads to the formation of a "capture zone" within the water-table depression. Groundwater inside the capture zone is eventually pumped to the earth's surface by the well.

When wells are used as a water source, we identify the drinking water protection area for the water system by delineating those portions of the capture zone around the well(s) where, on average, it will take 15 or 10 years (depending on the delineation technique used) for water moving through the aquifer to arrive at the well. We have also identified the 5-, 2-, and 1-year capture zones around the well(s) to enhance the overall usefulness of the drinking water protection area. Conversely, when springs are used as a water source, we have attempted to identify the recharge area uphill from the springs based on hydrogeologic mapping. In these cases we have attempted to identify the short-, intermediate-, and long-term groundwater flow regimes that provide water to the springs. Typically, we have labeled these areas as Zone 1

(short-term), Zone 2 (intermediate-term), and Zone 3 (long-term). When appropriate, we will also identify a Zone 4 which represents the watershed above the estimated recharge area which could quickly transport spilled contaminates into the DWPA via surface water runoff.

2. Kilchis Regional Water District Water System Information

2.1 Location of the Drinking Water Source

We have located your source(s) using a Trimble GeoExplorer II Global Positioning System (GPS) unit. The data has been differentially corrected to remove some of the common positioning errors. The location of the source(s), with the corresponding Drinking Water Protection Area, has been placed in a Geographic Information System (GIS) layer and overlain onto a USGS 7.5 minute topographic map that is included within this report.

The well was located using Trimble GeoExplorer II GPS unit. Data collection specifics include:

- 150 individual measurements,
- linked to a minimum of four satellites,
- a PDOP of less than 6 (pertains to precision of measurement),
- a signal to noise ratio of greater than 5

The raw data was subjected to differential correction using the PATHFINDER software. The location data for your well using the WGS84 datum is as follows:

Source	Latitude	Longitude
Well #1	*45 °31' 24.875" N*	*123 °48' 30.339" W*
Well #2	*45 °31' 23.999" N*	*123 °48' 29.442" W*

2.2 Source Construction

Well #1 was drilled in the 1975 by Zent Drilling Inc. and is fitted with a 12-inch casing from ground level to 26 feet and a 10-inch casing from 40 feet to 46.5 feet. Well #1 is screened on the interval of 26 to 40 feet. The annulus outside the well casing of well #1 is sealed with cement to a depth of 25 feet and prevents surface water and shallow groundwater from entering the bore hole. Well #2 was constructed in 1980 by Zent Drilling Inc. and is fitted with a 12-inch casing that extends from the surface to 21 feet. Water enters well #2 through the well screen that runs from 20 feet to 40 feet. The annulus outside the well casing of well #2 is sealed with cement to a depth of 20 feet and prevents surface water and shallow groundwater from gaining access to the well bore. A sanitary hazards inspection conducted by DHS Drinking Water Program staff on

03/17/1988 did not reveal any deficiencies pertaining to source water protection. A copy of the well report for Well #1 and #2 is included in Appendix D.

2.3 Nature and Characteristics of the Aquifer

According to the well logs the aquifer supplying drinking water to the Kilchis Regional Water District's Wellfield consists of a relatively thin alluvial aquifer composed of sandy gravel to gravelly cobbles. The alluvial deposits that make up the Kilchis Regional Water Dist. wellfield are made up of unconsolidated clay, silt, sand and gravel alluvium deposited along the Kilchis River. (Wells, Snavely, Macleod, 1994) The well logs for the Kilchis Regional Water Dist. Wellfield indicate that water is drawn primary from the sand and gravel layers. The well driller reported first encountering water at a depth of 15 feet at the Well #1 and 17 feet at well #2. The well driller also reported that the static water level (water level in the well when it is at rest, i.e. not being pumped) rests at a depth of 15 for well #1 and 17 feet for well #2.

3. Delineation of the Drinking Water Protection Area

3.1 Methodology

The delineation of the Drinking Water Protection Area (DWPA) is a fundamental aspect of the source water assessment for a public water system. When information regarding the DWPA location is provided to the community, it enables the community to develop management strategies that will have the most impact with regard to preserving long-term drinking water quality. For groundwater systems, the DWPA identifies the area on the surface which directly overlies the portion of aquifer that supplies enough groundwater to the well, wellfield, or spring to meet long-term water demand (i.e., 10 to 15 years). Once delineated, the DWPA outline is placed on a map and provides the community with the knowledge of the geographic area providing water to the well. This is the area where contamination poses the greatest threat to the drinking water supply.

The delineation exercise requires the use of site-specific information so that the identified DWPA adequately reflects the hydraulic characteristics of the aquifer and the operation of the water system. The level of hydrogeologic assessment performed during the delineation depends on the population served, the presence of potentially interfering wells, and the complexity of the local hydrogeology. The delineation methods are described in the text and table below. The method used for your delineation is indicated in Appendix E (Parameters Used in the Delineation Model).

Calculated Fixed Radius (CFR): The CFR method determines the volume of the aquifer that would be needed to supply the system for next 15 years assuming a flat water-table. The delineation is circular in shape, centered on the well.

Enhanced CFR: If the water system has more than one well or a groundwater boundary is present near the well(s) and there is a potential for interference between the wells and/or the groundwater boundary, a more sophisticated analytical method is used. In such cases we specifically use an analytical model that allows interference to be accommodated. However, like the CFR, this delineation method does not account for groundwater flow direction (i.e., it assumes a flat water-table). As with the CFR, the next 15 years of groundwater supply is identified.

Analytical: Neither the CFR or Enhanced CFR method takes into account the direction and rate of groundwater flow. Analytical models incorporate the groundwater gradient and aquifer permeability into the calculations. Because of the more site-specific nature of this model, only the next 10 years of groundwater supply is identified. For systems serving 501 to 50,000 from aquifer sources lacking complex hydrogeologic boundaries, the groundwater gradient is either estimated from water-levels indicated on well logs or taken from published reports. For water

systems that fall in this category and serve more than 3,300, the gradient may be determined directly by field measurement.

Analytic or Numerical: These more sophisticated models allow for the incorporation of complex boundaries such as streams and formation contacts, can be checked with local water levels, and can incorporate spacial variations in aquifer properties.

Hydrogeologic Mapping: This delineation method involves identifying the hydrogeologic boundaries of the aquifer and is most often used in conjunction with the analytical, analytic element, and/or numerical delineation methods. Hydrogeologic boundaries include constant head boundaries (i.e. streams and/or reservoirs) and no-flow boundaries which occur when an aquifer comes in direct contact with a relatively impermeable material. Hydrogeologic mapping may be used as a stand alone delineation technique when identifying DWPAs for springs and/or wells where there are no means available for determining aquifer properties.

Population	Interfering Wells?	Complex Hydrogeology?	Delineation Method	Parameters Needed[1]
25-500	N	N	CFR	Q, n, b
25-500	N	Y	Enhanced CFR	Q, b, n, K
25-500	Y	Y/N	Enhanced CFR	Q, b, n, K
501-3,300	Y/N	N	Analytical	Q, b, n, K, i
501-3,300	Y/N	Y	Analytic or Numerical	Q, b, n, K, i, h
3,301-50,000	Y/N	N	Analytical	Q, b, n, K, i, h
3,301-50,000	Y/N	Y	Analytic or Numerical	Q, b, n, K, i, h
50,000+	Y/N	Y/N	Numerical	Q, b, n, K, i, h
Spring	NA	Y/N	Hydrogeologic Mapping	Local Geology

1. Q = pump rate; n = aquifer porosity; b = aquifer thickness; K = hydraulic conductivity (permeability); i = gradient (slope of the water table); h = hydraulic head (elevation of the water table).

3.2 Results

The Kilchis Regional Water District Drinking Water Protection Area was delineated in 2001 by Mike Hayes of the Oregon Association of Water Utilities. Based on the conceptual

hydrogeologic model developed for the area, Numerical Modeling was determined to be the best method for identifying the DWPA. The hydrogeologic conceptual model and mapping indicated that the entire watershed upriver of the wellfield (including all tributaries) is the source for the local groundwater resources (see Appendix B, Figure 5), however much of the surface water in this drainage is likely to seasonally flow through the basin without contributing significant amounts of water to the valley-fill aquifer (Appendix B, Figure 1). Much of the watershed consists of state forest land where potential chemical contaminations sources were expected to be minimal compared to more developed areas. Due to the large expanse of the watershed it is recommenced that Kilchis Regional Water Dist contact the Oregon Department of Forestry and inquire about the forest practices that are expected to take place within the watershed in the near future. Specific information regarding the parameters used in the delineation process including; the delineation method, estimated pump rate of each well, and aquifer characteristics can be found in Appendix E.

4. Sensitivity Analysis

After the Drinking Water Protection Area (DWPA) has been identified, aquifer susceptibility to potential contaminate sources inside the DWPA can be evaluated. Aquifer susceptibility is dependent on two factors, the natural environment's characteristics that permit migration of a contaminate into the aquifer (i.e., aquifer sensitivity) and the presence, distribution, and nature of the potential contaminate sources within the DWPA. It should be understood that the public water system's drinking water source cannot be susceptible to contamination, even if the aquifer is sensitive, unless potential contaminate sources are present within the DWPA. Therefore, the intent of the sensitivity analysis is to identify those areas within the DWPA where the aquifer is most sensitive to contamination. The analysis is based on data collected or generated during the DWPA delineation process and is designed to meet the needs of other existing or developing programs such as Monitoring Waivers and the Groundwater Rule.

4.1 Sensitivity Analysis Methodology

Aquifer sensitivity refers to those factors characteristic of the aquifer and overlying materials, in addition to those that are imposed upon the aquifer, such as well construction, that increase the potential for both surface and subsurface contaminants to gain access to the aquifer. The aquifer sensitivity analysis depends on a number of factors that can collectively or individually allow the aquifer to become contaminated. Factors considered during the sensitivity analysis are described below and are summarized in Appendix F, Sensitivity Summary. Characteristic factors pertaining to sensitivity are categorized as highly or moderately sensitive. **Those factors related to the public water supply well, wellfield, and/or springbox are conditions that can be corrected by the water system, thus potentially lowering the overall sensitivity**. However, those factors related to the aquifer tend to be a direct result of natural conditions and in most cases can not be modified.

4.1.1 Depth to first water-bearing zone below casing seal

The depth to the first water-bearing zone below the casing seal is important in controlling the aquifer's sensitivity because it relates to the time of travel from the surface to groundwater. The greater the distance and estimated travel time, the greater the potential for the contaminant to be degraded to insignificant levels. Although not specifically evaluated on the sensitivity summary form in Appendix F, the depth to the first water-bearing zone below the casing seal is used in the Traverse Potential and Infiltration Potential calculations described later.

4.1.2 Aquifer Characteristics and Hydraulic Nature

Aquifer characteristics refer to the geologic material (lithology) that groundwater is moving through and how the lithology controls groundwater movement. Aquifer characteristics that contribute to sensitivity include materials that provide large open pore spaces and/or short pathways for contaminates to travel through the aquifer. Therefore, we consider aquifer materials such as gravels, boulders, and fractured bedrock to contribute to overall aquifer sensitivity. These types of materials do not provide for natural filtration of contaminates as water can move with relative ease through the larger diameter pore spaces and/or fractures. The presence of fractured bedrock at the surface inside the DWPA is also an indication that contaminates could move quickly from the surface into the local aquifer system. Therefore, our concern is raised if the characteristics and hydraulic nature of the aquifer cannot be determined.

For the purpose of the source water assessment, the hydraulic nature of the water inside the aquifer is described as either unconfined, confined, semi-confined, and/or fractured confined. Unconfined aquifers are often shallow and are not separated from the surface by a protective low-permeability layer. Confined aquifers are often deeper and are overlain by a protective low-permeability layer. As a result, unconfined aquifers have minimal protection from downward percolating contaminates and are considered sensitive to potential contaminate sources. However, the overall protective nature of the overlying low-permeability (confining) layer for a confined aquifer may be limited if it is thinner than 15 feet. Under such conditions the aquifer may be considered semi-confined, raising concern that the confining layer may be absent or ineffective within large portions of the DWPA. Likewise, concern is raised if a well or spring is drawing water from a fractured aquifer exhibiting confined characteristics which lies within 50 feet of the surface. At shallow depths, the potential for fractures to intercept the surface or near surface increases. Any fracture reaching the shallow subsurface can provide a pathway for contaminated shallow groundwater to enter the aquifer, effectively raising aquifer sensitivity.

4.1.3 Overburden Thickness and Characteristics

The material resting between the surface and the aquifer can have a significant impact on the aquifer sensitivity analysis. Overburden thickness can be related to the time of travel from the surface to the aquifer. The greater the distance and time, the greater the potential for contaminates to be degraded to insignificant levels. In addition, laterally persistent materials of low permeability (such as silt, clay, and unfractured bedrock) will restrict the downward movement of contaminants. Therefore, the presence of a thick (greater than 15 feet) confining unit resting on top of the aquifer offers the greatest amount of natural protection to a drinking water supply. Confining units consisting of plastic clay and/or unfractured bedrock are much more protective than those consisting of silt.

4.1.4 Soil Types

Although soils usually compose a very small portion of the overburden above the aquifer, they are the first natural barrier between the surface and the water-table. Therefore, the amount of time it takes for water to pass through the soil zone can be used as a factor in determining overall aquifer sensitivity. Even over short distances, the permeability and thickness of different soil types can be highly variable as some soils are thinner and/or have a higher permeability than others. Therefore, for the purposes of the source water assessment, we identify soils with high, moderate and low sensitivity based on the amount of time it takes for water to pass through a specific soil under saturated conditions. Highly sensitive soils are those soils for which it has been estimated to take less than 65 hours for water to pass through their profile under saturated conditions. This means that there is little opportunity for degradation of a contaminant, such as nitrate, within the soil zone. In addition, the travel time through the soil indicates the amount of response time available before an accidental spill becomes significantly more difficult to clean up.

Moderately sensitive soils are those for which it has been estimated to take between 65 and 256 hours (approximately 2.7 to 10.7 days) for water to pass through their profile and low sensitivity soils are those which it has been estimated to take more than 256 hours for water to pass through. Recognition of these soil types and their occurrence within the Drinking Water Protection Area can indicate those parts of the protection area where contamination may pose a greater risk to the water system, therefore it is useful to compare the distribution of these soil types with respect to potential contaminate sources. The distribution and relative sensitivity of soils within the Drinking Water Protection Area is shown on the Sensitivity Map (Appendix B, Figure 3) and the distribution of potential contaminate sources with respect to soils is shown on the Susceptibility Map (Appendix B, Figure 4).

4.1.5 Infiltration Potential

The Infiltration Potential (IP) is an estimate of the ability of water to infiltrate from the surface to the aquifer. It is based on (1) the depth to the aquifer, (2) an estimate of the weighted permeability of the material between the surface and the aquifer, a parameter referred to as the Traverse Potential (TP), and (3) the hydraulic surplus, or amount of water available from precipitation and/or irrigation at the surface that is able to infiltrate into the aquifer. Both IP and TP values are determined for each drinking water source and are used as factors for determining overall aquifer sensitivity near the wellhead and/or springhead (i.e., within the 100 foot sanitary setback or 2-year Time-of-Travel Zone). If enough well log data is available for the surrounding area, DWPA sensitivity and susceptibility maps (Appendix B, Figures 3 and 4) can be produced based on TP and IP data rather than soil sensitivity for those water systems serving more than 500 people.

In our analysis, both IP and TP scoring varies from 1 to 10. A low TP value of 1 indicates that the materials above the aquifer are of very low permeability and/or are of great thickness. Conversely, a high TP value of 10 indicates materials above the aquifer have a very high permeability and/or are very thin. Therefore, we interpret TP values greater than 5 as an indication of areas where the potential for movement of water (and/or contaminates contained in the water) from the surface to the aquifer is greatest and we classify the Drinking Water Protection Area (or portions thereof, if TP is mapped) as highly sensitive to contamination.

IP values are determined using TP values and an estimate of the available water at the surface for aquifer recharge. Our estimate of available water at the surface assumes that rainfall, evaporation, plant uptake, and runoff remain constant throughout the DWPA, however we do recognize that irrigation practices can vary with regard to land use and/or crop type. Therefore, for those water systems where TP and IP have been mapped, IP values can vary even if TP values are constant throughout the DWPA. A low IP value of 1 indicates that as a result of water availability (hydraulic surplus) and geologic conditions (Traverse Potential) there is a low probability that water from the surface, at that location, will reach the aquifer. Conversely, a high IP value of 10 suggests that, due to local hydraulic surplus and geologic conditions, there is a high probability that water occurring at the surface will recharge the aquifer and therefore has the potential to transport large quantities of contaminates into the aquifer with little or no reduction in concentration. We classify the DWPA (or portions thereof, if IP is mapped) as having a high, moderate, or low sensitivity to contamination with respect to the calculated IP value as follows:

Sensitivity	Infiltration Potential
High	> 7
Moderate	4 to ≤ 7
Low	< 4

4.1.6 Water Intake Construction

A groundwater based public water system's sensitivity to contamination is dependent not only on aquifer characteristics but also the integrity of the well(s) and/or spring boxes used to extract or collect water for distribution. If improperly constructed, these structures can also serve as conduits for contamination to move from the surface or near-surface environment and into the well and/or spring. We have evaluated the sensitivity of the water system's intakes to potential contamination by reviewing: (1) construction deficiencies reported on recent sanitary surveys; (2) the construction and depth of casing seal for the public water supply well(s); and (3) the age of the constructed intake.

When a well is drilled in soft or loose materials, a casing (steel or plastic pipe) is inserted to hold the hole open during and after drilling. The casing does not in itself provide adequate protection

from contaminated shallow water gaining access to the well. Contaminated shallow groundwater can migrate to the casing and follow the casing directly down to the well intake. The real protection from potentially contaminated shallow water is the casing seal. This seal is put in place by drilling a hole that is at least four inches greater in diameter than the final casing. After the larger hole is drilled, the casing is installed and the annular space between the casing and the bore hole wall is filled with a sealant, either bentonite (an expanding clay), cement, or a combination of the two materials. The casing seal must, by law, be placed a minimum of 18 feet below the surface, however, it should be placed to a depth that is controlled by the local geology, e.g., for a confined aquifer, the casing seal should extend a minimum of five feet into the confining layer. Having a well drilled by a licensed well constructor greatly reduces the risk that the well will be improperly constructed.

4.1.7 Other Wells

Other wells that fall in close proximity to the public water supply well and/or spring may provide a conduit for contaminates to reach the local aquifer if their construction is inadequate or has been compromised. We assume that the risk of encountering an improperly constructed or compromised well increases as the density of wells in the vicinity of the public water supply well and/or spring increases. Even a properly constructed well has a given life-time, after which the casing seal may begin to deteriorate and eventually fail, allowing shallow water to gain access to the aquifer. Therefore, overall risk becomes significantly greater when older wells are present, in part due to age and also due to the less stringent construction standards that were in effect prior to 1979.

We evaluate aquifer sensitivity to contamination posed by other wells in the Drinking Water Protection Area (DWPA) by totaling the number of well reports on file at the Oregon Water Resources Department that are within the same section containing the public water system's well(s) and/or spring(s) and develop a score based on the number of wells and their age. The equation for determining the Other Wells Score is as follows:

Other Well Score = (No. of wells drilled after 1978) + 4 x (No. of wells drilled before 1979)

The above expression assumes that wells drilled before 1979 are four times more likely to lead to water quality problems than those wells drilled after 1978. An Other Wells Score greater than 400 is assumed to represent a high density of wells and a moderate risk to local groundwater resources. In addition, a score that falls between 225 and 400 indicates a moderate density of wells, which is not an immediate cause for concern, unless a large number of wells are observed inside the DWPA or routine water quality monitoring suggests an ongoing degradation of source water quality. In either case, local well owners can obtain useful information regarding private wells over the internet at www.wellowner.org or at http://wellwater.orst.edu. It might also be useful to provide Home-A-Syst assessment packets, available through the OSU Extension Service, to local well owners who are interested in protecting their private wells (and in turn,

local groundwater resources) from contamination. For more information regarding the Home-A-Syst program contact:

Gail Glick Andrews
Oregon Home-A-Syst Coordinator
Bioresource Engineering
116 Gilmore Hall
Corvallis, OR 97331-3906
Phone: (541) 737-6294

4.1.8 Monitoring History

Most groundwater contamination originates at the surface (accidental/deliberate spills, chemical applications, roadway/parking lot runoff, etc...) or in the shallow subsurface (underground storage tanks, septic systems, shallow injection wells, etc...) therefore, a review of water quality monitoring results for each water system can provide valuable information regarding aquifer sensitivity. Clearly, if a contaminant has been detected in the water source, a pathway from the surface to the aquifer must exist. As a means of protecting public health, public water systems in Oregon are required to routinely monitor drinking water quality for contaminates identified by the U.S. Environmental Protection Agency as hazardous to human health. However, it is important to understand that the results from a given sample only provide information regarding water quality at the time that the sample was collected. Water quality within an aquifer can change with time for a number of reasons, including contamination and seasonal recharge. **The fact that a water sample, or series of water samples, is free of contaminates is no guarantee that contamination of the aquifer can not happen in the future.** Therefore, if a water system is determined to have a moderate or low sensitivity with respect to monitoring history, it still may in fact be highly sensitive to contamination with respect to one or more other sensitivity analysis criteria.

Our review of water quality monitoring history included all Volatile Organic Compounds (VOCs), Synthetic Organic Compounds (SOCs), Inorganic Compounds (IOCs), nitrate, and coliform monitoring results available in the DHS Drinking Water Program SDWIS on-line database. Required routine monitoring for nitrate and coliform occurs more frequently than that for VOCs, SOCs, and IOCs, therefore both nitrate and coliform are particularly useful as indicators of contaminate pathways into the aquifer. Coliform bacteria are ubiquitous in the environment and their presence in source water (i.e., the aquifer) may indicate a microbial source nearby. Likewise nitrate provides similar information and is highly mobile compared to most contaminates and in some cases will act as a precursor to other contaminates entering the aquifer. Therefore, we consider an aquifer yielding water that meets any of the following criteria to be highly sensitive to contamination:

- Any VOC or SOC detections,
- IOC detections greater than 50% of the EPA established MCL,
- Source-related coliform detections, and/or
- Nitrate concentrations of 5 mg/L or greater.

4.2 Sensitivity Analysis Results

According to the well logs the aquifer supplying drinking water to the Kilchis Regional Water Districts Wellfield consists of a relatively thin alluvial aquifer composed of sandy gravel to gravelly cobbles. The alluvial deposits that make up the Kilchis Regional Water Dist. wellfield are primary made up of unconsolidated clay, silt, sand and gravel alluvium deposited along the Kilchis River. (Wells, Snavely, Macleod, 1994) The well logs for the Kilchis Regional Water Dist. Wellfield indicate that water is drawn primary from the sand and gravel layers. The well driller reported first encountering water at a depth of 15 feet at the Well #1 and 17 feet at well #2. The well driller also reported that the static water level (water level in the well when it is at rest, i.e. not being pumped) rests at a depth of 15 for well #1 and 17 feet for well #2.

Traverse Potential (TP) and Infiltration Potential (IP) values for the Kilchis Regional Water Dist Wellfield DWPA are based entirely on the geologic description included on the well driller's reports for Wells #1 & #2. Data collected for this assessment did not reveal enough other wells inside the DWPA which could be used to conduct additional calculations. However, since the DWPA is confined to a narrow alluvial valley where the aquifer characteristics are expected to act in a uniform manner, it is reasonable to assume that overburden characteristics, and thus TP and IP values, are also uniform throughout the DWPA. On this basis, the calculated TP value for the DWPA is 7.0. Using climate data collected by NOAA, we estimated an annual recharge rate to the aquifer of 55.0 inches which combined with the TP values, yield an IP of 9.

Soils information for the DWPA were collected from the Soil Survey Tillamook Area Oregon (Bowlsby and Swanson, 1964). Based on sensitivity analysis results, most of the soils present in the groundwater DWPA are moderately permeable with a calculated time of travel of 66 hours. The moderate soil encompasses the entire DWPA and is shown in Appendix B, Figure 2.

Well #1 was drilled in the 1975 by Zent Drilling Inc. and is fitted with a 12-inch casing from ground level to 26 feet and a 10-inch casing from 40 feet to 46.5 feet. Well #1 is screened on the interval of 26 to 40 feet. The annulus outside the well casing of well #1 is sealed with cement to a depth of 25 feet and prevents surface water and shallow groundwater from entering the bore hole. Well #2 was constructed in 1980 by Zent Drilling Inc. and is fitted with a 12-inch casing that extends from the surface to 21 feet. Water enters well #2 through the well screen that runs from 20 feet to 40 feet. The annulus outside the well casing of well #2 is sealed with cement to a

depth of 20 feet and prevents surface water and shallow groundwater from gaining access to the well bore. A sanitary hazards inspection conducted by DHS Drinking Water Program staff on 03/17/1988 did not reveal any deficiencies pertaining to source water protection. A copy of the well report for Well #1 and #2 is included in Appendix D.

Well report records indicate that there are approximately 5 other wells within the section containing the Kilchis Regional Water District Wellfield. Of these, 3 were drilled before 1979. The remaining wells were drilled after 1978. This leads to an Other Well Score of 8, far below the significant risk indicator threshold of 225. Thus, other wells in the area are not believed to represent a significant risk to the water system. However, it should be understood that the above numbers only represent wells on record at the Water Resources Department. Prior to 1960, there were no requirements regarding the filing of well reports. In addition, unauthorized wells are not uncommon in many areas. Therefore, the Other Well Score should be considered a minimum assessment of risk.

DHS Drinking Water Program records indicate that nitrate concentrations at the combined entry point for the wells are 0.90 mg/L, far below the current EPA nitrate MCL of 10 mg/L. Records also indicate that there haven't been any positive detections for total coliform. However, we recommend that the water system operator continue to track nitrate testing results so that corrective action through the implementation of Best Management Practices can be taken if nitrate concentrations are observed to rise with time.

Inorganic chemicals testing for the Kilchis Regional Water Dist indicated that barium (0.0003 mg/L, conducted in 2002) is present in the drinking water at concentrations far below the current EPA MCLs of 2.0000 mg/L for barium. It is not uncommon to find trace amounts of barium in a drinking water source as it can be leached from the geologic material that groundwater is moving through. Required testing for VOCs and SOCs, also conducted in 2002, did not indicate the presence of either chemical type in the source water at concentrations great enough to be detected using current testing procedures. This means that VOC, SOC, and most IOC concentrations within the water drawn from the Kilchis Regional Water District Wellfield are far below the current EPA MCLs.

The aquifer sensitivity for the system is summarized on the sensitivity summary sheet in Appendix F. If a criterion on the form is checked "No", it implies that, based on our evaluation, that criterion does not contribute significantly to the aquifer's sensitivity. If neither box is checked for a criterion and/or "N/A" is written beside a criterion, it implies that there is either no information available for that specific criterion or that the criterion does not apply to the water system. We have identified the following criteria which we believe increases the aquifer's sensitivity to contamination from the surface.

4.2.1 Highly Sensitive Criteria

Based on our assessment of the well reports for Wells #1 & #2, most recent sanitary survey, and monitoring history for the Kilchis Regional Water District. The aquifer that the Wellfield draws water from is considered highly sensitive to contamination due to the shallow unconfined nature of the aquifer, Infiltration Potential score that is greater than 7 and the traverse potential score greater the 5. Wells#1 and #2 are not considered highly sensitive to contamination.

An Infiltration Potential score that exceeds 7 suggests that the combined availability of water and geologic conditions present near the Kilchis Regional Water District Wellfield will likely allow water and water-transported contaminates from the surface to easily reach the aquifer with little opportunity for a reduction in concentration.

4.2.2 Moderately Sensitive Criteria

Water quality within the aquifer is deemed to be moderately sensitive due to the presence of naturally occurring inorganic chemicals, presence of moderately permeable soils throughout the DWPA, and the close proximity of surface water to the wellfield.

Although probably naturally occurring, small concentrations of barium have been found in the source water for Kilchis Regional Water District . The presence of this chemical in the water supply could indicate aquifer sensitivity if there is a potential contaminant source that uses or produces such inorganic chemicals located within the DWPA. The following detections are far below current EPA MCLs and are considered safe concentrations for both short- and long-term exposure. Associated exposure symptoms and health risks are included here as general information and **are not** intended to raise an immediate concern.

- **Barium.** Present in the source water at a concentration of 0.0003 mg/L, the EPA MCL is 2.0000 mg/L. Ingesting high levels of barium over the short-term can result in difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, brain swelling, muscle weakness, and damage to the liver, kidney, heart, and spleen. However, the long-term effects of people ingesting low levels of barium are unknown.

The Kilchis River is within 500 feet of both wells. Surface water can be a source of micro-organisms, including Giardia and Cryptosporidium in addition to bacteria and viruses and therefore contributes to aquifer sensitivity. If the water system's wellfield is in hydraulic connection with either surface water body, surface water may be moving directly into the wells. Kilchis Regional Water District initiated a field investigation that indicated surface water and groundwater near the wellfield were likely to be hydraulically connected. Subsequent Microscopic Particulate Analysis (MPA) testing resulted in two low scores, suggesting that local surface water bodies do not represent a threat to drinking water quality in terms of Giardia and/or Cryptosporidium contamination. **However, MPA testing alone does not rule out the potential**

for bacteria and viruses, originating in local surface water sources, to impact local groundwater quality near the wellfield. In addition to the potential threat of bacterial and viral contamination, any accidental chemical spill within the Kilchis River, either within the DWPA or upstream from the DWPA, could also impact water quality.

Kilchis Regional Water District Well #1 was drilled in the 1975 before the Oregon Water Resources Department (OWRD) significantly raised their well construction standards in 1979. This suggests that even if the well had been built to meet the current construction standards, enough time has passed for the original casing and casing seal to begin deteriorating under normal conditions.

5. Inventory of Potential Contaminant Sources

5.1 Methodology

The primary intent of an inventory is to identify and locate potential contaminate sources of concern within the drinking water protection area. Significant sources of contamination can be defined as any facility or activity that stores, uses, or produces contaminants of concern and has a sufficient likelihood of releasing such contaminants to the environment at levels that could contribute significantly to the concentration of these contaminants in the source waters of the public water supply. The inventory is a very valuable tool for the local community in that it:

- Provides information on the locations of potential contaminant sources, especially those that present the greatest risks to the water supply,
- Provides an effective means of educating the local public about potential problems, and
- Provides a reliable basis for developing a local management plan to reduce the risks to the water supply.

Inventories were focused primarily on the potential contaminate sources regulated under the federal Safe Drinking Water Act (SDWA). This includes contaminants with a maximum contaminant level (MCL), contaminants regulated under the Surface Water Treatment Rule, and the microorganism Cryptosporidium. The inventory was designed to identify several categories of potential contaminate sources including micro-organisms (i.e., viruses, Giardia lamblia, Cryptosporidium, and bacteria); inorganic compounds (i.e., nitrates and metals); and organic compounds (i.e., solvents, petroleum compounds and pesticides). Contaminants can reach a water body (groundwater, rivers, lakes, etc.) from activities occurring on the land surface or below it. Contaminant releases to water bodies can also occur on an area-wide basis or from a single point source.

It is advantageous to identify as many potential risks as possible within the drinking water protection area during the inventory. It is important to remember the sites and areas identified in this section are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly. Not all of these inventoried activities pose actual high risks to your public water supply. The day-to-day operating practices and environmental (contamination) awareness varies considerably from one facility or land use activity to another.

When identifying potential risks to a public water supply, it is necessary to make "worst-case" assumptions. This is important because it is the potential risk that we are attempting to

determine. The worst-case assumption that has to be made when considering potential risks to water bodies is that the facility or activity is not employing good management practices or pollution prevention. Also, assumptions are made about what sources are included in particular types of land use. For example, it is assumed that rural residences associated with farming operations have specific potential contamination sources such as fuel storage, chemical storage and mixing areas, and machinery repair shops. Any errors in these assumptions can be easily corrected as the community moves beyond the assessment to develop a protection plan.

