WATER SYSTEM PLAN FOR
THURSTON PUD

PART B (COMPREHENSIVE WATER SYSTEM PLAN)
SWARD #278 WATER SYSTEM
ID #06046H

APRIL 2017

ENGINEER'S CERTIFICATION:

"I hereby state that this Water System Plan for Thurston PUD, Part B for Sward #278 Water System has been prepared by me or under my supervision and meets or exceeds the minimum requirements for such plans as defined under WAC 246-290-100."

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This report was prepared under the guidance and direction of the Thurston PUD. The technical data provided within this plan is based on Public Utility District records and reporting.

John Weidenfeller
General Manager

Kim Gubbe
Operations Manager

TABLE OF CONTENTS

Page

ABBREVIATIONS AND ACRONYMS

ADD	Average Daily Demand
DI	Ductile Iron (pipe)
DBP	Disinfection Byproduct Rule
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
fps	Feet per second
gpd	Gallons per day
gpm	Gallons per minute
IOC	Inorganic Compound
MADD	Maximum Average Day Demand
MCL	Maximum Contaminant Level
MDD	Maximum Daily Demand
PHD	Peak Hour Demand
psi	Pounds per square inch
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
Thurston PUD	Public Utility District No. 1 of Thurston County
Umbrella Plan	Part A of the Thurston PUD Water System Plan
VOC	Volatile organic compound
WAC	Washington Administrative Code
WFI	Water Facilities Inventory
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WSP	Water System Plan

INTRODUCTION

The Thurston PUD Umbrella Plan contains financial program information for the operation of all Thurston PUD water systems. See the Umbrella Plan for information on the following: historical financial information, improvement program financing, financial viability testing, and rate structure analysis.

Purpose and Organization of This Water System Plan

The PUD is required to update the water system plan (WSP) according to Washington Department of Health (DOH) regulations under Chapter 246-290 (Group A Public Water Supplies) of the Washington Administrative Code (WAC). The purpose of a WSP is to provide a uniform process for water purveyors to:

- Identify present and future needs,
- Set forth the means for addressing those needs, and
- Demonstrate that the system has the operational, technical, managerial, and financial capability to achieve and maintain compliance with all relevant local, state, and federal plans and regulations.

For utilities that own multiple water systems, a WSP is typically comprised of two elements: Part A and Part B. Part A of the WSP, also referred to as the Umbrella Plan, provides general information pertaining to the utility and programmatic elements that are common to all water system owned, operated, and/or managed by the utility. This includes a description of the utility, its organizational structure and operating policies, a utility-wide water conservation program, water quality regulatory compliance requirements, an overall improvements program and related financial program, an operations and maintenance program, a cross connection control program, design standards and construction specifications, and discussion of the utility's satellite system management program.

Part B then contains detailed elements regarding each individual water system. This includes a system description, basic planning data, system analysis, monitoring requirements and compliance review, source protection, detailed improvements program, coordination with local entities and agencies, consumer confidence reporting, and specific conservation activities.

This document represents the Part B element of the PUD's WSP as it relates to the Sward #278 water system. The Part A element of the PUD's WSP (Umbrella Plan) was prepared in June, 2007 and a draft update was submitted to DOH in July 2013. The PUD's water system planning activities have been conducted in accordance with Chapter 246-290 WAC, the DOH Water System Planning Handbook, dated April, 1997, and the water system plan outline provided in the DOH pre-plan meeting.

General Description of Thurston PUD

The PUD was created by the citizens of Thurston County in 1938. As a public utility district established under Chapter 54 of the Revised Code of Washington (RCW), the PUD has authority to serve public water systems in the State of Washington. For many years, the only system owned by the PUD was the water system for the Tanglewilde-Thompson Place community in Thurston County. This changed in 2005 with the acquisition of multiple systems in Western Washington. The PUD currently owns and operates 157 water systems in five counties (Thurston, Grays Harbor, Lewis, Mason, and Pierce), consisting of Group A and Group B systems, serving approximately 4,000 active connections. In addition, the PUD manages over 900 connections for water systems owned by towns, private companies, and homeowner associations.

Relationship of the WSP with the 2017 Sward#278 "System Reconstruction" Project Report

This WSP and the 2017 Sward #278 System Consolidation and Improvements Project Report (project report) are being submitted concurrently to DOH for approval. The system consolidation and improvements detailed in the project report are described as complete in the WSP. This clarifies the presentation of the WSP and improves its utility as planning document for the system. The WSP will be updated based on comments provided for the project report and construction as-built documents.

Chapter 1: Description of Sward #278 Water System

CHAPTER 1:
DESCRIPTION OF SWARD #278 WATER SYSTEM

1.1 Ownership and Management

The Sward #278 Water System is a Group A water system with DOH System ID No. 06046H. The system was formed by the consolidation of the following two Group B water systems:

- Sward #1 - 278 (Group B water system, System ID No. 60046)
- Platt 2-511 (Group B water system, System ID No. 08272)

The water systems were both owned and managed by the Thurston Public Utility District (Thurston PUD) prior to consolidation and Thurston PUD continues to own and manage the consolidated system. Information regarding the type of ownership and management structure of Thurston PUD can be found in the Thurston County Public Utility District Water System Plan Part A – Umbrella Plan (Umbrella Plan). Refer to Appendix A for a vicinity map of the system locations and copy of the current water facilities inventory (WFI) report forms, which have been updated for this water system plan (WSP).

1.2 System Background

1.2.1 History of Water System Development and Growth

The current water system was originally two separate water systems. The systems were consolidated into a single Group A system in 2015 due to the failure of the Platt 2-511 well. The history of each of the formerly separate water systems is described below.

1.2.1.1 Sward #1 - 278

Prior to consolidation, the Sward #1 – 278 system was a Group B residential water system. The system was developed by Prime West Development, Inc. in 1996 to serve four connections. Thurston PUD acquired the system in 2005. The well was retained for use as the primary source for the consolidated water system.

1.2.1.2 Platt 2 - 511

Prior to consolidation, the Platt 2 – 511 system was a Group B residential water system. The system was developed by American Water Resource, Inc. in 2000 to serve six connections. Thurston PUD acquired the system in 2005. In 2009, the well failed and an emergency intertie was opened to the Sward system. The system's well will be decommissioned as part of the consolidation.

1.2.2 Geography

The water system service area is a rural residential area. Land cover is primarily forested with wetlands, pastures, and single-family residences. Local land cover adjacent to residences includes undeveloped areas, large residential lots; including outbuildings, pasture, and crop land. Access to the area is provided by paved, two-lane County roads. Local access includes paved and gravel roads. Elevations in the service area (based on Lewis County GIS data) range from a low of approximately 420-feet at the north boundary of the service area to a high of approximately 457-feet at the southwest corner of the service area.

Refer to Appendix A for a Service Area Map showing the service area location.

1.2.3 Neighboring/Adjacent Purveyors

There are no neighboring or adjacent Group A or Group B water systems within 0.5-miles of the water system service area. The nearest public water system is the *Lewis CO Area 3 Shop*, Group B system (DOH ID No. 02311) located approximately 0.68-miles to the northeast near the intersection of Highway 603 and Pleasant Valley Road. The adjacent single-family residences are served by private wells.

Refer to Appendix A for a map depicting neighboring purveyors in relation to the boundaries of the water system.

1.2.4 Ordinances/Bylaws

The water system was designed in accordance with Chapter 246-290 of the Washington Administrative Code, "Group A Public Water Supplies," as well as the Washington State Department of Health (DOE) Water System Design Manual (December, 2009). Water demand was determined based on well meter and service meter records.

Fire flow was not considered in the design of this water system. The Lewis County Fire Marshal does not require fire flow for single-family dwelling units in unincorporated areas of the County as shown in the email provided in Appendix A.

1.3 Inventory of Existing Facilities

The source for the water system is a groundwater well with no treatment. Meters are located at the source well and at all service connections. The completed depth of the well is 195-feet and the existing pump capacity is 5-gpm. A 10,000 gallon reservoir and two 1 hp booster pumps pressurize the distribution system. The water distribution network typically consists of 2-inch polyvinyl chloride (PVC) pipe.

The combined water system has ten active connections and is approved by DOH for up to ten connections. There are no interties with other water systems. See Chapter 3 for an extensive inventory and assessment of system infrastructure.

1.4 Related Plans

1.4.1 Related Plans

Planning activities, studies, and reports that affect this water system plan are shown below. There are no known inconsistencies between these related plans and the water system plan.

1.4.1.1 Thurston County Public Utility District Water System Plan Part A – Umbrella Plan

This plan was developed by Thurston PUD to fulfill DOH requirements to develop a WSP for the water system. This plan provides general information pertaining to the utility and programmatic elements that are common to all water systems owned, operated, and/or managed by the utility. This includes a description of the utility, its organizational structure, its operating policies, a utility-wide water conservation program, water quality regulatory compliance requirements, an overall improvement program (and related financial program), an operations and maintenance program, a cross connection control program, design standards, construction specifications, and discussion of the utility's satellite system management program.

1.4.1.2 Watershed Assessment for WRIA 23

The Sward #278 water system is located within Water Resource Inventory Area 23 (WRIA 23). This initial assessment was prepared for Ecology in 1995 and includes compiled information on groundwater, surface water hydrology, water quality, and water rights within WRIA 23. Existing water rights and resource management plans for the area are summarized.

1.4.1.3 Lewis County Comprehensive Plan

This latest amendment to the plan was developed in 2010 by Lewis County to meet state-wide requirements for growth management planning. It identifies a long term vision for development and resource management within the county.

1.4.2 Local Government Consistency

The planning and engineering documents in this WSP were submitted to Lewis County for consistency with local plans and regulations. A Local Government Consistency Review Checklist will be completed.

1.4.3 Comments from Agencies and Adjacent Purveyors

This WSP will be submitted to Lewis County for their review. Comments received and Thurston PUD's responses to the comments will be incorporated into this WSP.

1.5 Existing Service Area and Characteristics

1.5.1 Existing Service Area Map

Refer to Appendix A for a Service Area Map showing the service area location.

1.5.2 Zoning and Land Use

The water system is located in unincorporated Lewis County. The entire service area is zoned Rural lands – RDD-10. The land to the north, east, and south of the service area is also zoned RDD-10. The land immediately to the west is zoned RDD-20. These zoning designations are all for rural development.

All ten lots in the service area are currently improved with single-family structures. The property to the east and south is also developed with single-family residences. The property to the north is a mix of single family residences and timber land. The property to the east is a 122-acre parcel with pasture land immediately adjacent to the service area but it also has a rock quarry and a residential building.

1.6 Future Service Area

The future service area is the same as the existing service area, this is an existing, non-expanding system.

1.7 Service Area Agreements

Service area agreements are included in the Thurston PUD Umbrella Plan.

1.8 Service Area Policies

Service area policies are included in the Thurston PUD Umbrella Plan.

1.9 Satellite Management

This system is owned and operated by Thurston PUD.

1.10 Conditions of Service Policies

Conditions of service requirements are included in the Thurston PUD Umbrella Plan.

1.11 Complaints

The policy and process for dealing with complaints and recordkeeping are included in the Thurston PUD Umbrella Plan.

Chapter 2: Basic Planning Data

CHAPTER 2:
BASIC PLANNING DATA

2.1 Current Data Population, Service Connections, and ERUs

2.1.1 Population

The total population served by the combined water system is currently 28 people based on information from Thurston PUD. The population is composed entirely of full-time residents and does not vary seasonally. The calculated average population per residential unit for this system is approximately 2.8 people, which is higher than the 2008-2012 Lewis County average of 2.53 reported by the United States Census Bureau.

Updated Water Facilities Inventory (WFI) forms detailing the current population is included in Appendix A.

2.1.2 Service Connections

The system has ten active single-family residential service connections which is the maximum number of approved service connections for the system.

2.1.3 Water Use Data Collection

Thurston PUD reads source and service meters for the system on a monthly basis. Service meter records the most recent two years (2016 – 2017) are used as the basis for water use calculations in this WSP. Table 2-1 shows service metering for 2016 – 2017. The service meter data is used to calculate average day demand (ADD), maximum month average day (MMAD), maximum day demand (MDD), and peak hour demand (PHD). The total demand can be attributed to a single user class because the service meter records are not complete and the system is entirely single-family residential users; therefore each connection is considered to be one ERU.

Table 2-1: Service Meter Data

	100 DRAWS LN	109 DRAWS LN	141 QUARY LN	108 DRAWS LN	125 QUARY LN	135 QUARY LN	140 QUARY LN	144 QUARY LN	118 QUARY LN	128 QUARY LN		total cft per month	total gallons per month	total gallons per day
12/6/2017	336	329	377	639	71	966	342	620	408	1,302		5,390	40,317	1,344
11/7/2017	297	291	363	336	77	896	307	1,096	286	1,067		5,016	37,520	1,251
10/10/2017	410	348	323	1,012	92	1,253	286	1,053	1,786	1,344		7,907	59,144	1,971
9/8/2017	448	481	357	851	70	1,347	434	1,285	3,548	1,177		9,998	74,785	2,493
8/10/2017	390	804	334	546	74	1,784	343	982	4,744	1,181		11,182	83,641	2,788
7/11/2017	610	608	212	834	98	1,065	481	486	1,010	1,250		6,654	49,772	1,659
6/8/2017	398	338	331	672	85	733	265	631	359	1,698		5,510	41,215	1,374
5/9/2017	263	293	269	656	75	569	272	554	287	1,234		4,472	33,451	1,115
4/10/2017	535	339	285	802	89	574	349	588	185	1,243		4,989	37,318	1,244
3/9/2017	208	306	344	691	85	536	198	583	157	1,116		4,224	31,596	1,053
2/9/2017	408	349	344	795	86	609	363	564	183	1,103		4,804	35,934	1,198
1/9/2017	394	369	225	824	88	789	301	736	274	1,258		5,258	39,330	1,311
12/8/2016	416	308	266	766	93	664	199	573	276	1,111		4,672	34,947	1,165
11/8/2016	270	284	318	555	79	585	238	565	212	1,044		4,150	31,042	1,035
10/11/2016	324	368	401	828	90	664	295	653	2,150	1,599		7,372	55,143	1,838
9/8/2016	365	506	576	980	98	826	494	1,124	2,951	1,716		9,636	72,077	2,403
8/9/2016	306	745	424	1,020	97	786	518	769	3,766	1,252		9,683	72,429	2,414
7/8/2016	47	533	281	771	99	1,094	570	607	4,471	1,352		9,825	73,491	2,450
6/8/2016	361	544	362	854	76	719	439	638	1,416	1,341		6,750	50,490	1,683
5/9/2016	467	540	379	667	111	1,795	388	649	313	1,699		7,008	52,420	1,747
4/8/2016	469	404	302	845	126	891	378	469	258	1,498		5,640	42,187	1,406
3/9/2016	372	338	330	695	103	520	500	635	159	1,213		4,865	36,390	1,213
2/9/2016	517	345	437	655	94	525	449	643	221	1,326		5,212	38,986	1,300
1/8/2016	434	321	355	965	84	519	322	709	266	1,334		5,309	39,711	1,324

2.1.4 Equivalent Residential Units (ERUs)

With only single-family residential service connections, the ERUs for the system are equivalent to the total number of active connections. As shown in Table 2-2, average ERU demand for the system is 134-gpd per ERU. Maximum Monthly Average Daily Demand (MMDD) IS 278.8 gpd/ERU. A monthly to daily peaking factor of 1.7 is used to calculate Maximum Daily Demand (MDD), resulting in an MDD of 474 gpd/ERU. PHD is calculated as 27.9 gpm using the equation"

$$PHD = \left(\frac{MDD}{1440} * 3 * N\right) + 18 = \left(\frac{474}{1440} * 3 * 10\right) + 18 = 27.9 \text{ gpm}$$

Table 2-2: ERU Demands

ADD	161.6	GPD/ERU
MMDD	278.8	GPD/ERU
Multiplier	1.7	
MDD	474.0	GPD/ERU
PHD	27.9	GPM

2.1.5 Existing Land Use

The service area of the existing system is composed entirely of single-family residential development in unincorporated Lewis County. The system is located outside all identified municipal water service area boundaries. Platted lot sizes within the service area vary from a minimum of 0.56- acres to a maximum of 2.39- acres. The lots are mostly cleared of trees with the exception of one lot at the northwest corner of the service area that has trees on the western half of the lot. The majority of all lot areas are covered with grass. Some lots have small gardens and areas of landscaping.

2.2 6-Year and 20-Year Projections

2.2.1 Projected Land Use

All lots in the service area are currently developed and the number of service connections will not increase in the future. There are no known projects that would modify the land use.

2.2.2 Projected Population

It is assumed that the average population per residence will remain constant for the next 20-year period and therefore the total system population will remain constant.

Table 2-3: Population Projections

	Current	6-yr Projection	20-yr Projection
	2016	2022	2036
Service Connections	10	10	10
Population per Connection	2.8	2.8	2.8
Total Population	**28**	**28**	**28**

2.2.3 Projected Non-Residential Water Needs

The system is currently composed entirely of single-family residential users which is not projected to change within the 20-year planning horizon.

2.2.4 Projected Non-Revenue Water

Potential sources of non-revenue water for this system include leaks, main flushing, and meter inaccuracy. Table 2-5 shows the calculation of non-revenue water based on service meter records for the last seven years. The records erroneously show that service meter consumption is greater than source production by approximately 4-percent. Therefore, the table is not useful for accurate DSL calculations. Verifying the accuracy of the source meter and replacing the meters as necessary is identified as a capital improvement project in Section 8 of this plan.

Table 2-4: Distribution System Leakage

Year	Source Production[1] (gal)	Service Consumption[1] (gal)	Distribution System Leakage	
			Volume (gal)	Percentage
2010	462,862	504,631	-41,768	**-9.0%**
2011	574,636	580,754	-6,118	**-1.1%**
2012	464,889	475,414	-10,525	**-2.3%**
2013	465,022	483,678	-18,656	**-4.0%**
2014	325,761	349,144	-23,382	**-7.2%**
2015	454,470	511,789	-57,319	**-12.6%**
2016	633,549	619,075	14,474	**2.3%**
7-yr AVG	**483,027**	**503,498**	**-20,471**	**-4.2%**

Notes:
1. Water used for main flushing is not recorded and is therefore included in DSL.
2. The calculation year includes water used from January to December.

2.2.5 Water Rates and Rate Impacts of Water Demand

See the Thurston PUD Umbrella Plan for details of the water rate structure and incentives for conservation.

2.2.6 Water Demand Forecasting

Residential users are projected to remain the only customer class in the system through the 20-year planning horizon and the number of service connections will remain the same unless homes are unoccupied for extended periods. The water demand calculations for ADD, MDD, PHD and annual withdrawal volume for 6-years and 20-year time horizons are presented in Table 2-6.

Due to the unreliable service meter records, the percent of consumption attributed to distribution system losses is unknown. Therefore, an accurate future demand projection accounting for increased water conservation is not possible at this time.

The service area is not expanding and water use is not anticipated to increase over the 20-year planning period. Therefore, the permit exempt water rights are projected to be sufficient for the existing, 6-year, and 20-year planning horizons.

Table 2-5: Water Use Projections

Projected Demand					
		(ADD=134-gpd/ERU)			
	ERUs	ADD (GAL)	MDD (GAL)	PHD (GPM)	Annual Volume (GAL)
Existing	10	1,616	4,740	27.9	589,746
2022	10	1,616	4,740	27.9	589,746
2036	10	1,616	4,740	27.9	589,746

Chapter 3: System Analysis

CHAPTER 3:
SYSTEM ANALYSIS

3.1 System Design Standards

See the Thurston PUD Umbrella Plan for system design standards, construction standards, and general operational policies.

3.2 Water Quality Analysis

3.2.1 Historical Review of Trends

The source water for the system has always been provided by groundwater wells. Prior to consolidation, the two Group B systems (Sward #1 - 278 & Platt 2-511) were served by individual wells. Currently, the Sward #278 water system has a single source (S01) that was originally developed for the Sward system.

3.2.1.1 Well (Source S01)

The raw water for the permanent active source, Well S01, has not historically required treatment. There have not been exceedances recorded for VOC or IOC contaminants for this source.

The test results for the secondary contaminants of iron, manganese, and turbidity have been detected in the raw water samples but below Maximum Contaminant Levels (MCL's). See Appendix B for recent water quality test results and exceedances.

3.2.1.2 Distribution System Water Quality

The source water from source S01 is not chlorinated or subject to other treatment prior to distribution. The finished water quality throughout the distribution system has historically been good.

3.2.2 Future Requirements

See Chapter 6 "Operations and Maintenance Program" for a discussion of current and future sampling requirements.

3.3 System Inventory and Description

3.3.1 System Overview

A map showing the water system layout and infrastructure is provided as Figure 3.2.

3.3.2 Source

The source of supply for this system is a groundwater well. The well is source S01 and is located on parcel No. 015006004012 (100 Draws Lane) near the southern lot line.

Well characteristics are listed in Table 3-1 and raw water quality for these sources is discussed in Section 3.2.1.

Table 3-1: Sources of Supply – Groundwater Wells

Source No.	Source Name/ Well Tag ID	Use	Casing Dia.	Capacity (gpm)	Total Depth (feet)	Depth to 1st Open Interval (feet)
S01	Well #1 AKK-666	Permanent	6-in (+2' to 35') 4-in (35' to 195')	5	195	182

Notes:
1. Source S01 was the well for the Sward #1 – 278 Group B water system prior to consolidation.
2. The well source serving the Platt 2-511 Group B water system (Well Tag ID AFC-758) has been decommissioned as part of the system consolidation.

When Well S01 was drilled in July 1996, the static water level was 13-feet below the top of casing. A pumping test was performed in March 2019 with a static level of 27.15 feet, a pumping rate of 5 gpm, and stabilized pumping level of 98.3 feet. Subsequent recovery to 32.33 feet required 60 minutes. A variable speed drive has been installed to facilitate pumping at 5 gpm.

After the failure of the Platt well in June 2009, Well S01 served the entire 10-lot service area through an emergency intertie. The system has not experienced known well problems since its development. The historical system records indicate that the well has adequate capacity to serve the system for the next 20-year planning period.

3.3.3 Water Treatment

The water system source does not require water treatment and none is provided.

3.3.4 Storage

Prior to failure of the Platt well the Sward water system was supplied by a 1,550 gallon storage tank, and the Platt system by a 2,000 gallon storage tank. These have been removed and the consolidated system is now supplied by the Sward well only, which pumps via a 2-inch transmission line directly to a 10,000 gallon storage tank located at the Platt pumphouse. Float switches control the well pump to maintain tank level. The 10,000 gallon tank is constructed of polyethylene and located at grade, with a base elevation of 431 feet and overflow level of 443.25 feet elevation. Refer to Appendix A for a Storage Tank Exhibit.

See Section 6.2.1 for a description of system controls affecting storage level. See Table 3-5 for a list of individual storage components.

3.3.5 Pumps

Well and booster pumps are the two types of pumps within the system. Refer to Appendix A for pump curves and specifications.

The existing submersible pump within Well S01 has been recently replaced. The well pump produces at 5 gpm per the most recent pump test, with a variable speed drive for control based on an on/off float switchcall from the reservoir.

Two 1 HP Goulds HSC pumps located at the Platt pump house are used to pressurize the distribution system. These pumps operate on a lead/lag alternating pressure switch and are supplied by the new 10,000 gallon reservoir. Each pump is able to individually meet system PHD of 28 gpm for build out of 10 connections.

The lead pump is programmed to operate between a pressure range of 40-to 60-psi measured near the discharge piping, and the lag at 2 psi below the above setpoints. The pump house also contains three, 85-gallon bladder tanks to handle small demands. See Section 6.2.1 for a detailed description of pump operation and control.

Table 3-3: Pump Equipment Data

Type	Location	Manufacturer and Model	No. of Pumps	Horse Power	Design	
					Capacity (GPM)	Total Dynamic Head (ft)
Submersible	Well S01	Goulds Model 25GS30	1	3	5	7
Centrifugal	Platt Pump House	Goulds HSC10	2	1	26	112

3.3.6 Bladder Tanks

Three, 85-gallon bladder tanks are installed at the Platt pump house after the booster pumps. As shown by the calculations included in Appendix A, the existing tanks should adequately maintain pressures between 40- and 60-psi for the associated booster pump delivery capacities. See Section 6.2.1 for a detailed description of the bladder tank operation and control.

3.3.7 Distribution System

The water system has a single pressure zone. Service pressure at PHD is about 45-psi at all service locations. System pressure is monitored at the discharge of the booster pump manifold in the Plat pump house. The distribution system piping for the system is composed of 2-inch diameter class 200 PVC pipe.

The water distribution mains are located within the right-of-way and within easements. The water main is generally located outside of the pavement surface. All residences in the area are served by private septic systems and there are no storm water conveyance pipes in the area, therefore separation between water and sewer lines is not applicable.

All services are metered.

Table 3-4: Distribution System Piping

	Material	Pipe Diameter (in)	Installed Quantity (feet)
Existing	PVC	2	1,062
Proposed	PVC	2	541
		Total	1,603

Refer to **Figure 3.2** for an overall system map of Sward #278.

3.4 System Capacity Analysis

3.4.1. Source Capacity Analysis

3.4.1.1 Physical Capacity Analysis

Historical system performance and record pumping tests are the basis for the source physical capacity. The well has been in operation for over 15-years. Following a pumping test the source pumping rate has been set to 5 gpm. Operation of the well a maximum of 20 hours per day allows for production of 6,000 gpd, which exceeds system wide maximum day demand of 4,740 gpd.

3.4.1.2 Water Rights Analysis

The two Group B systems that consolidated to form this Group A system were both supported by permit exempt water rights and the consolidated system continues to rely on a permit exempt water right. This system falls under the permit exempt criteria because it is composed of a small group of residential homes and the historical and forecasted water withdrawal is below 5,000-gpd. See Table 2-2 for calculated maximum day demand (MDD) for the combined system.

The service area is not expanding and water use is not anticipated to increase over the 20-year planning period. Therefore, the permit exempt water rights are projected to be sufficient for the existing, 6-year, and 20-year planning horizons. If water consumption increases in the future beyond 5,000-gpd then a water right application will need to be obtained.

3.4.2. Water Treatment Capacity Analysis

The source for this system does not require treatment and no treatment is provided.

3.4.3. Storage Capacity Analysis

Required and recommended water storage volumes are calculated using the DOH criteria. See Table 3-5 for a storage capacity analysis. The reservoir for this system does not supply the distribution system through gravity; system pressure is provided through the use of the booster pump stations. The DOH analysis shows that the new reservoir has the capacity to provide the DOH-required storage volumes for the operational and standby storage components throughout the 20-year planning horizon.

Operational Storage

The operational storage component is dependent on the operational procedures utilized. The minimum operational storage volume needs to be set to function with the sensitivity of the level sensors and to prevent excessive cycling of the well pump during fill cycles. The set difference between the pump-on and pump-off levels is 6-inches. This equates to an operational volume of approximately 397 gallons. At a fill rate of 5 gpm the well pump will cycle less than once per hour, therefore operational volume is sufficient for pump protection.

Equalizing Storage

Equalizing storage is required by DOH when the source pumping capacity cannot meet the peak consumption demands of the water system. Minimum recommended equalizing storage is 150 minutes of system PHD (27.9 gpm) less source production rate (5 gpm), resulting in 3,435 gallons equalizing storage.

Fire Suppression Storage

This system is a rural system and the local fire marshal does not require fire suppression storage. Therefore, this system does not provide fire suppression storage.

Standby Storage

Standby storage provides a measure of reliability in case of source failure or unusually high water demands. The DOH provides recommendations for standby storage volumes but water system purveyors have flexibility to reduce the volume based on system characteristics and community expectations. The recommended volume is two days of average demand for the system, equivalent to 3,232 gallons.

The standby storage provided for this system meets the recommended DOH volume.

Dead Storage

Dead storage is the volume of stored water that is not available to consumers at the

minimum design pressures due to elevation or tank and equipment configuration. This system utilizes booster pumps to provide design pressures. Therefore, dead storage is a function of the volume unavailable due to the overflow pipe elevations and outlet pipe elevations feeding the booster pumps. This is 6 inches of freeboard and 6 inches below the booster pump protection float switch, for a total of 794 gallons dead storage.

Total required storage volume is 7,858 gallons, therefore the installed 10,000 gallon tank is adequate to meet system needs.

Table 3-5: Storage Capacity Analysis

SOURCE AND STORAGE CAPACITY

SWARD #278	*ERUs*
EXISTING/COMMITTED	10
FUTURE	0
TOTAL	10
SOURCE CAPACITY (Eq. ERUs)	12
TOTAL ERUs	-10
AVAILABLE ERUs	***2***

SOURCE CAPACITY (Qs) NAME	**GPM**	
S01 Well Pump	5	
EQUIVALENT ERUs	**12**	= Total GPM / (MDD / 1200)

STORAGE CAPACITY FACILITY	**STANDBY/EQ. VOLUME (GAL)**	
Platt Storage Tank	**10,000**	
PEAK HOUR DEMAND (GPM).	27.9	
MAXIMUM DAY DEMAND (GPD/ERU)	474.0	
AVERAGE DAY DEMAND (GPD/ERU)	161.6	
OPERATIONAL VOLUME	397	6" of storage
FIRE SUPPRESSION VOLUME (GAL)	0	
DEAD STORAGE (GAL)	794	= (MDD/1440) * (3 * ERU) + 18
STANDBY STORAGE (GAL)	3,232	= PHD / ERU
EQUALIZING STORAGE	3,435	= (2 days)*ADD*ERU
TOTAL REQURED STORAGE VOLUME (GAL)	**7,858**	= (PHD - Qs)*150
TOTAL AVAILBLE VOLUME (GAL)	**10,000**	= Operational + Standby + Equalizing

The calculations show that the existing storage reservoirs have the capacity to meet the required and recommended storage needs for the next 20-years and beyond.