Past, current, and possible future potential contaminate sources were identified through a variety of methods and resources. In completing this inventory, DEQ used readily available information including a review of DEQ and other agencies' databases of currently listed sites, interviews with the public water system operator, and field observation as discussed below. In-depth analysis or research was not completed to assess each specific facility's compliance status with local, state and/or federal programs or laws. Further, the inventory process did not include an attempt to identify unique contamination risks at individual sites such as facilities (permitted or not) that do not safely store potentially hazardous materials.

The process for completing the inventory for the alluvial aquifer portion of Kilchis Regional Water District's drinking water protection area included several steps, which are summarized as follows:

1. Relevant information as of August 2001 were collected from applicable state and federal regulatory databases including the following lists:

    - DEQ Environmental Cleanup Site Information System (ECSI) which includes the U.S. EPA National Priorities List (NPL) and the U.S. EPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLA) list;
    - DEQ leaking underground storage tank (LUST) list;
    - DEQ registered underground storage tank (UST) list;
    - DEQ Source Information System (for water discharge permit sites including National Pollutant Discharge Elimination System (NPDES) permits, Water Pollution Control Facility (WPCF) permits, storm water discharge permits, and on-site sewage (septic) system permits);
    - DEQ Active Solid Waste Disposal Permits list;
    - DEQ Dry-Cleaners list;

- State Fire Marshall Hazardous Material Handlers (HAZMAT) site list (information on materials in a gas-form was not used since gaseous compounds rarely pose a threat to surface water or groundwater);

- DEQ Underground Injection Control (UIC) list of facilities with registered underground injection control systems; and

- DEQ Hazardous Waste Management Information System (HWIMSY) list which includes U.S. EPA Resource Conservation Recovery Act (RCRA) generators or notifiers and U.S. EPA RCRA Treatment, Storage, and Disposal Facility (TSDF) Permits.

Because of the way various state and federal databases are set up, the specific location of listed sites is not always given or accurate within the database. DEQ verified the presence and approximate location of potential contaminant sources within the drinking water protection area by consulting with local community members and/or by driving through the area (windshield survey) as discussed below in subsequent inventory steps.

2. A windshield survey was conducted by driving through the alluvial aquifer portion of the drinking water protection area to field locate and verify as many as possible of the potential contaminant source activities. We looked for potential contaminant sources within four general categories of land use: residential/municipal, commercial/industrial, agricultural/forest, and other land uses (see Appendix C, Table 1).

3. Relative risk levels of higher-, moderate-, or lower-risk were assigned to each potential contaminant source based on the Oregon Source Water Assessment Plan (1999). A summary of the types of potential contaminant sources and level of assigned risk is presented in Appendix C, Table 1 (Summary of Potential Contaminant Sources by Land Use). The comments section of Appendix C, Table 2 (Inventory Results- List of Potential Contaminant Sources) provides justification for any modifications to the risk rating that may have resulted from field observations that were different from what is typically expected for the specific facility. For example, a "random dumpsite" is typically considered a moderate risk to groundwater. However, if disposal of hazardous or toxic substances was observed during the field visit, the risk rating may be modified to "higher". Relative risk ratings are considered an effective way for the water supply officials and community to prioritize management efforts for the drinking water protection area. When the local water supply officials and community "team" enhance the inventory for use in developing management options, further analysis may need to be conducted to more closely evaluate the actual level of risk.

4. A final summary of the inventoried sources and the GIS base map were prepared and included in this report.

Oregon Health Division (OHD) had determined that the Kilchis Regional Water District's wells are "in hydraulic connection" with the Kilchis River. This inventory addresses only the

groundwater portion of the delineation. Completing a detailed evaluation of potential contaminant sources within the Kilchis River watershed upstream of the public water system's wells is outside the scope of this Source Water Assessment.

5.2 Results

The results of the inventory were analyzed in terms of current, past, and future land uses; their time of travel (TOT) relationship to the well site; and their associated risk to the public water system. In general, land uses that are closest to the well and those with the highest risk pose the greatest threat to your drinking water supply. Inventory results are summarized in Appendix C, Tables 1 and 2 and are shown on Figure 2. There were no facilities or sites identified within the Drinking Water Protection Area on the regulatory databases that were searched (see Step 1 in the previous section).

5.2.1 Within The Alluvial Aquifer Boundary

Two potential contaminant sources (Reference Number 6 on Figure 2 and Appendix C, Table 2) were identified within the alluvial aquifer boundary. The potential contaminant sources within the alluvial aquifer boundary pose a moderate risk to the drinking water supply. The moderate risk site with in the DWPA is a transportation corridor. With the exception of a transportation-stream crossing-perennial which represents a low risk.

5.2.2 Overview of Inventory Results for the Surface Water Protection Area

As discussed above, potential contaminant sources within the Kilchis River watershed upstream of the public water system's wells is outside the scope of this Source Water Assessment. We recommend the water system and community "enhance" the inventory of the alluvial aquifer area by identifying potential contaminant sources within the Kilchis River watershed upstream of the wells. A list of potential contaminant sources to a surface water supply that are most likely to affect groundwater is provided in Table 3 (Attachment C). This short-list of potential contaminant sources includes primarily sources that present a high risk of transmitting toxics and micro-organisms. At a minimum, these sources should be considered for their potential risk to the water supply.

6. Susceptibility of the Drinking Water Source

Drinking water susceptibility can be defined as the potential for contamination within the Drinking Water Protection Area (DWPA) to reach the well(s) and/or spring(s) being used by a Public Water System. The overall purpose of the susceptibility analysis is to identify the potential threats to drinking water quality and help prioritize community efforts for minimizing the contamination risk associated with those threats. Therefore, the susceptibility analysis is dependent on four factors; (1) identifying the location of the DWPA, (2) the sensitivity of the constructed intake (i.e. well or spring), (3) the sensitivity of the aquifer to contamination, and (4) the occurrence and distribution of high- and moderate-risk potential contaminate sources within the DWPA. These four steps were accomplished during the delineation, sensitivity analysis, and potential contaminate source inventory phases of this assessment.

The susceptibility analysis is a management guidance tool that should be used to recognize and identify environmental conditions that are favorable for contamination of the drinking water supply. For example, if a contaminate is released to soils or groundwater in an area of high sensitivity, it is likely that contamination of the aquifer will occur if remedial action is not taken. However, the susceptibility analysis should **not** be used to predict when or if contamination will actually occur.

The susceptibility analysis is completed by overlaying the potential contaminate source inventory results onto a map of the highly and moderately sensitive aquifer areas inside the DWPA (Appendix B, Figure 4) which were identified using an overlay of either soil sensitivity, traverse potential (TP), or infiltration potential (IP) in Appendix B, Figure 3. These are areas within the DWPA where rapid infiltration of water from the surface is most likely to occur. Potential contaminate source inventory results are analyzed in terms of current, past, and future land uses; their time of travel relationship or proximity to the well and/or spring location(s); and their associated risk rating (Appendix B, Figure 2). High- and moderate-risk contaminate sources have been identified using a "worst-case" assumption (See Chapter 5, Inventory of Potential Contaminate Sources) and are defined as any facility or activity that stores, uses, or produces a contaminate of concern in large enough quantities that if released, could be detectable in the public water supply.

In general, land use activities which pose the greatest threat to the drinking water supply are those which are closest to the well(s) and/or spring(s) and have the highest associated risk rating. Therefore, the DEQ and DHS Drinking Water Program strongly recommend that the community address all high- and moderate-risk potential contaminate sources that occur within their DWPA in order to reduce the risk of their drinking water supply becoming contaminated. How the potential contaminate sources are prioritized and the level of management strategies that are appropriate depend on the proximity of the potential contaminate source to the well and/or spring and whether the sensitivity of the aquifer at the PCS site is high, moderate, or low.

If a public water system's drinking water source is considered susceptible to contamination, it is

recommended that the system identify those condition(s) that lead to the susceptibility and take steps to protect the resource (i.e., work directly with the public and facility operators to implement sound management practices, etc...). Public water systems that are not considered susceptible should identify factors that could lead to future susceptibility and are encouraged to take action to preserve future water quality by developing a management strategy that will ensure on-going resource protection.

6.1 Intake Susceptibility

Well #1 is moderately sensitive due to the age of the well and its commingling. Well #2 is not sensitive and there for can not be susceptible.

6.2 Aquifer Susceptibility

We consider the aquifer that the wellfield is drawing water from to be highly sensitive to contamination due to shallow unconfined nature of the aquifer and the Infiltration Potential score that is greater than 7 near the wellfield. We also consider the aquifer to be moderately sensitive due to trace amounts of naturally occurring inorganic chemicals, and the close proximity of surface water to the wellfield. **Therefore, it is reasonable to assume that the aquifer is highly susceptible to contaminate sources located within the Drinking Water Protection Area.**

6.2.1 Potential Contaminant Sources and Time-of-Travel Zones

In general, PCSs within the shorter time-of-travel zones pose greater risk than those in the longer time-of-travel zones. Also of concern is the location and distribution of these sources with respect to high and moderately sensitive areas. Overlaying the PCS location map and the sensitivity map for the Water System provides a tool to determine the susceptibility of the community's drinking water supply to contamination from each PCS (see Appendix B, Figure 4). The table below indicates the relationship between potential contaminate source risk, aquifer sensitivity, and estimated contaminate arrival time at the well, wellfield, and/or spring. The community can use the PCS location numbers on the inventory map in conjunction with the displayed aquifer sensitivity and relative risk rankings for each PCS from Table 2 (Appendix C) to identify the susceptibility of the drinking water source to contamination from each PCS and take steps to reduce the risk accordingly.

We have attempted to quantify the relative susceptibility of the water system with regard to the PCSs present in the DWPA using the table below. Across the top of the table, the groundwater protection area is subdivided to account for areas of high, moderate, and low sensitivity. Potential contaminate source risk categories (high, moderate, and low) are listed down the left hand side of the table. The relative aquifer susceptibility to each PCS is demonstrated by the

shading of each cell in the table. Cells that are shaded dark grey indicate a highly-susceptible condition, light grey shaded cells indicate a moderately-susceptible condition, and white cells indicate conditions of low susceptibility. The numbers in each cell correspond to the potential contaminate source reference numbers shown in Appendix C, Table 2 and shown on Figure 4, Appendix B. It should be noted that there are multiple sources for most the reference numbers indicated in Table 2. The Table below takes into account the existence of these multiple contaminate sources with multiple reference number entries. Cells that do not contain a number indicate that there are no known potential contaminate sources that meet the conditions for the cell. Potential contaminate sources that meet the specific criteria for a cell in the table can be identified by reviewing Figure 4 in Appendix B and Table 2 in Appendix C. The number of potential contaminate sources are totaled across the bottom of the table.

Table. Kilchis Regional Water District Wellfield Susceptibility as a Function of PCS Risk, and Aquifer Sensitivity.

	Groundwater Protection Area		
	High	Mod	Low
High Risk PCSs			0
Moderate Risk PCSs		0	0
Low Risk PCSs	0	6	0
Total PCSs	0	2	0

The distribution of high, moderate, and low sensitivity areas inside the Drinking Water Protection Area can be determined using either soil sensitivity or the mapped distribution of Traverse Potential (TP) or Infiltration Potential (IP). In the case of the Kilchis Regional Water District Wellfield, we have decided to rely upon the distribution of sensitive soils throughout the DWPA. In this case, our decision to use soil sensitivity is driven by a lack of available TP and IP scores throughout the Kilchis River Valley. Therefore, it is reasonable to assume that the natural aquifer sensitivity to contamination throughout the DWPA is dependent on water travel time through the local soils.

A total of 2 potential contaminate sources were identified(one Moderate and one low risk) inside the Kilchis Regional Water District Wellfield Drinking Water Protection Area. Based on the analysis results shown in the relative susceptibility table, we consider the Kilchis Regional Water District Emergency Well to be moderately susceptible to this potential contaminate source inside the Groundwater DWPA. There are 6 other inventoried potential contaminate source locations

that appear outside the DWPA the should be addressed in the Drinking Water Protection Plan. **As a result of this analysis we recommend that the water system develop a Drinking Water Protection Plan that addresses all high and moderate risk potential contaminate sources in and around the DWPA, beginning with those sources which represent the greatest susceptibility risk. At a minimum, the water system should work with representatives from those PCSs posing a moderate to high susceptibility risk within the DWPA to (1) determine the level of environmental protection employed in the day-to-day operations of the facility and (2) identify any reasonable Best Management Practices that will lead to an additional reduction of contamination risk.**

6.2.2 Susceptibility to Microbial Contaminate Sources

The U.S. EPA is authorized under the Safe Drinking Water Act to develop disinfection requirements for all public water systems. The EPA has already established such requirements for drinking water sources identified as surface water and groundwater under the direct influence of surface water through the Surface Water Treatment Rule. Currently the EPA is in the process of developing a National Primary Drinking Water Regulation that will address disinfection requirements for drinking water sources identified as groundwater. The purpose of the Groundwater Rule will be to protect the public from microbial (i.e., fecal) pathogens in groundwater and to prevent other waterborne disease outbreaks.

Under the Groundwater Rule, groundwater-based public water systems will have to disinfect their drinking water unless they can demonstrate that their source is not susceptible to fecal contamination. This demonstration will likely comprise four different elements: (1) enhanced sanitary surveys, (2) source water monitoring, (3) correction of source water intake defects, and (4) hydrogeologic assessments. The hydrogeologic assessment is based on determining the groundwater (aquifer) sensitivity with respect to microbial contamination. **If a sensitive aquifer exists in conjunction with a source of fecal contamination, the drinking water source is considered to be susceptible to microbial contamination.** In addition, it is also recognized that the source water intake construction may be significant in contributing to the susceptibility of a groundwater source to microbial contamination. **Specifically, if the current construction or condition of the source water intake (well or spring box) allows for the migration of shallow water into the aquifer and/or the distribution system, the drinking water source should be considered susceptible.**

The susceptibility analysis used in the Source Water Assessment was developed with the pending Groundwater Rule in mind. The Source Water Assessment specifically includes an evaluation of aquifer characteristics, well construction, and estimated time for recharging surface water to reach the aquifer within the Drinking Water Protection Area, which are the critical factors in determining aquifer susceptibility to microbial contamination. In addition, the delineation effort usually includes the identification of the 2-year Time-of-Travel boundary where potential microbial sources of contamination (identified in the potential contaminate source inventory)

may present an acute (immediate) risk to public health. However, in the case of Kilchis Regional Water District, a 2-year Time-of-Travel boundary was not identified. The entire groundwater DWPA for Kilchis Regional Water District is encompassed within the one year time of travel.

The two-year time frame is used as a conservative estimate of the survival time for some viruses. **Based on the assessment results, the aquifer is considered sensitive to viral contamination due to an Infiltration Potential score that is greater than 7 and a Traverse Potential score greater than 5, which suggests a short travel time to the aquifer. Since viral contaminate sources have been identified within close proximity to the wellfield, we consider the aquifer to be susceptible to viral contamination. Therefore, it is in the water system's best interest to reduce the potential for future viral contamination by complying with all Oregon Department of Human Services setback standards related to public drinking water supply sources.**

7. Recommended Use of the Source Water Assessment Report

The process for developing a Drinking Water Protection Plan can be summarized as follows:

Assessment Phase (Source Water Assessment provided by DHS and DEQ)

- Delineate the area that serves as the source of the public water supply (Drinking Water Protection Area (DWPA)
- Inventory the potential risks or sources of contamination within the DWPA
- Determine the areas most susceptible to contamination

Protection Phase (performed by the water system or community)

- Assemble a local Drinking Water Protection Team
- Enhance the Source Water Assessment if necessary
- Develop a plan to reduce the risk of contamination (protect the resource)
- Develop a contingency plan to address the potential loss of the drinking water supply
- Certify (optional) and implement the Drinking Water Protection Plan

The assessment phase was funded by the federal Safe Drinking Water Act. Its purpose is to supply the water system with the information necessary to develop a Drinking Water Protection Plan. In Oregon, development of a protection plan is voluntary.

Prior to moving into the protection phase, DEQ recommends the inventory presented in this document be reviewed in detail to clarify the presence, location, operational practices, actual risks, etc. of the identified facilities and land use activities. The SWA inventory should be regarded as a preliminary review of potential sources of contamination within the drinking water protection area. Resources within the community should be used to do an "enhanced inventory" to refine this preliminary list of potential sources of contamination.

It is also important to remember that not all of the inventoried activities will need to be addressed if you choose to develop a Drinking Water Protection Plan. When developing a protection plan, sources which pose little or no threat to your drinking water source can be screened out. For example, if any of the land use activities are conducted in a manner that already significantly reduces the risk of a contamination release, the facility would not need to re-evaluate their practices based on drinking water protection "management". One of the goals of developing a plan based on the inventory results is to address those land use activities that do pose high or moderate risks to your public water supply. The system should target these facilities with greater levels of education and technical assistance to minimize the risk of contamination.

Limited technical assistance is available through the DEQ and Drinking Water Program at DHS for water systems that choose to move beyond the assessments and voluntarily develop a Drinking Water Protection Plan. Using the results of the assessment, the water system/community can form a Drinking Water Protection Team of individuals that have a stake in the plans implementation.

Forming a local team to help with the development of a protection plan is very important. Oregon's drinking water protection approach relies upon the concept of "community based protection", as are many other water quality programs. This simply refers to the concept of allowing local control and decision-making to implement the water quality protection effort. Community-based protection is successful only with significant local citizen stakeholder involvement. Community-based protection can draw on the knowledge and successful adaptive practices within the area. Landowners generally know best how to achieve water resource restoration and protection as long as a thorough explanation of the problem is provided, the objectives to solve the problem are clearly defined and technical assistance is available.

In community-based protection, citizens have more control and are therefore more likely to participate in the program and be more willing to assist with the educational and outreach effort which will make the plan successful. We recommend that the protection plan be developed so as to minimize any burdens on individual property owners, but maximize the equity in responsibility for reducing the risks of future contamination.

Protecting the drinking water supply in a community can also be a very effective way to encourage all citizens to participate in an issue which directly affects everyone in that community. This often leads to more public involvement in other significant local decisions concerning future livability issues, e.g., land use planning. In communities already developing and implementing Drinking Water Protection Plans, the process has served to bring many diverse interests together on a common goal and strengthen the local rural and urban relationships through communication and increased understanding. The risks and sources of water quality problems are not only from industries, farmers and managed forests, but every individual living, commuting, and working in that area.

Communities/water systems interested in developing Drinking Water Protection Plans may contact the Department of Environmental Quality (503-229-5413) or the DHS Drinking Water Program (541-726-2587) for further information.

Appendix

A. References

B. Figures

C. Inventory of Potential Contaminant Sources

D. Well Report

E. Parameters Used in Delineation Model

F. Sensitivity Summary

G. Groundwater Fact Sheet

H. BMPs For Some Activities Commonly Found Within Drinking Water Protection Areas

I. Drinking Water Protection in Oregon

Additional copies of the appendix materials are available upon written request to the following address:

Groundwater Coordinator
Drinking Water Program
Department of Human Services
442 A Street
Springfield, OR 97477

Appendix A: References

Bowlsby, C. C. and Swanson, R. C., 1964. Soil Survey of the Tillamook Area, Oregon. U.S. Department of Agriculture, Series 1957, No. 18.

Ray E.Wells, Parke D. Snavely, Jr, N.S. MacLeod, Michael . Kelly, and Michael J. Praker, 1994, U.S. Geological Survey, Geologic Map of the Tillmook Highlands, Open file report 94-21.

National Oceanic and Atmospheric Administration (NOAA), 1982. Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1951 - 80 Oregon, Climatography of the United States No. 81 (By State).

Stewart, S. and Nelson, D., 1996. Oregon Wellhead Protection Program Guidance Manual. Oregon Department of Environmental Quality (available at www.deq.or.state.us).

Stewart, S. and Nelson, D., 1999. Oregon Source Water Assessment Plan. Oregon Department of Environmental Quality.

Appendix B: Figures

Figure 1: Drinking Water Protection Area - Groundwater Source

Figure 2: Potential Contaminant Survey

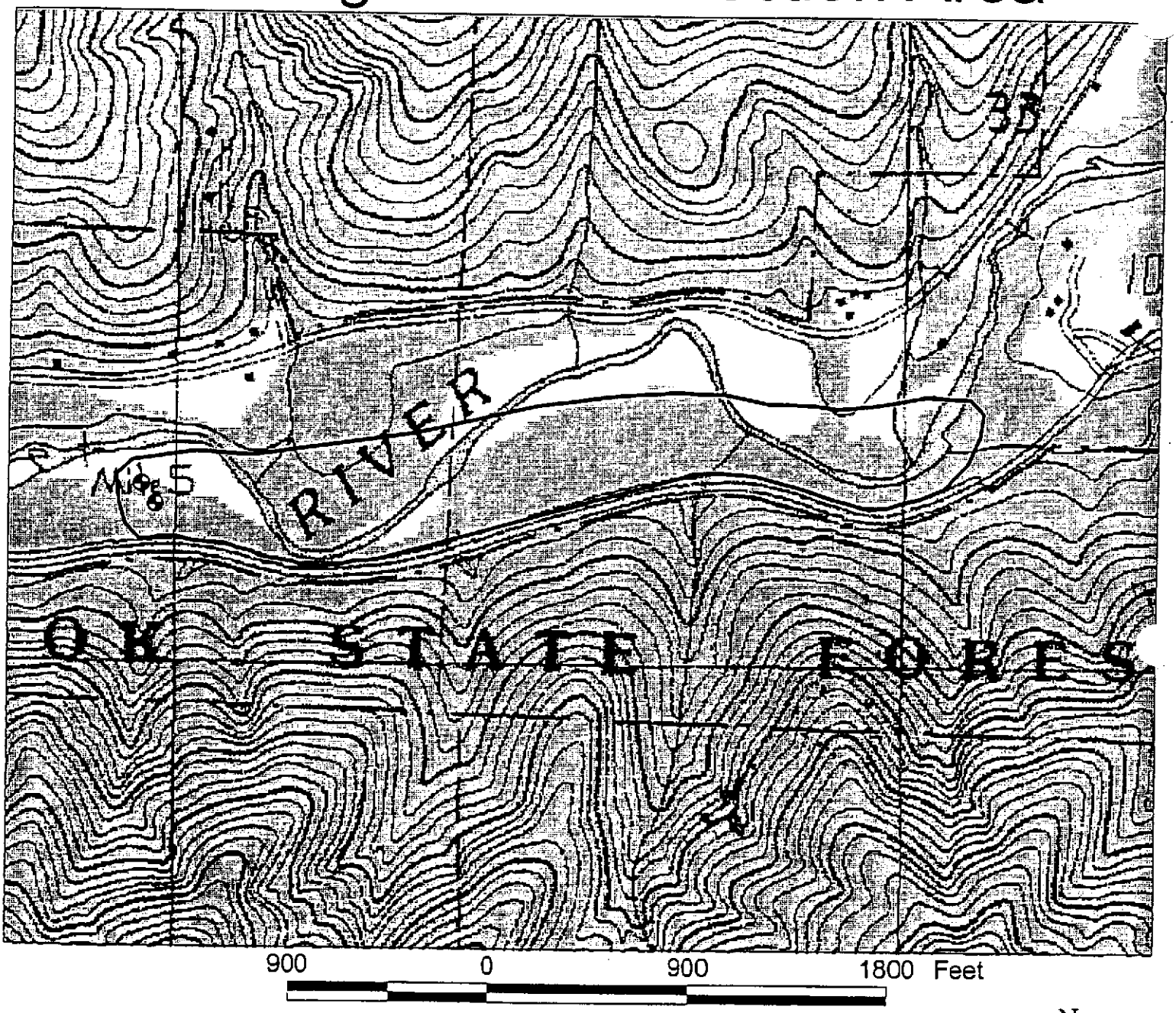
Figure 3: Sensitivity Map

Figure 4: Susceptibility Map

Figure 5: Drinking Water Protection Area - Watershed

Kilchis Regional Water District Drinking Water Protection Area

Figure 1



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Drinking Water Protection Area (DWPA)
Time-of-Travel (TOT) Entire Area
Outlined is within the 1-year TOT

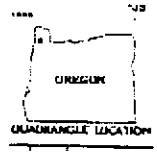
Delineation Area: 0.061 mi2
Numerical Model: MODFLOW/Steady State
Model Parameters:
Hydraulic Conductivity
Kx=Ky=10200ft/day: Kz=1020 ft/day
Aquifer Thickness: 75ft
Water Use: 325pgm

Prepared By Mike Hayes
Oregon Assoc. of Water Utilities
Review by: Dennis Nelson RG#1224
PWS# 4100079

Well Location:
Well 1: 45 31'24.875" N 23 48'30.339"W
Well 2: 45 31' 23.999"N 23 48'29.442"W
Datum: WGS 1984

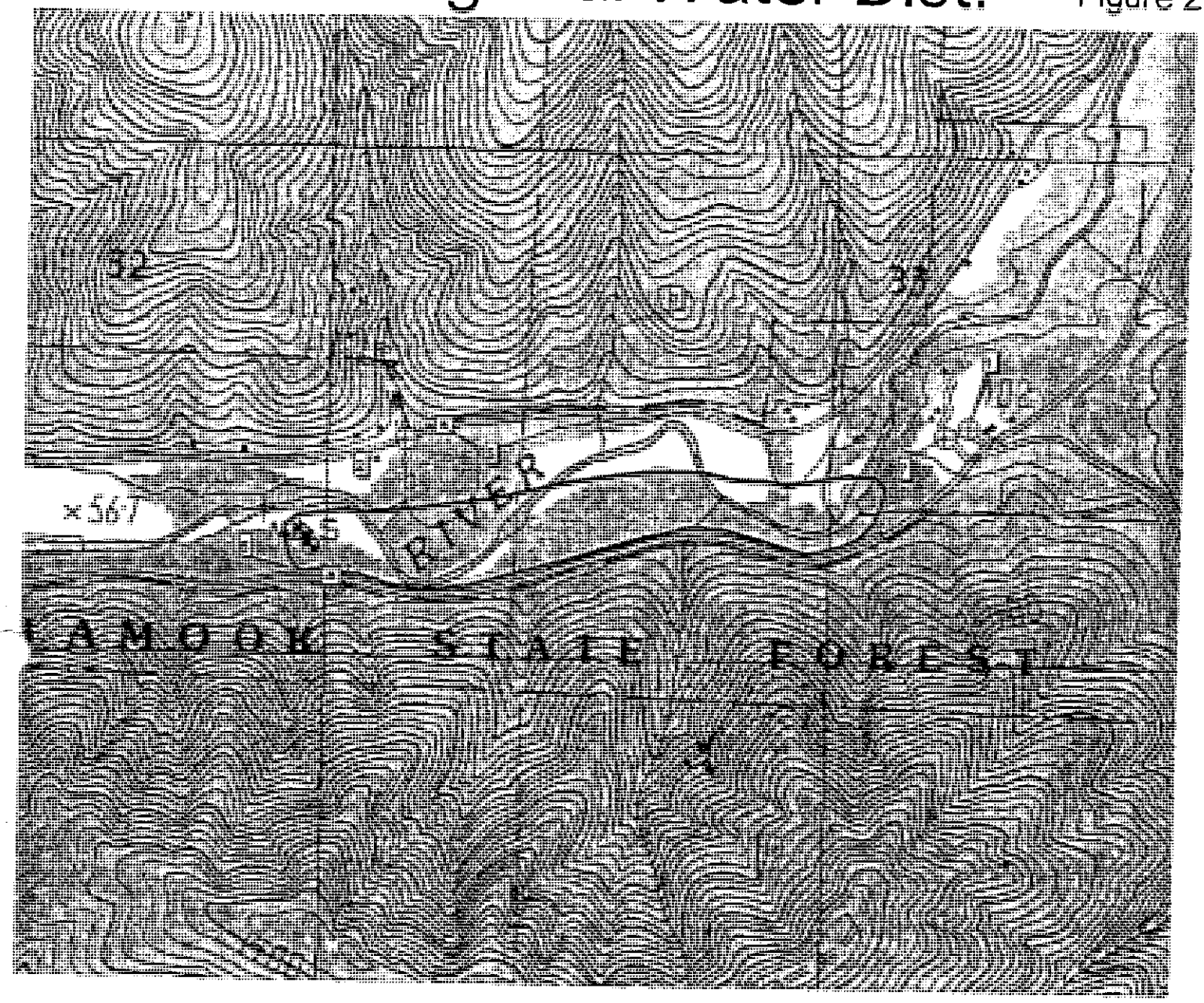
T1NR9W Sec 32 USGS Kilchis River, OR 7.5 minute topographic quadrangle

Tillmook County



Potential Contaminant Inventory Kilchis Regional Water Dist.

Figure 2



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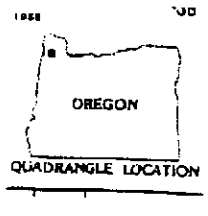
Potential Contaminant Inventory
Relative Risk Level

⊕ Higher
▣ Mderate
△ Lower

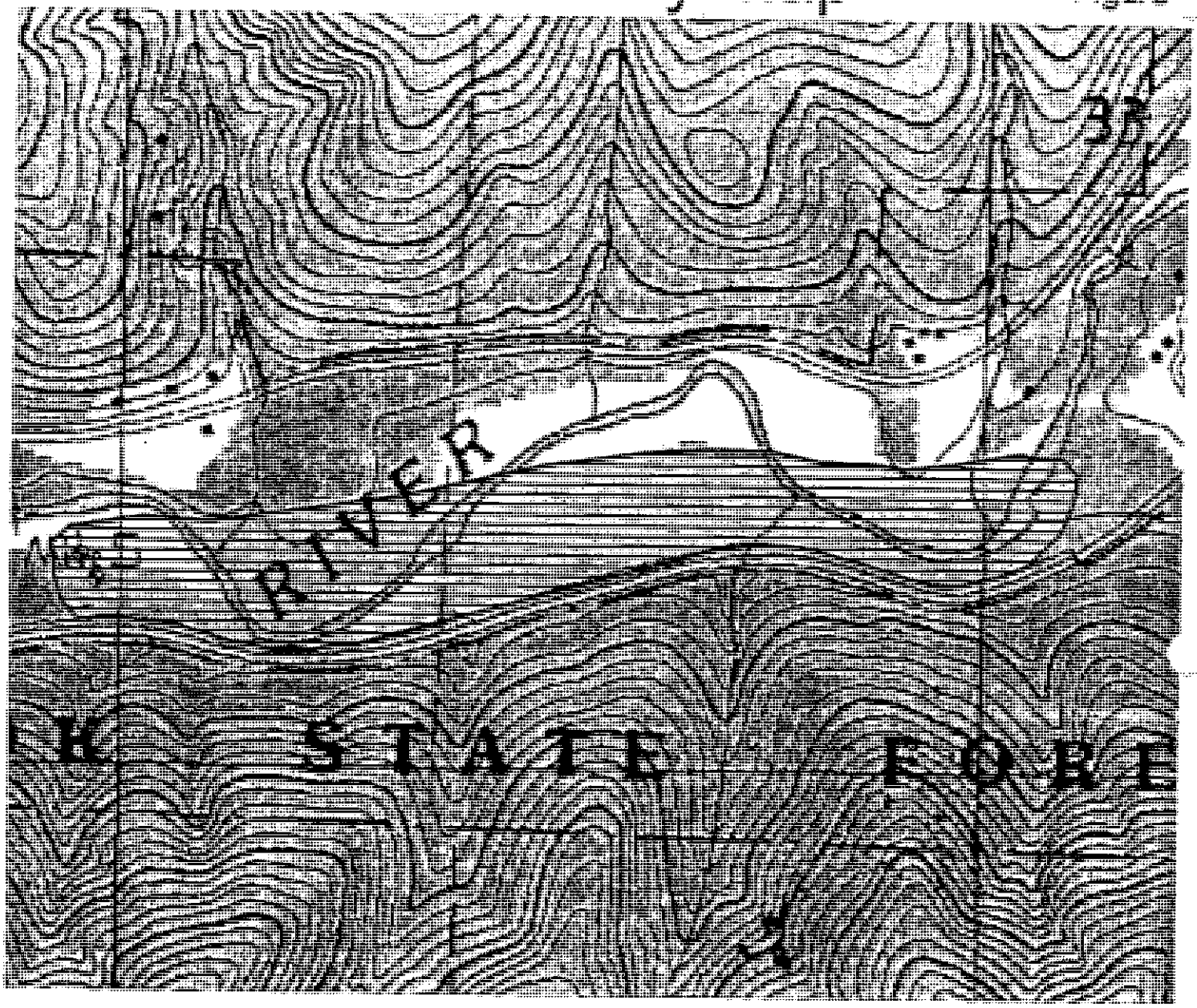
Note: Sites and areas noted in this figure are potential sources of contamination to the drinking water identified by oregon drinking water protection staff. Environmental contamination is not likely to occur when chemicals are used and managed properly.