3.4.4. Distribution System Capacity Analysis

The distribution system was analyzed for physical capacity based on the maximum allowable velocity permissible in the system. A maximum velocity of 8-fps under PHD conditions was used as the standard. The physical capacity analysis for system distribution pipes shown in Table 3-6 uses the current PHD system value of 2.7-gpm/ERU based on the last 2-years of metered data.

Table 3-6: Distribution System – Physical Capacity

Pipe Diameter	Material	Pipe Capacity at a velocity of 8-fps (gpm)	PHD/ERU (gpm)	Physical Capacity (ERUs)
2"	PVC	78	2.7	29

The system capacity is adequate to handle the current and projected ERUs.

3.4.5. Limiting Factor Analysis

An analysis of the physical capacity of individual system components and the legal capacity of water sources has been prepared for the existing, 6-year forecast and 20-year forecast. The worksheets show that the standby storage and booster pumps are the limiting components for all forecast but that the system has the required physical and legal capacity to meet projected demands for the 6-year and 20-year forecast. Refer to Figure 3.3 for detailed calculations.

3.4.6. Hydraulic Analysis

3.4.6.1 Hydraulic Calculations Overview

A basic hydraulic analysis in WaterCAD was performed to evaluate the distribution system under peak demand scenarios and to verify that delivered service pressures where above the minimum allowable pressures per WAC guidelines and below pressures that would require pressrun re reducing valves. Pipes were also analyzed to insure that distribution system velocities remained below the DOH recommended maximum of 8-fps under PHD conditions.

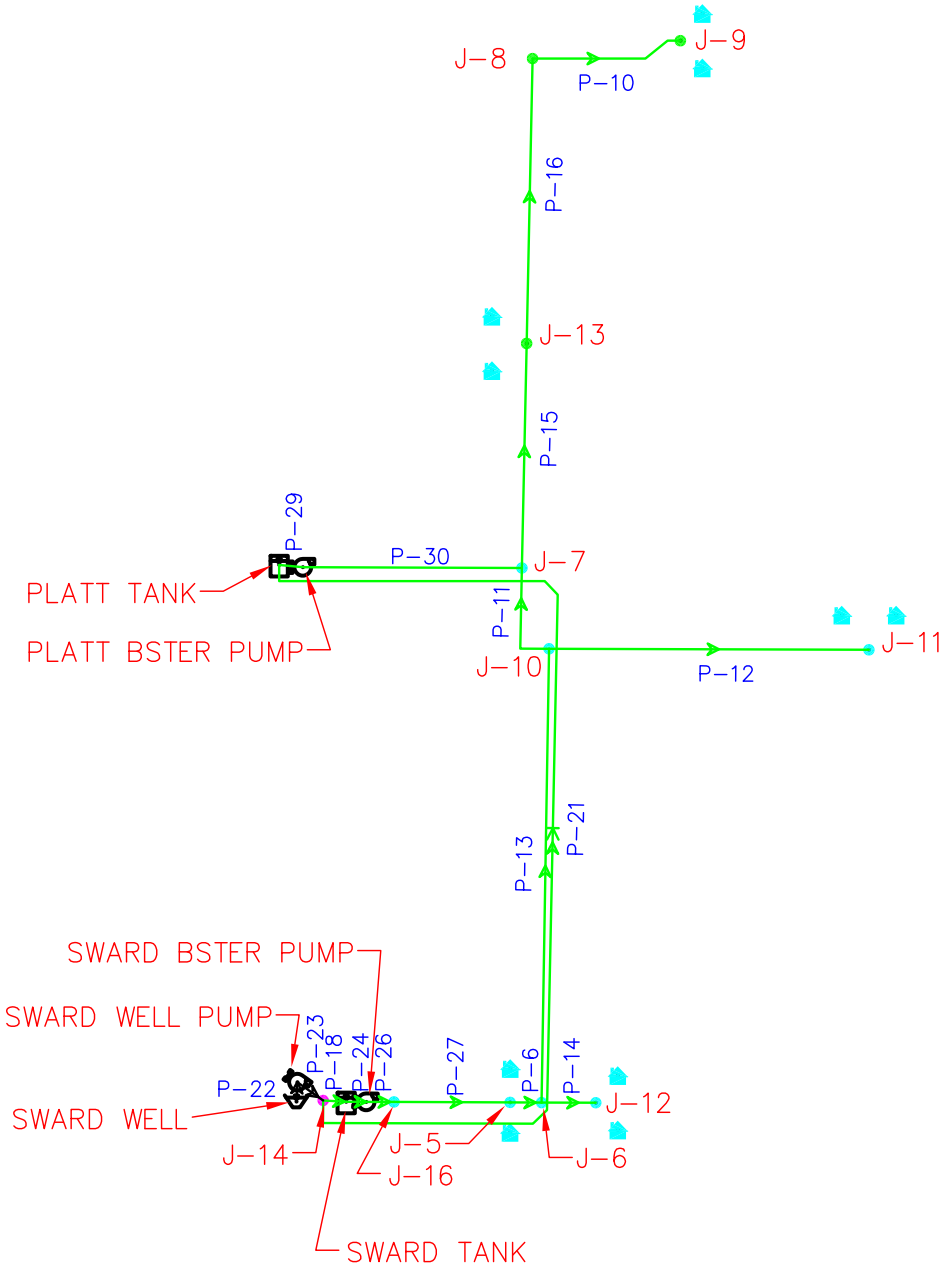
3.4.6.2 Analyzed Scenarios and Results

The system is currently serving the maximum connections allowed and peak demand is not projected to change in the future. Therefore, the existing, 6-year, and 20-year scenarios were evaluated with the same analysis. System pressures were checked at nodes for both static pressures during times of no demand and service pressures during PHD.

The calculations show that the system pressures for both scenarios fall within a range of 10-psi for all points in the system and at PHD the system pressure is above the DOH minimum of 30-psi at all points in the distribution system. See Figure 3.1 for a schematic layout of the system and Tables 3-7 and 3-8 for a summary of analysis results.

Refer to Appendix D for detailed calculations and results.

SWARD WATER SYSTEM



Color Coding Legend Junction: Pressure (psi)		
	<=	0.0
	<=	20.0
	<=	30.0
	<=	50.0
	<=	100.0
	>	100.0

Color Coding Legend Pipe: Velocity (ft/s)		
	<=	0.00
	<=	7.00
	<=	10.00
	>	10.00

Figure 3.1

33548

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Table 3-7: Hydraulic Calculations Summary – Pipe Segments

Label	Length (feet)	Diameter (in)	Material	Flow (gpm)	Velocity (fps)	Headloss (Friction) (feet)
P-6	16	2	PVC	4	0.44	0.01
P-10	80	2	PVC	5	0.5	0.07
P-11	57	2	PVC	14	1.43	0.33
P-12	167	2	PVC	5	0.5	0.14
P-13	236	2	PVC	9	0.94	0.62
P-14	28	2	PVC	5	0.5	0.02
P-15	117	2	PVC	10	1	0.35
P-16	148	2	PVC	5	0.5	0.12
P-18	5	1.3	PVC	5	1.3	0.04
P-21	541	2	PVC	27	2.8	11.15
P-22	5	1.3	PVC	32	8.47	1.35
P-23	5	1.3	PVC	32	8.47	1.35
P-24	5	2	PVC	1	0.06	0
P-26	14	2	PVC	1	0.06	0
P-27	60	2	PVC	1	0.06	0
P-29	5	2	PVC	24	2.43	0.08
P-30	114	2	PVC	24	2.43	1.76

Table 3-8: Hydraulic Calculations Summary – Nodes

Label	Elevation (feet)	Demand (gpm)	Hydraulic Grade (feet)	Pressure (psi)
J-5	444	5	549.5	46
J-6	444	0	549.51	46
J-7	440	0	550.47	48
J-8	425	0	550	54
J-9	428	5	549.93	53
J-10	442	0	550.14	47
J-11	447	5	550	45
J-12	444	5	549.49	46
J-13	433	5	550.12	51
J-16	444	0	549.51	46

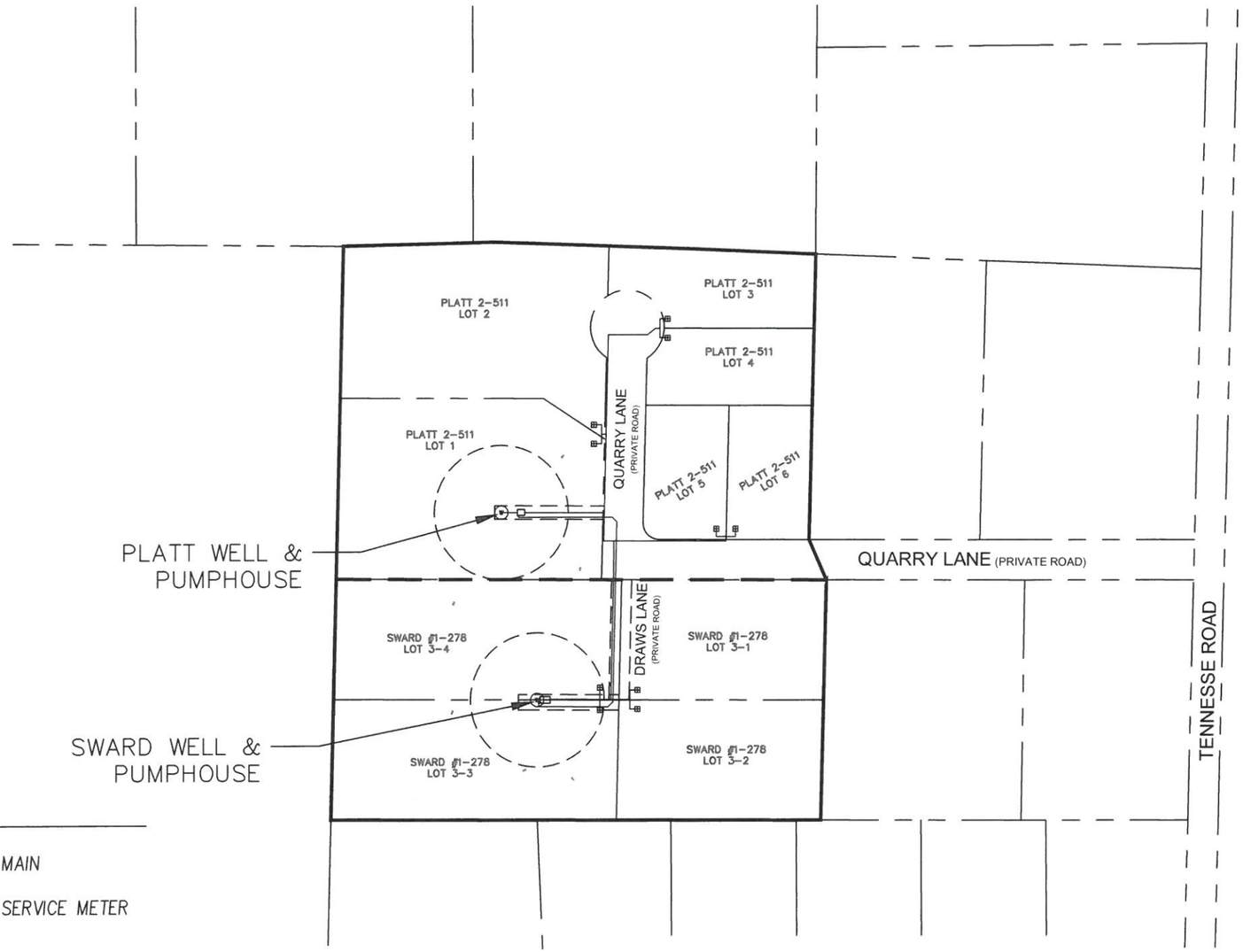
3.5 Summary of System Deficiencies

There is a discrepancy between source meter and service meter consumption records. The accuracy of all meters needs to be tested and inaccurate meters need to be replaced.

See Section 8 for a list of identified improvement projects.

THURSTON PUD
SWARD - PLATT
WATER SYSTEM CONSOLIDATION

GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.



LEGEND

- EXISTING WATER MAIN
- EXISTING WATER SERVICE METER
- EXISTING WELL
- EXISTING LOT LINE
- EXISTING EASEMENT
- EXISTING SERVICE AREA
- PROPOSED SERVICE AREA BOUNDARY

SWARD - PLATT WATER SYSTEM
SYSTEM MAP

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NOTE:
THE BOUNDARY AND SITE LAYOUT INFORMATION SHOWN HERON WAS TAKEN FROM PUBLIC AND PRIVATE DOCUMENTS AND SHOULD NOT BE RELIED ON FOR ACCURACY.

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8/2/2016

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Fax: (253) 473-0599

FOR: SWARD -LIMITING FACTOR ANALYSIS		FILE NO. 33548
		TASK NO.
PREPARED BY: CRH	DATE: April 1, 2017	PAGE 1 OF 1
CHECKED BY: KAS	SCALE:	

- MEASURED DEMANDS:
  - ADD = 134 GPD/ERU
  - MDD = 371 GPD/ERU
  - PHD = 2.6 GPM/ERU
  - CURRENT / FUTURE ERUs = 10 ERUs
- SYSTEM COMPONENTS AS ERUs:
  - WATER RIGHTS = 5000 GPD / MDD
    = 5000 / 371 = 13 ERUs
  - SOURCE = 116 ERUs (SEE TABLE 3-5)
  - STANDBY STORAGE = 2,680 GAL / (2 DAYS * ADD)

Chapter 4: Water Use Efficiency Program

CHAPTER 4:
Water Use Efficiency Program

The PUD's comprehensive Water Conservation Program is included in the Umbrella Plan. The following sections summarize portions of the Umbrella Plan and provide supplemental information that is specific to the Sward #278 water system.

4.1 Source and Service Meters

The water system's source and all service connections are metered. Analysis of meter data is an essential element of the PUD's Water Conservation Program. The PUD also has a meter replacement program by which fogged or broken meters are replaced on an as-needed basis.

Leaks can occur in customer service piping and in the distribution system. The PUD identifies customer-side leaks by meter reader observations of meter leak detectors, routine examination of billing records by accounting software (from which excessive use is flagged), and customer calls. The PUD follows up with customers via phone or site visits to aid in addressing possible leak sources in customer plumbing. Distribution system leaks are identified when the PUD staff or customers observe water surfacing above or near water mains and appurtenances. The PUD immediately addresses such leaks.

Thurston PUD is aware that the source and service meter records for this system do not reconcile. The inaccuracy of the meters is identified as a system deficiency and is listed as a capital improvement project in Section 8.

4.2 Source of Supply Analysis

As discussed in Section 3.4.1.2, the water rights analysis for this system projects that the current source meets projected water demands and it is not projected that the water system will pursue additional water rights within the next 20-year planning period.

A source of supply analysis is not required for this system. However, some general analysis was performed to identify and evaluate opportunities to obtain new sources or optimize the use of the existing source already developed, and evaluate other innovative methods to meet water needs.