Numbers indicate potential contaminante sources which are explained in Table 2



Kilchis Regional Water Dist.
Soil Sensitivity Map

Figure



700 0 700 1400 Feet

Scale 1:12000

N

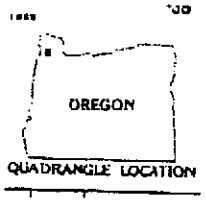
Drinking Water protection area (DWPA)
Time of Travel (TOT) entire area outlined is with in the 1-year TOT.

Aquifer sensitivity based on depth to aquifer and permeability of subsurface materials.

Map patterns are based on soil sensitivity and indicate how rapidly water moves across the soil zone under saturated conditions

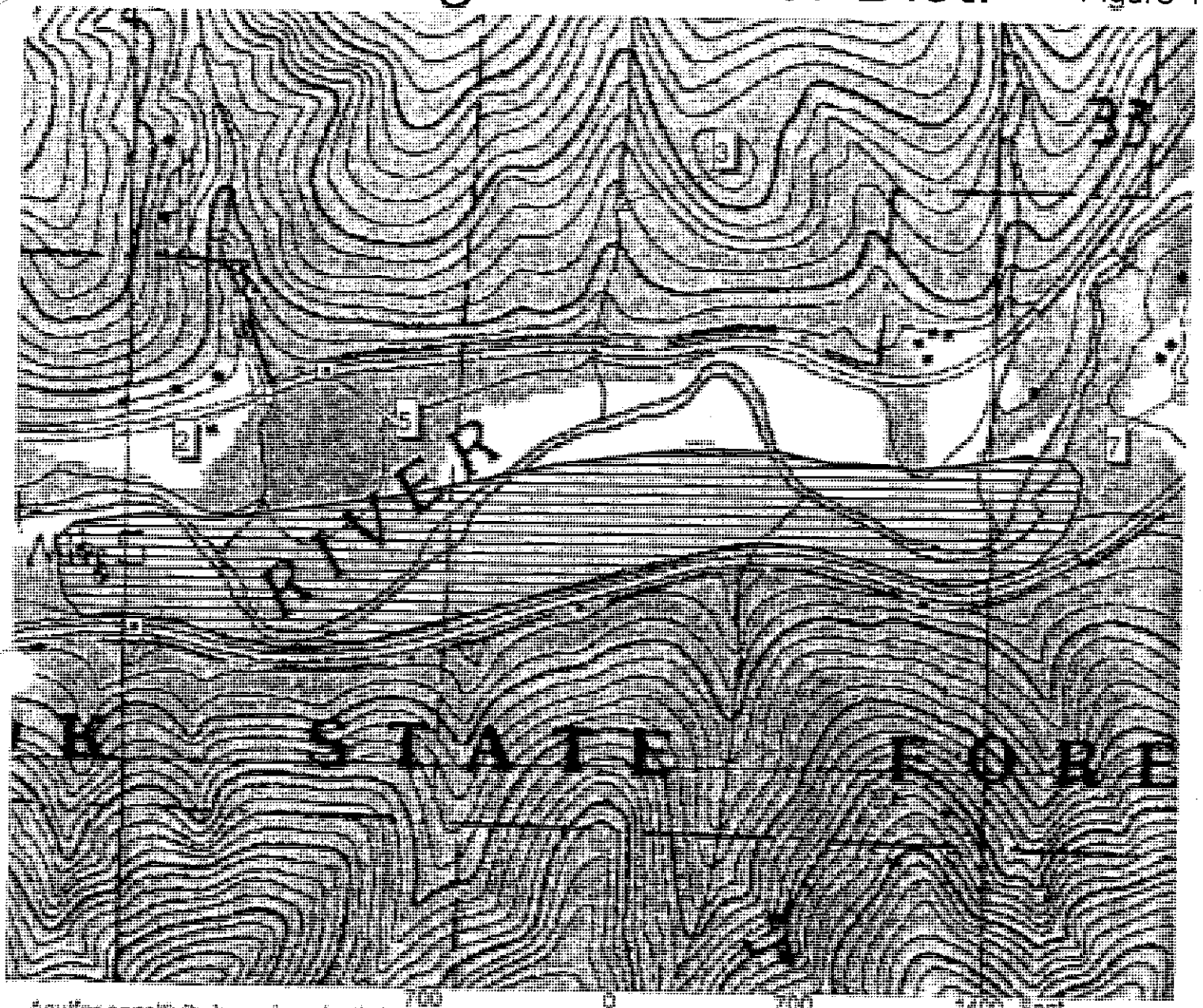
Soil Sensitivity Patterns
(within DWPA only)

Horizontal Lines: Medium



Aquifer Susceptibility Map
Kilchis Regional Water Dist.

Figure 4



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Aquifer sensitivity based on depth to aquifer, permeability of subsurface materials

Map patterns are based on soil sensitivity and how rapidly water moves accross the soil zone under saturated conditions

Potential Contaminant Inventory
Relative Risk Level

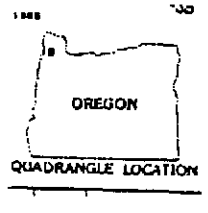
- ⊕ Higher
- ▣ Mderate
- ▵ Lower

Soil sensitivity pattern
Horizontal lines: Medium

Note: Sites and areas noted in this figure are potential sources of contamination to the drinking water identified by oregon drinking water protection staff. Environmental contamination is not likely to occur when chemicals are used and managed properly.

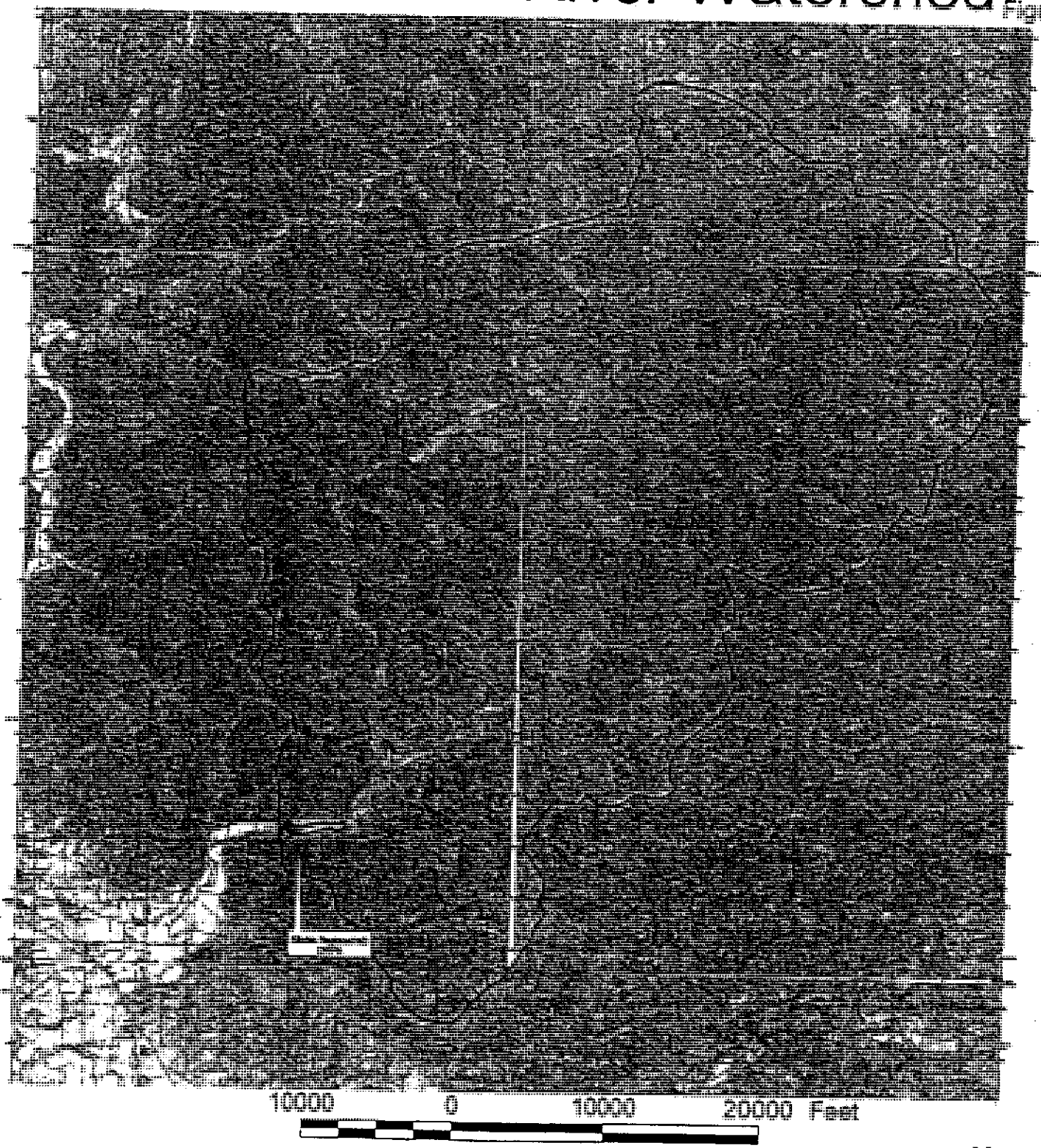
Numbers indicate potential contaminante sources which are explained in Table 2

Features or activities that are identified as high or moderate rish that occur within an area designated as high or moderate sensitivitypose a greater risk to drinking water quality than those in areas of low sensitivity



Kilchis Regional Water District
Northern Kilchis River Watershed

Fig. 5



Scale: 1:110,000

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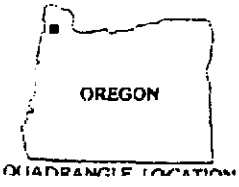
Kilchis River watershed upstream of Kilchis Regional Water District Drinking Water Supply Wells. Land use activities within the watershed may impact the supply wells.

Watershed delineated based on areal topography



QUADRANGLE LOCATION

Appendix C: Inventory of Potential Contaminant Sources

APPENDIX C - INVENTORY OF POTENTIAL CONTAMINANT SOURCES
KILCHIS REGIONAL WATER DIST., - PWS # 4100079
OREGON SOURCE WATER ASSESSMENT

Inventory Results

Table 1. Summary of Potential Contaminant Sources by Land Use

Table 2. Inventory Results - List of Potential Contaminant Sources

Notes for Tables:

Sites and areas identified in these Tables are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

Total number of sources listed in Table 1 in the DWPA may not add up to the total number of potential contaminants sources in Table 2 because more than one type of potential contaminant source may be present at any given facility.

Data collected by Mike Hayes, Oregon Association of Water Utilities on 11/14/01.

Acronyms:

AST - Aboveground Storage Tank
DC - DEQ's Dry Cleaner database
DEQ - Oregon Department of Environmental Quality
DWPA - Drinking Water Protection Area
ECSI - DEQ's Environmental Cleanup Site Information database
HWIMSY - DEQ's Hazardous Waste Information Management System database
LUST - DEQ's Leaking Underground Storage Tank database
NPDES - National Pollution Discharge Elimination System
PCS - Potential Contaminant Source
PWS - Public Water System
SFM - State Fire Marshall's database of hazardous materials
SIS - DEQ's Source Information System database (includes WPCF & NPDES permits)
SWMS - DEQ's Solid Waste Management System database
UST - DEQ's Underground Storage Tank database or Underground Storage Tank
WPCF - Water Pollution Control Facility
WRD - Oregon Water Resources Division database for water rights information

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100079 KILCHIS REGIONAL WATER DIST.,

Residential/Municipal Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Airport - Maintenance/Fueling Area		Higher	0
Apartments and Condominiums		Lower	0
Campgrounds/RV Parks	(1)	Lower	1
Cemeteries - Pre-1945		Moderate	0
Drinking Water Treatment Plants		Moderate	0
Fire Station		Lower	0
Fire Training Facilities		Moderate	0
Golf Courses		Moderate	0
Housing - High Density (> 1 House/0.5 acres)		Moderate	0
Landfill/Dumps	(1)	Higher	0
Lawn Care - Highly Maintained Areas		Moderate	0
Motor Pools		Moderate	0
Parks		Moderate	0
Railroad Yards/Maintenance/Fueling Areas		Higher	0
Schools		Lower	0
Septic Systems - High Density (> 1 system/acre)	(1)	Higher	0
Sewer Lines - Close Proximity to PWS	(1)	Higher	0
Utility Stations - Maintenance Transformer Storage		Higher	0
Waste Transfer/Recycling Stations	(1)	Moderate	0
Wastewater Treatment Plants/Collection Stations	(1)	Moderate	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100079 KILCHIS REGIONAL WATER DIST.,

Commercial/Industrial Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Automobiles - Body Shops		Higher	0
Automobiles - Car Washes		Moderate	0
Automobiles - Gas Stations		Higher	0
Automobiles - Repair Shops		Higher	0
Boat Services/Repair/Refinishing		Higher	0
Cement/Concrete Plants		Moderate	0
Chemical/Petroleum Processing/Storage		Higher	0
Dry Cleaners		Higher	0
Electrical/Electronic Manufacturing		Higher	0
Fleet/Trucking/Bus Terminals		Higher	0
Food Processing		Moderate	0
Furniture/Lumber/Parts Stores		Moderate	0
Home Manufacturing		Higher	0
Junk/Scrap/Salvage Yards		Higher	0
Machine Shops		Higher	0
Medical/Vet Offices	(1)	Moderate	0
Metal Plating/Finishing/Fabrication		Higher	0
Mines/Gravel Pits		Higher	0
Office Buildings/Complexes		Lower	0
Parking Lots/Malls (> 50 Spaces)		Higher	0
Photo Processing/Printing		Higher	0
Plastics/Synthetics Producer		Higher	0
Research Laboratories		Higher	0
RV/Mini Storage		Lower	0
Wood Preserving/Treating		Higher	0
Wood/Pulp/Paper Processing and Mills		Higher	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100079 KILCHIS REGIONAL WATER DIST.,

Agricultural/Forest Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Auction Lots	(1)	Higher	0
Boarding Stables	(1)	Moderate	0
Confined Animal Feeding Operations (CAFOs)	(1)	Higher	0
Crops - Irrigated (inc. orchards, vineyards, nurseries, greenhouses)	(2)	Moderate	0
Crops - Nonirrigated (inc. Christmas trees, grains, grass seed, pasture)		Lower	0
Farm Machinery Repair		Higher	0
Grazing Animals (> 5 large animals or equivalent/acre)	(1)	Moderate	0
Lagoons/Liquid Wastes	(1)	Higher	0
Land Application Sites	(1)	Moderate	0
Managed Forest Land - Broadcast Fertilized Areas		Lower	0
Managed Forest Land - Clearcut Harvest (< 35 yrs.)		Moderate	0
Managed Forest Land - Partial Harvest (< 10 yrs.)		Moderate	0
Managed Forest Land - Road Density (> 2 mi./sq. mi.)		Moderate	0
Pesticide/Fertilizer/Petroleum Storage, Handling, Mixing, & Cleaning Ar		Higher	0
Recent Burn Areas (< 10 yrs.)		Lower	0
Managed Forest Lands - Status Unknown		Moderate	0
Other: managed forest >35 years old		Lower	1

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water.
Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100079 KILCHIS REGIONAL WATER DIST.,

Miscellaneous Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Above Ground Storage Tanks - Excluding Water		Moderate	0
Channel Alterations - Heavy		Lower	0
Combined Sewer Outfalls	(1)	Lower	0
Stormwater Outfalls	(1)	Lower	0
Composting Facilities	(1)	Moderate	0
Historic Gas Stations		Higher	0
Historic Waste Dumps/Landfills	(1)	Higher	0
Homesteads - Rural - Machine Shops/Equipment Maintenance		Higher	1
Homesteads - Rural - Septic Systems (< 1/acre)	(1)(3)	Lower	2
Injection/Dry Wells, Sumps - Class V UICs	(1)	Higher	0
Kennels (> 20 Pens)	(1)	Lower	0
Military Installations		Higher	0
Random Dump Sites		Moderate	0
River Recreation - Heavy Use (inc. campgrounds)	(1)	Lower	1
Sludge Disposal Areas	(1)	Moderate	0
Stormwater Retention Basins	(1)	Moderate	0
Transmission Lines - Right-of-Ways		Lower	0
Transportation - Freeways/State Highways/Other Heavy Use Roads		Moderate	2
Transportation - Railroads		Moderate	0
Transportation - Right-Of-Ways - Herbicide Use Areas		Moderate	0
Transportation - River Traffic - Heavy		Lower	0
Transportation - Stream Crossing - Perennial		Lower	2
UST - Confirmed Leaking Tanks - DEQ List		Higher	0
UST - Decommissioned/Inactive		Lower	0
UST - Nonregulated Tanks (< 1,100 gals or Large Heating Oil Tanks)		Higher	0
UST - Not Upgraded and/or Registered Tanks		Higher	0
UST - Upgraded/Registered - Active		Lower	0
UST - Status Unknown		Higher	0
Upstream Reservoirs/Dams		Lower	0
Wells/Abandoned Wells		Higher	2
Large Capacity Septic Systems (serves > 20 people) - Class V UICs	(1)	Higher	0
Construction/Demolition Areas		Moderate	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100079 KILCHIS REGIONAL WATER DIST.,

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
1	Homesteads - Rural - Machine Shops/Equipment Maintenance	Rural homestead with machine shops/equipment maintenance	South Kilchis River Road	Bay City	Field-Observation	Outside sensitive areas.	Higher	Spills, leaks, or improper handling of solvents, fuels, and other materials or chemicals during transportation, use, storage and disposal may impact the drinking water supply.	Possibly a commercial fisherman
2	Wells/Abandoned Wells	Rural Homesteads with septic systems and wells	Kilchis River Road	Bay City	Field-Observation	Outside sensitive areas.	Higher	Improperly installed or maintained wells and abandoned wells may provide a direct conduit for contamination to groundwater and drinking water source.	All homes have private wells and septic systems and are on lots greater than 2 acres in size.
	Homesteads - Rural - Septic Systems (< 1/acre)						Lower	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water. Use of drain cleaners and dumping household hazardous wastes can result in groundwater contamination.	All homes have private wells and septic systems and are on lots greater than 2 acres in size.
3	Other managed forest >35 years old	Kilchis River Watershed	North of well	Bay City	Field-Observation	Outside sensitive areas.	Lower	The impacts of this potential contaminant source will be addressed during the enhanced inventory.	Watershed logged more than 35 years ago
4	Campgrounds/RV Parks	Kilchis Park/Boat Ramp	Kilchis Park	Bay City	Field-Observation	Outside sensitive areas.	Lower	Leaks or spills of automotive fluids or improperly managed septic systems and wastewater disposal may impact drinking water supply. Heavy usage along edge of waterbody may contribute to erosion, causing turbidity.	
	River Recreation - Heavy Use (inc. campgrounds)						Lower	Inadequate disposal of human wastes may contribute bacteria and nutrients to the drinking water supply. Heavy use may contribute to streambank erosion causing turbidity. Fuel spills and emissions may also contribute to contamination.	

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

(1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

(2) See Table 3 for database listings (if necessary).

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100079 KILCHIS REGIONAL WATER DIST.,

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
5	Transportation - Stream Crossing - Perennial	Kilchis River Road	Kilchis River Road	Bay City	Field-Observation	Outside sensitive areas.	Lower	Road building, maintenance & use may increase erosion & slope failure causing turbidity. Vehicle use increases the risk of leaks or spills of fuel & other chemicals. Over-application/improper handling of pesticides in right-of-way may also impact water.	Road crosses several small to moderate sized streams.
	Transportation - Freeways/State Highways/Other Heavy Use Roads						Moderate	Vehicle use increases the risk for leaks or spills of fuel & other haz. materials. Road building, maintenance & use can increase erosion/slope failure causing turbidity. Over-application or improper handling of pesticides/fertilizers may impact water.	Road crosses several small to moderate sized streams.
6	Transportation - Stream Crossing - Perennial	South Kilchis River Road	South Kilchis River Road	Bay City	Field-Observation	Outside sensitive areas.	Lower	Road building, maintenance & use may increase erosion & slope failure causing turbidity. Vehicle use increases the risk of leaks or spills of fuel & other chemicals. Over-application/improper handling of pesticides in right-of-way may also impact water.	Road crosses several small to moderate sized streams.
	Transportation - Freeways/State Highways/Other Heavy Use Roads						Moderate	Vehicle use increases the risk for leaks or spills of fuel & other haz. materials. Road building, maintenance & use can increase erosion/slope failure causing turbidity. Over-application or improper handling of pesticides/fertilizers may impact water.	Road crosses several small to moderate sized streams.
7	Wells/Abandoned Wells	Rural homesteads with septic and wells	South Kilchis River Road	Bay City	Field-Observation	Outside sensitive areas.	Higher	Improperly installed or maintained wells and abandoned wells may provide a direct conduit for contamination to groundwater and drinking water source.	All homes have private wells and septic systems and are on lots greater than 2 acres in size.
	Homesteads - Rural - Septic Systems (< 1/acre)						Lower	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water. Use of drain cleaners and dumping household hazardous wastes can result in groundwater contamination.	All homes have private wells and septic systems and are on lots greater than 2 acres in size.

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

2) See Table 3 for database listings (if necessary).

Appendix D: Well Reports

filed with the

...GINEER, SALEM, OREGON 97310
...within 30 days from the date
of well completion.

STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No. _____

State Permit No. _____

(1) OWNER:

Name City of Bay City

Address Bay City, Oregon

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:

Threaded ☐ Welded ☒

12 " Diam. from plus 2 ft. to 0 ft. Gage .375
12 " Diam. from 0 ft. to 26 ft. Gage _____
10 " Diam. from 40 ft. to 46½ ft. Gage .250

(6) PERFORATIONS:

Perforated? ☐ Yes ☒ No

Type of perforator used

Size of perforations in. by in.

_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? ☒ Yes ☐ No

Manufacturer's Name Johnson

Type low carbon steel Model No. _____

Diam. 10 Slot size 100 Set from 20 ft. to 40 ft.

Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom?

Yield: 1200 gal./min. with 3 ft. drawdown after 24 hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow ¼ g.p.m.

Temperature of water Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used cement grout

Well sealed from land surface to 25 ft.

Diameter of well bore to bottom of seal 16 in.

Diameter of well bore below seal 12 in.

Number of sacks of cement used in well seal 6 sack mix sacks

Number of sacks of bentonite used in well seal 0 sacks

Brand name of bentonite _____

Number of pounds of bentonite per 100 gallons of water _____ lbs./100 gals.

Was a drive shoe used? ☒ Yes ☐ No Plugs _____ Size: location _____ ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☐ No Size of gravel: _____

Gravel placed from _____ ft. to _____ ft.

USE ADDITIONAL SHEETS IF NECESSARY

(10) LOCATION OF WELL:

County _____ Driller's well number _____

SW ¼ SW ¼ Section 33 T. 1N R. 9W

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well

Depth at which water was first found 17 ft.

Static level 17 ft. below land surface. Date 9/23/75

Artesian pressure _____ lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing _____

Depth drilled 60 ft. Depth of completed well 46½ ft.

Formation: Describe color, texture, grain size and structure of materials and show thickness and nature of each stratum and aquifer penetrated with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
clay grave soil brown	0	3	12
sandy gravel gray brown	3	19	12
sand gravel water gray	19	35½	17
clay brown	35½	38½	17
rocky clay brown	38½	42	
brown weathered rock	42	60	42
hard rock	60	60½	

Work started 9/15/75 19 Completed 9/27/75 19

Date well drilling machine moved off of well 9/27/75 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervisio... Materials used and information reported above are true to ... best knowledge and belief.

[Signed] _____ (Drilling Machine Operator) Date 9/30/75 19

Drilling Machine Operator's License No. 213

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

Name Zent Drilling, Inc. (Person, firm or corporation) (Type or print)

Address 7310 St. Johns Vancouver, Wash. 986...

[Signed] _____ (Water Well Contractor)

Contractor's License No. 228 Date 9/30/75 19

STATE ENGINEER, SALEM, OREGON — (Please type or print)

within 30 days from the date of well completion.

(Do not write above this line) Well #2

State Permit No. _____

(1) OWNER:

Name City of Bay City

Address Bay City, Oregon

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:

Threaded ☐ Welded ☒

12 " Diam. from plus 2 ft. to 21 ft. Gage .250

_____ " Diam. from _____ ft. to _____ ft. Gage _____

_____ " Diam. from _____ ft. to _____ ft. Gage _____

(6) PERFORATIONS:

Perforated? ☐ Yes ☒ No

Type of perforator used

Size of perforations _____ in. by _____ in.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? ☒ Yes ☐ No

Manufacturer's Name Johnson

Type stainless Model No. _____

Diam. 10"PS Slot size 100 Set from 20 ft. to 40 ft.

Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller

Yield: 1000 gal./min. with 3.5 ft. drawdown after 24 hrs.

" " " "

" " " "

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Artesian flow _____ g.p.m.

Temperature of water _____ Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used Cement

Well sealed from land surface to 20 ft.

Diameter of well bore to bottom of seal 16 in.

Diameter of well bore below seal 10 in.

Number of sacks of cement used in well seal 6 sack mix sacks

Number of sacks of bentonite used in well seal none sacks

Brand name of bentonite _____

Number of pounds of bentonite per 100 gallons of water _____ lbs./100 gals.

Was a drive shoe used? ☐ Yes ☒ No Plugs _____ Size: location _____ ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ depth of strata _____

Method of sealing strata off _____

Was well gravel packed? ☐ Yes ☒ No Size of gravel: _____

Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Tillamook Driller's well number _____

SW ¼ SW ¼ Section 33 T. 1 R. 9

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found 15

Static level 15 ft. below land surface. Date _____

Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing 10

Depth drilled 50 ft. Depth of completed well 50

Formation: Describe color, texture, grain size and structure of mate and show thickness and nature of each stratum and aquifer penet with at least one entry for each change of formation. Report each chan position of Static Water Level and indicate principal water-bearing s

MATERIAL	From	To	S
clay sand brown	0	7	
clay gravel cobbles gray	7	18	
sand gravel water gray	18	29	
clay gravel cobbles brown	29	36	
sand gravel water brown	36	41	
clay brown	41	43	
clay gravel brown	43	50	

Work started 4/28/80 19 Completed 5/9/80 19

Date well drilling machine moved off of well 5/12/80 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervisi Materials used and information reported above are true to best knowledge and belief.

[Signed] _____ Date 5/12, 19.
(Drilling Machine Operator)

Drilling Machine Operator's License No. 574

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this repor true to the best of my knowledge and belief.

Name Zent Drilling, Inc.
(Person, firm or corporation) (Type or print)

Address 7310 St. Johns Vancouver, Wash. 986

[Signed] _____
(Water Well Contractor)

Contractor's License No. 228 Date 5/13/80 19.

Appendix E: Parameters Used in Delineation Model

Delineation Method: ☐ Calculated Fixed Radius ☐ Enhanced CFR ☐ Analytical
☒ Numerical ☐ Hydrogeologic Mapping

Pump Rate (Q in gpm): *323*

Source: ☒ System ☐ Water Resources Dept ☐ Comparable Community
☐ Pump Capacity ☐ Population Estimate ☐ 90% of Safe Yield

Nature of the Aquifer: ☐ Unknown ☒ Unconfined
☐ Semi-confined ☐ Confined

Aquifer name: Kilchis River Alluvium

Confining unit lithology: NA
Depth to 1st confining unit: NA
Thickness of confining unit: NA
Depth to 2nd confining unit: NA
Thickness of confining unit: NA
Depth to Aquifer: 15 feet

Aquifer Characteristics:

Lithology:

☐ Unknown ☐ Sandy Silt ☐ Layered Volcanic Rocks
☐ Sand ☒ Sand & Gravel ☐ Fractured Volcanic Rocks
☐ Gravel ☐ Cobbles/Gravel ☐ Fractured Sedimentary Rocks
☐ Other: _____

Thickness (b): Water-Bearing Zone: 20 feet

Effective Porosity (n): 0.25

Hydraulic Conductivity (Permeability): 0.1181 ft/day ☐ N/A
☒ Estimated from lithology ☐ Specific Capacity (Well Report)
☐ Published Report ☐ Aquifer Test

Hydraulic Gradient: 0.0000347 Flow Direction: Down Stream ☐ N/A
☐ Published Report ☐ Graphical Solution
☐ Field Measurements ☒ Model Results

Irrigation Wells Accounted for: 0 wells

Appendix F: Sensitivity Summary: Kilchis Regional Water District Well #1

Highly Sensitive Source: ☒ Yes ☐ No

Yes	No	
☒	☐	Unconfined Aquifer: Shallow (< 100 Ft), No significant clay layers
☐	☒	Unconfined Aquifer: Cobbles/gravel
☐	☒	Unconfined Aquifer: Fractured bedrock
☐	☒	Fractured Confined Aquifer <50 feet Below the Surface
☐	☒	Other Aquifer (describe: .....
☐	☒	Organic Chemical Detection: .....
☐	☒	Inorganic Chemical Detection (>50% MCL) .....
☐	☒	Source-related Coliform: total ..... fecal ..... Date .....
☐	☒	Nitrate-N≥ 5mg/L: Concentration ..... Date .....
☐	☒	Well Construction/Setback or Monitoring Deficiencies from Site Visit: .....
☐	☒	Well Report Missing/Unavailable
☐	☒	Casing Seal Missing/Unknown
☐	☒	Inappropriate Casing Seal Depth (depth recommendation: .....)
☐	☒	Inappropriate Casing Seal Material
☐	☒	Casing Seal Not Constructed Properly:.....
☒	☐	Traverse Potential >5 (Not performed on TNCWS)
☒	☐	Infiltration Potential >7 (Not performed on TNCWS)

Moderately Sensitive Source: ☒ Yes ☐ No

Yes	No	
☐	☒	Shallow (<50 feet) Confined Alluvial Aquifer and Thin (<15ft) Confining Unit
☐	☒	Deep Unconfined Aquifer
☐	☒	Fractured Bedrock at Surface
☐	☒	Aquifer Character unknown
☒	☐	Commingling of Aquifers Suspected
☐	☒	Nitrate-N 1-4.9 mg/L: Concentration .....Date
☒	☐	Inorganic Chemical Detection (<50% of MCL): **Barium** .....
☐	☒	Well Construction Deficiencies from Site Visit.....
☒	☐	Well constructed prior to 1979
☐	☒	Other Wells Score ≥ 400
☐	☒	Soil with TOT <65 hours or lack of soil information in DWPA
☐	☒	Infiltration Potential 4 to ≤ 7 (Not performed on TNCWS)
☒	☐	Surface water within 500 feet:

1. Note that it is possible for a single system to have criteria from both the high and moderately sensitive lists. Having a criterion checked "yes" indicates that this characteristic contributes to the sensitivity at the indicated level.

Additional Comments: Well reports indicates bore hole drilled into bed rock with lower head level .....

Sensitivity Analysis Completed by: Mike Hayes ..... **Date:** 04/09/2003 .....