4.2.1 Enhanced Conservation Measures

The PUD's comprehensive Water Conservation Program is included in the Umbrella Plan. The following enhanced conservation measures are discussed in addition to the Water Conservation Program.

4.2.1.1 Water Right Application

Water consumption is projected to remain below 5,000-gpd for the system and within the permit exempt water right. If system demand increases above projected volumes and cannot be reduced by enhanced conservation measures, then a water right application will be filed with the Ecology.

4.2.1.2 Interties

There are no adjacent water systems located nearby that provide an opportunity to intertie with this system.

4.2.1.3 Artificial Recharge

Existing land use in the service area is primarily pervious surface consisting of undeveloped forest, pastures, wetlands, and lawns. Impervious surfaces in the service area consist of roadways, houses, barns, shops, sheds, and other small structures. Runoff from these impervious areas flows to pervious areas where it is infiltrated or enters creeks and wetlands. The collection of runoff for groundwater recharge is not feasible given these rural conditions.

4.2.1.4 Use of Reclaimed Water, Reuse and Other Non-Potable Sources

There are limited opportunities for using reclaimed water, reuse, non-potable water, or grey water as approaches to providing additional water for the water system. Connections to the water system consist entirely of rural single-family residences that have relatively low water use and that lack significant sources of water for reclamation or reuse. All residences connected to the water system have septic tanks with drain fields.

4.2.1.5 Treatment

The source well for the water system has good water quality without treatment. If water quality issues are identified at the source in the future, then treatment alternatives and their associated costs will be considered.

4.3 Evaluation of Supply Alternatives

The water system's well is the only water source in the service area. Surrounding areas are also served exclusively by wells. In the event that the water system's primary source well experiences a failure, then another well would likely need to be developed as a replacement. A replacement

well could potentially be located adjacent to source S01 or near the decommissioned well that previously served the Platt 2-511 Group B system.

Chapter 5: Source Water Protection

CHAPTER 5:
SOURCE WATER PROTECTION

5.1 Wellhead Protection Program

5.1.1 Overview

The Wellhead Protection Program (WHPP) for the water system was developed in accordance with the Washington State Wellhead Protection Program Guidance Document (June, 2010). The WHPP includes:

- A susceptibility assessment for every source.
- A delineated wellhead protection area for the well.
- An inventory of potential contaminant sources in the wellhead protection area that could threaten the water-bearing zone (aquifer) used by the well.
- Documentation showing that the water system has sent delineation and inventory findings to required entities.
- Contingency plans for providing alternate drinking water sources if contamination does occur.
- Coordination with local emergency responders for appropriate spill or incident response measures.

5.1.2 Susceptibility Assessment

A susceptibility assessment has been completed and is included in Appendix C for DOH's use in evaluating geologic and hydrologic factors associated with the water supply source in order to estimate vulnerability to contaminants regulated under the State Drinking Water Rule (WAC 246-290) and the Federal Safe Drinking Water Act (SDWA).

5.1.3 Wellhead Protection Area Information

The wellhead protection area for this water system is comprised of multiple management zones that correspond to established time-of-travel in the aquifer. The management zones were determined using the calculated fixed radius method as described in Appendix C of the Washington State Wellhead Protection Program Guidance Document. The zones include:

- Zone 1 – 6-month horizontal time-of-travel boundary = 58-feet
- Zone 1 – 1-year horizontal time-of travel boundary = 82-feet
- Zone 2 – 5-year horizontal time-of-travel boundary = 182-feet
- Zone 3 – 10-year horizontal time-of-travel boundary = 257-feet

See the susceptibility assessment in Appendix C for details.

The sanitary control area (SCA) for the wellhead is 100-feet. Residential single-family lots are the only land use within the SCA. Other than the pump house there are no buildings within the SCA (There are two homes just outside the 100-foot SCA boundary). The majority of the land use within the SCA is residential landscaping, although a portion of the driveway for the lot to the south is approximately 80-feet from the well.

Other than residential septic systems, no potential sources of contamination could be identified within the Sward #278 Wellhead Protection Area.

5.1.4 Contaminant Source Inventory

Past and present land use in the vicinity of the water system includes low density residential areas and forest land with some small-scale agricultural areas. Future land use is anticipated to be the same. Zoning in the vicinity of the water system is primarily rural residential. The potential contaminant sources associated with this type of land use are:

- Subsurface percolation from septic tanks (Category I)
- Fertilizer applications (Category IV)

5.1.5 Notification of Findings

All residents within the Sward #278 water system have been mailed a letter informing them about the sensitivity of their location with regards to their groundwater supply. Refer to Appendix C for examples of letters that were sent. Table 5-1 lists the locations of potential contaminant sources within the water system.

Table 5-1: WHP Area Potential Contaminant Source List

Potential Contaminant Source	Property Owner	Address
Residential Septic System	Jones, Jodie	100 Draws Ln
Residential Septic System	Grove, David M. and Allyson T.	108 Draws Ln
Residential Septic System	Cole, James and Ranee Delong	109 Draws Ln
Residential Septic System	Campbell, Roberta	118 Quary Ln
Residential Septic System	Hamilton, Charles	125 Quary Ln
Residential Septic System	Franco-Hernandes, Meredith	128 Quary Ln
Residential Septic System	Fletcher, Lester S. and Karen E.	135 Quary Ln
Residential Septic System	Nelson, Claude M. and Judith L.	140 Quary Ln
Residential Septic System	Allied Enterprises	141 Quary Ln
Residential Septic System	Bednorz, Russell	144 Quary Ln

5.1.6 Contingency Plan

The water system includes a primary source well. The system does not have an emergency water source. In the event of complete failure or contamination of the primary well a new well will need to be developed.

5.1.7 Spill Response Planning

A complete spill response plan is included in Thurston PUD Umbrella Plan.

5.1.8 Regional Implementation Efforts

There is no regional wellhead protection program among purveyors.

Chapter 6: Operation and Maintenance Program

CHAPTER 6:
OPERATION AND MAINTENANCE PROGRAM

6.1 Water System Management and Personnel

See the Thurston PUD Umbrella Plan for detailed information on system management guidelines, personnel, operator certifications, standard emergency response program, safety procedures, customer complaint response program, and recordkeeping and reporting. The Umbrella Plan should be referenced for the general operational and maintenance guidelines that Thurston PUD follows. The information provided in this section is system specific information to supplement the Umbrella Plan.

6.2 Routine Operating Procedures

6.2.1 Major System Components and Routine System Operation

The following sections detail the major components of the water system including: routine operation, the relationship with other components, and possible alternate operation modes. See Figure 3.2 for a map of the system components.

6.2.1.1 Source of Supply

This system source of supply is a groundwater well. See Section 3.3 for a detailed description and analysis of the source of supply well.

Standard Operation:

Under standard operating conditions, Well S01 is the only active source for system domestic use. The proposed submersible well pump shall be controlled by level control floats within the storage reservoir. The well pump can be manually operated in the event that the storage floats fail or for well pump testing.

Emergency Operation:

In the event that the well needs to be temporarily taken offline, the system can continue operating using either of the booster pump stations and the water already in the storage reservoirs. The standby storage in the reservoir provides a minimum of 2-days of average water use in case of an emergency. If the well pump is taken off line for maintenance or due to an emergency, then Thurston PUD will notify system customers and request that water use is limited

to extend the duration of supply. During emergency operation system staff will visit the system daily to check and maintain water storage levels.

6.2.1.2 Water Storage Facilities

This system has a 10,000 gallon polyethene reservoir located adjacent to the decommissioned Platt well, within the pump house. See Section 3.3 for a detailed description and analysis of the water storage facility.

Standard Operation:

Under standard operating conditions, level control floats control the filling of the water storage reservoir. When the water level in the reservoir drops below the operating storage level, the well pump is activated to pump directly to the reservoir until the operating storage volume is replenished.

Emergency Operation:

In the event that the reservoir needs to be taken offline for emergency maintenance a small temporary reservoir will be required in order to meet equalizing storage needs.

6.2.1.3 Booster Pumps

This system has two parallel booster pumps within the Sward pump house that serve all service connections, with booster pump suction supply from the reservoir. See Section 3.3 for a detailed description and analysis of the booster pumps.

Standard Operation:

The booster pumps within the Sward pump house are controlled by pressure switches, which maintain system pressure between 40- and 60-psi in the distribution system as measured in the discharge piping. The booster pumps are constant speed pumps and are currently set so the lead pump is initiated once pressure drops to 40-psi. The pump will then operate to meet system demand until pressure reaches 60-psi. While the booster pumps are off, small system demands will be met by the bladder tanks. The booster pump station is designed so that a single pump can handle peak system demands. If for some reason the lead pump does not meet system demands, then the lag pump is set to initiate operation when system pressure drops to 35-psi. The lag pump will continue operating until system pressure reaches 55-psi.

Emergency Operation:
If the booster pumps require maintenance, they can be isolated and the system can operate with one pump online. If an emergency occurs and the pumps require maintenance, system valves and well pump pressure switch settings can be manually configured to temporarily allow the well to pump directly to the distribution system.

6.2.1.4 Bladder Tanks

This system has three, 85-gallon bladder tanks at the Sward pump house after the existing booster pumps. See Section 3.3 for a detailed description and analysis of the bladder tanks.

Standard Operation:
While the booster pumps are off, small system demands will be met by the bladder tanks. The bladder tanks have pre-charged air-bladders to maintain system pressures between 40- and 60-psi for the associated booster pump delivery capacities.

Emergency Operation:
If the bladder tanks require maintenance, they can be isolated in the same way the booster pumps can be.

6.2.1.5 Distribution Piping

This system has a single pressure zone. See Section 3.3 for a detailed description and analysis of the system distribution piping.

Standard Operation:
The dead end streets in the system service area resulted in the system configured in a branched configuration without looped mains.

Emergency Operation:
In the event of a main break, the nearest system valve will be closed and all services on that branch will be temporarily out of service until the repair is complete.

6.3 Comprehensive Monitoring Plan (Regulatory Compliance)

6.3.1. Water Quality Sampling Procedures and Program

The source for all water for this system is a groundwater well. No treatment is necessary or provided to the source water. See Chapter 3, Section 3.2 "Water Quality Analysis" for information on the water quality.

The rules for water quality testing are established under WAC 246-290-300. See the Thurston PUD Umbrella Plan for standard testing requirements applicable to all Group A water systems. This section contains system specific testing requirements and procedures not covered by the Umbrella Plan.

6.3.2. Coliform Monitoring Plan

The Coliform Monitoring Plan for this system is included for reference in Appendix B. This plan includes monitoring locations and standard frequencies, along with recent test results.

Cross-Connection Control Program

See the Thurston PUD Umbrella Plan for the current Cross-Connection Control Program Plan that is implemented on all Thurston PUD systems.

As described in the Umbrella Plan, Thurston PUD does survey customers to determine if they have facilities that require premises isolation. Currently there are no residential services on this system that require DCVA or RPBA isolation and no devices are installed for residential services.

6.4 Summary of Operation and Maintenance Deficiencies

See Section 3.5 for a discussion of meter record discrepancies. Testing and verification of meter accuracy needs to be performed to identify inaccurate meters for calibration or replacement.

Chapter 7: Distribution Facilities Design & Construction Standards

CHAPTER 7: DISTRIBUTION FACILITIES DESIGN AND CONSTRUCTION STANDARDS

7.1 Project Review Procedures

The Thurston PUD umbrella plan contains the design and construction standards for all Thurston PUD systems. See the umbrella plan for information on the following: Policies and Requirements for Outside Parties, Design Standards, Construction Standards, Construction Certification, Identification of System Improvements, Assessment of Alternatives, Prioritizing Improvements, and Selection of Alternatives.

Chapter 8: Improvement Program

CHAPTER 8: IMPROVEMENT PROGRAM

8.1 Identified Improvement Projects

Many system improvements were included as part of the consolidation of the two Group B systems. The following identified improvement projects are listed in order of priority:

8.1.1. Project 1

Verify meter accuracy for all service meters and calibrate or replace meters as necessary.

Preliminary Estimated Project Cost: $180 per replaced meter

Schedule for Improvement: Verification and testing of meters will begin this year

Chapter 9: Financial Program

CHAPTER 9:
FINANCIAL PROGRAM

9.1 Financial Program

The Thurston PUD umbrella plan contains financial program information for the operation of all Thurston PUD water systems. See the umbrella plan for information on the following: historical financial information, improvement program financing, financial viability testing, and rate structure analysis.

Chapter 10: Miscellaneous Documents

CHAPTER 10: MISCELLANEOUS DOCUMENTS

10.1 Environmental Documents

Consideration of the State Environmental Policy Act (SEPA) is mandatory for water systems with 1,000 or more service connections. The Sward #278 water system has less than 1,000 service connections and is therefore not required to provide a SEPA checklist as part of this plan.

10.2 Agreements

This system does not have intertie, source, wheeling, joint use, cooperation, or mutual aid agreements. See Appendix A for utility easements agreements.

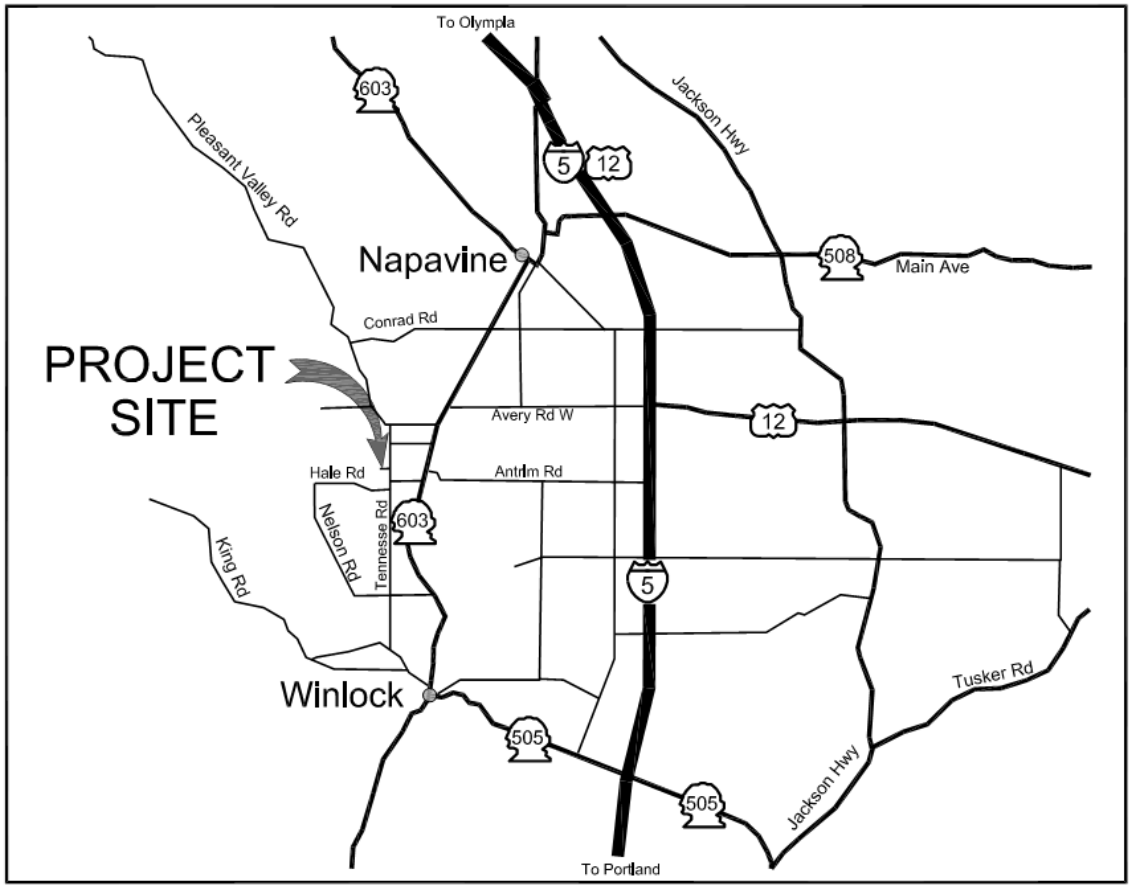
10.3 Public Meetings

A public meeting for all system consumers will be held to inform customers of the system consolidation and improvements proposed in the water system plan update. A meeting agenda and meeting minutes will be provided when completed.