Appendix F: Sensitivity Summary: **Kilchis Regional Water District Well #2**

Highly Sensitive Source: ☒ Yes ☐ No

Yes	No	
☒	☐	Unconfined Aquifer: Shallow (< 100 Ft), No significant clay layers
☐	☒	Unconfined Aquifer: Cobbles/gravel
☐	☒	Unconfined Aquifer: Fractured bedrock
☐	☒	Fractured Confined Aquifer <50 feet Below the Surface
☐	☒	Other Aquifer (describe: .....
☐	☒	Organic Chemical Detection: .....
☐	☒	Inorganic Chemical Detection (>50% MCL) .....
☐	☒	Source-related Coliform: total ..... fecal ..... Date .....
☐	☒	Nitrate-N≥ 5mg/L: Concentration ..... Date .....
☐	☒	Well Construction/Setback or Monitoring Deficiencies from Site Visit: ....
☐	☒	Well Report Missing/Unavailable
☐	☒	Casing Seal Missing/Unknown
☐	☒	Inappropriate Casing Seal Depth (depth recommendation: .....)
☐	☒	Inappropriate Casing Seal Material
☐	☒	Casing Seal Not Constructed Properly:.....
☒	☐	Traverse Potential >5 (Not performed on TNCWS)
☒	☐	Infiltration Potential >7 (Not performed on TNCWS)

Moderately Sensitive Source: ☒ Yes ☐ No

Yes	No	
☐	☒	Shallow (<50 feet) Confined Alluvial Aquifer and Thin (<15ft) Confining Unit
☐	☒	Deep Unconfined Aquifer
☐	☒	Fractured Bedrock at Surface
☐	☒	Aquifer Character unknown
☐	☒	Commingling of Aquifers Suspected
☐	☒	Nitrate-N 1-4.9 mg/L: Concentration ..... Date
☒	☐	Inorganic Chemical Detection (<50% of MCL): **Barium** .....
☐	☒	Well Construction Deficiencies from Site Visit.....
☐	☒	Well constructed prior to 1979
☐	☒	Other Wells Score ≥ 400
☐	☒	Soil with TOT <65 hours or lack of soil information in DWPA
☐	☒	Infiltration Potential 4 to ≤ 7 (Not performed on TNCWS)
☒	☐	Surface water within 500 feet: **Kilchis River within 500 ft**

1. Note that it is possible for a single system to have criteria from both the high and moderately sensitive lists. Having a criterion checked "yes" indicates that this characteristic contributes to the sensitivity at the indicated level.

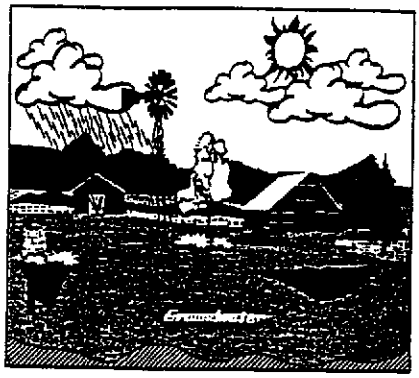
Additional Comments: .....

.....

Sensitivity Analysis Completed by: Mike Hayes ..... **Date:** 0409/2003 .....

Appendix G: Groundwater Fact Sheet

DRINKING WATER PROTECTION FACT SHEET
GROUNDWATER BASICS

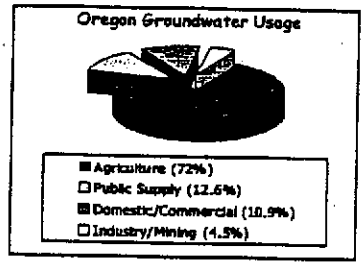


What Is Groundwater?

Groundwater can be found at various depths at any location on the Earth's surface. It is the water that fills the natural open spaces (e.g., fractures or pore spaces between grains) in soil and rocks underground in much the same way as water fills a sponge. Groundwater begins as precipitation and soaks into the ground where it is stored in underground geological water systems called aquifers. An aquifer is any geologic material (like sand and gravel or fractured bedrock) that is filled with water and will yield that water to a well. Groundwater can move sideways as well as up or down in response to gravity, differences in elevation, and differences in pressure. The movement is usually quite slow – frequently as little as a few feet per year – although it can move as much as several feet per day in more permeable zones. Groundwater does not occur as underground lakes or streams.

Who Uses Groundwater?

Of all groundwater used in Oregon, the majority is used for irrigation. Future population growth and land development is increasingly depending on groundwater resources. Prior allocation and rising treatment costs limit future use. Over 70 percent of all Oregonians (that's more than two million people) are at least partially dependent on groundwater for their drinking water supplies. Approximately 95 percent of Oregonians in rural areas are dependent on groundwater. In many areas, groundwater is the only source of drinking water. Protecting our water supply from contamination now will help maintain a clean and safe water supply for generations to come.

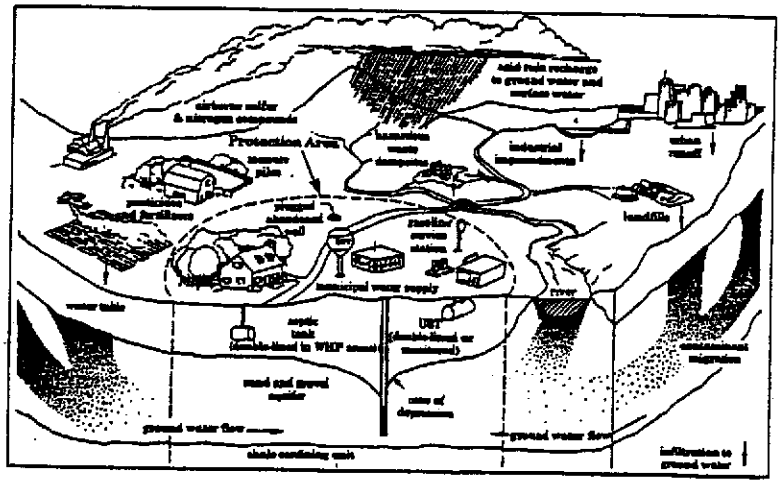


Potential Sources of Contamination

- Household chemicals and cleaning products.
- Excess nitrogen fertilizers including manure and lawn fertilizers.
- Industrial solvents.
- Chemical spills from highway, railroad accidents, or spills from business or manufacturing sites.
- Improperly applied pesticides or pesticide spills.
- Leaking underground storage tanks.
- Improperly installed or old domestic wells.
- Poorly maintained septic systems.
- Urban runoff.
- Waste disposal sites or dumps.

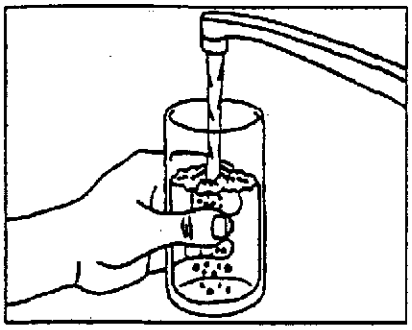
How Does Groundwater Become Contaminated?

With the increased use of chemicals in the 20th century, the contamination of groundwater has become a growing concern. When rainwater comes in contact with any source of contamination at the surface or in the soil, it dissolves some of that contaminant and carries it to the aquifer. Groundwater moves from areas where the water table is high to where the water table is low. Consequently, a contaminant may enter the aquifer some distance upgradient of a public or private drinking water well and move towards the well. When a well is pumping, it lowers the water table in the immediate vicinity of the well increasing the tendency for water to move towards the well.



Although it is common practice to associate contamination with highly visible features such as landfills, gas stations, industry or agriculture, potential contaminants are widespread and often come from common everyday activities as well, such as septic systems, lawn and garden chemicals, pesticides applied to highway right-of-ways, stormwater runoff, auto repair shops, beauty shops, dry cleaners, medical institutions, photo processing labs, etc. Importantly, it takes only a very small amount of some chemicals in drinking water to raise health concerns. For example: 1 gallon of pure trichloroethylene, a common solvent, will contaminate approximately 292 million gallons of water to the health-based limit for drinking water.

Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
811 S.W. Sixth Avenue * Portland, Oregon 97204



How Can We Protect Drinking Water?

In Oregon, the state Department of Environmental Quality (DEQ) and the Oregon Health Division (OHD) are conducting "source water assessments" for most public water systems. These assessments include the identification of the source area supplying the well (commonly called the Drinking Water Protection Area), an inventory of potential contaminant sources within that area, and an identification of the areas most susceptible to contamination. Using the results of the assessment, members of the local community can form a "Drinking Water Protection Team" and develop a plan to reduce the risks of contamination from those sources. Technical assistance in Drinking Water Protection Plan development, and implementation is available from DEQ. The management options implemented as part of the Drinking Water Protection Plan are highly individualized, and should be developed by the community to meet their specific needs. Cooperative decision making by public officials, water systems, public interest groups, business, agriculture, and individual citizens can create a powerful long-lasting partnership that will facilitate implementation and public acceptance of the drinking water protection plan.

Communities with groundwater systems interested in initiating a drinking water protection plan can get assistance from **Julie Harvey**, DEQ's Drinking Water Protection Specialist, at **503-229-5664** or toll free in Oregon at **1-800-452-4011**.

Prevention Is The Key To Protection

Once groundwater is contaminated, it is difficult, costly, and sometimes impossible to clean up; communities are faced with the task of installing treatment facilities or locating an alternate source. Some examples of this occurring in Oregon are:

* Milwaukie spent $2,000,000 to study and treat solvents in their groundwater. Annual operations and maintenance costs for the treatment system are $100,000/year.
* Over $500,000 was spent on study and treatment at Lakewood Estates. Residents used bottled water for two years.
* Lake Oswego, Woodburn, Lebanon, and Madras have all lost the use of wells due to contamination.

That is why prevention is the key to groundwater quality protection. Because of their interrelationship, maintaining groundwater quality also helps protect surface water quality.

Oregon Drinking Water Protection Success Stories

Several water purveyors in Oregon already have Drinking Water Protection Plans certified by DEQ and many others have initiated drinking water protection activities in their communities. For example, between 1995 and 1998, members of the local governments, commercial/industrial sector, agricultural growers, and residents in the cities of **Coburg** and **Junction City** worked together to develop a plan that fit the local conditions and priorities. Nitrate (a common product of septic systems and agricultural practices) was identified in the local groundwater which served as a flag to the communities that the water is also vulnerable to other potential sources of contamination. These cities are now in the process of implementing management efforts which include a highly successful citizen, agriculture, and business involvement/outreach plan and a recognition program for growers and businesses that voluntarily apply practices that are in the best interest of drinking water protection and the community.

The **Powell Valley Road Water District** in Portland also had their drinking water protection plan approved in 1998. To get the word out on drinking water protection, Powell Valley Road Water District has contacted many of the business owners within the drinking water protection area, stenciled all stormdrains, developed a video on drinking water, and hosts a community *Clean Water Festival* in September of each year.

In 1991, trace amounts of a solvent were discovered in one of **Springfield's** water supply wells indicating the wellfield was susceptible to contamination. Although the source for the solvent was identified and removed, Springfield initiated a drinking water protection program for their 12 wellfields (containing 30 individual wells) that will help ensure future risks to the public water supply are minimized. The primary protection measures in Springfield's recently completed Drinking Water Protection Plan are preventative and include a public education program and adoption of a Drinking Water Protection Zoning Overly District.

Other water purveyors are using the information obtained during the planning process to make informed choices for the land use, decide the best location to site new wells, and to focus pollution prevention efforts on the areas that matter most to the community's drinking water supply. Your community can become involved as well by contacting your public water system to find out about where your water comes from, its quality, and what is being done to protect it.

How Can I Help?

One person can make a difference. By making small changes in our lifestyles, we can make our environment better. We can als ·ourage our friends, relatives, co-workers, and neighbors to help prevent pollution. Some of the things you can do to protec ·oundwater in your community are listed below. **Oregon's future depends on us!**

Things You Can Do To Protect Groundwater

In Your Community

- Learn more about where your water supply comes from, potential sources of contamination, and local and state waste protection efforts.
- Organize a groundwater forum, community water festival, water testing or other educational event.
- Support groundwater education in local schools.
- Volunteer to help develop and implement your community's Drinking Water Protection Program.
- Encourage your community to become active in the "Groundwater Guardian" program, a national non-regulatory program that recognizes local groundwater protection efforts. Contact the Groundwater Foundation for information **1-800-858-4844.**

In The Home

- Properly dispose of **household hazardous wastes.** Take toxic chemicals like weed killers, pesticides, paint, thinners, strippers, wood preservatives, furniture polish, cleaning chemicals, and bleach to a hazardous waste collection center. Don't dump toxic chemicals down the drain or on the ground. Call your local garbage hauler for more information.
- Find out if you have **underground storage tanks** (USTs) on your property. Residential USTs typically are used to store heating oil. Rural properties and farms may have USTs for gasoline, diesel, chemical, and waste oil storage. Active USTs should be checked for leakage, which can increase with UST age. DEQ strongly recommends inactive USTs be properly removed or closed in place to prevent expensive leaks that endanger public health or damage the environment. Homeowners that replace or decommission a heating oil tank may be eligible for free technical assistance and grants from DEQ. Contact DEQ's Tank Helpline at **1-800-742-7878.**
- Conserve Water — Turn off the faucet when you are brushing your teeth, shaving, or washing your face and you will save 2-3 gallons of water each minute. Install low flow faucets and fix leaky faucets right away. Clean vegetables and fruits in a pan of water — not under a running faucet. Keep a container of drinking water in the refrigerator instead of letting the faucet run until the water is cold enough to drink. Run the dishwasher and washing machine only when fully loaded. **Make every drop count!**

In Your Garage/ Workshop

- Recycle or properly dispose of **used motor oil, grease and parts cleaners**, and **antifreeze.** Solid and hazardous waste laws prohibit land spreading of waste oil for dust or weed suppression. Call your local garbage hauler for more information.
- Check for **leaking fluids** from vehicles. Clean up drips with an absorbent like kitty litter or sawdust and properly dispose of contaminated absorbent. Do not use water to wash spills since water percolates into the ground or discharges to storm drains in the street (which typically lead to streams and rivers).
- **Inventory** your hazardous household products like thinners, solvents, oil based paints, stains and finishes, paint and finish preparation products, photographic chemicals, and art supplies. Store only what you'll use; properly dispose of waste materials; and give extras to a neighbor for their use. Use less toxic alternatives whenever possible.

Things You Can Do To Protect Groundwater (Continued)

In The Yard

- Carefully follow label directions for use and disposal of fertilizers and pesticides and use less toxic alternatives whenever possible.
- Select disease and pest resistant plants and learn about biological controls. Call your local County Extension Service Office for free information.
- Go easy on fertilizers and pesticides. Test your soil to help determine fertilizer and compost needs for your lawn and garden to avoid over fertilization.
- Water Wisely — Water during the cooler parts of the day (late evening and early morning). Water slowly and evenly with 1 to 1½ inches of water per week so that moisture soaks down to the roots. **If it doesn't grow, don't water it!** Use a broom (not a hose) to clean driveways, sidewalks, and other hard surfaces. Check for leaks in pipes, hoses, faucets, and couplings.
- Organize a local workshop with your neighbors to learn more about your wells and septic system. Call OSU's Extension Service (Gail Glick) for assistance.

Well & Septic System Owners

- Never store pesticides, fertilizers, and other chemicals in your well house to avoid direct well contamination.
- Properly abandon old wells and never use them as disposal pits. For information on abandoning wells or to order well records (logs), contact Oregon Water Resources Department at **1-800-624-3199**.
- Ensure your well construction and surface seal is adequate to minimize the chance of chemicals wicking through the soil down the outside of the casing or entering the well directly. Call your local watermaster (Oregon Water Resources Department) for a free inspection.
- Regularly test your well water for nitrates, bacteria, and other contaminants, as necessary.
- Properly maintain your septic system by having the septic tank pumped out every 2 – 3 years.
- Use less water. The more groundwater you use, the higher the risk is for pulling nearby groundwater pollution toward the well. Also, your septic system functions better if less water goes down the drain.
- Do not put improper materials down the household drains like garbage disposal food wastes, drain cleaner household chemicals, and other toxic-cleaning agents.

Who To Call For Help

For local assistance, check the government section of your phone directory for telephone numbers.

- Water Utility or Public Works Department.
- County Environmental Health Department.
- County Extension Service.
- County Development or Planning Office.
- Waste Disposal and Recycling Facility (check your monthly garbage bill for name and number).

Contact	What
Oregon Department of Environmental Quality (DEQ) 1-800-452-4011 or (503) 229-5630 Internet Page: *http://deq.state.or.us*	Drinking water protection planning, groundwater contamination, septic tanks, underground storage tanks, toxic wastes, pollution prevention, and hazardous waste reduction, collection, and disposal.
Oregon Health Division (503) 731-4010 or (541) 726-2587 Internet Page: *http://www.ohd.hr.state.or.us*	Groundwater issues, health effects, water quality concerns, drinking water testing laboratories, groundwater susceptibility, and drinking water protection.
Oregon Water Resources Department 1-800-624-3199 or (503) 378-8455 Internet Page: *http://www.wrd.state.or.us*	Abandoned wells, well construction, well logs, well maintenance, water rights, and water master.
Oregon State University Extension Service / Home*A*Syst (541) 737-6294 Internet Page: *http://www.agcomm.ads.orst.edu*	Groundwater quality assessment for rural homeowners, farmers, and private well owners, groundwater friendly gardening, and lawn care.
Oregon Department of Agriculture (503) 986-4550 Internet Page: *http://www.oda.state.or.us/Natural_Resources/wqual.htm*	Technical assistance regarding agricultural practices, effect of soil type on groundwater vulnerability, pesticides, fertilizers, best management practices, and permits.

Accessibility Information

This publication is available in alternate format (e.g., large type, braille) by calling DEQ Public Affairs at (503) 229-5317 or toll free within Oregon at 1-800-452-4011. People with hearing impairments can call DEQ's TTY number at (503) 229-6993.

7/99 — Water Quality Div.

Appendix H: BMPs For Some Activities Commonly Found Within Drinking Water Protection Areas.

Household Hazardous Waste

CHEMICAL HAZARDS IN THE HOME

PRODUCT	DISPOSAL SUGGESTIONS	SUBSTITUTES AND PRECAUTIONS
Aerosols	Best: Put only empty cans in trash. 2nd Best: Full or partially full cans to HHW collection site.	Instead: Use non-aerosol products. Safe Use: Store in cool place. Do not burn or put in trash compactor.
Batteries: household (mercury, cadmium, lithium, silver, lead)	Best: HHW collection site.	Instead: Use rechargeable batteries. Avoid battery-operated products.
Bleach: chlorine	Best: Use up/give away. 2nd Best: Flush small amounts down drain with plenty of water. Large amounts to HHW collection site.	Instead: Use 1/2 cup borax per washer load, or use hydrogen peroxide in a 3 percent solution. Safe Use: NEVER mix chlorine with ammonia or strong acids like toilet bowl cleaner. The combination produces hazardous fumes.
Detergent cleaners	Best: Use up/give away. 2nd Best: Dilute and wash down sink or take to HHW collection site.	Instead: Use nontoxic alternatives. (See below) Safe Use: Liquid dishwashing detergent is mildest, laundry detergent is moderate, automatic dishwasher detergent is harshest. Use mildest product for your needs.
Drain cleaners	Best: Use up/give away. Put empty container in trash. 2nd Best: Dilute small amounts and wash down sink or take to HHW collection site.	Instead: Use nontoxic alternatives. Do not pour grease down the drain. Pour boiling water down drain weekly. Use plunger or plumber's snake. Pour 1/2 cup baking soda and 1/2 cup vinegar down drain. Let stand 15 minutes. Pour boiling water down drain.
Medicines: unneeded or expired	Best: HHW collection site. 2nd Best: Flush down drain.	Safe Use: Check contents of medicine chest regularly. Old medications may lose their effectiveness, but not their toxicity.
Metal polishes	Best: Use up/give away. 2nd Best: HHW collection site. 3rd Best: Expose to air to evaporate solvents, then put in garbage.	Instead: Use nontoxic alternatives. Safe Use: Use only in well-ventilated area. (See below)
Mothballs	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: Before storing clean articles, double wrap in tightly sealed plastic bags or in tight container (such as a cedar chest). Safe Use: Don't use in living areas. Air out clothing before use.
Oven cleaner	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: Use a soap/borax combination, followed by a mixture of baking soda and salt for abrasion. Apply with a copper scrubber. Use cleaner without lye. Safe Use: Do not use aerosols; they can explode.
Toilet bowl cleaner	Best: Use up/give away. 2nd Best: Flush with lots of water.	Instead: Use a paste of borax and lemon juice. Scrub with a stiff brush.
Window cleaner	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: Spray on solution of 1/2 water and 1/2 vinegar; wipe dry with newspaper or squeegee. Safe Use: Ventilate room.
Wood cleaners, polishes, and waxes	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: Damp mop wood floors with mild vegetable oil soap. Rub black heel marks with paste of baking soda and water. For furniture, apply olive or almond oil. Let stand for several hours. Polish with a soft dry cloth.
Mildew remover	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: Scrub with a vinegar and salt mixture. Use borax to remove mildew from plastic shower curtains.

PESTICIDES AND YARD PRODUCTS

Insecticides	Best: If not banned, use according to label instructions. Empty cardboard containers: Dispose of empty box in garbage. Empty glass and plastic containers: Triple rinse with water and apply according to label directions. Wrap in newspaper and put in garbage. If banned: Take to HHW collection site. Do not pour on ground, in a ditch, or down a drain.	Instead: Use nontoxic alternatives. (See below) Safe Use: Do not buy more than you need.
Fertilizers	Best: Use up/give away. Put empty bag in garbage. 2nd Best: If it does not contain pesticides, put in heavy bag, tie and dispose of in garbage. If it contains pesticides, take to HHW collection site.	Instead: Use compost as fertilizer. Use organic fertilizers: bone meal, fish emulsion, manure.
Herbicides	Best: If not banned, use up/give away. Triple rinse empty containers and apply rinse water as directed. Put empty containers in trash. 2nd Best: HHW collection site. Do not dispose of in garbage, sewer, septic tank or storm drain.	Instead: Cover garden with plastic or mulch (such as alfalfa hay) to prevent weed germination. Grow a healthy lawn to out-compete weeds. Pull weeds when they first appear.

Rodenticides	Best: If not banned, use up/give away. Triple rinse empty containers and apply as directed. Put empty containers in trash. 2nd Best: HHW collection site. Do not dispose of in garbage, sewer, septic tank or storm drain.	Instead: For mice and rats: Use traps baited with a peanut butter, oatmeal and honey mixture. Use glue boards or sticky traps. Baits with warfarin are lethal to rodents, yet relatively safe for household use. For moles: Do you really want to kill them? They are voracious insect eaters. Scissor traps are effective. For gophers: Use spring traps or box traps. Set in burrow runways.

CHEMICAL HAZARDS IN THE GARAGE AND HOME WORKSHOP

Asphalt roofing compounds	Best: Use up/give away. 2nd Best: HHW collection site. 3rd Best: Expose open container to air to evaporate solvents/put in garbage.	Instead: No substitutes. Safe Use: Do not use indoors.
Auto: antifreeze	Best: HHW collection site. 2nd Best: Contact sewage treatment plant for permission to flush small amounts down the sewer. Do not flush into septic tank or pour in storm drain.	Instead: Propylene Glycol-based antifreeze is less toxic than Ethylene Glycol-based. Check the antifreeze each year to see if it really needs to be replaced. Safe Use: Clean up leaks or spills carefully.
Auto: batteries	Best: Take old batteries to battery retailer or wholesaler for recycling. (If is illegal to dispose of auto batteries.) 2nd Best: HHW collection site.	Instead: No substitutes.
Auto: degreasers	Best: Use up/give away. 2nd Best: HHW collection site. Do not mix with used oil.	Instead: Choose strong detergent type over solvent type.
Auto: used motor oil and transmission fluid	Best: Recycle at HHW collection site, recycling center or at curbside (if available). Do not pour on ground, in a ditch or down drain. Absorbent containing "easy-change" boxes cannot be recycled.	Instead: Have your oil changed at a service station that has its oil recycled.
Auto: waxes and polishes	Best: Use up/give away. 2nd Best: HHW collection site.	Instead: No substitutes. Safe Use: Use outside.
Paints: water-based and latex	Best: If paint does not contain lead (generally if manufactured since 1973), use up or give away. If paint contains mercury, use outdoors. 2nd Best: Allow to harden in can, then dispose of in garbage. 3rd Best: HHW collection site.	Instead: Use whitewash (a combination of hydrated lime, water, and salt) for fences, barns, basements and outbuildings. Safe Use: Ventilate area well.
Paints: oil-based and varnishes	Best: If paint does not contain lead, use up or give away. Let empty can dry and dispose of in garbage. 2nd Best: HHW collection site.	Instead: Use water-based or latex paints. Safe Use: Ventilate area well. Do not use near open flame. May take weeks for fumes to go away.
Paint strippers	Best: Use up or give away. Let the empty container air outside, wrap scrapings in several layers of newspaper and put in garbage. 2nd Best: HHW collection site.	Instead: Use a scraper, heat gun or sandpaper to remove paint. Use strippers with less toxic ingredients (bearing a caution advisory). Safe Use: Use in well-ventilated area. Use precautions against lead-bearing dust in some old paints.
Paint thinners	Best: Let settle, pour off thinner for reuse. Take sludge to HHW collection site. If thinner is not reusable, let small amounts (less than 1 cup) evaporate outside. Take large amounts of thinner to HHW collection site. Do not pour down a storm drain, down an inside drain, or on the ground.	Instead: Avoid paint thinners by choosing water-based paints.

CONSIDER USING NON-TOXIC ALTERNATIVES

Cleaners

- Use baking soda, whiting (powdered chalk sold at hardware and paint stores) or a nonchlorinated scouring powder such as Bon Ami™ for general cleaning.
- Use full strength vinegar plus salt to remove grease.
- Use borax to remove spots on counters.
- Use a pumice stick to clean ovens and grills and remove rust from tools.
- Use half the recommended amount of automatic dish washer detergent.

Recipes for all-purpose cleaners:

1. 1/2 cup household ammonia, 1/2 cup white vinegar, 1/2 gallon water, 1/4 cup baking soda.

2. 1 tsp. liquid soap (castile), 1 tsp. borax, 1 qt. water, 1/4 cup vinegar

Polish

Copper polish Use lemon juice and salt.

Aluminum polish Inside pan - Use 2 Tbsp. of cream of tartar to one quart of water. Bring to boil and simmer 10 minutes. Outside pan - Use baking soda and scouring pad.

Chrome polish Use baking soda or vinegar. To remove scum, try baby oil.

Brass polish Apply thick coating of 1/2 tsp. salt, 1/2 cup vinegar and enough flour to make a paste: Let set for 15-60 minutes. Rinse with water. (Do not use on metal with a lacquer coating.)

Stainless steel Use baking soda and a plastic scouring pad.

Silver Use baking soda and soft sponge or boil silver for 3 minutes with a sheet of aluminum foil, 2 inches water, 1 tsp. soda and 1 tsp. salt.

Insects on plants:

- Spray with soapy water and rinse after a few minutes.
- Place tobacco on potted plant soil.

For slugs and snails:

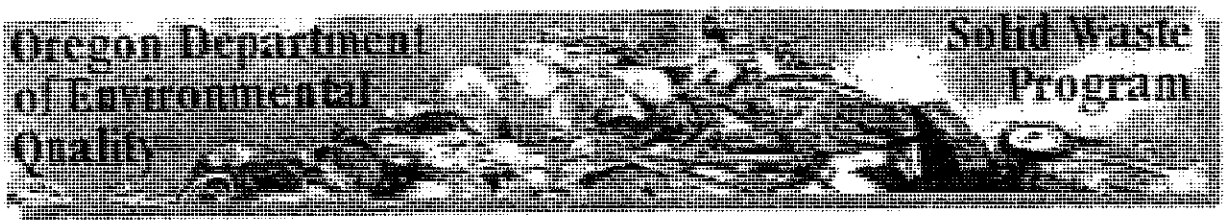
- Sprinkle sawdust, diatomaceous earth, ashes or lime around affected areas.
- Place bowls of beer around the garden.

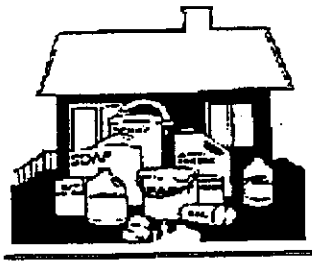
For ants:

- Use commercial sticky barriers to block ants.
- Sprinkle boric acid on trails and where ants are found in nooks and crannies.

For fleas:

- Vacuum house regularly and thoroughly.
- Bathe pet regularly.
- Launder pet bedding frequently.
- Feed cats and dogs brewer's yeast.





What Is Household Hazardous Waste?

Why Is It A Problem?

Many products found in your home can pose a health or environmental hazard if you don't dispose of them properly. Anything labeled as toxic, flammable, corrosive, reactive, infectious or radioactive can threaten family health and safety.

According to national estimates, each home contains 3 - 8 gallons of hazardous materials in kitchens, bathrooms, garages and basements. Throwing these materials into the garbage can result in sanitation workers who may be injured by fires or explosions or poisoned by acids.

Hazardous wastes that reach our landfills can leach into the soil, polluting water and threatening all living things.

Substances poured into Oregon's household drains and toilets enter into the sewage treatment process, eventually impacting fish and wildlife. Substances poured on soil or streets or into storm drains are carried to our streams. As little as one pint of solvent can cause measurable fish kills.

How To Minimize Hazardous Waste In Your Home

- Use safer alternatives.
- Read labels before purchasing. Watch for the words "caution," "warning," and "danger." Follow label directions.
- Buy only what you need and will use up.
- If you do have products left over, give them to friends, neighbors, or charitable institutions to use up.

Handle Hazardous Waste The Recommended Way

Watch For Household Hazardous Waste Collection Days.

Your community may be among those holding household hazardous waste collection events, where residents can bring unused and unwanted hazardous substances to a central location for proper sorting and disposal by local officials and hazardous waste collectors.

Until you safely dispose of these materials, you can

- Keep containers upright, tightly closed, with labels intact.
- Keep unused portions and empty containers (check labels to see if an empty container can be triple-rinsed and safely discarded in your household garbage.)
- Never mix substances or pour into other containers.
- Avoid burning or reusing empty containers.
- Keep out of reach of children, pets, and wildlife.

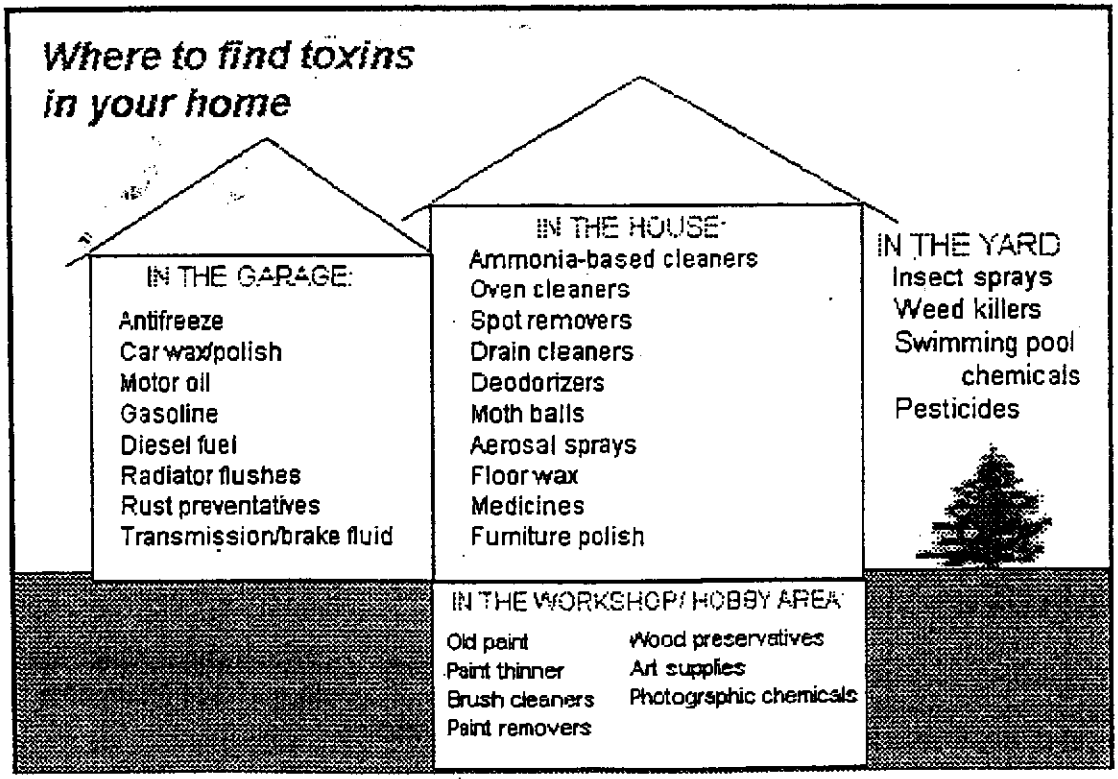
What Should You Know About Hazardous Waste?