10.4 County / Adjacent Utility Correspondence

Draft water system plans were provided to Lewis County at the time of draft submittal to the Department of Health. Comments will be provided and addressed as part of the final WSP submittal.

Appendix A: Existing Facilities Details

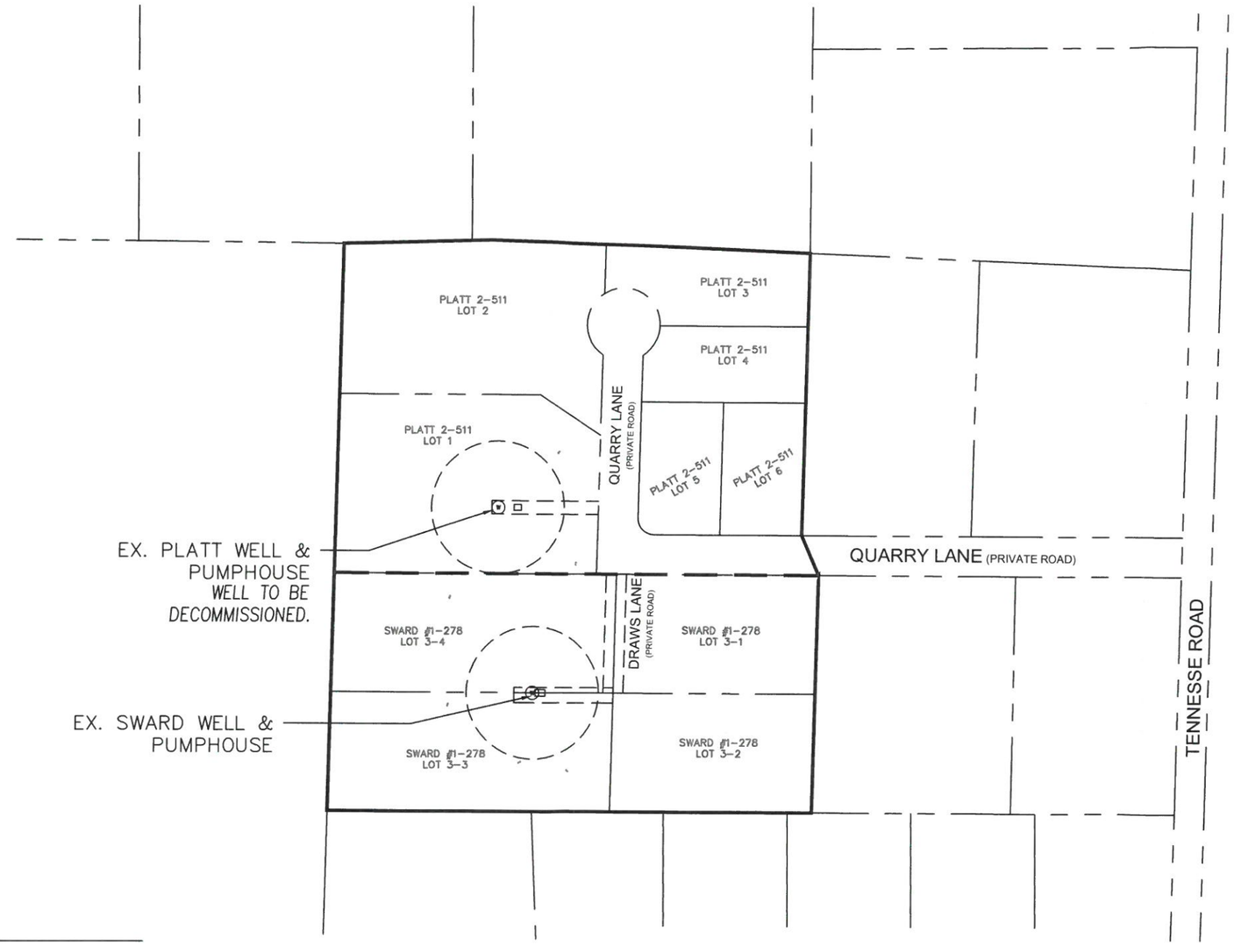


VICINITY MAP

SCALE: NTS

THURSTON PUD
SWARD - PLATT
WATER SYSTEM CONSOLIDATION

GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.



LEGEND

- (W) EXISTING WELL
- EXISTING LOT LINE
- EXISTING EASEMENT
- EXISTING SERVICE AREA
- PROPOSED SERVICE AREA BOUNDARY

SWARD WATER SYSTEM
SERVICE AREA MAP

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(253) 473-4494 FAX: (253) 473-0599

NOTE:
THE BOUNDARY AND SITE LAYOUT INFORMATION SHOWN HERON WAS TAKEN FROM PUBLIC AND PRIVATE DOCUMENTS AND SHOULD NOT BE RELIED ON FOR ACCURACY.

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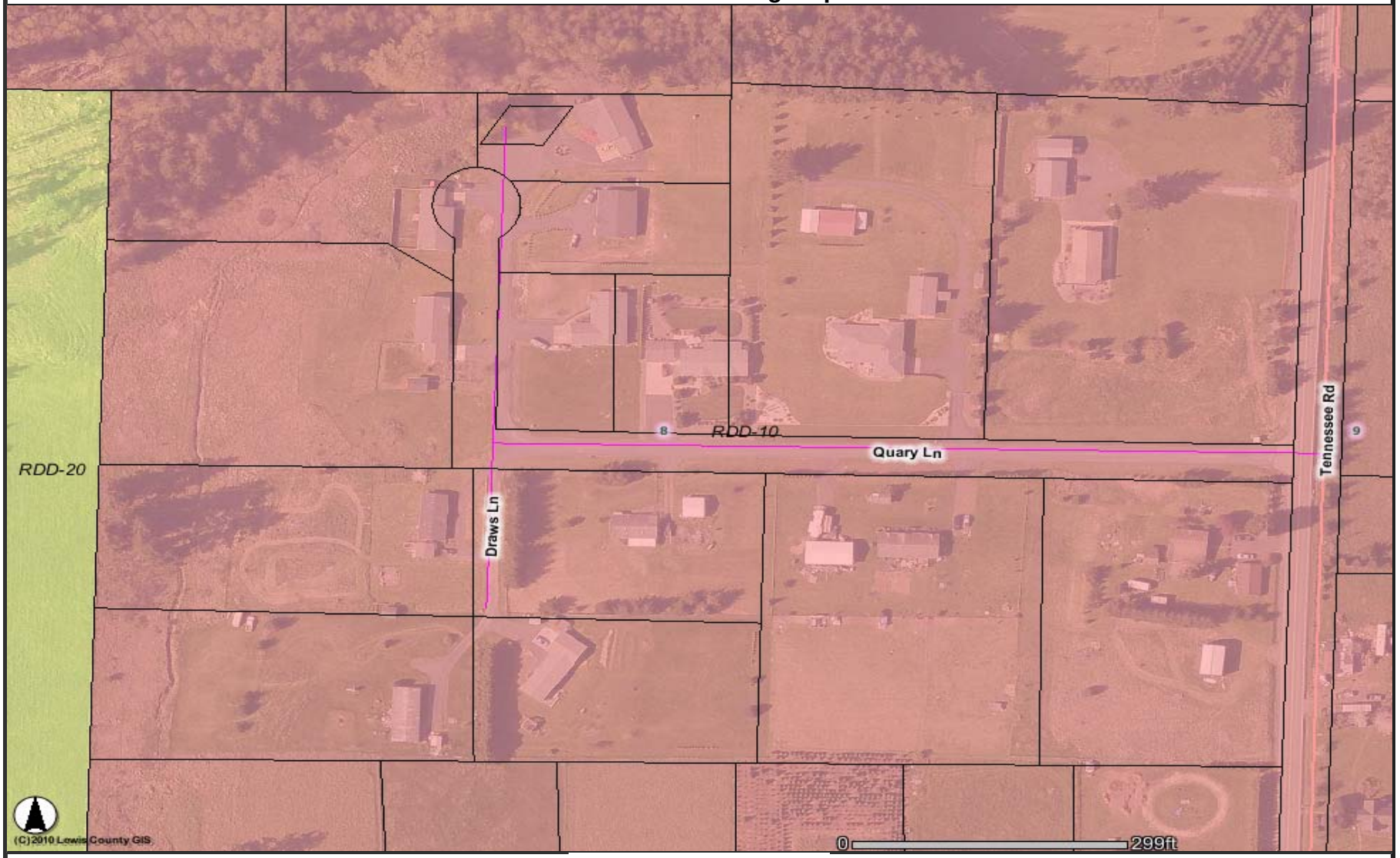
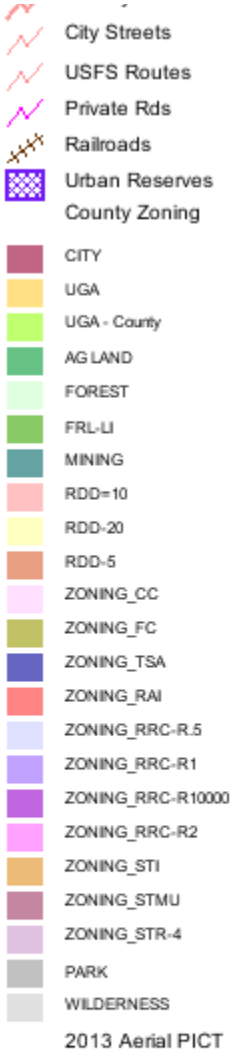
4/12/2017

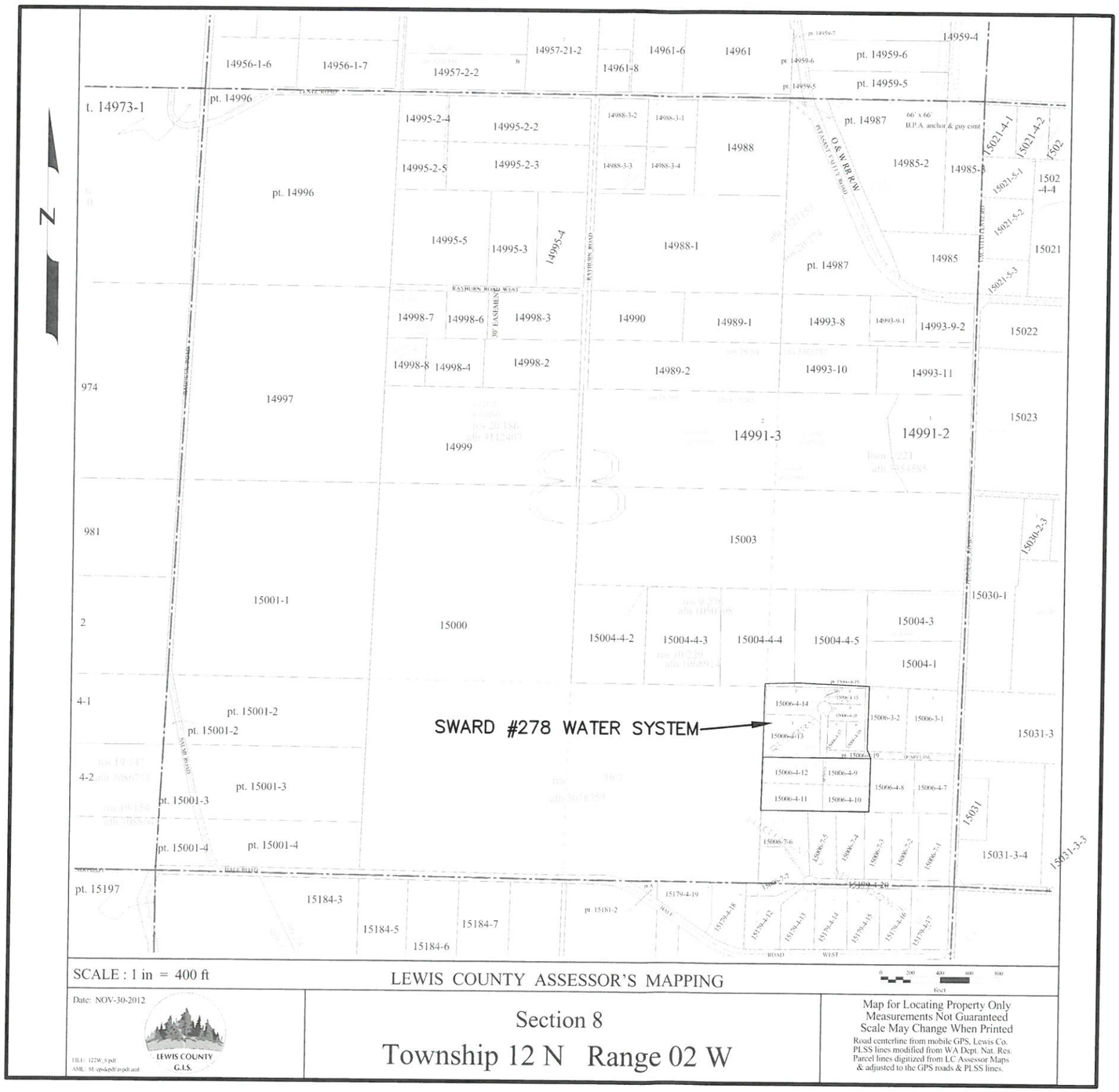
Sward Platt Zoning Map



Legend

- Tax Parcels
- Sections
- Twp-Rge
- State Routes
- County Rds


City Streets
USFS Routes
Private Rds
Railroads
Urban Reserves
County Zoning
CITY
UGA
UGA - County
AG LAND
FOREST
FRL-LI
MINING
RDD=10
RDD-20
RDD-5
ZONING_CC
ZONING_FC
ZONING_TSA
ZONING_RAI
ZONING_RRC-R.5
ZONING_RRC-R1
ZONING_RRC-R10000
ZONING_RRC-R2
ZONING_STI
ZONING_STMU
ZONING_STR-4
PARK
WILDERNESS
2013 Aerial PICT


N
14956-1-6
14956-1-7
14957-2-2
14957-21-2
14961-8
14961-6
14961
pt. 14959-6
pt. 14959-5
14959-4
t. 14973-1
pt. 14996
14995-2-4
14995-2-2
14995-2-5
14995-2-3
14988-3-2
14988-3-1
14988-3-3
14988-3-4
14988
pt. 14987
66' x 66' B.P.A. anchor & guy esmt
O & W RR R/W
14985-2
14985-1
15021-4-1
15021-4-2
1502
15021-5-1
1502 -4-4
15021-5-2
15021
14995-5
14995-3
14995-4
14988-1
14985
15021-5-3
14998-7
14998-6
14998-3
14990
14989-1
14993-8
14993-9-1
14993-9-2
15022
14998-8
14998-4
14998-2
14989-2
14993-10
14993-11
974
14997
14999
14991-3
14991-2
15023
981
15003
15001-1
15030-1
2
15000
15004-4-2
15004-4-3
15004-4-4
15004-4-5
15004-3
15004-1
15030-2-3
4-1
pt. 15001-2
SWARD #278 WATER SYSTEM
15006-4-14
15006-4-13
15006-3-2
15006-3-1
15031-3
4-2
pt. 15001-3
15006-4-12
15006-4-9
15006-4-11
15006-4-10
15006-4-8
15006-4-7
15031
pt. 15001-4
15006-7-6
15006-7-5
15006-7-4
15006-7-3
15006-7-2
15006-7-1
15031-3-4
15031-3-3
pt. 15197
15184-3
15179-4-19
15179-4-18
15179-4-12
15179-4-13
15179-4-14
15179-4-15
15179-4-16
15179-4-17
15184-5
15184-7
15184-6
ROAD
WEST
SCALE : 1 in = 400 ft
LEWIS COUNTY ASSESSOR'S MAPPING
Date: NOV-30-2012
LEWIS COUNTY
G.I.S.
Section 8
Township 12 N Range 02 W
Map for Locating Property Only
Measurements Not Guaranteed
Scale May Change When Printed
Road centerline from mobile GPS, Lewis Co.
PLSS lines modified from WA Dept. Nat. Res.
Parcel lines digitized from LC Assessor Maps
& adjusted to the GPS roads & PLSS lines.

QUARRY LANE

LP #96-021

PART OF THE EAST HALF OF THE SOUTHEAST QUARTER SECTION 8, TOWNSHIP 12 NORTH, RANGE 2 WEST, W.M.

DESCRIPTION

PART OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER AND THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 8, TOWNSHIP 12 NORTH, RANGE 2 WEST, W.M., LEWIS COUNTY, WASHINGTON, MORE PARTICULARLY DESCRIBED AS FOLLOWS: COMMENCING AT THE SOUTHWEST CORNER OF SAID SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER; THENCE N01°11'28"E ALONG THE WEST LINE OF SAID SUBDIVISION A DISTANCE OF 857.08 FEET TO THE TRUE POINT OF BEGINNING; THENCE CONTINUING N01°11'28"E ALONG SAID WEST LINE A DISTANCE OF 496.41 FEET; THENCE N88°32'52"E A DISTANCE OF 223.72 FEET; THENCE S87°57'00"E A DISTANCE OF 296.63 FEET; THENCE S87°23'05"E A DISTANCE OF 140.55 FEET; THENCE S87°39'39"E A DISTANCE OF 41.84 FEET; THENCE S01°12'04"W A DISTANCE OF 425.72 FEET; THENCE S89°48'22"E A DISTANCE OF 27.03 FEET; THENCE S89°52'21"E A DISTANCE OF 547.00 FEET TO TO THE WESTERLY MARGIN OF TENNESSEE ROAD; THENCE S01°12'04"W ALONG SAID MARGIN PARALLEL TO THE EAST LINE OF SAID SUBDIVISION A DISTANCE OF 60.01 FEET; THENCE N89°52'21"W A DISTANCE OF 547.00 FEET; THENCE N89°48'22"W A DISTANCE OF 729.47 FEET TO THE WEST LINE OF SAID SUBDIVISION AND THE TRUE POINT OF BEGINNING.

QUARRY LANE COVENANTS AND RESTRICTIONS ARE RECORDED UNDER LEWIS COUNTY AUDITOR'S FILE NO. 3012777, AND AMENDED UNDER AUDITOR'S FILE NO. 3024407.

UTILITY EASEMENTS ARE SHOWN ON THE MAP PORTION OF THIS PLAT AND ARE FULLY DESCRIBED IN COVENANTS, RESTRICTIONS AND STANDARDS WHICH ARE HEREBY IMPOSED UPON THE ENTIRE TRACT OF LAND HEREBY PLATTED AS SAME ARE RECORDED UNDER LEWIS COUNTY AUDITOR'S FILE NO. 3113686 ENTITLED OPERATION AND MAINTENANCE AGREEMENT. ALSO, AUDITOR'S FILE NO. 3113687 ENTITLED DECLARATION OF COVENANT. ALSO, AUDITOR'S FILE NO. 3113688 ENTITLED DECLARATION OF COVENANT. ALSO, AUDITOR'S FILE NO. 3113689 ENTITLED EASEMENT. ALSO, AUDITOR'S FILE NO. 3117298 ENTITLED DECLARATION OF COVENANT.

PLAT OF QUARRY LANE AGREEMENT TO EXTEND ROAD MAINTENANCE AGREEMENT IN PERPETUITY FILED UNDER AUDITOR'S FILE NO. 3141064.

QUARRY LANE STORMWATER MANAGEMENT SYSTEM SHARED MAINTENANCE AGREEMENT AND COVENANT FILED UNDER AUDITOR'S FILE NO. 3141065.

DEDICATION

KNOWN ALL MEN BY THESE PRESENT THAT DAVID AND GEORGIA PLATT AS TRUSTEES OF THE PLATT FAMILY REVOCABLE LIVING TRUST, THE LEGAL UNDERSIGNED OWNER, DO HEREBY DECLARE THIS PLAT AND DEDICATE TO THE QUARRY LANE HOMEOWNERS ASSOCIATION, INCORPORATED UNDER THE WASHINGTON NONPROFIT CORPORATION ACT (RCW 24.03), ALL PRIVATE ROADS AND WAYS AND OTHER COMMUNAL LANDS SHOWN ON THIS PLAT; AND FURTHER, DO HEREBY DEDICATE ALL EASEMENTS SHOWN ON THE PLAT FOR USE OF THE LOT OWNERS, EXCEPT AS MAY OTHERWISE BE INDICATED; TOGETHER WITH THE RIGHT TO MAINTAIN ALL NECESSARY CONTOURS ACROSS ANY LOT OR LOTS AND OTHER TRACTS WHERE WATER MIGHT TAKE A NATURAL COURSE IN THE ORIGINAL REASONABLE GRADING OF THE ROADS AND WAYS SHOWN HEREON. FOLLOWING ORIGINAL REASONABLE GRADING OF ROADS AND WAYS HEREON, NO DRAINAGE WATER ON ANY LOT OR LOTS AND OTHER TRACTS SHALL BE DIVERTED OR BLOCKED FROM THEIR NATURAL COURSE SO AS TO HAMPER PROPER ROAD DRAINAGE. AN ENCLOSING OF DRAINAGE WATERS IN CULVERTS OR DRAINS OR REROUTING THEREOF ACROSS ANY LOT OR TRACT, AS MAY BE UNDERTAKEN BY OR ON BEHALF OF ANY OWNER THEREOF, SHALL BE DONE BY AND AT THE EXPENSE OF SUCH OWNER, SUBJECT TO THE CONSENT OF THOSE IMPACTED BY SUCH CHANGE. ALL PRIVATE ROADS ARE CONSTRUCTED TO THOSE STANDARDS CONTAINED IN "LEWIS COUNTY ROAD STANDARDS OF URBAN AND RURAL DESIGN", AS APPROVED BY THE LEWIS COUNTY BOARD OF COUNTY COMMISSIONERS, IN EFFECT AT THE TIME PRELIMINARY PLAT APPLICATION WAS MADE FOR THIS PLAT. ANY AND ALL RIGHTS GRANTED BY SAID HOMEOWNERS ASSOCIATION, ENCUMBERING ANY PRIVATE ROAD SHOWN ON THIS PLAT, SHALL INCLUDE A PROVISION FOR THE TERMINATION OF SUCH RIGHTS WITHOUT COST TO LEWIS COUNTY, WASHINGTON, IN THE EVENT SUCH ROAD OR PART THEREOF IS ESTABLISHED A COUNTY ROAD OR OTHERWISE ADOPTED INTO THE LEWIS COUNTY ROAD SYSTEM AS PROVIDED BY STATUTE.

EASEMENT PROVISION

AN EASEMENT IS HEREBY RESERVED FOR AND GRANTED TO THE LEWIS COUNTY PUBLIC WORKS, LEWIS COUNTY PUBLIC UTILITY DISTRICT, PUGET SOUND ENERGY, ANY TELEPHONE COMPANY, ANY CABLE COMPANY AND OTHER UTILITIES, AND THEIR RESPECTIVE SUCCESSORS AND ASSIGNS, UNDER AND OVER THE PRIVATE ROADS SHOWN HEREON IN WHICH TO INSTALL, LAY, CONSTRUCT, RENEW, OPERATE, AND MAINTAIN UNDERGROUND DISTRIBUTION SYSTEMS WITH NECESSARY FACILITIES AND OTHER EQUIPMENT FOR THE PURPOSE OF SERVING THIS SUBDIVISION AND OTHER PROPERTY, WITH UTILITY SERVICES, TOGETHER WITH THE RIGHT TO ENTER UPON SUCH PRIVATE ROADS AT ALL TIMES FOR THE PURPOSES HEREIN STATED. NO LINES OR WIRE FOR THE TRANSMISSION OF ELECTRIC CURRENT, OR FOR TELEPHONE USE, CABLE TELEVISION, FIRE OR POLICE SIGNALS, OR FOR OTHER PURPOSES, SHALL BE PLACED UPON ANY LOT UNLESS THE SAME SHALL BE UNDERGROUND OR IN CONDUIT ATTACHED TO A BUILDING; PROVIDING THAT SAID EASEMENT SHALL TERMINATE WITHOUT COST TO LEWIS COUNTY, WASHINGTON, IN THE EVENT SUCH PRIVATE ROAD OR PART THEREOF IS ESTABLISHED A COUNTY ROAD OR OTHERWISE ADOPTED INTO THE LEWIS COUNTY ROAD SYSTEM AS PROVIDED BY STATUTE.

David S. Platt
DAVID PLATT, AS TRUSTEE OF THE PLATT FAMILY REVOCABLE TRUST

Georgia A. Platt
GEORGIA PLATT, AS TRUSTEE OF THE PLATT FAMILY REVOCABLE TRUST

ACKNOWLEDGEMENT

STATE OF WASHINGTON }

COUNTY OF LEWIS }

ON THIS 5th DAY OF July, 2002, BEFORE ME PERSONALLY APPEARED David S. Platt and Georgia A. Platt TO ME KNOWN TO BE THE INDIVIDUAL DESCRIBED IN AND WHO EXECUTED THE FOREGOING INSTRUMENT FOR ~~their~~ themselves AND AS ATTORNEY IN FACT FOR ~~the Platt Family Trust~~ and ACKNOWLEDGED THAT ~~they~~ SIGNED AND SEALED THE SAME AS ~~their~~ FREE AND VOLUNTARY ACT AND DEED FOR ~~their~~ themselves AND ALSO AS ~~their~~ FREE AND VOLUNTARY ACT AND DEED AS ATTORNEY IN FACT FOR SAID PRINCIPAL FOR THE USES AND PURPOSES THEREIN MENTIONED AND ON OATH STATED THAT THE POWER OF ATTORNEY AUTHORIZING THE EXECUTION OF THIS INSTRUMENT HAS NOT BEEN REVOKED AND THAT THE SAID PRINCIPAL IS NOW LIVING, AND IS NOT INCOMPETENT.

GIVEN UNDER MY HAND AND OFFICIAL SEAL THE DAY AND YEAR LAST ABOVE WRITTEN.

NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON RESIDING AT Island County, Washington

Myra L. Kilmer

MY APPOINTMENT EXPIRES 6-18-04

MYRA L. KILMER NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 6-18-2004

APPROVALS

EXAMINED FOR CONFORMANCE TO THE CONDITIONS OF PRELIMINARY PLAT APPROVAL AND APPROVED:

DATED: 7/12/02 — Roberta Johnson, PLANNING MANAGER

EXAMINED FOR SURVEY DATUM, RIGHT-OF-WAY LAYOUT, AND DESIGN OF BRIDGES AND OTHER STRUCTURES REQUIRED BY A RESOLUTION OF APPROVAL AND APPROVED:

DATED: 7/11/02 — COUNTY ENGINEER

EXAMINED FOR ABILITY TO CONFORM TO LEWIS COUNTY HEALTH DISTRICT REGULATIONS PERTAINING TO WATER SUPPLY AND SEWAGE DISPOSAL AND APPROVED:

DATED: 7-12-02 — Mark Lentz, RS for Dr. Yu, HEALTH OFFICER, LEWIS COUNTY HEALTH DISTRICT

I CERTIFY THAT ALL TAXES AND DELINQUENT ASSESSMENTS FOR WHICH THE PROPERTY MAY BE LIABLE AS OF THIS DATE HAVE BEEN PAID AND THAT DEPOSITS AS REQUIRED BY LAW AGAINST TAXES THAT MAY BECOME PAYABLE IN THE YEAR 2003 HAVE BEEN MADE.

DATED: 7/8/02 — 015006004006 Amanda Powers, LEWIS COUNTY TREASURER

EXAMINED FOR CONFORMANCE TO THE CONDITIONS OF PRELIMINARY PLAT APPROVAL AND APPROVED:

DATED: _____ — Richard G. Graham, CHAIRPERSON, BOARD OF COUNTY COMMISSIONERS

AUDITOR'S CERTIFICATE

FILED FOR RECORD AT THE REQUEST OF Bluhm & Assoc THIS 15th DAY OF July, A.D., 2002, AT 50 MINUTES PAST 10:00 O'CLOCK A M., AND RECORDED IN VOLUME 8 OF PLATS, AT PAGES 45 AND _____, RECORDS OF LEWIS COUNTY, WASHINGTON.

Tony E. Kandell
LEWIS COUNTY AUDITOR

BY Jeanne Hadley, DEPUTY

SURVEYOR'S CERTIFICATE

I, KEVIN BLUHM, HEREBY CERTIFY THAT THIS PLAT OF "QUARRY LANE" IS A TRUE AND CORRECT REPRESENTATION OF THE LANDS ACTUALLY SURVEYED BY ME OR UNDER MY DIRECTION IN CONFORMANCE WITH THE REQUIREMENTS OF THE SURVEY RECORDING ACT AND THE MONUMENTS AND LOT CORNERS HAVE BEEN SET AS SHOWN ON THE PLAT.