Many home and garden products contain potentially dangerous chemicals. They may cause injury to living things or damage the environment if not used and disposed of safely.

If Something Spills ...

Your first concern must be for your own safety. If you have been exposed to toxic materials, call the Oregon Poison Control Center at 1-800-452-7165. In the Portland area, call 494-8968. For medical emergencies or large spills, call 911 or your fire department.

- Read the product label for exposure and spill information.
- Keep the area well-ventilated.
- Keep children and pets away.
- Wear gloves and protective clothing.
- Contain and cover the spill with absorbent material such as cat litter, clay, or sand.
- Sweep and scoop the material into a container with a lid or doubled plastic bags. Secure well.
- Finally, wash the surface well with soap and water.



For information on collection events, call 1-800-732-9253. For more information, call your garbage hauler, local government solid waste department, or the Oregon Department of Environmental Quality at (503)229-5913, or toll free 1-800-452-4011. If you live in the Portland area, call Metro at (503)234-3000. Ask for household hazardous waste information.

October 1998

Houshold Hazardous Waste

CHEMICAL HAZARDS IN THE HOME		
PRODUCT	DISPOSAL SUGGESTIONS	SUBSTITUTES & PRECAUTIONS
Aerosols	**Best:** Put only empty cans in trash. **2nd Best:** Take full or partially full cans to HHW collection site.	**Instead:** Use non-aerosol products. **Safe Use:** Store in cool place. Do not burn or put in trash compactor.
Batteries: *Household (mercury, cadmium, lithium, silver, lead)*	**Best:** Take to HHW collection site.	**Instead:** Use rechargeable batteries. Avoid battery-operated products.
Bleach: Chlorine	**Best:** Use up/give away. **2nd Best:** Flush small amounts down drain with plenty of water. Take large amounts to HHW collection site.	**Instead:** Use ½ cup borax per washer load, or use hydrogen peroxide in a 3% solution. **Safe Use:** Never mix chlorine with ammonia or strong acids such as toilet bowl cleaner. The combination produces hazardous fumes.
Detergent Cleaners	**Best:** Use up/give away. **2nd Best:** Dilute and wash down sink or take to HHW collection site.	**Instead:** Use non-toxic alternatives (see below). **Safe Use:** Liquid dishwashing detergent is mildest, laundry detergent is moderate, automatic dishwasher detergent is harshest. Use mildest product for your needs.
Drain Cleaners	**Best:** Use up/give away. Put empty container in trash. **2nd Best:** Dilute small amounts and wash down sink or take to HHW	**Instead:** Use non-toxic alternatives. Do not pour grease down the drain. Pour boiling water down drain weekly. Use

	collection site.	plunger or plumber's snake. Pour ½ cup baking soda and ½ cup vinegar down drain. Let stand 15 minutes. Pour boiling water down drain.
Medicines: *Unneeded or expired*	**Best:** Take to HHW collection site. **2nd Best:** Flush down drain.	**Safe Use:** Check contents of medicine chest regularly. Old medications may lose their effectiveness, but not their toxicity.
Metal Polishes	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site. **3rd Best:** Expose to air to evaporate solvents, then put in garbage.	**Instead:** Use non-toxic alternatives. **Safe Use:** Use only in well-ventilated area (see below).
Mildew Remover	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site.	**Instead:** Scrub with a vinegar and salt mixture.
Mothballs	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site.	**Instead:** Before storing clean articles, double wrap in tightly sealed plastic bags or in tight container (such as a cedar chest). **Safe Use:** Don't use in living areas. Air out clothing before use
Oven Cleaner	**Best:** Use up/give away. **2nd Best:** Flush with lots of water.	**Instead:** Use a non-chlorinated scouring powder, a pumice stick or a copper or steel wool scrubbing pad. Use cleaner without lye. **Safe Use:** Do not use aerosols; they can explode.
Toilet Bowl Cleaner	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site.	**Instead:** Use a paste of borax and lemon juice,. Scrub with a stiff brush.
Window Cleaner	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site.	**Instead:** Spray on solution of ½ water and ½ vinegar; wipe dry with newspaper or squeegee. **Safe Use:** Ventilate room.
Wood Cleaners, Polishes, and Waxes	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site.	**Instead:** Damp mop wood floors with mild vegetable oil soap. Rub black heel marks with a paste of baking soda and water. For wood furniture, apply olive or almond oil. Let stand for several hours. Polish with a soft dry cloth.

PESTICIDES AND YARD PRODUCTS		
PRODUCT	DISPOSAL SUGGESTIONS	SUBSTITUTES &

Fertilizers: *Plant food*	**Best:** Use up/give away. Put empty bag in garbage. **2nd Best:** If it does not contain pesticides, put in heavy bag, tie and dispose of in garbage. If it contains pesticides, take to HHW collection site.	**Instead:** Use compost as fertilizer. Use organic fertilizers: bone meal, fish emulsion, and manure.
Herbicides: *Weed killers*	**Best:** If not banned, use up/give away. Triple-rinse empty containers and apply rinse water as directed. Put empty containers in trash. **2nd Best:** Take to HHW collection site. Do not dispose of in garbage, sewer, septic tank, or storm drain.	**Instead:** Cover garden with plastic or mulch such as alfalfa hay to prevent weed germination. Grow a healthy lawn to out-compete weeds. Pull weeds when they first appear.
Insecticides: *Insect killers*	**Best:** If not banned, use according to label instructions. Empty cardboard containers, dispose of empty box in garbage. Empty glass and plastic containers. Triple-rinse with water and apply according to label directions. Wrap in newspaper and put in garbage. If banned: Take to HHW collection site. Do not pour on ground, in a ditch, or down a drain.	**Instead:** Use non-toxic alternatives (see below). **Safe Use:** Do not buy more than you need.
Rodenticides: *Rat poison*	**Best:** If not banned, use up/give away. Triple-rinse empty containers and apply as directed. Put empty containers in trash. **2nd Best:** Take to HHW collection site. Do not dispose of in garbage, sewer, septic tank, or storm drain.	**Instead:** For mice and rats: Use traps baited with a peanut butter, oatmeal, and honey mixture. Use glue boards or sticky traps. Baits with *warfarin* are lethal to rodents, yet relatively safe for household use. For moles: Do you really want to kill them? They are voracious insect eaters. Scissor traps are effective. For gophers, use spring traps or box traps. Set in burrow runways.

CHEMICAL HAZARDS IN THE GARAGE AND HOME WORKSHOP

PRODUCT	DISPOSAL SUGGESTIONS	SUBSTITUTES & PRECAUTIONS
Asphalt Roofing Compounds	**Best:** Use up/give away. **2nd Best:** Take to HHW collection site. **3rd Best:** Expose open container to air to evaporate solvents, then put in garbage.	**Instead:** No substitutes. **Safe Use:** Do not use indoors.
Auto: *Antifreeze*	**Best:** Take to HHW collection site. **2nd Best:** Contact sewage treatment plant for permission to flush small amounts down the sewer. Do not	**Instead:** Propylene glycol-based antifreeze is less toxic than ethylene glycol-based. Check the antifreeze each year to see if it really needs to

	storm drain.	leaks or spills carefully.
Auto: *Batteries*	**Best:** Take old batteries to battery retailer or wholesaler for recycling. (It is illegal to dispose of auto batteries.) 2nd **Best:** Take to HHW collection site.	**Instead:** No substitutes.
Auto: *Degreasers*	**Best:** Use up/give away. 2nd **Best:** Take to HHW collection site. Do not mix with used oil.	**Instead:** Choose strong detergent-type over solvent-type.
Auto: *Used motor oil and transmission fluid*	**Best:** Recycle at HHW collection site, recycling center or at curbside (if available). Do not pour on ground, in a ditch, or down drain. Absorbent containing "easy-change" boxes cannot be recycled.	**Instead:** Have your oil changed at a service station that has its oil recycled.
Auto: *Waxes and polishes*	**Best:** Use up/give away. 2nd **Best:** Take to HHW collection site.	**Instead:** No substitutes. **Safe Use:** Use outside.
Paints: *Water-based and latex*	**Best:** If paint does not contain lead (generally, if manufactured since 1973,), use up or give away. If paint contains mercury, use outdoors. 2nd **Best:** Allow to harden in can, then dispose of in garbage. 3rd **Best:** Take to HHW collection site. Do not mix with used oil.	**Instead:** Use whitewashes (a combination of hydrated lime, water, and salt) for fences, barns, basement and outbuildings. **Safe Use:** Ventilate area well.
Paints: *Oil-based and varnishes*	**Best:** If paint does not contain lead, use up/give away. Let the empty can dry and dispose of in garbage. 2nd **Best:** Take to HHW collection site. Do not mix with used oil.	**Instead:** Use water-based or latex paints. **Safe Use:** Ventilate area well. Do not use near open flame. May take weeks for fumes to go away.
Paint Strippers	**Best:** Use up/give away. Let the empty container air outside, wrap scrapings in several layers of newspaper and put in garbage. 2nd **Best:** Take to HHW collection site. Do not mix with used oil.	**Instead:** Use a scraper, heat gun or sandpaper to remove paint. Use strippers with less toxic ingredients (bearing a caution advisory). **Safe Use:** Use in well-ventilated area. Use precautions against lead-bearing dust in some old paints.
Paint Thinners	**Best:** Let settle, pour off thinner for reuse. Take sludge to HHW collection site. If thinner is not reusable, let small amounts (less than 1 cup) evaporate outside. Take large amounts to HHW collection site. Do not pour down a storm drain, an inside drain, or on the ground.	**Instead:** Avoid paint thinners by choosing water-based paints.

Consider using nontoxic alternatives

Cleaners

- Use baking soda, whiting (powdered chalk, sold at hardware and paint stores), or a non-chlorinated scouring powder such as Bon Ami™ for general cleaning.
- Use full-strength vinegar plus salt to remove grease.
- Use borax to remove spots on counters.
- Use a pumice stick to clean ovens and grills and remove rust from tools.
- Use half the recommended amount of automatic dishwasher detergent.

Recipes For All-Purpose Cleaners:

1. ½ cup household ammonia, ½ cup white vinegar, ½ gallon water, ¼ cup baking soda.
2. 1 tsp. Liquid soap (castile), 1 tsp. Borax, 1 qt. Water, ¼ cup vinegar.

Polish

Copper Polish - Use lemon juice and salt.

Aluminum Polish - Inside pan, use 2 tbsp. of cream of tartar to one quart of water. Bring to boil and simmer 10 minutes. Outside pan, use baking soda and scouring pad.

Chrome Polish - Use baking soda or vinegar. To remove scum, try baby oil.

Brass Polish - Apply thick coating of ½ tsp. salt, ½ cup vinegar and enough flour to make a paste. Let set for 15 - 60 minutes. Rinse with water. (Do not use on metal with a lacquer coating.)

Stainless Steel - Use baking soda and a plastic scouring pad.

Silver - Use baking soda and soft sponge or boil silver for 3 minutes with sheet of aluminum foil, 2 inches of water 1 tsp. baking soda, and 1 tsp. salt.

Insects On Plants:

- Spray with soapy water and rinse after a few minutes.
- Place tobacco on potted plant soil.

For Slugs and Snails:

- Sprinkle sawdust, diatomaceous earth, ashes or lime around affected areas.
- Place bowls of beer around the garden.

For Ants:

- Use commercial sticky barriers to block ants.
- Sprinkle boric acid on trails and where ants are found in nooks and crannies.

For Fleas:

- Vacuum house regularly and thoroughly.
- Bathe pet regularly.
- Launder pet bedding frequently.
- Feed cats and dogs brewer's yeast.

Solid Waste Program Site
Oregon DEQ Home Page

Return to Household Hazardous Waste
Updated: December 4, 1998

Other Publications Available from the DEQ Solid Waste Program:

- Natural Gardening - A Guide to Alternatives to Pesticides
- The Hazardless Home Handbook - A Guide to Hazardous Household Products and Effective Alternatives
- Aphids - Safe and Successful Control - A Washington Toxics Coalition Fact Sheet
- Garden Insect Pests - A Washington Toxics Coalition Fact Sheet
- Weed Management for the Lawn and Garden - A Washington Toxics Coalition Fact Sheet
- Reducing Exposure to Lead in Older Homes - A Washington Toxics Coalition Fact Sheet
- Lawn Care - A Washington Toxics Coalition Fact Sheet
- Appropriate Plants for Northwest Landscapes - A Washington Toxics Coalition Fact Sheet
- Clothing Moths - Prevention and Control - A Washington Toxics Coalition Fact Sheet
- Spiders, Ants, Flies, and Cockroaches: Four Common Household Invaders - A Washington Toxics Coalition Fact Sheet
- Paints, Solvents, and Wood Preservatives: Protecting Your Wood and Your Health - A Washington Toxics Coalition Fact Sheet
- Managing Fleas in Your Home - A Washington Toxics Coalition Fact Sheet
- Safer Cleaning Products - A Washington Toxics Coalition Fact Sheet
- A Safer Home: Reducing Your Use of Hazardous Household Products - A Washington Toxics Coalition Fact Sheet
- Art and Hobby Supplies - A Washington Toxics Coalition Fact Sheet
- Protecting Your Home from Carpenter Ants - A Washington Toxics Coalition Fact Sheet
- Managing Tent Caterpillars without Chemicals - A Washington Toxics Coalition Fact Sheet

To obtain copies of these publications, contact the Oregon DEQ at (503) 229-5913 or toll free 1-800-452-4011.

HOME • A • SYST
HOMESTEAD ASSESSMENT SYSTEM

Fact Sheet #6

Reducing the Risk of Groundwater Contamination by Improving Household Wastewater Treatment

A properly installed and maintained system for treating and disposing of household wastewater will minimize the impact of that system on groundwater and surface water. State and local codes specify how wastewater systems must be designed, installed, and maintained. For example, see Oregon Administrative Rules (OAR) Chapter 340, Division 71.

At a minimum, follow the codes. But also consider whether the minimum requirement is sufficient for your site.

Septic tank/soil absorption system: The most common system

The most common form of onsite wastewater treatment is a septic tank/soil absorption system. In this system, wastewater flows from the household pipes into an underground septic tank.

- There the waste components separate—the heavier solids (sludge) settling to the bottom, and the grease and fatty solids (scum) floating to the top.
- Bacteria partially decompose and liquefy the solids.
- Baffles are placed in the tank to provide maximum retention of solids, prevent inlet and outlet plugging, and prevent rapid flow of wastewater through the tank.
- The more liquid portion (effluent) flows through an outlet to the soil absorption field.
- The absorption field is usually a series of parallel trenches (fingers), each containing a distribution pipe or tile embedded in drainfield gravel or rock.
- The effluent leaks out through holes in the pipe or seams between tile sections, then down through the drainfield gravel or rock and into the soil.
- The soil filters out remaining minute solids and pathogens (disease-producing microorganisms), and dissolved substances slowly percolate down to the watertable.

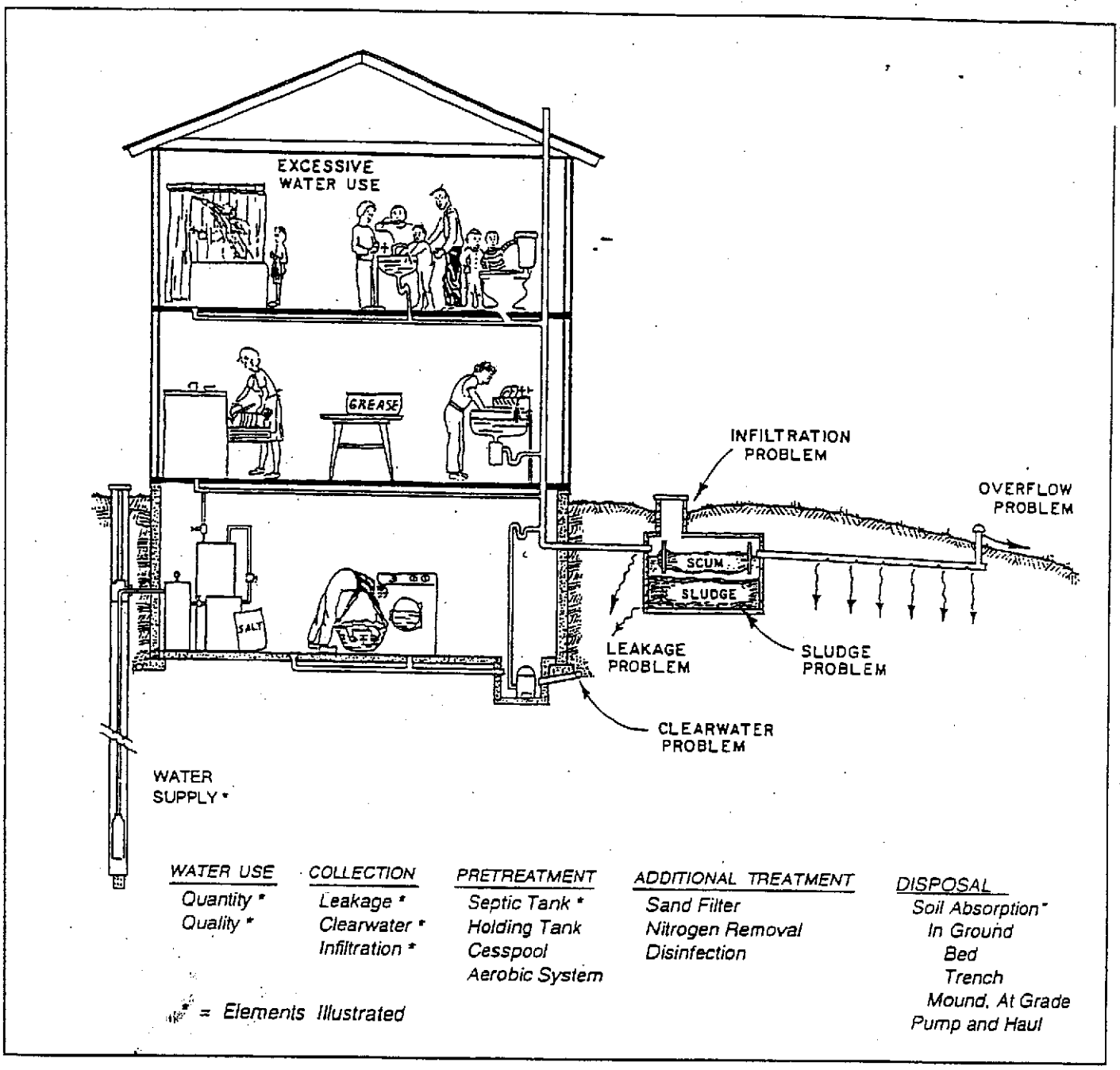


Figure 1: Typical household wastewater treatment system with problems. *Illustration by Andy Hopfensperger, University of Wisconsin-Madison Department of Agricultural Engineering.*

Figure 1 shows a typical household system for wastewater generation, collection, treatment, and disposal. While systems for many homes may be very similar (groundwater supply, septic tank, subsurface treatment, and disposal), note the lists of options below each part of the diagram. You may wish to circle the parts found in your system. The "leakage," "overflow," "infiltration," and "clearwater" components represent possible problems with the system. Unfortunately, these problems are often difficult to recognize. Overflow from systems may be noticed as wet spots, odors, and some changes in vegetation cover. Water entry (infiltration and clear water) will be more difficult to detect, involving tracing where floor drains, roof drains, foundation drains and sumps are directing waters that do not need treatment into and overfilling the treatment system. Leakage from the collection and treatment system as well as infiltration of water into the system through unsealed joints, access ports, and cracks can be very difficult to assess. The flow chart at the bottom of the box follows the flow of wastewaters and sludge through the treatment system.

1. Quantity of wastewater

Strategy: Minimize the volume of household wastewater

Reducing the volume of wastewater entering the treatment system is important because less flow (volume) means better treatment, longer system life, and less chance of overflow. For holding tanks, less volume reduces costs but increases the number of times the tank has to be emptied.

Reducing the volume of water entering the system will improve the treatment by increasing the time the waste spends in the system, thus providing more time for settling, aeration, and soil contact.

The quantity of water used depends upon the number of people using the dwelling, how water is used, and maintenance of the water supply system. Average water use in rural households is 50-75 gallons per person per day. With low-use fixtures and individual awareness and concern, a reduction to fewer than 25 gallons per person per day is possible. However, even conservative use by several people may exceed the capacity of the wastewater treatment system.

Consider the following ways to minimize water use:

- Eliminate non-functional uses, such as flushing toilets to dispose of tissues or other wastes that should be handled as solid waste. Turn off water between uses, fix plumbing fixture leaks, and try to eliminate sources of clear water and infiltration into the system (e.g., divert roof drains away from the soil absorption field.)

- Consider which actions use the most water. Toilet flushing usually ranks highest. Low-flow models could decrease water use by more than half. In the United States, 35-40 percent of the population has plumbing codes that require 1.5-gallon-or-less toilets on all new construction. Composting toilets allow even greater reductions, but they can present other waste disposal challenges. If interested in installing a composting toilet, contact the Oregon Department of Environmental Quality (DEQ) for pertinent regulations.

- Bathing and laundry are next in order of water use. For bathing, consider such reduction options as installing low-flow or controlled-flow showerheads, which give good cleansing with less water; taking shorter showers; and taking "wet-down-soap-up-without-water-then-rinse" showers.

- For laundry, run only full loads. Front-loading washers use much less water. If you must run small loads, be sure to use the reduced water level setting. Avoid using the permanent press cycle as it uses more water than regular or delicate cycles. If you have adequate room and are willing to change how you do laundry, explore a suds saver attachment for your washer.

- Modern efficient plumbing fixtures, including 0.5 to 1.5-gallon toilets, 0.5-2.0 gallons per minute (gpm) showerheads, faucets of 1.5 gpm or less, and front-loading washing machines of 20 to 27 gallons per 10-to-12-pound dry load offer the potential of substantial reduction in residential water use and wastewater generation. These reductions have commonly amounted to between 30 and 70 percent of total in-house water use. (See Figure 2.)

- In hard water areas, the water softener may use a significant amount of water. Proper adjustment and timing of the softener's flushing mechanism can reduce excessive water use. Spent salts should not be discharged into the septic system.

- Being aware of how your family can reduce its water use is as important as the use of water conservation devices.

Conventional fixture	Gal. used	Water-saving fixture/device	Gal. used
Toilet	4-6/flush	Air-assisted toilet	0.5/flush
Shower Head	4-6/min.	Low-flow shower head	2.0/min
Faucets: Bathroom and kitchen	4-6/min.	Faucet-flow-control aerators: Bathroom Kitchen	0.5/min 1.5/min
Top-loading clothes washer	40-55/load	Front-loading clothes washer	22-33/load

*Installation of all these water-saving devices could reduce water use by about 35%.

Source: Penn State Cooperative Extension Circular 302

Figure 2. Water use by conventional fixtures and water-saving fixtures and devices.

2. Quality of wastewater

Strategy: Minimize the amount and complexity of contaminants in the wastewater

The quality of water refers to what is in the water, not to the water itself. Even wastewater is more than "99.44% pure" water. Wastewater usually contains relatively small amounts of contaminants—but they make a big difference in the usefulness of the water.

Contaminants found in wastewater include:

- **Bacteria and viruses,** some of which can cause disease in humans. These microorganisms are large enough to be removed by settling or through filtration in beds or soil. Many will die from the adverse conditions or aging in the system.
- **Suspended solids,** particles which are more dense (sludge) or less dense (scum) than water. Most can be separated from liquid waste by allowing enough time in a relatively calm tank. Grease and fats are a part of the suspended solids Filtration beds and absorption systems can be clogged by wastewater high in suspended solids.
- **Oxygen demand.** The microorganisms that decompose organic wastes use oxygen. The amount of oxygen required to "stabilize" wastewater measured as biochemical and chemical "oxygen demand." Wastes such as blood, milk residues and garbage disposal grindings have high oxygen demand. Aeration and digestion processes, in the presence of oxygen and organisms, produce stable, low-odor wastewater when given enough time. Wastewater with excess oxygen demand can cause problems for soil absorption fields, groundwater, streams, and lakes by reducing levels of oxygen.
- **Organic solvents from cleaning agents and fuels** are not degraded or removed through treatment and can pass along with the wastewater back into the water supply.

- **Nutrients.** Nitrogen from human wastes and phosphorus from detergents and some chemical water conditioners are the most notable. Nitrate-nitrogen is a common groundwater contaminant, and phosphorus over-fertilizes surface water.

Consider the following ways to improve wastewater quality:

Note: Following these steps carefully is the key to a "healthy" septic system. Septic tank additives do not significantly help, and some can even be harmful.

- Minimize use of the garbage disposal unit. Garbage disposal use contributes a large load of suspended solids and organic matter to wastewater, as well as using additional water. They should not be used in homes with septic systems unless the septic tank is increased in size.

- Do not put items down drains that may clog septic tanks (fats, grease, coffee grounds, paper towels, sanitary napkins, tampons, disposable diapers, cigarettes, condoms).

- Do not put toxic substances in drains that might end up in the groundwater, such ash, solvents, degreasers, acids, oils, paints, disinfectants, and pesticides. (This does not include using bleach to disinfect laundry or to wash clothing worn for pesticide applications.) Normal use of household cleaning products will not adversely affect the septic system.

- Do not use chemicals to clean or "sweeten" your system. They may interfere with the biological action in the tank, clog the drain field by flushing sludge and scum into the field, or add toxic chemicals to groundwater.

3. Collection of wastewater

Strategy: Collect all wastes that need treatment. Minimize loss of untreated waste. Exclude from the treatment system water that doesn't need treatment or disposal.

Leaking pipes or treatment tanks ("leakage losses") can allow wastewater to return to the local water supply without adequate treatment. Infiltration of clear water overloads the system and dilutes the wastes. Don't allow water that doesn't need treatment (basement floor drain sumps, foundation drains, infiltration of rain water, roof drainage) to add to your waste volume. Divert clear water, which doesn't require treatment, away from house, well and wastewater treatment system. Plumb the water softener so that backwashing water does not enter the septic system. (This water is very salty.)

4. System design

Septic tanks retain most of the suspended solids (sludge and scum) from wastewater. In the tank, bacteria digest and compact the sludge. The partially treated water moves on to additional treatment or disposal (for example, in a soil absorption field.)

Design and construction of septic tanks influence their water tightness and effectiveness of retaining sludge and scum. Multiple tanks or chambers in series can improve sludge and scum removal. Gas deflectors and filter screens or inclined-plate settling units help to minimize solids carryover. Tanks should be sized to accommodate at least 24 hours of wastewater flow, while still allowing for sludge and scum retention. Pumping the tank before it is more than one-third filled with scum and sludge improves functioning of the system. When the tank is pumped, you should also have the baffles checked and check for tank leaks.

Aerobic (oxygen-using) biological systems (packaged systems) provide more extensive treatment of wastewater than the typical anaerobic (no oxygen) septic units, improving solids separation, releasing volatile chemicals, and reducing sludge volume. These systems (Figure 3) are, however, more expensive to operate and maintain and are more subject to problems caused by changes in wastewater quality or environmental conditions. Contact DEQ for regulations pertaining to aerobic units.

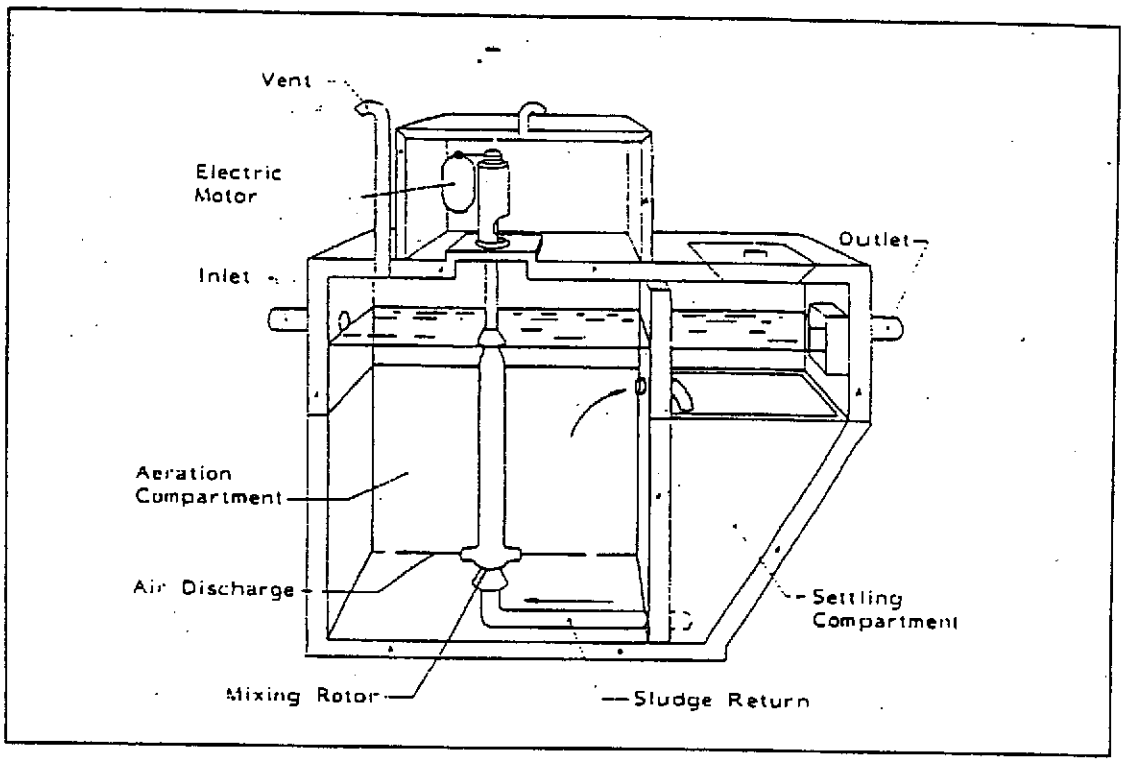


Figure 3: Aeration tank of a household aerobic treatment system. *Source: Onsite Domestic Sewage Disposal Handbook, MWPS-24, Midwest Plan Service, 1982.*

5. Additional treatment

Strategy: Reduce concentration and amount of contaminants in the wastewater to expand options for appropriate disposal.

Aerobic systems, described in the previous section, may be used for additional treatment of septic tank effluent, yielding a better quality effluent suitable for more disposal options. Contact DEQ for pertinent regulations.

Sand filters improve the quality of wastewater after septic tank pretreatment. Effective treatment involves aerobic biochemical activity as well as physical filtration. Filters consist of at least 2 feet of graded sand (or other media) in a bed equipped with a distribution and collection system (Figure 4). Wastewater is applied by dosing.

Wastewater treated in such systems is generally lower in bacteria, nitrogen, phosphorus, oxygen demand, suspended solids and organic matter. The amount of reduction depends on design of the system.

Pretreatment and quality of wastewater, hydraulic loading rate, depth and type of filter media, dosing frequency, temperature and distribution, and collection systems are all important considerations in designing filters. Maintenance includes resting and attention to dosing equipment.