Kevin D. Bluhm
KEVIN D. BLUHM, P.L.S. NO. 29269

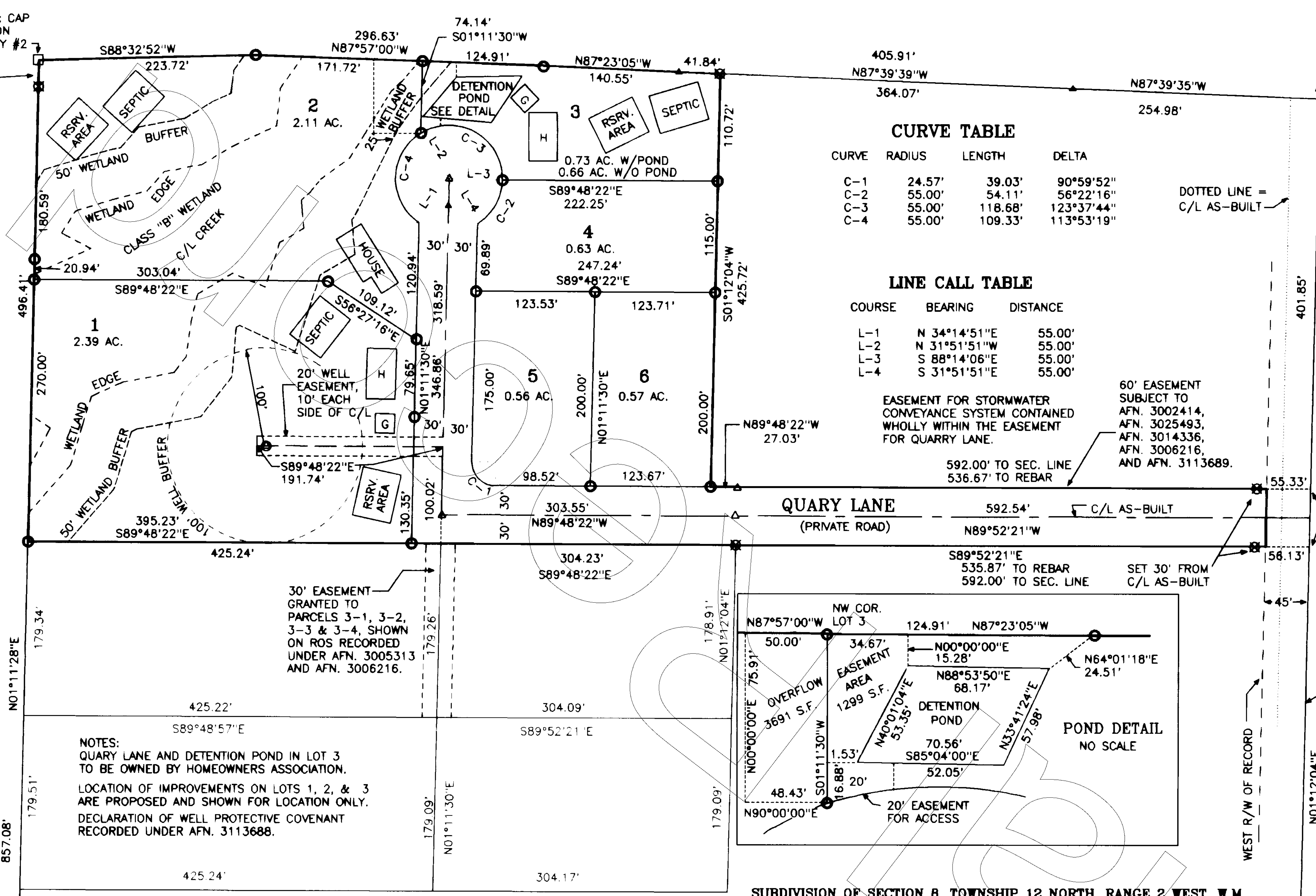
July 8, 2002
DATE

7-8-02 KEVIN D. BLUHM STATE OF WASHINGTON 29269 REGISTERED PROFESSIONAL LAND SURVEYOR EXPIRES 12-19-2002

BLUHM & ASSOCIATES LAND SURVEYORS, INC.
1068 S. MARKET BLVD. CHEHALIS, WA 98532
PHONE (360) 748-1551 FAX (360) 748-6282

QUARRY LANE
LP #96-021

PART OF THE E1/2 SE1/4 SECTION 8 -T.12N.-R.2W.,W.M.



CURVE TABLE

CURVE	RADIUS	LENGTH	DELTA
C-1	24.57'	39.03'	90°59'52"
C-2	55.00'	54.11'	56°22'16"
C-3	55.00'	118.68'	123°37'44"
C-4	55.00'	109.33'	113°53'19"

LINE CALL TABLE

COURSE	BEARING	DISTANCE
L-1	N 34°14'51"E	55.00'
L-2	N 31°51'51"W	55.00'
L-3	S 88°14'06"E	55.00'
L-4	S 31°51'51"E	55.00'

EASEMENT FOR STORMWATER CONVEYANCE SYSTEM CONTAINED WHOLLY WITHIN THE EASEMENT FOR QUARRY LANE.

NOTE:
PREVIOUSLY SET REBAR ALONG TENNESSEE ROAD ARE LINE ONLY AND NOT INTENDED TO BE PLACED ON R/W

NOTE:
TENNESSEE ROAD #998 IS PER DEED FILED UNDER AUDITOR'S FILE NO. 262588, IN VOLUME 211, PAGE 051.
RECORD R/W IS 45 FEET.

NOTES:
QUARY LANE AND DETENTION POND IN LOT 3 TO BE OWNED BY HOMEOWNERS ASSOCIATION.
LOCATION OF IMPROVEMENTS ON LOTS 1, 2, & 3 ARE PROPOSED AND SHOWN FOR LOCATION ONLY.
DECLARATION OF WELL PROTECTIVE COVENANT RECORDED UNDER AFN. 3113688.

BASIS OF BEARING: RECORD OF SURVEY FILED IN VOL. 09, PG. 276 RECORDS OF LEWIS COUNTY, WASHINGTON.

100 0 100 200 300
GRAPHIC SCALE - FEET

LEGIND

- O = SET 1/2" x 24" REBAR W/PLASTIC CAP: K. BLUHM LS 29269
- Δ = ANGLE POINT
- □ = SET OR FOUND AS NOTED
- ⊠ = 6-21-96 SET 1/2" x 24" REBAR W/PLASTIC CAP: K. BLUHM LS 29269, ON REFERENCE SURVEY #2

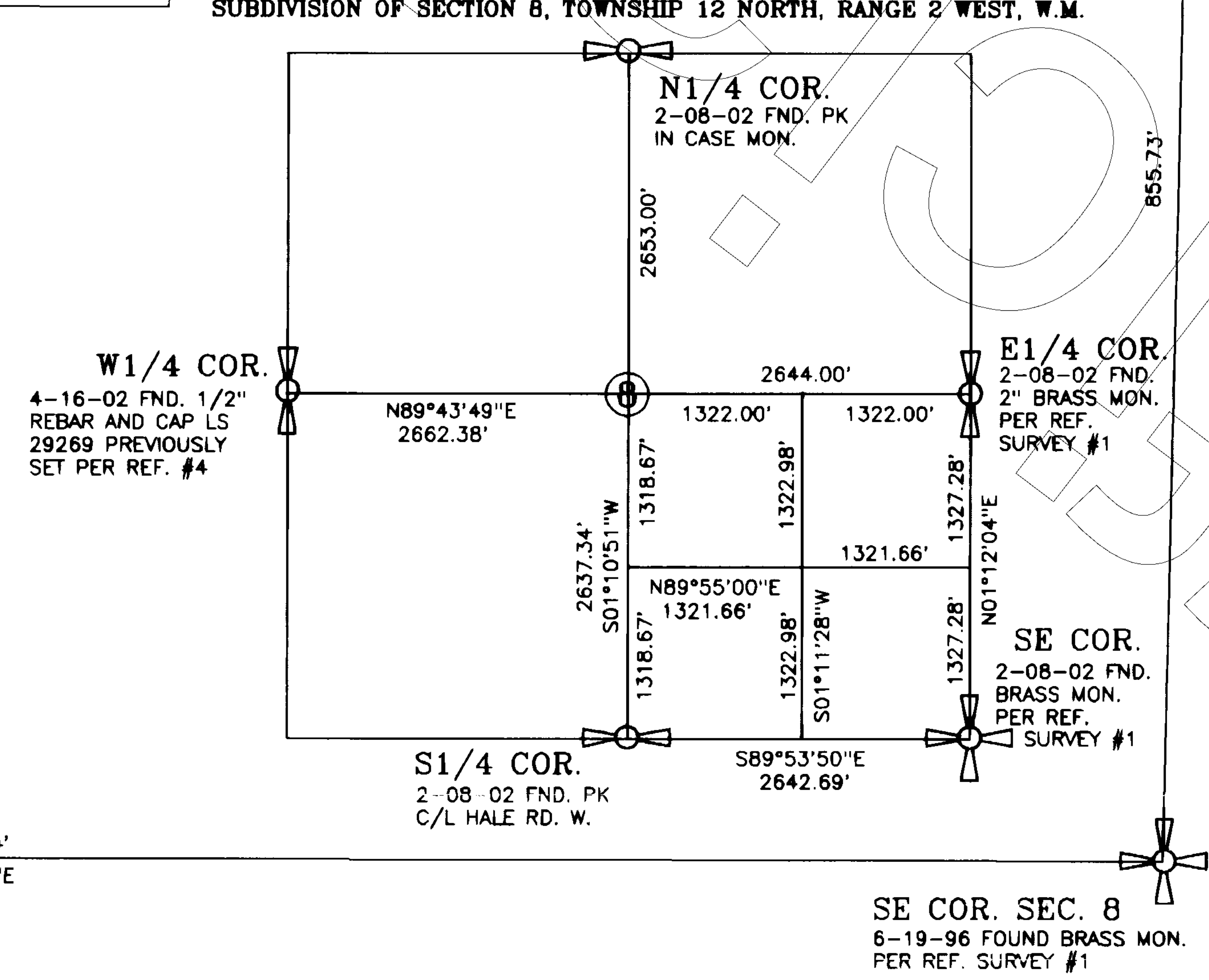
METHOD OF SURVEY

FIELD TRAVERSE USING A KERN K1-S (00°00'30") THEODOLITE AND SOKKIA RED 2-A E.D.M.

REFERENCE SURVEYS

1) RECORD OF SURVEY FILED IN VOL. 09, PG. 276 BY LS 18896
2) RECORD OF SURVEY FILED AFN. 3005313 BY LS 29269
3) SHORT PLAT NO. 97-001 NOT YET RECORDED BY OUR OFFICE
4) RECORD OF SURVEY FILED IN VOL. 19, PG. 147 BY LS 29269

SUBDIVISION OF SECTION 8, TOWNSHIP 12 NORTH, RANGE 2 WEST, W.M.



CONDITIONS OF DEVELOPMENT

1. A 50' BUFFER SHALL BE MAINTAINED FROM THE WETLAND BOUNDARY. USE OF THE WETLAND BUFFER AND WETLAND SHALL CONFORM WITH THE LEWIS COUNTY INTERIM CRITICAL AREAS ORDINANCE AND APPLICABLE STATE AND FEDERAL REGULATIONS.
2. ALL LOW INTENSITY DEVELOPMENT SHALL MAINTAIN A 25' BUFFER FROM THE ORDINARY HIGH WATERMARK OF THE CREEK. ALL HIGH INTENSITY DEVELOPMENT SHALL MAINTAIN A 50' BUFFER FROM SAID CREEK.
3. DESIGNER/ENGINEER JUSTIFICATION SHALL BE PROVIDED AND MEET THE SATISFACTION OF THE ENVIRONMENTAL SERVICES DIVISION PRIOR TO DEVELOPMENT.
4. RUNOFF FROM ALL IMPERVIOUS SURFACES SHALL BE TREATED BY AN OIL-WATER SEPARATOR, OR THE EQUIVALENT, AS CERTIFIED BY A QUALIFIED PROFESSIONAL.
5. BURIED TANKS OF ANY PETROLEUM OR HAZARDOUS MATERIAL SHALL BE PROHIBITED UNLESS SAID TANK IS DOUBLE WALL PROTECTED.
6. DISCHARGE OF PETROLEUM OR HAZARDOUS MATERIAL TO ANY DITCH, SWALE, OR OTHER NON-IMPERVIOUS SURFACED AREA WHERE MIGRATION TO AN AQUIFER IS REASONABLY LIKELY, SHALL BE PROHIBITED.

NOTE:
QUARRY LANE STORMWATER SYSTEM REPORT DATED NOV. 17, 1997 BY RONALD J. POLLOCK, P.E. NO.25790, ON FILE WITH LEWIS COUNTY PUBLIC WORKS DEPARTMENT.

CERTIFICATION BY R.B. ENGINEERING (ROBERT W. BALMELLI, P.E. #32107) OF PRIVATE ROAD CONSTRUCTION AND STORM DRAIN IMPROVEMENTS TO LEWIS COUNTY STANDARDS.

KEVIN D. BLUHM — STATE OF WASHINGTON — 29269 — REGISTERED PROFESSIONAL LAND SURVEYOR — EXPIRES 12-19-2002

3143059

3143059 Page 2 of 2 07/15/2002 10:59A Ecological Land Services PLAT $79.00 Lewis Co. WA

BLUHM ⊕ ASSOCIATES LAND SURVEYORS, INC.
1068 S. MARKET BLVD. CHEHALIS, WA 98532
PHONE (360) 748-1551 FAX (360) 748-6282 E-MAIL kbluhm@surveyservices.com

DRAWN BY: R. EDWARDS	DATE: JUNE 20, 2002	JOB # 97-406-A COMP # 2
CHECKED BY: KEVIN BLUHM	SCALE: 1" = 100'	SHEET 2 OF 2

APPROVED FOR RECORDING
LEWIS COUNTY ENGINEER
BY _____ DATE _____

3005313

PART OF THE E1/2 SE1/4
SECTION 8 -T.12N.-R.2W.,W.M.

C1/4 COR. SEC. 8
CALC. PER R-O-S
VOL. 9, PG. 276

E1/4 COR. SEC. 8
6-19-96 FND. 2" BRASS MON.
PER R-O-S
VOL. 9, PG. 276

1321.19' S 89°46'42" E
1321.19' S 89°46'42" E

1329.94' N 01°11'49" E
1328.61' N 01°11'40" E
1327.27' N 01°11'30" E

FND. BAR & CAP LS 18896
S 88°32'52" W 223.66' 24.88'
N 87°57'00" W 296.63'
N 87°23'05" W 140.55'
405.91' N 87°39'39" W 364.28'
254.76' N 87°39'35" W 206.56'
1/16 CORNER 9.68'
6-19-96 FND. BAR & CAP LS 18896 48.20'

1321.27' S 89°50'11" E

SE1/16 COR. SEC. 8
6-21-96 SET 1/2" X 24" REBAR
W/PLASTIC CAP K BLUHM LS 29269
R.P.'S:
1) 26" FIR S44°W 20.88'
2) 8" FIR N55°E 18.30'
3) 9" FIR N78°E 7.11'

AS-BUILT C/L TENNESSE RD

2
8.85 AC.