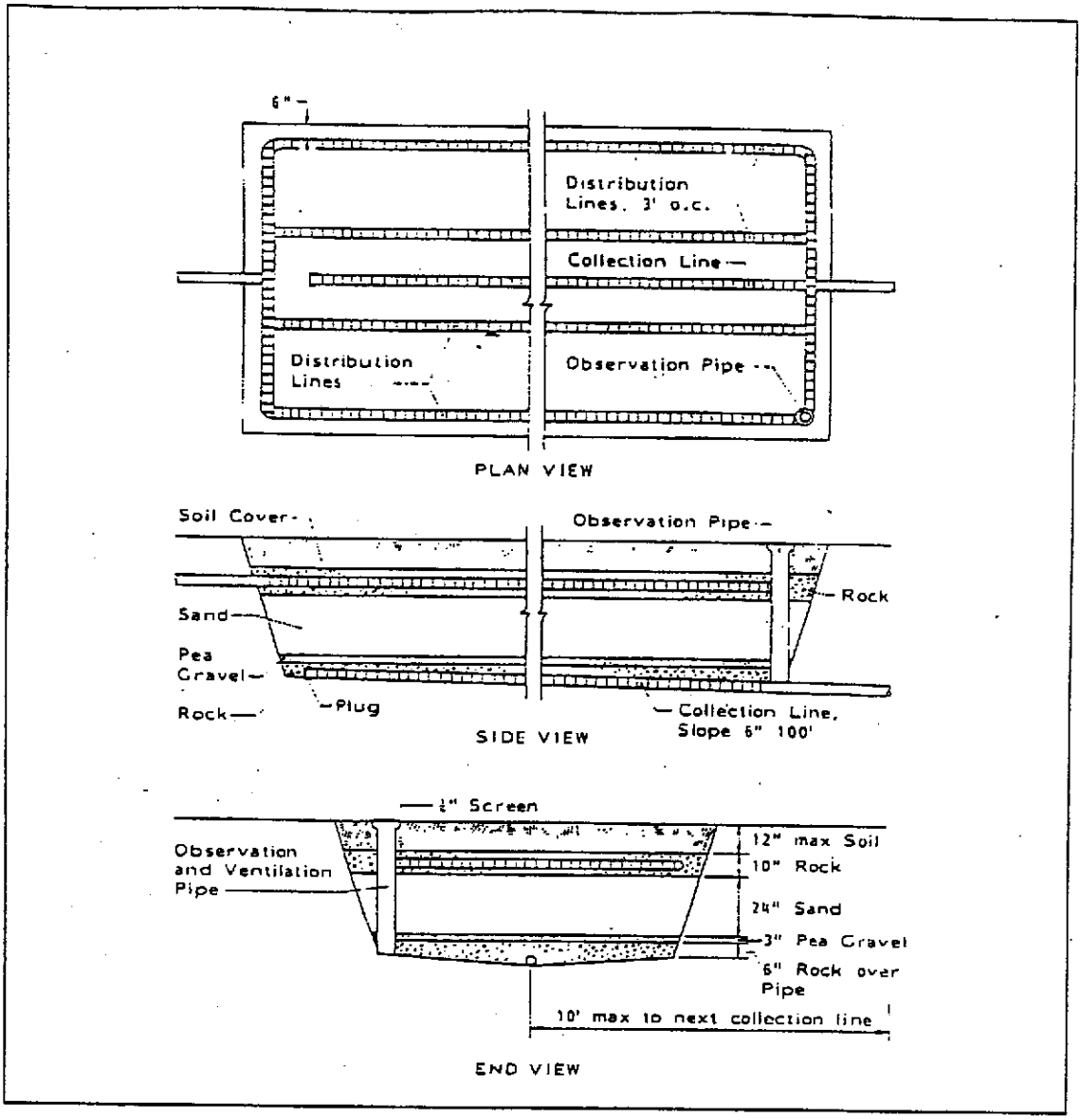


Figure 4: Buried sand filter. *Source: Onsite Domestic Sewage Handbook, MWPS-24, Midwest Plan Service, 1982.*

Nitrogen removal can be achieved through denitrification (conversion of nitrate to nitrogen gas) or ion exchange. Denitrification requires anaerobic conditions in the presence of more decomposable organic matter for bacteria to reduce nitrate to nitrogen gas for removal from wastewater. Denitrification and ion exchange processes are not used extensively at this time, as they are quite expensive to install, operate, and maintain.

Disinfection systems kill disease-causing microorganisms in wastewater and are used where discharge to surface water is permitted. Chlorine, iodine ozone, and ultraviolet light systems are available for treatment of good quality effluent, such as those from properly functioning aerobic units and sand filters.

Disinfection of holding tank waste prior to land spreading has been studied, but it is not in common use. Disinfection with lime is feasible.

6. Disposal of wastewater and pumpage

Strategy: Disperse wastes, take advantage of additional treatment afforded by contact with soils, and minimize opportunity for waste to contaminate water supplies.

Off-site disposal of wastewater, by connection to a municipal sewage system, hauling to a municipal treatment facility, or land spreading, can help protect the local homestead water supply. Discharging treated wastes to surface water from private systems is not permitted in Oregon. Improper waste management of the home site can endanger the health of others in your community. Also, it may eventually contribute to poor water quality at your well.

Application of wastewater to the soil surface provides an opportunity to recycle nutrients and to further reduce the contaminant content of wastewater in a safe manner. The application time should be chosen so that there will be 1) little runoff, 2) maximum use of nutrients by plants, and 3) additional reduction in microorganisms. Site characteristics (soil, land use, depth to groundwater, weather, climate, and hydrogeology) should be considered when selecting a site.

Subsurface treatment and disposal using soil absorption (trenches, beds, mounds, at-grade and gravel-less) is the common practice for household wastewater after pretreatment in a septic tank or aerobic system. There are, however, sites where soil absorption systems are not acceptable because of high or low soil permeability, depth to bedrock or the saturated zone, or other factors. Deep, well-drained, well-developed, medium-textured soils (such as silt loam and loam) are desirable soil absorption sites.

Incorporation of wastewater into surface soils is most desirable because the chance of runoff is reduced. While wastewater applications are often controlled by the amount that will infiltrate, the rate of application should be estimated to match the nutrient uptake by vegetation harvested from the site, thus minimizing loss of nutrients to the groundwater.

Soils and separation from the water supply are important factors. Unsaturated soils allow movement of air, helping keep the wastewater aerobic. A minimum of three feet of unsaturated soils is recommended for removal of bacteria. Finer-textured soils (clay loams and clay) retain water better, allowing plant roots to take up wastewater and nutrients and allowing increased die-off of microorganisms. Coarse, sandy soils allow effluent to flow too quickly downward to groundwater, not providing adequate time for filtering solids and pathogens from the liquid. Disposal sites that are more distant and downslope from the well increase the isolation of your water supply from the contaminated wastewater.

Disposal of pumpage from septic tanks and other treatment systems on site should follow similar rules as for wastewater. Sludges are more concentrated than treated wastewater, so lower application rates are recommended.

Land application of wastewater and sludge must only be done on sites permitted by the DEQ. Approved sites for land application must meet requirements found in OAR Chapter 340, Division 71, including requirements for soil, depth to groundwater or bedrock, slope, and distance from well and residences.

Matching nutrient applications to crop nutrient needs is critical. Contact your OSU county Extension agent or private crop consultant for assistance in developing a waste utilization plan.

7. Assistance with failing systems or new designs

If you suspect your household wastewater treatment system is backing up or your distribution system is clogged, first contact your plumber or septic system installer, who may have suggestions for extending the life of your system. Contact the Department of Environmental Quality (DEQ) or its authorized agent in your area for permits to repair or replace your wastewater treatment system.

- Do not use septic tank cleaners that contain degreasing solvents like TCE. They can contaminate groundwater.
- Do not place more soil over a surfacing soil absorption field; this does not fix the system, and it will soon surface again.
- Do not just pipe the sewage to the road ditch, storm sewer, stream or farm drain tile; this pollutes the water and creates a health hazard.
- Do not run the sewage into a sink hole or drainage well; this pollutes the groundwater.
- Do not wait for the system to fail before pumping the septic tank. Once a system fails, it is too late to pump the tank. Develop a regular tank maintenance and pumping schedule.

A properly designed, constructed and maintained septic system can effectively treat wastewater for many years. For more information on septic systems, contact your County Extension Agent, the DEQ or its authorized agents.

Contacts and References

Who to call about...

Household wastewater treatment and local regulations

Contact the Oregon Department of Environmental Quality (toll free number) 1-800-452-4011, or their authorized agent for your county. Refer to the phone number following your county:

Baker (276-4063)
Benton (757-6841)
Clackamas (655-8521)
Clatsop (325-8660)
Columbia (397-1501)
Coos (269-2721)
Crook (447-8155)
Curry (247-7011 x229)
Deschutes (388-6575)
Douglas (440-3338)
Gilliam (276-4063)
Grant (276-4063)
Harney (388-6146)
Hood River (386-1115)
Jackson (776-7556)
Jefferson (475-4456)
Josephine (471-2850)
Klamath (883-1122)
Lake (388-6146)
Lane (687-3951)
Lincoln (265-4192)
Linn (967-3821)
Malheur (473-5186)
Marion (588-5147)
Morrow (276-4063)
Multnomah (823-7247 or 823-7303)
Polk (623-9237)
Sherman (296-4636)
Tillamook (842-3409)
Umatilla (276-4063)
Union (276-4063)
Wallowa (276-4063)
Wasco (296-4636)
Washington (648-8722)
Wheeler (276-4063)
Yamhill (434-7516)

Statewide regulation of private sewage systems

Oregon Department of Environmental Quality (toll free number) 1 (800) 452-4011.

What to read about...

Publications are available from sources listed at the end of the reference section. (Refer to number in parentheses after each publication.)

Design, installation, use and maintenance of onsite sewage systems

Design Manual: Onsite Wastewater Treatment and Disposal Systems. 1980. EPA Technology Transfer 625/1-80- 012. (1) 391 pages. Contains information on site evaluation procedures, wastewater characteristics, onsite treatment and disposal methods, and management of onsite systems.

Onsite Domestic Sewage Disposal Handbook. First Edition. 1982. $5.00. Midwest Plan Service. MWPS-24. (2)
40 pages. Includes information on septic tanks, soil absorption systems, site selection, small and alternative wastewater treatment technologies

National Small Flows Clearinghouse (3)

Small Scale Waste Management Project (4)

Household water conservation

Why Do Septic Systems Fail? Oregon State University Extension Service. EC 1340 (5)

Septic Tank—Soil Absorption Systems. Oregon State University Extension Service. EC 1341. (5)

Holding Tanks. Oregon State University Extension Service. EC 1342. (5)

Septic Tank Maintenance. Oregon State University Extension Service. EC 1343. (5)

Water-saving toilets and showerheads

"How To Save Water," *Consumer Reports,* July 1990, pages 465-473.

1. U.S. Environment Protection Agency, 401 M Street SW, Washington, DC 20460.

2. Midwest Plan Service Publications may be ordered from Bioresource Engineering Department, Oregon State University, Gilmore Hall 116, Corvallis, OR 97331-3906.

3. West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064, or call 1 (800) 624-8301.

4. University of Wisconsin-Madison, 1450 Linden Drive, Madison,WI 53706, (608) 262-0853 or (608) 262-6968.

5. Your county Extension office or directly from Publications Orders, Agricultural Communications, Oregon State University, Administrative Services A422, Corvallis, OR 97331-2119, (503) 737-2513. There may be charges for publications.

Information derived from Home•A•Syst worksheets is intended only to provide general information and recommendations to homeowners regarding their own home practices. It is not the intent of this educational program to keep records of individual results.

Adapted for use in Oregon from the cooperative project (Farm•A•Syst/Farmstead Assessment System) of the University of Wisconsin-Cooperative Extension, Minnesota Extension Service, and U.S. Environmental Protection Agency Region V. Reviewed and adapted for use in Oregon by members of the Extension Service, Oregon State University; the Oregon Department of Agriculture, the Oregon Department of Environmental Quality, the Oregon Department of Water Resources, and the Oregon Division of Health.

Appendix I: Drinking Water Protection In Oregon

Drinking Water Protection In Oregon

Information and Resources

State of Oregon Department of Environmental Quality

♦Agency Programs

Oregon Department of Human Service's Drinking Water Website
http://www.ohd.hr.state.or.us/dwp/welcome.htm
Includes a directory of all public water systems in Oregon, drinking water standards, fact sheets on contaminants, Annual Compliance Reports for water systems, information on the Safe Drinking Water Revolving Loan Fund, Consumer Confidence Reports, and more.

Oregon Department of Environmental Quality's Drinking Water Protection Website
http://deq.state.or.us/wq/dwp/dwphome.htm
Includes an introduction to drinking water protection in Oregon, information on the Source Water Assessments required by the Safe Drinking Water Act, technical assistance resources for protection, example Source Water Assessment Reports, example Drinking Water Protection Plans, and *links to many other useful sites.*

U.S. Environmental Protection Agency Websites
EPA's Office of Ground Water and Drinking Water http://www.epa.gov/ogwdw/
EPA's Drinking Water Information site http://www.epa.gov/safewater/dwinfo
Safe Drinking Water Hotline 1-800-426-4791

Oregon Plan for Salmon and Watersheds
Information and Education Tools Available: http://www.oregon-plan.org
In an effort to initiate a campaign to raise awareness and the understanding of the ecological, social and economic challenges facing Oregon, the Oregon Plan for Salmon and Watersheds Outreach Team has created a toll free telephone line and mailing service.
Oregon Watershed Information Line: 1-888-854-8377
Information is available in 21 separate user packets. The packets provide help for the individual boater, business owner, educator, farmer, forest landowner, gardener, home builder/developer, rancher, recreationalist, small acreage landowner, wish to volunteer, looking for incentive programs, or are interested in other issues such as the Willamette Restoration Initiative or local Watershed Councils.

Water Resources Department
The map and list of all watermasters (by county) for the state of Oregon:
http://www.wrd.state.or.us/staff/watermasters.html

♦Water Quality Standards

Federal/State *Safe Drinking Water Act* Standards
A reference list of all drinking water standards is available through DHS's website or on EPA's Office of Water website at:
http://www.epa.gov/safewater/standards.html

Federal *Clean Water Act* Standards
A reference of water quality standards for Oregon waters is available on DEQ's website at:
http://www.deq.state.or.us/wq/standards/wqstdhome.htm
This website will enable any user to obtain information on the water quality standards in Oregon that are in effect under the Clean Water Act. The site includes a full text of Oregon Administrative Rules Section 340, Division 41. Designated uses are also a component of water quality standards. The designated use information is available at this site as well.

♦Water Quality Monitoring Data and Information

Oregon's Year 2000 Water Quality Status Assessment Report
(Section 305(b) Report) is an excellent source of information on Oregon's water quality improvement efforts. The report is issued every two years, and covers water quality trends, overviews of all Oregon programs, assessment procedures and data collection procedures. It is available for viewing on the DEQ water quality web site, listed under "Information by Subject Area."
http://deq.state.or.us/wq/

DEQ's Database of Water Quality Data
Records of Oregon's existing water quality monitoring data can be accessed through the LASAR website at:
http://deq.state.or.us/wq/lasar/LasarHome.htm
On this page you will find four options for finding and retrieving water quality data.
1. Selecting monitoring stations from an interactive Geographic Information Systems (GIS) map
2. Locating monitoring stations by entering search criteria like station location description, station type or latitude and longitude - once you enter your search criteria and click enter you will get a summary page of all the monitoring stations that meet your search criteria. From there you choose the monitoring station of interest and you will get a list of water quality data available for that station and you can choose which data to retrieve.
3. Locating monitoring stations by basin, sub-basin and watershed - this page lists in summary form the basins, sub-basins and watersheds in Oregon along with the number of monitoring stations in each sub-basin and watershed. You select the sub-basin or watershed of interest and you will get a list of all the monitoring stations in that sub-basin or watershed. From there you select a station and retrieve the water quality data of interest to you.
4. Selecting parameters for data retrieval - this option gives you a summary of all parameters that have data in LASAR and the number of data points. You select the parameter of interest and you will get a listing of all the monitoring stations that have data for that parameter. From there you can select from 1 to 10 stations (or all stations) to retrieve the water quality data for the parameter you selected. *Please note that these queries can take a while to run where there are lots of data points.*

♦Additional Resources for Drinking Water Protection

Source Protection: A National Guidance Manual for Surface Water Supplies
This manual includes descriptions of new SDWA programs, source protection case studies from across the country, information on pollutants and their sources, funding and implementation assistance information, and a chapter on source protection planning and implementation. The document was published in 2000 by the New England Interstate Water Pollution Control Commission (NEIWPCC). Available on NEIWPCC's website at http://www.neiwpcc.org/. Click on "Publications", then click "Technical Guidance" and scroll down to "Source Protection".

EPA's Nonpoint Source Control Technical Assistance
Draft Guidance "CONTROLLING NONPOINT SOURCE POLLUTION FROM FORESTRY"
EPA has developed and is requesting comment on draft technical guidance for managing nonpoint source pollution from forestry. It discusses the broad concepts of assessing and addressing water quality problems on a watershed level, and it presents up-to-date technical information about how to reduce nonpoint source pollution from forestry.
The draft guidance is available on EPA's Nonpoint Source Control website at:
http://www.epa.gov/owow/nps/forestrymgmt/

Oregon Stream*A*Syst
EM 8761, Stream*A*Syst: A Tool To Help You Examine Stream Conditions on Your Property, June 2000, 16 pages. See OSU Extension Service Publications web page at:
http://eesc.orst.edu/agcomwebfile/edmat/EM8761.pdf

Resources for Educators
"Keeping it Clean: Student Involvement in Drinking Water Protection" 300-page resource document for teachers. Call Sheree Stewart at DEQ 503-229-5413 to obtain a free copy.
See also DEQ Online's "Especially for Educators" page at:
http://www.deq.state.or.us

Topographic Maps
Geographic Data (topographic maps): http://www.terraserver.microsoft.com
http://www.topozone.com/

Educational Materials
The Terrene Institute is a nonprofit organization working to provide information and resources on how the conserve resources and protect the environment. The website provides excellent descriptions of water quality issues, as well as good links to other water quality sites.
http://www.terrene.org/index.htm

The Center for Watershed Protection works with local governments to provide scientifically based information on tools to protect watersheds.
http://www.cwp.org

US Geological Survey Monitoring Data
The following link will also provide available USGS data for Oregon rivers.
http://water.usgs.gov/or/nwis/nwis

EPA's Watershed Assessment, Tracking and Environmental Results (WATERS)
This is an information system that enables users to connect and display important water quality information on maps in their geographic context. (Not all states are 100% available.) WATERS is at: http://www.epa.gov/waters
WATERS can:

* display key water quality information about the quality of surface water bodies, the designated use of a waterbody (e.g., drinking water supply, recreation, fish protection) from state water quality standards, and an identification of which waters are identified as being impaired;
* allow users to quickly identify the status of individual waters of interest within a specified geographic area;
* allow users to easily generate reports summarizing key information on waters of a state;
* use EPA's standard mapping application, Enviromapper, to display the information;
* use the National Hydrography Dataset (NHD) maintained by the U.S. Geological Survey, as the common language to connect the information hydrologically.

EPA's Index of Federal Data Sources
http://www.epa.gov/safewater/protect/feddata.html
The list of federal data sources includes a breakout by assessment function and by agency and also provides links to regional contacts.

US Geological Survey Streamflow Data
USGS's streamflow data is available at: http://water.usgs.gov/dwc/national_map.html

Wastewater Permit Information
Oregon DEQ's Water Quality Division has a new website called Water Quality Permit Assistance Corner, to assist the public with their questions about wastewater permits. Highlights include:

1. All information that a permit holder might need is centralized.
2. Potential permittees can find out what kind of permit, if any, is needed, get the application forms, find out how much it will cost, and the address of the DEQ office that will process the application.
3. Links to sites of interest, for example ODA site for agricultural management plans and WRD for water rights information.

It is accessible through the DEQ Water Quality Program home page, click on Permits and then click on Water Quality Permit Assistance Corner. The direct website address is:
http://deq.state.or.us/wq/permitcorner/

3

Well Evaluations

Well Evaluation Request

DHS-DWP Plan Review

* Items in **bold** are required

Background Information:

Name of System: Kilchis Regional
Well Name: Well 1
Plan Review#: _____
Requested by: M. Poloni

PWS ID #: 00079
County: Tillamook
Date well log sent to Springfield: 1/25/10
Entry Point/Source ID: AA
Surface water w/i 500 ft[1]: ☒ Yes ☐ No

[1]For all but monitoring reduction requests.

Nature of Request:

☐ Please review/suggest Proposed Well Construction
Township: _____ **Range:** _____ **Section:** _____
Or **Lat:** _____ **Long:** _____ (☐ Earthtools.org ☐ Terraserver-USA.com ☐ Submitted Plans)
Or **Property Address:** _____

☒ Please review As Built Well Construction (i.e., well construction and aquifer nature)

☐ Please review for Septic/Sewer Setback Waiver (i.e., well construction and aquifer nature)
Distance to septic tanks, drainfields, gravity sewer lines, and/or pressurized sewer lines: _____

☐ Please review for GWUDI
Distance to surface water = _____

☐ Please review for DBP monitoring reduction[1]
Other well ID#s: _____
Distance to other wells: _____

☐ Please review for initial chemical monitoring reduction[1]
Other well ID#s: _____
Distance to other wells: _____
☐ Well under consideration on New Entry Point
☐ Well under consideration on Existing Entry Point

For all but Proposed Well Construction Request, provide 1) copy of well log or 2) one of the following and Date Well Completed:

County Well ID: _____ Well Tag: L_____ Start Card: _____

Date Well Completed: 9/27/75

Additional Notes/Comments/Requests: Has had TC+ at well. is hydraulically connected to Kilchis River.

Evaluation Results From Regional Geologist:

Proposed Well Construction Recommendations:

Estimated depth to water–bearing zone: _____
Estimated aquifer nature: ☐ Confined ☐ Unconfined
Estimated depth of casing seal: _____
Comments: _____

As Built Well Construction Evaluation for Plan Review and/or Septic/Sewer Setback Waiver:

☐ Well construction is adequate
  ☐ WRD special construction standards, see well log or Comments
☐ Conditional use approved. Require source sample if total coliform detected in distribution system. Consider for reconstruction if nitrate ≥ 5mg/L or confirmed positive total coliform in well.
☒ Well construction is inadequate
  ☐ Not sealed to appropriate depth. Recommended depth: _____
  ☐ Not appropriate seal materials
  ☐ Open to more than one aquifer
  ☐ Seal info missing or unknown
  ☒ Seal not constructed properly (☒ Insufficient sealant volume ☐ Insufficient annular space)

Comments: Although this well is inadequately constructed, the nature of the aquifer and close proximity of surface water are likely to be larger contributing factors to any future confirmed e.coli detection. Therefore, I'm not recommending well construction be used as a means of corrective action.

Nature of Aquifer Evaluation:

Aquifer Nature: ☐ Confined aquifer ☐ Semi-confined aquifer ☒ Unconfined aquifer

Comments: Well draws water from a shallow unconfined sand and gravel aquifer. Historic GWUDI monitoring established that this source is groundwater with a hydraulic connection to the Kilchis River. Thus, the river serves as a permanent source of viral contamination for this well. I recommend reviewing the other forms of corrective action with the knowledge that reconstruction of the well and eliminating the source of contamination are not options that are likely to correct the problem.

GWUDI Review:

☐ Need to consider for GWUDI (**Geologist forward info to GWUDI Coordinator**)
  ☐ Fractured bedrock, < 500 ft to surface water
  ☐ Coarse sand, gravel, and boulders, < 200 ft to surface water
  ☐ Sand and gravel, < 100 ft to surface water
  ☐ Sand, < 75 ft to surface water
☐ Conditional use approved, source must be included as one of repeat coliform sampling sites, consider for GWUDI if *e. coli* ever confirmed in the source.
☐ Do not need to consider for GWUDI.

Comments:_____

Monitoring Reduction Determinations:

☐ Qualifies for initial chemical monitoring reduction as part of existing Wellfield – one round of chemical testing is sufficient.
  ☐ Source is on existing entry point – future monitoring required at entry point.
  ☐ Source is on a separate entry point – future monitoring includes nitrate at all entry points & source monitoring at entry point designated by geologist in comments below.
☐ Qualifies for monitoring reduction based on historical data from nearby public water supply well(s) sharing the same aquifer – one round of chemical testing is sufficient.

☐ Qualifies for Common Aquifer designation for DBP monitoring – additional DBP sample sites not required.
☐ Does not qualify for monitoring reduction.
☐ Other: _____
Comments: _____

Reviewed by: Tom Pattee Date: 01/25/2011

Well Evaluation Request

DHS-DWP Plan Review

* Items in **bold** are required

Background Information:

Name of System: Kilchis Regional
Well Name: Well 2
Plan Review#: _____
Requested by: M. Poloni

PWS ID #: 00079
County: Tillamook
Date well log sent to Springfield: _____
Entry Point/Source ID: AB
Surface water w/i 500 ft[1]: ☒ Yes ☐ No

[1]For all but monitoring reduction requests.

Nature of Request:

☐ Please review/suggest Proposed Well Construction
Township: _____ **Range:** _____ **Section:** _____
Or **Lat:** _____ **Long:** _____ (☐ Earthtools.org ☐ Terraserver-USA.com ☐ Submitted Plans)
Or **Property Address:** _____

☒ Please review As Built Well Construction (i.e., well construction and aquifer nature)

☐ Please review for Septic/Sewer Setback Waiver (i.e., well construction and aquifer nature)
Distance to septic tanks, drainfields, gravity sewer lines, and/or pressurized sewer lines: _____

☐ Please review for GWUDI
Distance to surface water = _____

☐ Please review for DBP monitoring reduction[1]
Other well ID#s: _____
Distance to other wells: _____

☐ Please review for initial chemical monitoring reduction[1]
Other well ID#s: _____
Distance to other wells: _____
☐ Well under consideration on New Entry Point
☐ Well under consideration on Existing Entry Point

For all but Proposed Well Construction Request, provide 1) copy of well log or 2) one of the following and Date Well Completed:

County Well ID: _____ Well Tag: L_____ Start Card: _____

Date Well Completed: 5/9/80

Additional Notes/Comments/Requests: Has had EC+ at well. Is hydraulically connected to Kilchis River.

Evaluation Results From Regional Geologist:

Proposed Well Construction Recommendations:

Estimated depth to water–bearing zone: _____
Estimated aquifer nature: ☐ Confined ☐ Unconfined
Estimated depth of casing seal: _____
Comments: _____

As Built Well Construction Evaluation for Plan Review and/or Septic/Sewer Setback Waiver:

☐ Well construction is adequate
  ☐ WRD special construction standards, see well log or Comments
☐ Conditional use approved. Require source sample if total coliform detected in distribution system. Consider for reconstruction if nitrate ≥ 5mg/L or confirmed positive total coliform in well.
☒ Well construction is inadequate
  ☐ Not sealed to appropriate depth. Recommended depth: _____
  ☐ Not appropriate seal materials
  ☐ Open to more than one aquifer
  ☐ Seal info missing or unknown
  ☒ Seal not constructed properly (☒ Insufficient sealant volume ☐ Insufficient annular space)

Comments: Although this well is inadequately constructed, the nature of the aquifer and close proximity of surface water are likely to be larger contributing factors to any future confirmed e.coli detection. Therefore, I'm not recommending well construction be used as a means of corrective action.

Nature of Aquifer Evaluation:

Aquifer Nature: ☐ Confined aquifer ☐ Semi-confined aquifer ☒ Unconfined aquifer

Comments: Well draws water from a shallow unconfined sand and gravel aquifer. Historic GWUDI monitoring established that this source is groundwater with a hydraulic connection to the Kilchis River. Thus, the river serves as a permanent source of viral contamination for this well. I recommend reviewing the other forms of corrective action with the knowledge that reconstruction of the well and eliminating the source of contamination are not options that are likely to correct the problem.

GWUDI Review:

☐ Need to consider for GWUDI (**Geologist forward info to GWUDI Coordinator**)
  ☐ Fractured bedrock, < 500 ft to surface water
  ☐ Coarse sand, gravel, and boulders, < 200 ft to surface water
  ☐ Sand and gravel, < 100 ft to surface water
  ☐ Sand, < 75 ft to surface water
☐ Conditional use approved, source must be included as one of repeat coliform sampling sites, consider for GWUDI if *e. coli* ever confirmed in the source.
☐ Do not need to consider for GWUDI.

Comments:_____

Monitoring Reduction Determinations:

☐ Qualifies for initial chemical monitoring reduction as part of existing Wellfield – one round of chemical testing is sufficient.
  ☐ Source is on existing entry point – future monitoring required at entry point.
  ☐ Source is on a separate entry point – future monitoring includes nitrate at all entry points & source monitoring at entry point designated by geologist in comments below.
☐ Qualifies for monitoring reduction based on historical data from nearby public water supply well(s) sharing the same aquifer – one round of chemical testing is sufficient.

☐ Qualifies for Common Aquifer designation for DBP monitoring – additional DBP sample sites not required.
☐ Does not qualify for monitoring reduction.
☐ Other: _____
Comments: _____

Reviewed by: Tom Pattee Date: 01/25/2011

4

Water Right Permits

Application No. 51053 Permit No. 43858

RECEIVED
JAN 23 1979
WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for Permit to Appropriate Surface Water

I, Bay City, Oregon (Name of Applicant)

of City Hall (Mailing Address), Bay City (City)

State of Oregon, 97107 (Zip Code) Phone No. 377-2288 do hereby

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

1. The source of the proposed appropriation is Kilchis River

, a tributary of Tillamook Bay

2. The point of diversion is to be located 819.65 ft. N (N. or S.) and 3895.03 ft. E (E. or W.)

from the SW Section corner of Sec. 32, TS 1N, R9S, WM. (present well) (Public Land Survey Corner)

plus all that portion of the Southwest quarter of Section 33 and the (If there is more than one point of diversion, each must be described)

Southeast quarter of Section 32, Township 1 North, Range 9 West of the

Willamette Meridian, Tillamook County, Oregon, which lies South and East of the centerline of the Kilchis River and North of Old Whitney Co. Railroad Right of Way. being within the - ¼ of the - ¼ of

Sec. 32 & 33 Tp. 1 N (N. or S.) R. 9W (E. or W.), W. M., in the county of Tillamook

See Exhibit A & B

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

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated
1 North	9 West	31	All	All
1 North	9 West	32	South 1/2	All
1 North	9 West	33	S 1/2 & NE 1/4	All
1 North	9 West	34	W 1/2	All
1 South	9 West	6	All	All
1 South	9 West	5	N 1/2 & SW 1/4	All
1 South	9 West	4	N 1/2	All
1 South	9 West	7	All	All
1 South	9 West	8	W 1/2	All
1 South	9 West	15	W 1/2	All

Form 690-1-0-1-77

(SEE ATTACHED SHEET)

Application No. 51053 *Permit No.* 43858

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 20.0 *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* Kilchis River.

The use to which this water is to be applied is municipal.

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 August 10, 1973

Actual construction work shall begin on or before March 2, 1980 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*80

*Complete application of the water to the proposed use shall be made on or before October 1, 19*81

WITNESS my hand this 2nd *day of* March, *19*79

B+C to 10-1-2000

James E. Sexson

Water Resources Director

Application # S-51053 / **Permit #** S-43858

Permit Holder: City of Bay City

Use interactive mapping to check: Stream Basin *Greg Beaman #01*

Add this information to the Checklist for PFO

Place a (✓) in the box if the item is satisfied	**Division 315 - Municipal/Quasi-Municipal Extension of Time - Completeness Checklist OAR 690-315-0070(3)** *NOTE: According to correspondence dated August 29, 1978, it has been determined that an appropriation of water from the Kilchis River may be made by developing shallow wells within the immediate gravel areas adjacent to the Kilchis River, therefore, the type of development being proposed would be considered a surface water appropriation.
X	*1. [OAR 690-315-0070(3)]* The appropriate extension of time fee (as specified in ORS 536.050). $100 - applications received by September 30, 2003 $250 - applications received on or after October 1, 2003 DUPLICATE FEES? _____
X	* *[OAR 690-315-0070(3)(a)]* The name and mailing address of the water right permit holder(s);
X	* *[OAR 690-315-0070(3)(b)]* The application number and the permit number for which an extension is requested;
X Note →	*2. [OAR 690-315-0070(3)(c)]* For quasi-municipal water use permit holders, evidence of the actions taken to begin actual construction on the project, as defined in 690-315-0020(3)(d), if required under the applicable statute; *NOTE:* ORS 537.230(1) [1997 edition] only **exempts surface water** municipal use permits from the "A" Date requirement. If you are reviewing a ground water municipal use permit, they must provide evidence that the "A" Date has been met. • "Actual construction" means physical work performed towards completion of the water system, which demonstrates both the present good faith of the water right permit holder and the water right permit holder's intention to complete the project with reasonable diligence; • "Actual construction" does not include planning a diversion system, formulating a business plan, securing financing, letting contracts, purchasing but not installing equipment, or surveying. Began work by on _____, ~~Began work within 5 years~~, see Application for Extension of Time received on October 31, 1980
NEED	*3. [OAR 690-315-0070(3)(d)]* - This is extension request #5 Evidence of actions taken to develop the right within the original permitted time period OR, during the most recent extension period from 10/1/95 to 10/1/2000 Master plan completed in 1992. Not within last extension period.
X	*4. [OAR 690-315-0070(3)(e)]* Evidence of compliance with conditions contained in the permit and any previous extension(s) or the reason the condition was not satisfied; No time sensitive conditions.
NEED	*5. [OAR 690-315-0070(3)(f)]* Evidence of the maximum INSTANTANEOUS rate of diversion, if any, made to date; Do not provide instantaneous rates.
X	*6. [OAR 690-315-0070(3)(g)]* An estimate of the population served and a description of the methodology(ies) used to make the estimate; - Total of 2186 including four other water districts
NEED	*7. [OAR 690-315-0070(3)(h)]* A description of financial expenditures made toward completion of the water development; you have provided an itemized list it is unclear which items are associated provide total - post 1980

Place a (✓) in the box if the item is satisfied	**Division 315 - Municipal/Quasi-Municipal Extension of Time - Completeness Checklist OAR 690-315-0070(3)** *NOTE: According to correspondence dated August 29, 1978, it has been determined that an appropriation of water from the Kilchis River may be made by developing shallow wells within the immediate gravel areas adjacent to the Kilchis River, therefore, the type of development being proposed would be considered a surface water appropriation.
NEED	***8. [OAR 690-315-0070(3)(i)]*** An estimate of the cost to complete the water development; = $2,000,000 - no description of components
X	***9. [OAR 690-315-0070(3)(j)]*** A summary of any events that delayed completion of the water development or application of water to full beneficial use, including other governmental requirements, if any, relating to the project that have significantly delayed completion of construction or perfection of the right;
	10. [OAR 690-315-0070(3)(k)] An estimated demand projection and a description of the methodology(ies) used for the subject water right permit, considering the other water rights held by the municipal or quasi-municipal water use permit holder, and a date by which the water development is anticipated to be completed and water put to full beneficial use. Extension requests for <u>greater than 50 years</u> must include documentation that the demand projection is consistent with the amount and types of lands and uses proposed to be served by the permit holder. Current Peak Water Demands - NO Projected Population - they have room for 4,495 new homes - 172 new services installed since last application. Total of 4,323 new connections associated population?? Potential Growth - OK - Where is info? Inventory of Water Rights Held - NO
NEED	***11. [OAR 690-315-0070(3)(l)]*** A summary of the applicant's plan and schedule to complete construction and/or perfect the water right; they say 2 million . Need to provide list of future improvements.
X	***12. [OAR 690-315-0070(3)(m)]*** Justification for the time requested to complete the project and/or apply the water to full beneficial use;
X	***13. [OAR 690-315-0070(3)(n)]*** Any other information the applicant determines is relevant to evaluate the application in accordance with applicable statutes and rules;
X	* ***[OAR 690-315-0070(3)(o)]*** Any other information required by the Department that is necessary to evaluate the application in accordance with applicable statutory requirements.
X	* Signature(s) of the water right permit holder(s).

S:\groups\wr\extensions\Municipal\muni ext_completeness checklist\s51053_City of Bay City.wpd

Name of Reviewer: Jonathan Unger **Date:** 12/28/04

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

S-51053
CITY OF BAY CITY
ATTN: JOHN LAW
P. O.BOX 3309
BAY CITY OR 97107

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Jaime L Heup ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Jaime L Heup C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(Transfer from service label) 7004 1160 0007 0796 9276

PS Form 3811, February 2004 Domestic Return Receipt WR 102595-02-M-1540

Oregon
Theodore R. Kulongoski, Governor

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

CERTIFIED MAIL
Return Receipt Requested

January 24, 2005

City of Bay City
Attn: John Law
PO Box 3309
Bay City, OR 97107

REFERENCE: Pending Application for Extension of Time
Water Right Application #S-51053 (Permit #S-43858)

Dear Municipal Water Right Permit Holder:

The Department is currently evaluating your request for an extension of time on the above referenced municipal water use permit. We have determined that your extension application does not provide sufficient detail necessary to fully evaluate your request. The information and materials that need clarification are listed below and must be submitted before evaluation can continue.

NOTE: ***If you make reference to other documents, reports and/or plans, you must provide copies with your responses and make specific references to the pages, tables and/or charts.***

Copies of your pending application received August 4, 2003, and your original permit are enclosed for reference.

Question #3 - OAR 690-315-0070(3)(d): *Describe and supply documentation of actions taken to develop the water right permit:*

- Your response to Question #3 of the Application for Extension of Time indicates that in the year 1992 the City of Bay City completed a Water Master Plan. This response does not accurately address actions taken within the most recent dates of extension under this permit, being from October 1, 1995, to October 1, 2000.
  Please provide evidence that includes dates of work accomplished and actions taken that occurred toward completion of construction and/or beneficial use of water during the time period of the most recent dates of extension under this permit, from October 1, 1995, to October 1, 2000.

  Information provided under this section should include both physical work and other types of water right development activities such as: water management planning; conservation planning; development of a water master plan for the Oregon Health Division; planning of a diversion system; demand forecasting; flow or water quality monitoring; source evaluation; entry into intergovernmental agreements for water delivery; property acquisition; engagement in governmental permitting or project financing; procurement of planning, design or construction services; surveying; and any physical work performed toward completion of the system and development of the right (e.g., pumps; pipes; well construction; treatment plant/facilities; transmission systems; distribution systems; and/or intake structures).

Question #5 - OAR 690-315-0070(3)(f): *Document evidence of the maximum instantaneous rate of water diverted to the date of this application, if any, for beneficial Quasi-Municipal or Municipal purposes.*

- Your response to Question #5 of the Application for Extension of Time refers to the monthly totals of water used under this permit. **Please identify the maximum instantaneous rate of water put to beneficial municipal use out of the 20.0 cubic feet per second (cfs) allowed under Permit #S-43858.**

  Identify the maximum ***instantaneous*** rate of water diverted by the date of this application for the beneficial use authorized under the permit and state the maximum rate of water use allowed under your permit. The maximum instantaneous rate should be indicated by using the unit specified in the water use permit, such as cubic feet per second, gallons per minute, or acre-feet. **Do not provide daily, monthly or annual water use totals.**

  Documentary evidence substantiating the maximum instantaneous rate of water diversion may include, but is not limited to: meter records; business records; and/or a sworn affidavit. ***The maximum instantaneous rate should be based upon at least a continuous 4-hour period of beneficial water use.***

NOTE: Attachment "A" may assist you in compiling the maximum instantaneous rates beneficially used under Permit #S-43858 and any other permits or certificates held by the City of Bay City.

Question #7 - OAR 690-315-0070(3)(h): *Provide a description of the financial expenditures made toward completion of the water development under this permit.*

- Your response to Question #7 of the Application for Extension of Time refers to Bay City's financial cost document submitted as an enclosure to your application. It is unclear which items are associated with Permit #S-43858. Additionally, there is no record of expenditures after the year 1980.

  Please provide a list that describes all major development components accomplished from the date this permit was issued up to the time you prepared this extension application. Include dates the work was accomplished, the cost of each development component listed, and the total cost of all work described. Actions under this section consist of both physical work and other water right development activities such as: water management planning; conservation planning; development of a water master plan for the Oregon Health Division; planning of a diversion system; demand forecasting; flow or water quality monitoring; source evaluation; entry into intergovernmental agreements for water delivery; property acquisition; engagement in governmental permitting or project financing; procurement of planning, design or construction services; surveying; and any physical work performed toward completion of the system and development of the right (e.g., pumps; pipes; well construction; treatment plant/facilities; transmission systems; distribution systems; and/or intake structures).

Question #8 - OAR 690-315-0070(3)(i): *Provide an estimate of the cost necessary to complete the water development.*

- Your response to Question #8 of the Application for Extension of Time indicates that the estimated cost to fully complete the water development will be $2,000,000. It is unclear which future components or actions are needed to complete the water development project. Additionally, please provide the approximate time schedule of these improvements.

  Provide your best estimate of the total remaining financial investment necessary to complete construction of the system and/or apply water to full beneficial use. **Provide a list that briefly describes the major future components or actions needed, the approximate time frames, and estimated costs anticipated to complete the water development within the parameters of this permit.** Actions under this section consist of both physical work and other water right development activities such as: water management planning; conservation planning; development of a water master plan for the Oregon Health Division; planning of a diversion system; demand forecasting; flow or water quality monitoring; source evaluation; entry into intergovernmental agreements for

water delivery; property acquisition; engagement in governmental permitting or project financing; procurement of planning, design or construction services; surveying; and any physical work performed toward completion of the system and development of the right (e.g., pumps; pipes; well construction; treatment plant/facilities; transmission systems; distribution systems; and/or intake structures).

NOTE: *You may wish to formulate your response to Question #8 in conjunction with your response to Question #11.*

Question #10 - OAR 690-315-0070(3)(k):

A. *Provide an estimated demand projection and a description of the methodology(ies) used for the subject water right permit, considering the other water rights and contracts held by the municipal or quasi-municipal water use permit holder, and a date by which the water development is anticipated to be completed and water put to full beneficial use.*

Prepare a qualitative analysis indicating the date by which you anticipate to fully develop the water right permit being extended (i.e., the date requested in your extension application). In developing your estimated demand projections for the permit being extended, you should describe the following:

1) Current Peak Water Demands
Describe the current demands for water. Indicate annual average, peak season, and peak day water demand figures.

2) Projected Population
Identify the projected population growth rate and the associated future demands for water. Describe the methodology used to create the population and water demand projections, such as historical growth rates or any factors affecting growth trends.

3) Potential Growth
Describe the potential for growth of the service area (such as the annexation of lands or new industrial and/or commercial ventures locating within the service area) and describe how those projects are expected to affect future water demands.

4) Inventory of Water Rights Held
List all water rights held. The Department's website (*www.wrd.state.or.us*) may be a helpful source for compiling this information.

This information is not clearly stated in your extension application. See enclosed Attachment "A" to assist you in providing a list of all water rights held by the City of Bay City.

Indicate which water rights are used to meet current water demands. Additionally, describe the manner in which the subject permit, other water rights and/or any water supply contracts you may hold are utilized to meet these present water needs. Identify any water rights not currently utilized, or used only in a limited capacity, and explain the reason(s) why. Describe any factors affecting use of the water rights, such as: system redundancy; emergency back-up water supply; climate patterns resulting in seasonal unavailability or high turbidity issues; reliability or quality of existing water supplies; and/or agreements to supply water to other entities.

Describe how the subject permit, other water rights and/or any water supply contracts you may hold are planned or expected to be used to meet anticipated future water needs.

4) Other Justification
Provide any other information that justifies your current and future need for the water under the subject permit.

Question #11 - OAR 690-315-0070(3)(l): *Please provide a summary of the plan and schedule to complete construction and/or perfect the water right.*

- Your response to Question #11 of the Application for Extension of Time does not contain a list of the planning, work and/or actions that must occur to fully develop and perfect Permit #S-43858. Please include an approximate time schedule within which you anticipate these future projects will be accomplished.

  Considering your demand projections in Item #10-A, describe major future projects, if any, that must be completed in order to fully develop and perfect the subject permit. Provide a list of the planning, work and/or actions that must occur and identify the projected time schedule within which you anticipate they will be accomplished. You may wish to review Capital Improvement Plans (CIP) or other system infrastructure improvement plans to help formulate your response.

  NOTE: You may wish to formulate your response to Question #11 in conjunction with your response to Question #8.

Please submit this information to the Department by **April 25, 2005**. If you cannot provide the requested information by this deadline, you must notify the Department in writing, explaining the reason(s) why, and indicate a date certain by which you anticipate the requested information can be supplied.

If the Department has not received the requested information by **April 25, 2005**, and has not received written notification explaining why the deadline for submittal cannot be met, the Department **will** return your "Application for Extension of Time for Quasi-Municipal and Municipal Water Use Permits" as incomplete and refund all fees paid toward the extension of time request.

If you have any questions concerning your extension request or completion of the required materials, please contact Jonathan Unger at (503) 986-0802, or Lisa Juul at (503) 986-0808. Thank you for your cooperation and attention to this matter.

Sincerely,

Lisa J. Juul
Water Rights Specialist

Enclosures: Copy of pending Application for Extension of Time, received August 4, 2003
Copy of Permit #S-43858
Sample copy of "Attachment A"

cc: Appl #S-51053 (Permit #S-43858)
Greg Beaman, Watermaster District #01

STATE OF OREGON

WATER RESOURCES DEPARTMENT

158 12TH ST. N.E.
SALEM, OR 97301-4172
378-8455 / 378-8130 (FAX)

EIPT # 61835 INVOICE # _____

EIVED FROM: City of Bay City

APPLICATION	51053
PERMIT	
TRANSFER	

H: CHECK:# [X] 6025 OTHER: (IDENTIFY) [ ] _____

TOTAL REC'D $ 100.00

0401 TREASURY 0417 WRD MISC CASH ACCT

0407	COPIES		$
_____	OTHER:	(IDENTIFY) _____	$
_____	OTHER:	(IDENTIFY) _____	$

0427 WRD OPERATING ACCT

MISCELLANEOUS

0407	COPY & TAPE FEES		$
0410	RESEARCH FEES		$
0408	MISC REVENUE: (IDENTIFY)	_____	$
TC162	DEPOSIT LIAB. (IDENTIFY)	_____	$
0240	EXTENSION OF TIME		$ 100.00

	WATER RIGHTS:	EXAM FEE		RECORD FEE
0201	SURFACE WATER	$	0202	$
0203	GROUND WATER	$	0204	$
0205	TRANSFER	$		

	WELL CONSTRUCTION	EXAM FEE		LICENSE FEE
0218	WELL DRILL CONSTRUCTOR	$	0219	$
	LANDOWNER'S PERMIT		0220	$

_____ OTHER (IDENTIFY) _____

0536 TREASURY 0437 WELL CONST. START FEE

0211	WELL CONST START FEE	$	CARD #	
0210	MONITORING WELLS	$	CARD #	

_____ OTHER (IDENTIFY) _____

0607 TREASURY 0467 HYDRO ACTIVITY LIC NUMBER

0233	POWER LICENSE FEE (FW/WRD)		$
0231	HYDRO LICENSE FEE (FW/WRD)		$
_____	HYDRO APPLICATION		$

_____ TREASURY OTHER / RDX

FUND _____ TITLE _____

OBJ. CODE _____ VENDOR # _____

DESCRIPTION _____ $

EIPT: 61835 DATED: 08/04/03 BY: Paula Taylor

Distribution – White Copy - Customer, Yellow Copy - Fiscal, Blue Copy - File, Buff Copy - Fiscal

APPLICATION FOR EXTENSION OF TIME

for Quasi-Municipal and Municipal Water Use Permits

TO THE WATER RESOURCES DIRECTOR OF OREGON

I, City of Bay City (NAME OF ENTITY) John Law (NAME OF CONTACT)

P.O. Box 3309 (ADDRESS) Bay City (CITY) OR (STATE) 97107 (ZIP) 503-377-4121 (PHONE)

owner of record, or duly authorized agent, of Application No. 51053, Permit No. 43858, do hereby request that the time in which to:

☐ complete the construction of diversion/appropriation works and/or purchase and installation of the equipment necessary to the use of water, which time now expires on October 1, ~~2003~~ 2000, be extended to October 1, ~~2053~~ 2050,

– per John Law on 8-15-03 ... see memo

and/or the time in which to:

☐ accomplish beneficial use of water to the full extent under the terms of the permit, which time now expires on October 1, ~~2003~~ 2000, be extended to October 1, ~~2053~~ 2050.

NOTE: **Permit extensions for Quasi-Municipal and Municipal permits are evaluated under OAR Chapter 690, Division 315. Except under limited circumstances, upon issuance of an order approving an extension, you will be required to submit within 3 years a Water Management and Conservation Plan (WMCP) under OAR Chapter 690, Division 86. Diversion of water beyond the maximum rate currently diverted under the permit shall only be authorized upon approval of your WMCP. The rules may be viewed at: *"www.wrd.state.or.us/law/oar1999.shtml"***

Attached are instructions to assist you in completing the information on the permit extension application form. Oregon Water Law and Administrative Rules require this information to be considered by the Water Resources Department when reviewing a Quasi-Municipal or Municipal water use permit extension application. For each permit, a separate extension application must be submitted. All items must be addressed or the application may be returned. Please feel free to provide the Department with any additional information or evidence that will aid us in making our decision. Please use additional sheets of paper as needed to fully respond to the questions.

After reviewing the application form and the instruction sheet, if you have any questions, you may contact the Department at (503) 378-3739, and request assistance from the Water Rights Division, permit extensions personnel.

In order for the Department to evaluate your extension of time request for a Quasi-Municipal or Municipal water use permit, please provide the following:

1. The appropriate fee, as specified under ORS 536.050.

2. For Quasi-Municipal water use permits, evidence of the actions taken to begin actual construction on the project, if required under the applicable statute.

3. Evidence of actions taken to develop the right within the permitted time period and/or time period of the previous extension.

4. Evidence of compliance with conditions contained in the permit and any previous extension(s). If any of the conditions have not been satisfied, please explain the reason(s) why.

5. Evidence of the maximum rate of water diverted to date, if any, for Quasi-Municipal or Municipal purposes.

6. An estimate of the population served under this permit and a description of the methodology(ies) used to make this estimate.

7. A description of the financial expenditures made toward completion of the water development.

8. An estimate of the cost necessary to complete the water development.

9. A summary of any events that delayed completion of the water development or application of water to full beneficial use, including other governmental requirements, if any, relating to the project that have significantly delayed completion of construction or perfection of the right.

10. An estimated demand projection and a description of the methodology(ies) used for the subject water right permit, considering the other water rights and contracts held by the municipal or quasi-municipal water use permit holder, and a date by which the water development is anticipated to be completed and water put to full beneficial use.

    Extension requests for greater than 50 years must include documentation that the demand projection is consistent with the amount and types of lands and uses proposed to be served by the permit holder.

11. A summary of the plan and schedule to complete construction and/or perfect the water right.

12. Justification for the time requested to complete the project and/or apply the water to full beneficial use.

13. Any other information you wish the Department to consider while evaluating the extension of time application.

I am the permittee, or have authorization from the permittee, to apply for an extension of time under this permit. I certify that the information I have provided in this application is true and correct to the best of my knowledge.

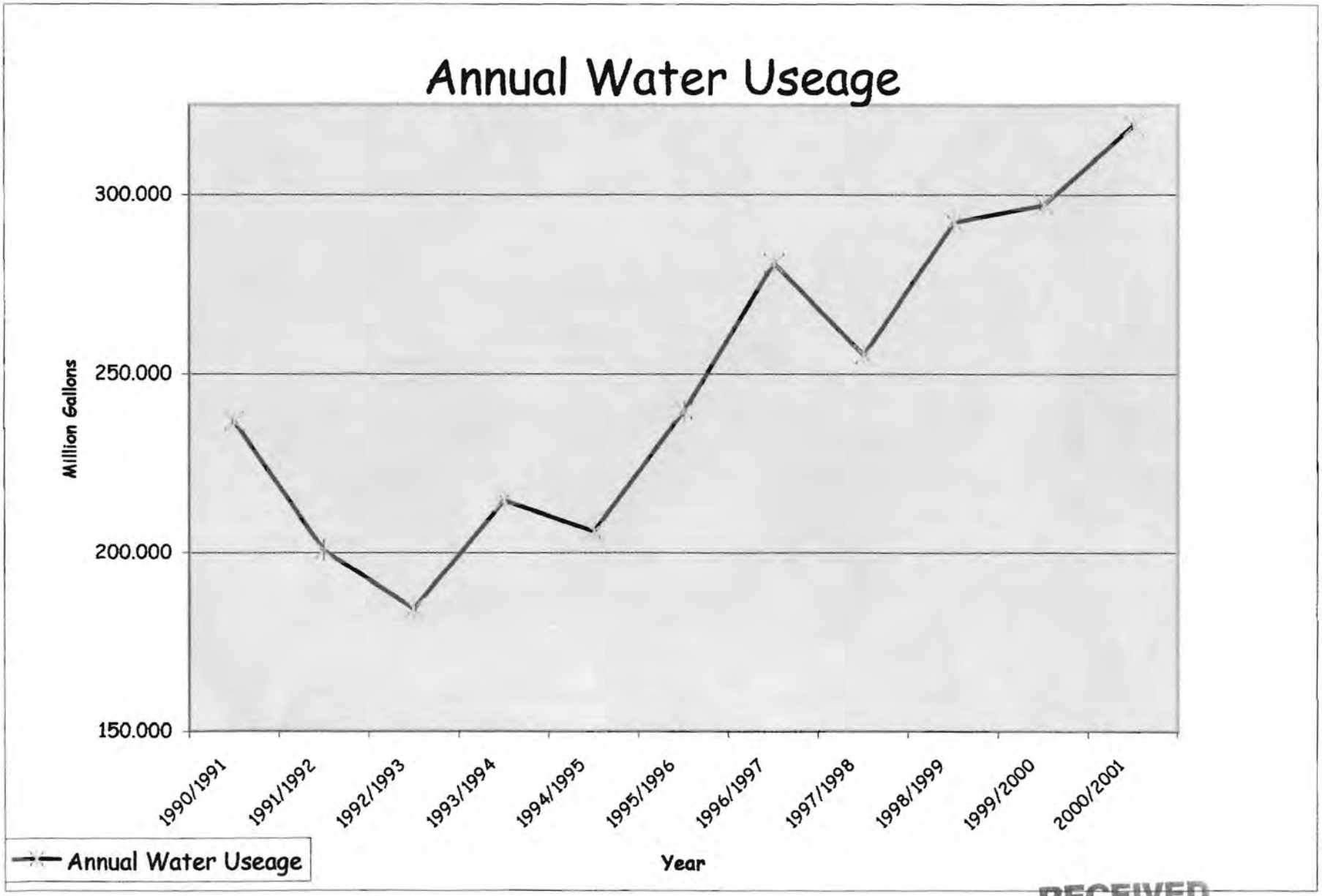
John Law
Signature

July 30, 2003
Date

MAIL COMPLETED APPLICATION *and* STATUTORY FEE (under ORS 536.050) TO:

WATER RIGHT PERMIT EXTENSIONS
WATER RESOURCES DEPARTMENT
158 - 12th STREET NE
SALEM, OREGON 97301-4172

revised: December 12, 2002



USER-ID 1050

1996 Oregon Water Resources Department 1997
October 1996 through September 1997
Annual Water Use - Monthly Quantities Form

Facility ☞ POD-ID ✏	Kilchis R.W.D. 11178				
October - 1996	19.45 MG				
November - 1996	16.35 MG				
December - 1996	21.80 MG				
January - 1997	19.34 MG				
February - 1997	19.34 MG				
March - 1997	22.48 MG				
April - 1997	21.79 MG				
May - 1997	23.94 MG				
June - 1997	23.41 MG				
July - 1997	26.22 MG				
August - 1997	27.47 MG				
September - 1997	21.10 MG				
TOTAL *	262.69 MG				

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: metered-wellhead. If use is irrigation, total number acres irrigated NA

I certify this information is true and accurate to the best of my knowledge.

Signature	Title	Reporting Entity	Date
John Law	Public Works Director	Kilchis Regional Water Dist.	1/7/98

Please complete and mail to: Water Resources Department; Water Use Reporting Program; 158 12th Street NE; Salem, OR 97310-0210

USER-ID 1050

1997 Oregon Water Resources Department 1998
October 1997 through September 1998
Annual Water Use - Monthly Quantities Form

Facility ☞ POD-ID ✏	Kilchis R.W.D. 11178				
October - 1997	20.250 MG				
November - 1997	18.844 MG				
December - 1997	20.044 MG				
January - 1998	19.698 MG				
February - 1998	17.983 MG				
March - 1998	20.296 MG				
April - 1998	19.902 MG				
May - 1998	20.572 MG				
June - 1998	20.410 MG				
July - 1998	24.335 MG				
August - 1998	27.735 MG				
September - 1998	25.012 MG				
TOTAL *	255.081 MG				

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WATER RESOURCES DEPT.
SALEM, OREGON

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: metered well-head. If use is irrigation, total number acres irrigated _____

I certify this information is true and accurate to the best of my knowledge.

John D. Law — Signature
Public Works Director — Title
Kilchis R.W.D. — Reporting Entity
12/29/98 — Date

John D. Law
Name - Please Print

Please complete and mail to: Water Resources Department; Water Use Reporting Program;
158 12th Street NE; Salem, OR 97310-0210

USER-ID 1050

1998 Oregon Water Resources Department 1999
October 1998 through September 1999
Annual Water Use - Monthly Quantities Form

Facility ☞ POD-ID ☜	Kilchis Regional Water District 11178				
October - 1998	23.045 MGD				
November - 1998	21.155 MGD				
December - 1998	25.138 MGD				
January - 1999	26.355 MGD				
February - 1999	22.598 MGD				
March - 1999	24.790 MGD				
April - 1999	23.844 MGD				
May - 1999	24.566 MGD				
June - 1999	23.240 MGD				
July - 1999	25.275 MGD				RECEIVED
August - 1999	25.275 MGD				AUG 0 4 2003
September - 1999	26.039 MGD				WATER RESOURCES DEPT. SALEM, OREGON
TOTAL *	291.320 MGD				

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: Flow Meters. If use is irrigation, total number acres irrigated _____

I certify this information is true and accurate to the best of my knowledge.

John Law
Signature

Public Works Director - Kilchis Regional Water Dist. 12/99
Title — Reporting Entity — Date

John Law
Name - Please Print

Please complete and mail to: Water Resources Department; Water Use Reporting Program; 158 12th Street NE; Salem, OR 97310-0210

USER-ID 1050

1999 Oregon Water Resources Department 2000
October 1999 through September 2000
Annual Water Use - Monthly Quantities Form

Facility ☞ POD-ID ☜	Kilchis Regional Water District 11178				
October - 1999	24.994				
November - 1999	24.924				
December - 1999	23.386				
January - 2000	23.923				
February - 2000	22.284				
March - 2000	24.034				
April - 2000	22.689				
May - 2000	23.222				
June - 2000	23.865				
July - 2000	28.445				
August - 2000	29.305				
September - 2000	26.075				
TOTAL *	297.146	MG			

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SALEM, OREGON

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: Sensus Flow Meters. If use is irrigation, total number acres irrigated NA

I certify this information is true and accurate to the best of my knowledge.

John Law — Signature
Public Works Director — Title
Kilchis Regional Water Dist. — Reporting Entity
11/1/00 — Date

John Law
Name - Please Print

Please complete and mail to: Water Resources Department; Water Use Reporting Program;
158 12th Street NE; Salem, OR 97310-0210

USER-ID 1050

2000 2001

Oregon Water Resources Department
October 1999 through September 2000
Annual Water Use - Monthly Quantities Form

Facility ☞ POD-ID ☞	Dill Bar 11178				
October - 2000	24.779				
November - 2000	27.712				
December - 2000	28.365				
January - 2001	29.246				
February - 2001	21.527				
March - 2001	25.834				
April - 2001	26.723				
May - 2001	30.059				
June - 2001	23.851				
July - 2001	24.333				
August - 2001	31.254				
September - 2001	25.594				
TOTAL *	319.277	MG			

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WATER RESOURCES DEPT
SALEM, OREGON

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: Sensus Flow Meters. If use is irrigation, total number acres irrigated NA

I certify this information is true and accurate to the best of my knowledge.

John Law — Signature

Public Works Director — Title

Kilchis Regional Water Dist. — Reporting Entity

11/29/01 — Date

John Law — Name - Please Print

Please complete and mail to: Water Resources Department; Water Use Reporting Program; 158 12th Street NE; Salem, OR 97310-0210

2001

Oregon Water Resources Department
October 2001 through September 2002
Annual Water Use - Monthly Quantities Form

USER-ID 1050

2002

WRD

Facility ☞ POD-ID ✏	Dill Bar 11178				
October - 2001	23.090				
November - 2001	23.358				
December - 2001	23.576				
January - 2002	24.089				
February - 2002	22.590				
March - 2002	23.871				
April - 2002	21.330				
May - 2002	21.644				
June - 2002	20.883				
July - 2002	24.454				
August - 2002	25.789				
September - 2002	19.805				
TOTAL *	274.479	MG			

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WATER RESOURCES DEPT.
SALEM, OREGON

* Describe the units of measure as G (gallons), KG (thousand gallons), MG (million gallons), CF (cubic feet), MCF (million cubic feet), or AF (acre-feet)

Describe method of measuring the water used: Sensus Flow Meters. If use is irrigation, total number acres irrigated NA

I certify this information is true and accurate to the best of my knowledge.

John Law
Signature

Public Works Director
Title

Kilchis Regional Water Dist.
Reporting Entity

10/15/02
Date

John Law
Name - Please Print

Please complete and mail to: Water Resources Department; Water Use Reporting Program;
158 12th Street NE; Salem, OR 97310-0210

City of Bay City

PO Box 3309
Bay City, OR 97107
Phone (503) 377-2288
Fax (503) 377-4044

State of Oregon
Water Resources Department
158 12th ST NE
Salem, Oregon 97301

July 30, 2003

ATTN: Lisa Juul

RE: Municipal Extension of Time, Water Use Permit.

Listed below is the information requested for the City of Bay City's extension of time for our Municipal Water Use Permit.

1. Check is enclosed.

2. NA - Municipal Water Use Permit.

3. City of Bay City Water Master Plan completed in 1992. The City is currently developing a Well Head Protection Plan for the Kilchis Well site. The City of Bay City and City of Tillamook are in the engineering stage of an intergovernmental agreement to supply each other with potable water in emergency situations. Copies of the Bay City Water Master Plan and Source Water Assessment are included.

4. The City of Bay City has not been assigned any conditions for permit extensions.

5. Enclosed are copies of the last five years of Water Use Report Forms sent to the Oregon Water Resources Department.

6. The current population of Bay City is 1160 according to the 2000 U.S. Census figures and the other four water districts that we provide water for have approximately 1026 for a total of 2186 persons. The Tillamook County Creamery Association, a large industrial complex and water district that we supply with water uses 56% of our systems total water supply.

7. Copies of Bay City's financial cost for the water system are enclosed.

8. The Bay City Water System has been suppling water since 1982. As growth continues in our water system area new supply lines, wells, pumps and reservoirs will be constructed to meet demand. The City of Bay City charges a water SDC on all new building permits and these funds are put into a water reserve account for the future expansion of the Bay City Water System.

An estimated cost to fully complete our water development would be $2,000,000.00.

9. The application of water to full beneficial use will take several years to accomplish based on the size and scope of our permit. The City of Bay City and surrounding area served by our water system is the only large area of land left in Tillamook County that can be developed for residential use. Bay City has an agreement with five other water districts to supply them with water and this collective group is called the Kilchis Regional Water District. The City of Bay City also has a mutual aid agreement with the Wilson River Water District to supply water in case of emergencies.

10. As stated in the 1996 extension application the City of Bay City had room for 4,495 new homes. The City has had 172 new water services installed since that time. There has also been continued growth in the surrounding area served by Bay City. We also provide water for two fire protection districts. The City does not feel it would be prudent to finalize the permit at this time and leave itself and our five contracted water districts without an adequate supply of water for the future. The City of Bay City is requesting an extension of fifty years to fully construct the water system and utilize our permit to full beneficial use.

11. A schedule to complete construction depends entirely on the rate of population growth in Bay City and the surrounding service area. Bay City is currently in the engineering stage of construction for a new 500,000 gallon reservoir at the North end of the system. As our reserve funding increases we also have plans for another reservoir at the South end of the system and another well and pump at the Kilchis Well site. The Bay City Water Master Plan is due to be updated in three years, much of our future planning to complete construction will be based on the findings of this document.

12. As you can see by the enclosed water usage chart, water use in our system has been slow but steadily increasing. This is the reason we have requested a fifty year extension. The City must do everything in its power to insure an adequate amount of water be available for its citizens in the upcoming future. Having the last large parcels of land left in Tillamook County that can be developed for residential use the City must insure that an adequate water supply will be available.

13. The City of Bay City and member water districts are fully metered and bill their customers by water usage. The City has an aggressive program for replacement of old water lines and appurtenances for leak control. The City also budgets funds for new technology and equipment to make our system more efficient and cost effective.

If you have any questions or need more information please contact me, thank you.

John Law

John Law
Public Works Superintendent

WATERWATCH
PROTECTING NATURAL FLOWS IN OREGON RIVERS

March 18, 2004

Dwight French
Water Rights Section
Oregon Water Resources Department
725 Summer Street NE Suit "A"
Salem, OR 97301

Re: Extension Requests for
A 41825, P 31365, Harbor Rural Water District, Chetco River
A 58045, P 43837, Harbor Rural Water District, Chetco River
A 5942, P 3778, South Fork Water Board, Clackamas River
A 11007, P 9982, South Fork Water Board, Clackamas River
A 28676, P 22581 South Fork Water Board, Clackamas River
A 47144, P 35297, Oak Lodge Water District, Clackamas River
A 43365, P 32410, Lake Oswego, Clackamas River
A 50819, P 37839, Lake Oswego, Clackamas River
A 55550, P 43246, Lake Oswego, Clackamas River
A 51053, P 43858, Bay City, Kilches River.
A 65051, P 48451, City of Sandy, Salmon River.
A 48146, P 35819, City of Adair Village, Willamette River

Dear Mr. French,

WaterWatch is very concerned about the pending extension requests for the above referenced permits. We enclose a check for $120 for a copy of any proposed final order and final order issued relating extensions of each one of these permits.

Please don't hesitate to call if you have any questions about this request.

Sincerely,

Karen Russell
Senior Staff Attorney

STATE OF OREGON
WATER RESOURCES DEPARTMENT

RECEIPT # 66097

725 Summer St. N.E. Ste. A
SALEM, OR 97301-4172
(503) 986-0900 / (503) 986-0904 (fax)

INVOICE # _____

RECEIVED FROM: Karen A. Russell

BY: _____

APPLICATION	see below
PERMIT	
TRANSFER	

CASH: ☐ CHECK:# ☒ 4920 OTHER: (IDENTIFY) ☐ _____

TOTAL REC'D $ 120.00

1083 TREASURY 4170 WRD MISC CASH ACCT

0407	COPIES		
_____	OTHER: (IDENTIFY)		
0243 I/S Lease _____	0244 Muni Water Mgr		

S
41825
58045
5942
11007
28678
47144

S
43365
50819
55550
51053
65051
48146

4270 WR

	MISCELLANEOUS		
0407	COPY & TAPE FEES		
0410	RESEARCH FEES		
0408	MISC REVENUE: (IDENTIFY)	PFO	$ 120.00
TC162	DEPOSIT LIAB. (IDENTIFY)		
0240	EXTENSION OF TIME		

		EXAM FEE		RECORD FEE
	WATER RIGHTS:			
0201	SURFACE WATER	$	0202	$
0203	GROUND WATER	$	0204	$
0205	TRANSFER	$		

		EXAM FEE		LICENSE FEE
	WELL CONSTRUCTION			
0218	WELL DRILL CONSTRUCTOR	$	0219	$
	LANDOWNER'S PERMIT		0220	$

_____ OTHER (IDENTIFY) _____

0536 TREASURY 0437 WELL CONST. START FEE

0211	WELL CONST START FEE	$	CARD #	
0210	MONITORING WELLS	$	CARD #	

_____ OTHER (IDENTIFY) _____

0607 TREASURY 0467 HYDRO ACTIVITY LIC NUMBER

0233	POWER LICENSE FEE (FW/WRD)		$
0231	HYDRO LICENSE FEE (FW/WRD)		$
_____	HYDRO APPLICATION		$

_____ TREASURY OTHER / RDX

FUND _____ TITLE _____

OBJ. CODE _____ VENDOR # _____

DESCRIPTION _____ $ _____

RECEIPT: 66097 DATED: 3/19/04 BY: Linda Doerfler

Distribution – White Copy - Customer, Yellow Copy - Fiscal, Blue Copy - File, Buff Copy - Fiscal

Water Supply Summary Table

A. Application Number[1]	B. Permit or Certificate Number[2]	C. Priority Date[3]	D. Maximum Allowable Rate[4] (cfs or ac-ft)	E. Reliable Peak Rate[5] (cfs)	F. Cumulative Total (cfs)[6]	G. Notes: Explain any differences between Columns D and E.[7]
S-51053	S-43858	08/10/73	20cfs	2.68cfs	2.68cfs	Have not fully developed
						our water right.

Add rows as needed to include all permitted and certificated rights.

---

[1] A. The application number is typically includes an alpha designator of "S" for a surface water right, "G" for a ground water right, "R" for a reservoir or storage right, or "D" for a decreed or adjudicated right (e.g., S-5667). A right that has been transferred continues to retain the original application number.

[2] B. If the right has been certificated, the certificate number should be provided. If the right has not been certificated, then the permit number should be used. The permit number retains the alpha designator used for application numbers. If the right has been transferred, the transfer number (e.g., T-4531) should be used in lieu of the permit number.

[3] C. The priority date of the right is shown on the permit or certificate. Water rights should be listed in priority date order with the right with the earliest priority date listed first.

[4] D. The Maximum Allowable Rate is listed on most permits and certificates, other than those for storage. For storage rights, the total quantity of water that can be stored is typically listed in acre-feet.

[5] E. The Reliable Peak Rate is that at which the community can reasonably expect to divert water during periods of high demand. The Reliable Peak Rate may not be greater than the Maximum Allowable Rate under the right, but may be less if the right is not met because reliability (e.g., summer streamflows are insufficient, a well produces less than the right allows), production must be curtailed because of water quality problems, the right serves as backup supply, or there are other limitations on the full exercise of the right. For reservoir rights, the rate at which water could reasonably be taken from storage should be shown.

[6] F. The total of the Reliable Peak Rate for this right added to the total of the Reliable Peak Rates for all of the other listed rights with earlier priority dates.

[7] G. A brief explanation of the reasons for any differences in the Maximum Allowable Rate and the Reliable Peak Rate shown. See Footnote 5 for examples of reasons for such a difference.

Water Demand Summary Table

Year	H. Estimated Population[8]	I. Peak Day Demand[9] (cfs)	J. Notes: Explain departures from historic population growth rates and increases in Peak Day Demand that are larger than 0.3 cfs per 1,000 addition persons to be served.
1950			The Kilchis Regional Water District is made
1960			up of a co-op of six water districts. The KRWD
1970			supplies water to four of the largest industial
1980	986		users in Tillamook County. The figures that are
1990	1,027	.59	shown for H.&I. are City of Bay City only. There
2000	1,149	.61	is no data at this time to determine the projected
present	1,160	.89	demands of the other five users of our water system
2010	1,300	.92	In 2005 we will be updateing our Water System and
2020	1,440	.94	Distribution Plan to include the district as a
2030	1,580	.97	whole.
2040	1,720	.99	
2050	1,860	1.10	

Add rows as needed identify the year in which full development of the permit to be extended will be needed to meet projected demands (i.e., the year in which the demand shown in Column I exceeds the cumulative supply in Column F for the permit to be extended.

---

[8] H. Provide estimates of the population served for each year from 1950 to present. Provide estimates of the future populations to be served in future years considering available population projections, changes in service area based on land use plans, potential regional agreements to supply water to other communities, and other expected changes.

[9] I. For years up to the present year, provide estimates of the Peak Day Demand as available. For future years, calculate the Peak Day Demand as 0.3 cfs per each increase in population of 1,000 persons served, or provide an explanation of the use other projections of Peak Day Demand. The use of other projections may be appropriate because of expected water conservation, planned industrial development, or other factors. To convert Million Gallons per Day to Cubic Feet Per Second, multiply by 1.55.

City of Bay City
P. O. Box 3309
Bay City, Oregon 97107-3309

PORTLAND OR
PM
29 OCT
2003

USA
37

Water Resources Department
Attn: Lisa Juul
Commerce Building
158 12th Street NE
Salem, Oregon 97301-4172

97301+4172

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

S-51053
CITY OF BAY CITY
ATTN: JOHN LAW
PO BOX 3309
BAY CITY, OR 97107

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* [signature] C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)* 7002 3150 0005 3664 0468

PS Form 3811, August 2001 Domestic Return Receipt WR/LJJ 102595-02-M-1540

File # S-51053

Oregon

Theodore R. Kulongoski, Governor

CERTIFIED MAIL
Return Receipt Requested

Water Resources Department
Commerce Building
158 12th Street NE
Salem, OR 97301-4172
503-378-3739
FAX 503-378-8130

August 28, 2003

Note: Spoke w/ John Law & he needs through Oct. 31, 2003 to submit requested info. OK'd. 9-26-03

City of Bay City
Attn: John Law
PO Box 3309
Bay City, OR 97107

REFERENCE: Application #S-51053 (Permit #S-43858)

Dear Mr. Law:

The Department is currently in the process of evaluating your request for an extension on the above referenced permit. However, based upon continued review, the Department has determined that additional information is necessary in order to evaluate your extension request. The following information must be received:

- **Please complete and return the enclosed Water Supply Summary and Water Demand Summary Tables.** This additional information is necessary for the Department to properly evaluate your extension request.

Please submit this information by **Monday, September 29, 2003.** Failure to submit the requested information by this deadline **may** result in the proposed rejection of your extension request.

If you need to request additional time to submit the information requested above, a written request must be received in the Salem office of the Department by the deadline above. The Department will evaluate timely requests and determine whether or not the request may be granted.

If you should have any questions concerning your extension request or the required materials listed above, you may contact me at (503) 378-8455, extension 272.

Sincerely,

Lisa J. Juul
Water Rights Specialist

Enclosure: Water Supply/Demand Summary Tables

cc: Appl #S-51053 (Permit #S-43858)
Greg Beaman, Watermaster District #01

File #S-51053

MEMORANDUM

Date: August 15, 2003

To: Appl #S-51053 (Permit #S-43858)

From: Lisa Juul, Permit Extension Review

Subject: Amended dates requested for extension

Today, I spoke with Mr. John Law with the City of Bay City. The extension of time application submitted for Permit #S-43858 indicated that a 50-year extension of time was being requested.... from October 1, 2003 to October 1, 2053.

The last authorized "C" Date for Permit #S-43858, however, was October 1, 2000. Mr. Law verified that the intent was to request a 50-year extension.

Per Mr. Law, therefore, the extension application should be requesting:

> **to extend the dates for complete construction of the water system and for complete application of water to full beneficial use under Permit #S-43858 from October 1, 2000, to October 1, 2050.**

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* CITY OF BAY CITY

of Bay City *, State of* Oregon *; has made proof*

to the satisfaction of the STATE ENGINEER of Oregon, of a right to store the waters of

Patterson Creek, a tributary of Tillamook Bay to be appropriated under Application No. 26691, Permit No. 20895.

for the purposes of

municipal use

under Reservoir Permit No. R-1287 *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* December 6, 1951

that the amount of water entitled to be stored each year under such right, for the purposes aforesaid, shall not exceed 3.3 *acre-feet.*

The reservoir is located in Section 35 (SE¼ NW¼) *, Tp.* 1 N *, R.* 10 W. *, W.M.*

WITNESS the signature of the State Engineer,

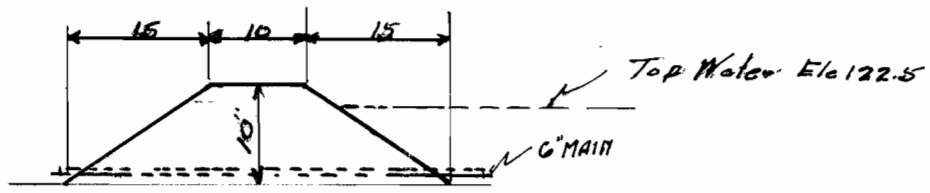
affixed this 21st *day*

of September *, 19*56 .

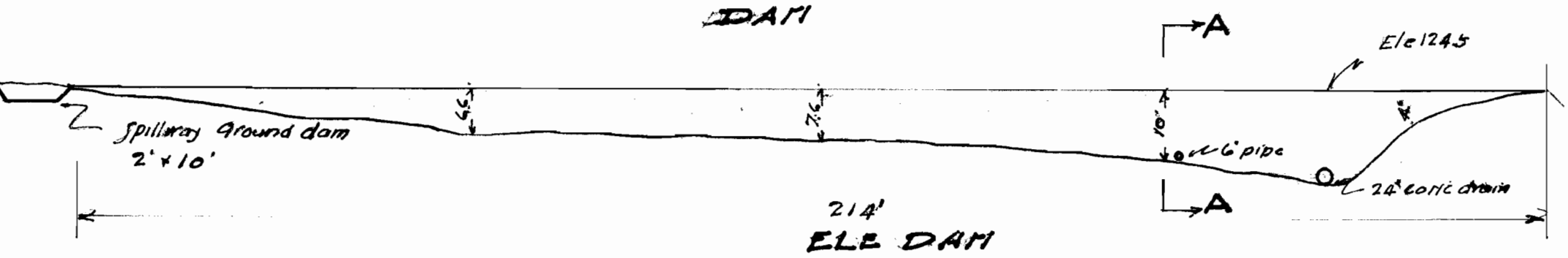
LEWIS A. STANLEY

State Engineer.

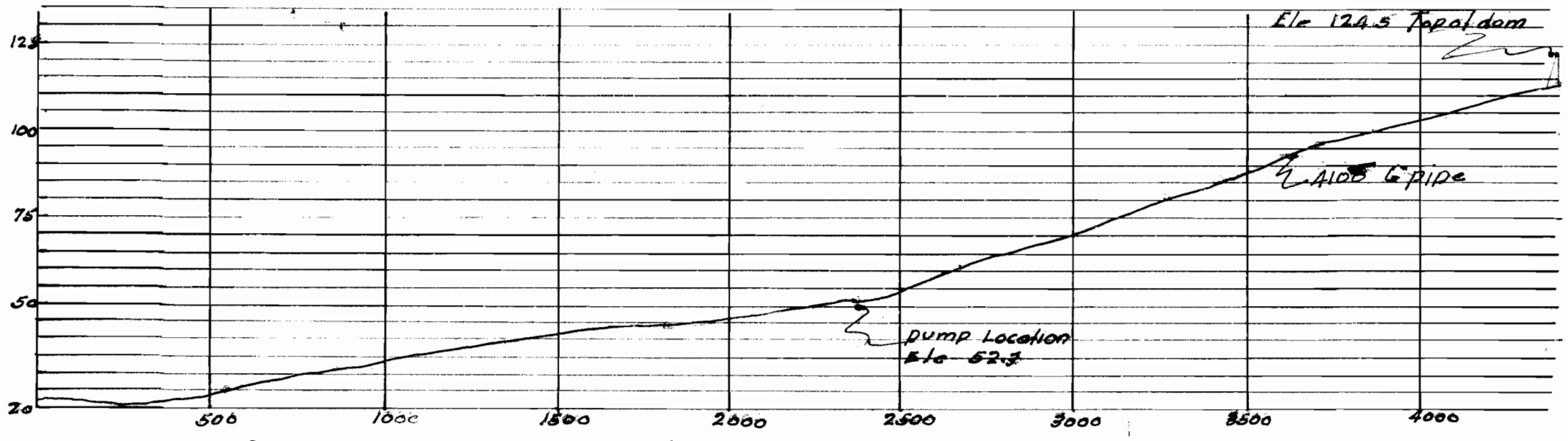
Recorded in State Record of Water Right Certificates, Volume 15 *, page* 21584 .



SEC A-A
DAM

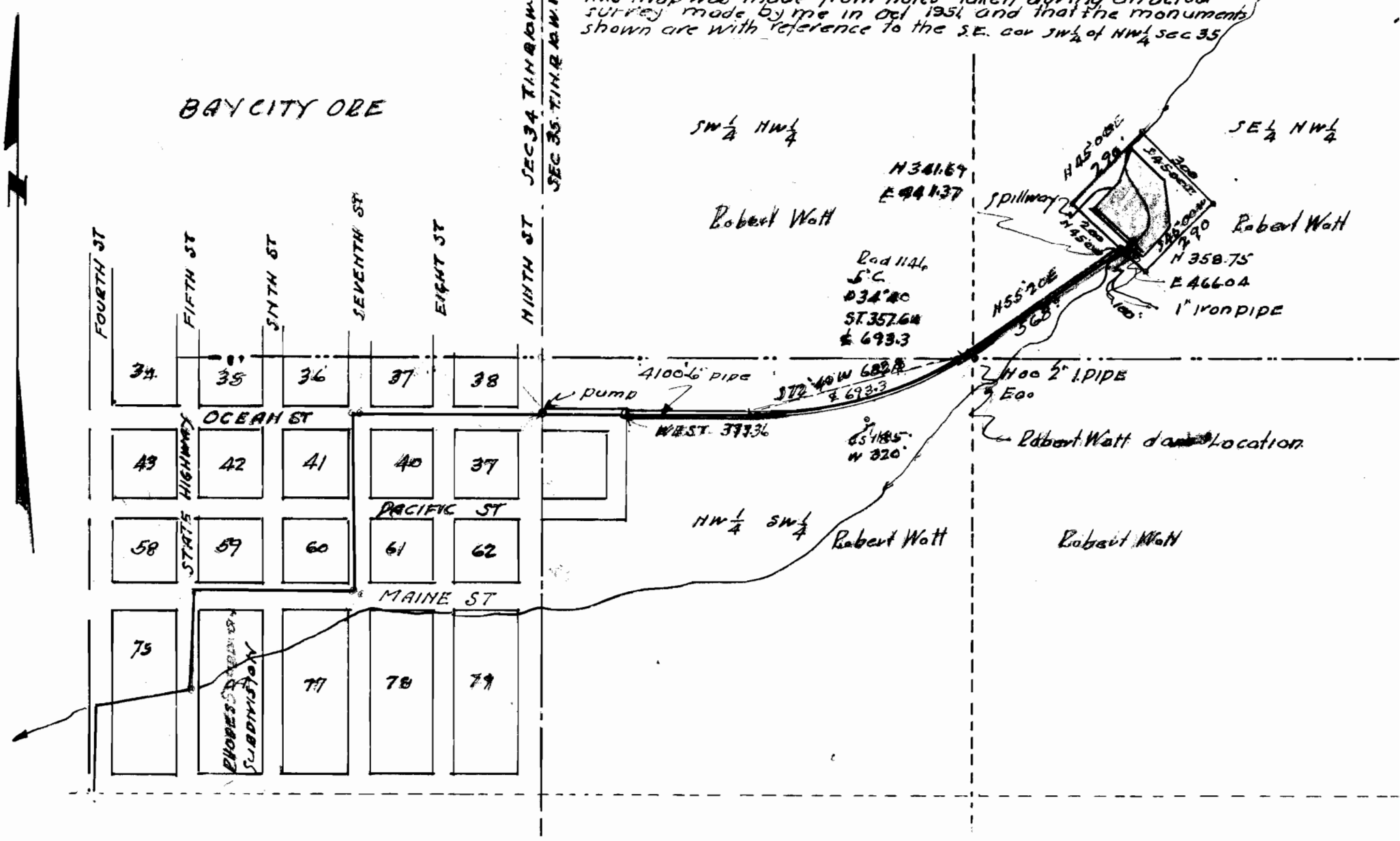


ELE DAM



SURVEYOR'S CERTIFICATE

I, W. E. Anderson of Tillamook, Ore. do hereby certify that this map was made from notes taken during an actual survey made by me in Oct 1951 and that the monuments shown are with reference to the S.E. cor SW¼ of NW¼ sec 35



BAY CITY WATER RIGHT
LOCATED ON
PATTERSON CREEK
SEC 35 T. 1N. R 10 W. W.M.
TILLAMOOK ORE
Scale 1" = 400'

W E Anderson

R-26690
Application No. 26691
Permit No. 21287

Permit A-1—1500—2-56 State Printing 92199

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* CITY OF BAY CITY,

of Bay City, *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* Patterson Creek and Reservoir to be constructed under App. No. R-26690, Per. No. R-1287 *a tributary of* Tillamook Bay *for the purpose of* municipal *under Permit No.* 20895 *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* December 6, 1951;

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 1.00 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 SE¼ NW¼, Section 35, Township 1 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:

SE¼ NW¼
SW¼ NW¼
NW¼ SW¼
Section 35
NE¼ SW¼
Section 34
Township 1 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, *19*56.

LEWIS A. STANLEY
State Engineer

Recorded in State Record of Water Right Certificates, Volume 15, *page* 21585

Permit No. 20895

*APPLICATION FOR PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Bay City, Oregon (Name of applicant)

of Bay City (Mailing address) Tillamook County,

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, SUBJECT TO EXISTING RIGHTS:

If the applicant is a corporation, give date and place of incorporation

1. The source of the proposed appropriation is Patterson Creek and reservoir (Name of stream), a tributary of Tillamook Bay

2. The amount of water which the applicant intends to apply to beneficial use is 1.00 cubic feet per second. (If water is to be used from more than one source, give quantity from each)

**3. The use to which the water is to be applied is General City Use (Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located 358.75 ft. N (N. or S.) and 466.04 ft. E (E. or W.) from the S.W. corner of SE¼ NW¼ section 35. Twp. 1 N.R. 10 W.W.M. (Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one point of diversion, each must be described. Use separate sheet if necessary)

being within the SE¼ NW¼ (Give smallest legal subdivision) of Sec. 35 Tp. 1 N. (N. or S.)

R. 10 W. (E. or W.), W. M., in the county of Tillamook.

5. The pipe line (Main ditch, canal or pipe line) to be 4100 ft (Miles or feet)

in length, terminating in the NE¼ SE¼ (Smallest legal subdivision) of Sec. 34 Tp. 1 N. (N. or S.),

R. 10 W.W. (E. or W.) W. M., the proposed location being shown throughout on the accompanying map.

DESCRIPTION OF WORKS

Diversion Works—

6. (a) Height of dam 8 ft average feet, length on top 214 feet, length at bottom 214 feet; material to be used and character of construction disrt and clay (Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam) Spillway around dam see plat.

(b) Description of headgate Steel 6" steel gate (Timber, concrete, etc., number and size of openings)

(c) If water is to be pumped give general description (Size and type of pump)

(Size and type of engine or motor to be used, total head water is to be lifted, etc.)

*A different form of application is provided where storage works are contemplated.

**Application for permits to appropriate water for the generation of electricity, with the exception of municipalities, must be made to the Hydroelectric Commission. Either of the above forms may be secured, without cost, together with instructions by addressing the State Engineer, Salem, Oregon.

20895

Canal System or Pipe Line—

7. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(b) At ..... miles from headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(c) Length of pipe, 4100 ft.; size at intake, 6" in.; size at 4100 ft. from intake 6" in.; size at place of use 6" in.; difference in elevation between intake and place of use, 100 ft. Is grade uniform? yes Estimated capacity, ... sec. ft.

8. Location of area to be irrigated, or place of use .....

Township	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
1.N.	10.W.	35	SE¼ NW¼	
1.N.	10.W.	35	SW¼ NW¼	
1.N.	10.W.	35	NW¼ SW¼	
1.N.	10.W.	34	NE¼ SW¼	

(If more space required, attach separate sheet)

(a) Character of soil .....

(b) Kind of crops raised .....

Power or Mining Purposes—

9. (a) Total amount of power to be developed ..... theoretical horsepower.

(b) Quantity of water to be used for power ..... sec. ft.

(c) Total fall to be utilized ..... (Head) ..... feet.

(d) The nature of the works by means of which the power is to be developed .....

(e) Such works to be located in ..... (Legal subdivision) ..... of Sec. ....., Tp. ..... (No. N. or S.), R. ..... (No. E. or W.), W. M.

(f) Is water to be returned to any stream? ..... (Yes or No)

(g) If so, name stream and locate point of return ..... , Sec. ....., Tp. ..... (No. N. or S.), R. ..... (No. E. or W.), W. M.

(h) The use to which power is to be applied is .....

(i) The nature of the mines to be served .....

20895

[redacted] the day of Bay City, Oregon

[redacted] County, having a present population of

[redacted] estimated population of 1000 in 19 61.

[redacted] the domestic use state number of families to be supplied

(Another questions 11, 12, 13, and 14 in all cases)

11. Estimated cost of proposed works, $ 6000.00

12. Construction work will begin on or before June 1952

13. Construction work will be completed on or before Aug 1952

14. The water will be completely applied to the proposed use on or before Aug 1952

BAY CITY
(Signature of applicant)

By: Lyn G. Gage, Mayor

By: Henry H. Schlaepfi, City Recorder

Remarks: A 6" pipe will be laid from the dam to the location shown on the map. At an elevation of 52 ft a pump will pump into the present water system. A 40 H.P. pump will be used. An electric centrafugal. with a 2" intake and 4 outlet.

STATE OF OREGON,
County of Marion, } ss.

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 State Engineer, with corrections on or before ....., 19 .....

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

STATE ENGINEER

PERMIT

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS 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 1.00 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 Patterson Creek and Reservoir to be constructed under Application No. R-26690, Permit No. R- 1287

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

If for irrigation, this appropriation shall be limited to - - - - - - - - - of one cubic foot per second

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 6, 1951

Actual construction work shall begin on or before March 31, 1953 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 1954

Complete application of the water to the proposed use shall be made on or before October 1, 1955

WITNESS my hand this 31st day of March 1952

Chas. E. Stricklin
STATE ENGINEER

Permits for power development are subject to the payment of annual fees as provided in sections 1 and 2, chapter 74, Oregon Laws 1933.

Application No. 26691

Permit No. R 1287

PERMIT
TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

Division No. ..... District No. .....

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 6 day of December, 1951, at 8:00 o'clock A M.

Returned to applicant:

Corrected application received:

Approved:
MAR 31 1952

Recorded in book No. 51 of Permits on page 20895

CHAS. E. STRICKLIN
STATE ENGINEER

Drainage Basin No. 1 Page 6 H

Fees Paid $

Water Resource Information Systems Report

5

Water Use Report Based on Water Right

Permit: S 43858 *

CITY OF BAY CITY PO BOX 3309 BAY CITY, OR 97107

Records per page: 26 View All

Acre-feet (AF) of Water Used

Water Year*	Report ID	Facility	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total Water Used	Irrigated Acres
2019	11178	DILL BAR	67.40	59.52	61.22	64.60	53.25	66.33	54.20	64.62	69.79	69.04	68.61	70.65	769.25	
2018	11178	DILL BAR	47.04	37.74	46.33	35.82	46.46	46.61	45.22	56.11	56.80	64.92	65.16	57.31	605.52	
2017	11178	DILL BAR	70.89	65.98	69.97	68.44	63.22	65.98	65.37	70.89	72.43	77.95	81.02	69.36	841.49	
2015	11178	DILL BAR	66.60	63.92	64.61	66.34	53.31	82.94	63.58	66.97	70.42	77.65	76.20	76.58	829.11	
2014	11178	DILL BAR	69.79	54.53	73.01	53.86	58.49	65.92	63.00	67.85	67.30	73.25	78.35	70.12	795.49	
2013	11178	DILL BAR	64.12	55.95	66.75	69.84	63.45	72.05	65.67	69.61	71.10	83.27	79.53	75.68	837.02	
2012	11178	DILL BAR	66.22	62.90	62.47	59.97	43.39	58.32	57.62	61.74	65.07	69.33	70.71	64.70	742.44	
2011	11178	DILL BAR	65.43	62.61	65.74	66.93	58.27	60.60	61.35	68.54	69.35	73.98	73.82	66.93	793.52	
2010	11178	DILL BAR	63.04	60.27	70.46	62.18	55.79	64.02	60.61	64.63	65.58	75.53	74.42	64.54	781.06	
2009	11178	DILL BAR	59.52	56.07	60.49	59.13	55.08	69.81	62.38	65.04	66.40	75.98	74.31	68.88	773.08	
2008	11178	DILL BAR	56.09	55.73	57.71	52.65	54.60	57.72	56.71	60.26	60.66	73.65	67.57	61.95	715.30	
2007	11178	DILL BAR	56.36	67.87	71.70	67.60	51.87	55.73	54.37	59.53	60.65	64.69	64.66	56.47	731.50	
2006	11178	DILL BAR	70.59	66.44	65.45	64.69	59.88	66.79	64.35	69.88	67.58	78.29	78.04	69.15	821.14	
2005	11178	DILL BAR	65.99	62.90	64.32	64.58	60.88	68.54	63.84	67.43	66.56	74.27	78.01	74.12	811.43	
2004	11178	DILL BAR	68.12	76.86	75.77	60.63	56.81	63.30	61.72	62.88	67.33	81.21	73.69	66.13	814.46	
2003	11178	DILL BAR	60.97	58.01	60.50	61.14	54.85	59.01	57.13	61.05	68.37	89.37	89.70	73.30	793.39	
2002	11178	DILL BAR	70.86	71.68	72.35	73.93	69.33	73.26	65.46	66.42	64.09	75.05	79.14	60.78	842.35	
2001	11178	DILL BAR	76.04	85.05	87.05	89.75	66.06	79.28	82.01	92.25	73.20	74.68	95.92	78.55	979.83	
1999	11178	DILL BAR	70.72	64.92	77.15	80.88	69.35	76.08	73.17	75.39	71.32	77.57	77.57	79.91	894.03	
1998	11178	DILL BAR	62.15	57.83	61.51	60.45	55.19	62.29	61.08	63.13	62.64	74.68	85.12	76.76	782.82	
1997	11178	DILL BAR	59.69	50.18	66.90	59.35	59.35	68.99	66.87	73.47	71.84	80.47	84.30	64.75	806.17	
1996	11178	DILL	56.68	57.57	56.73	56.76	59.52	57.60	55.78	58.89	61.86	66.82	74.56	65.98	728.75	

		BAR												
1995	11178	DILL BAR	56.35	49.23	53.22	46.47	44.00	50.06	47.29	51.16	53.10	60.71	60.19	56.26	628.06
1993	11178	DILL BAR	44.64	54.46	39.98	40.99	41.39	47.62	39.30	42.17	50.34	50.83	63.13	49.71	564.57
1991	11178	DILL BAR	57.28	54.08	61.70	99.64	54.53	54.65	54.52	41.57	43.65	63.02	68.60	72.68	725.92
1989	11178	DILL BAR	75.61	63.94	65.02	78.18	72.34	63.70	77.45	57.80	65.22	74.91	65.14	74.80	834.13

*The water year is named for the calendar year in which it ends. Example: the 2018 water year begins Oct. 1, 2017 and ends Sep. 30, 2018.

- The Water Resources Department makes reasonable efforts to screen the data for quality control; however, the Department cannot accept responsibility for errors, omissions, or accuracy of the information. Notification of any errors is appreciated. Send notifications to wateruse@wrd.state.or.us or call (503) 986-0905.
- Water use is reported by point of diversion (POD), rather than by water right.
- If a POD is shared with multiple water rights, it is not feasible to separate out the amount used under the water right being queried from water used by other rights using this same POD.
- Monthly amounts indicate:
  - For diverted rights, the total amount diverted during the month;
  - For storage rights, the amount generally stored in the reservoir/pond during the month, as represented by the volume of water impounded on approximately the same day each month.
- Water use amounts have all been converted to “acre-feet” (AF), regardless of the original measurement unit reported. One AF is the volume of water that will cover an acre of ground one foot deep = 325,850 gallons.
- Zeroes indicate that a report was received stating that no water was used during those months; if a year is not listed, no report of water use was received for that year.

Eureka, CA | Arcata, CA | Redding, CA | Willits, CA | Fort Bragg, CA | Coos Bay, OR | Klamath Falls, OR