1
5.88 AC.

425.72' N 01°11'30"E
401.88'
471.53' N 01°11'40" E

S 89°48'22"E 27.03'
592.00' 60.00' EASEMENT
55.18'
N 01°11'30"E 60.01'
55.99'
S 89°52'21"E 592.00'
60.00'
S 89°48'22"E
425.21' 30' EASEMENT
304.09'

W-2.40' FROM COR. TO FNC.
W-3.10' FROM COR. TO FNC.
W-3.70' FROM COR. TO FNC.

3-4
1.75 AC.
3-1
1.25 AC.
3-3
1.75 AC.
3-2
1.25 AC.

179.34' 179.26' 178.91'
358.85' 358.00'
179.51' 179.09' 179.09'
425.22' 304.09'
S 89°48'57"E
S 89°52'21"E
425.24' 304.09'
N 01°11'30"E

N60°49'05"W 28.60' FROM COR. TO FNC.
N-4.70' FROM REBAR TO FNC. COR.

FND. 1/2" BAR & CAP LS 10195
S40°33'45"W 0.28' FROM CALC. POSITION
S 89°52'21"E 729.33'

1329.94' N 01°11'49" E
1327.27' N 01°11'30" E
855.73'
498.23'

NOTE: THIS SURVEY CREATES A SUBDIVISION OF LAND THAT MAY BE SUBJECT TO CONDITIONS OF SHORT PLAT APPROVAL PRIOR TO SALE.

S1/4 COR. SEC. 8
CALC. PER R-O-S
VOL. 9, PG. 276

1321.36' S 89°53'39" E
1321.36' S 89°53'39" E

SE COR. SEC. 8
6-19-96 FND. BRASS MON.
PER R-O-S
VOL. 9, PG. 276

BASIS OF BEARING: RECORD OF SURVEY FILED IN VOL. 9, PG. 276, RECORDS OF LEWIS COUNTY, WASHINGTON.

200 0 200 400 600
GRAPHIC SCALE - FEET

LEGEND

○ SET 1/2" X 24" REBAR W/PLASTIC CAP K BLUHM LS 29269

METHOD OF SURVEY

FIELD TRAVERSE USING A KERN K1-S (00°00'30") THEODOLITE & SOKKIA RED 2-A E.D.M.

KEVIN D. BLUHM
STATE OF WASHINGTON
2214
29269
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES: 12-19-96
6-25-96

3005313 Auditor's Certificate

Filed for record this 1st day of Aug., 1996 at 8:21 A.M. In Book ____ of surveys at Page ____

at the request of Bluhm & Associates Land Surveyors, Inc.

County Auditor Gary E. Zandell /mp

Surveyor's Certificate

This map correctly represents a survey made by me or under my direction in conformance with the requirements of the Survey Recording Act at the request of LEE BLUHM in JUNE, 1996.

Kevin Bluhm
Kevin Bluhm - License No. 29269

Deed References

1) Statutory Warranty Deed filed in Vol. 500, Pg. 575 AFN. 9203345
2) Statutory Warranty Deed filed in Vol. 385, Pg. 236 AFN. 8803789
3) Quit Claim Deed filed in Vol. 462, Pg. 667 AFN. 9100781
4) Quit Claim Deed filed in Vol. 462, Pg. 669 AFN. 9100783
5) Quit Claim Deed filed in Vol. 462, Pg. 668 AFN. 9100782

Bluhm & Associates Land Surveyors, Inc.
1750 NE Kresky Ave. Chehalis, WA 98532
Phone (360) 748-1551 Fax (360) 748-6282

Drawn By: R. EDWARDS	Date: JUNE 25, 1996	Job # 95-137 COMP 1
Checked By: K. BLUHM	Scale: 1" = 200'	Sheet 1 of 1

3005313

fn:
Eric Sward
2221 Riverside Dr. Suite B
Mt. Vernon, Wa 98273

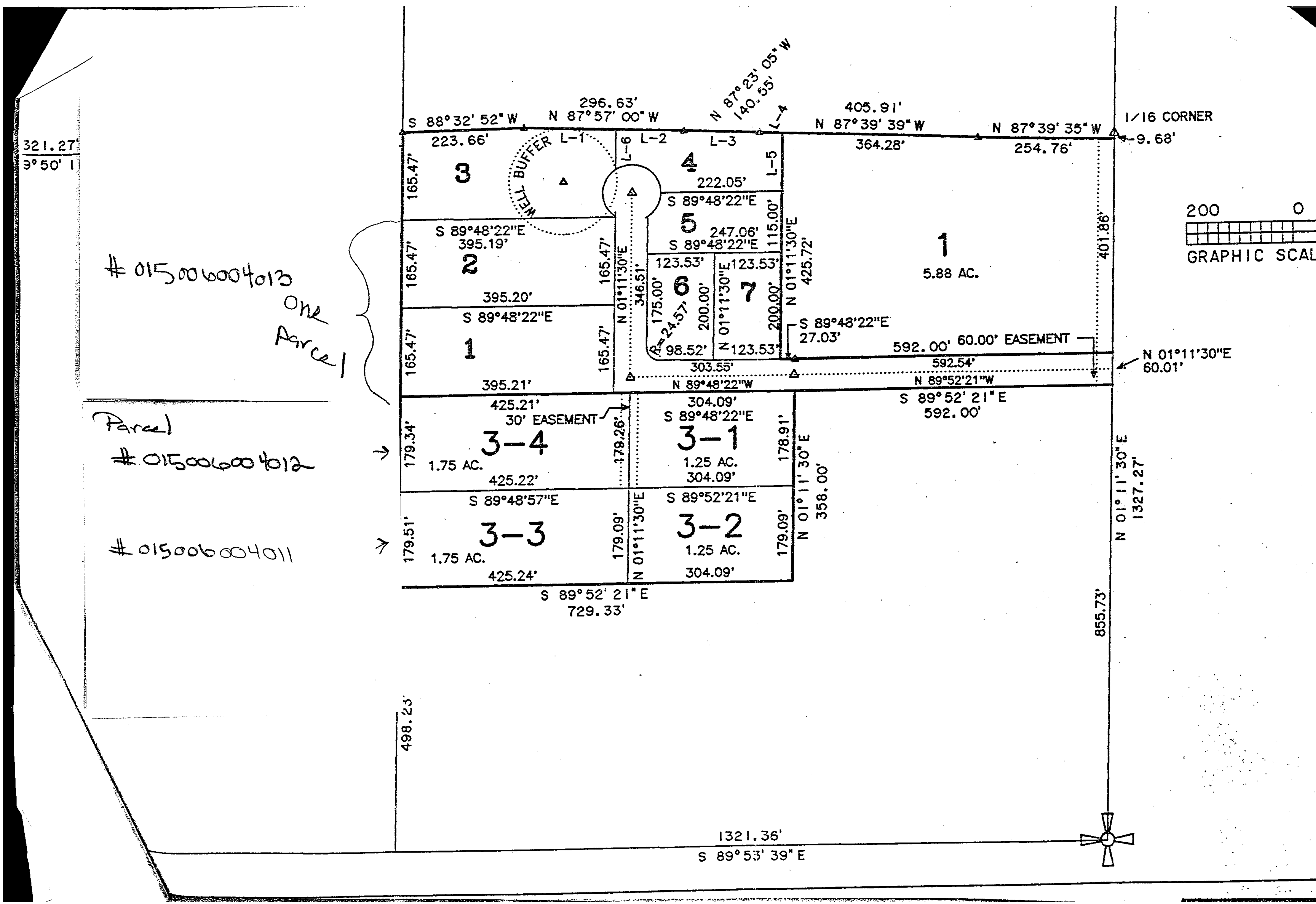
96-326.wpd
October 15, 1996

#27

Prepared by:
Bluhm & Associates Land Surveyors, Inc.
1750 NE Kresky Chehalis, Wa. 98532
(360) 748-1551 Fax (360) 748-6282

Main Access Easement for Lots 1 thru 7

TOGETHER WITH AND SUBJECT TO a 60 foot non-exclusive easement for ingress, egress and utilities lying 30 feet on each side of the following described centerline: Commencing at the Southeast corner of Section 8, Township 12 North, Range 2 West, W.M., Lewis County, Washington; thence N01°11'30"E along the East line of said subdivision a distance of 885.73 feet to the True Point of Beginning of said centerline; thence N89°52'21"W a distance of 592.54 feet; thence N89°48'22"W a distance of 303.55 feet; thence N01°11'30"E a distance of 346.51 feet to the terminus of said centerline and the center of a 55 foot radius Cul-de-Sac.
The interior curve of said roadway easement to be a 24.57 foot radius along the southerly and westerly lot line of Lot 6. (Sidelines of all easements to be extended and/or shortened at course changes so as to terminate at their respective intersections and/or property lines.)



#015006004013
One Parcel
Parcel
#015006004012
#015006004011
321.27'
9°50' 1
S 88°32' 52" W
296.63'
N 87°57' 00" W
N 87°23' 05" W
140.55'
405.91'
N 87°39' 39" W
364.28'
N 87°39' 35" W
254.76'
1/16 CORNER
9.68'
223.66'
WELL BUFFER
L-1
L-2
L-3
L-4
L-5
L-6
3
2
1
4
5
6
7
1
5.88 AC.
3-4
1.75 AC.
3-3
1.75 AC.
3-1
1.25 AC.
3-2
1.25 AC.
165.47'
S 89°48'22"E
395.19'
395.20'
395.21'
222.05'
247.06'
115.00'
N 01°11'30"E
425.72'
123.53'
175.00'
200.00'
R=24.57'
98.52'
346.51'
303.55'
N 89°48'22"W
27.03'
592.00'
60.00' EASEMENT
592.54'
N 89°52'21"W
S 89°52' 21" E
592.00'
N 01°11'30"E
60.01'
401.86'
425.21'
30' EASEMENT
179.34'
179.26'
425.22'
304.09'
S 89°48'22"E
178.91'
N 01° 11' 30" E
358.00'
S 89°48'57"E
S 89°52'21"E
179.51'
179.09'
425.24'
S 89°52' 21" E
729.33'
N 01° 11' 30" E
1327.27'
855.73'
498.23'
1321.36'
S 89°53' 39" E
200
0
GRAPHIC SCAL

ALSO SUBJECT TO a 10[illegible] foot easement for water utilities lying 5.[illegible] feet of even width on each side of the following described centerline:

Commencing at the Southeast Corner of said subdivision; thence N01°11'30"E along the east line of said subdivision a distance of 855.73 feet; thence N89°52'21"W a distance of 592.00 feet; thence N89°48'22"W a distance 304.09 feet; thence S01°11'30"W a distance of 179.26 feet to the True Point of Beginning; thence N89°48'57"W a distance of 125.00 feet to the center of a water well and the terminus of said centerline. The center of said well being the radius point of a 100.00 foot diameter circle designated as a buffer zone in accordance with current Lewis County regulations.

Post-it® Fax Note 7671	Date 12/18/96 # of pages ▶ 1
To Virgil Fox	From Eric Sward
Co./Dept. Lewis Co. Utility	Co. Prime West
Phone #	Phone # 360 424-9525
Fax # (360) 978-5225	Fax #

3113689
Page: 1 of 2
05/22/2001 09:07A
Lewis Co, WA
EAS $9.00

After Recording Return to:
Crystal Water, LLC.
Attention: Gary A. Fox
128 Granite Lane
Chehalis, WA 98532

EASEMENT

Grantor(s): David and Georgia Platt, husband and wife.

Grantee(s): Crystal Waters, LLC., a Washington State Limited Liability Company

Legal Description: The SE 1/4 of the SE 1/4 of Section 8, Township 12 N., Range 02 West, W.M. located in Lewis County.

Assessor's Tax Parcel Number: 15006-4-6

THIS PERPETUAL EASEMENT made this 11 day of MAY, 2001, between David and Georgia Platt, husband and wife, (hereinafter called "Grantor") and Crystal Waters, LLC., a Washington State Limited Liability Company (hereinafter called "Grantee").

WITNESSETH:

Grantors for valuable consideration, receipt whereof is hereby acknowledged, conveys, warrants and grants to Grantee, its successors, assigns and permittees a perpetual and assignable nonexclusive easement upon, under, over or across the hereinafter described lands for the purpose of construction, repair, replacement and operation of a water system, septic system, and/or other utilities together with the reasonable right of ingress and egress over and across Grantors' property reasonable required for enjoyment by Grantee of the easement rights herein granted.

The description of the easement and the property burdened are more particularly described on the face of Preliminary Lewis County Plat # LP96-021 for David Platt which is made a part hereof by reference.

Except otherwise agreed in writing, Grantor shall not construct permanent improvements on the easement.

Grantee shall be responsible for and promptly repair damage caused by Grantor's exercise of its rights of ingress and egress to and from the easement. As to the easement itself, Grantee's obligation shall be limited to repairing damage to surfaced roadways, seeding grass and restoring a smooth surface to landscaped areas. Grantor and its successors shall have no claim for loss of

landscaping including but not limited to plants or fencing which reasonable must be damaged or removed by Grantee in the exercise by Grantee of its easement rights.

Grantee agrees to defend and hold Grantor harmless from any claim by any third party for damages based upon injury to persons or property arising solely out of Grantee's negligence in use of the above described easement and exercise of its right of ingress and egress.

IN WITNESS WHEREOF, this instrument has been executed the day and year first written.

David Platt — 5/11/01
David Platt — Date
510 E. Panoramic Drive
Camano Island, WA

Georgia Platt — 5-11-01
Georgia Platt — Date
510 E. Panoramic Drive
Camano Island, WA.

STATE OF WASHINGTON }
} SS
COUNTY OF ~~PIERCE~~ Snohomish }

I, the undersigned, a notary public in and for the above named State and County do hereby certify that on this 11th day of May, 2001, personally appeared before me David and Georgia Platt, to me known to be the individuals described in and who executed the within and foregoing instrument, and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein mentioned.

JOEL V. MARIANO NOTARY PUBLIC STATE OF WASHINGTON COMM. EXP. NOVEMBER 10, 2003

Joel Mariano
Joel Mariano
Notary Public in and for the State of Washington
Residing at: Stanwood
My commission expires on 11/10/2003

511-Easement ksw

LEWIS COUNTY AUDITOR/RECORDER'S INDEXING FORM (COVER SHEET)

AFTER RECORDING RETURN TO:

COV $9.00

3013769
Page: 1 of 2
01/02/97 01:52P
Lewis Co, WA

PLEASE PRINT OR TYPE ALL INFORMATION

DOCUMENT TITLE(S) (OR TRANSACTIONS CONTAINED THEREIN):

Declaration of Covenant

REFERENCE NUMBER(S) OF DOCUMENTS ASSIGNED/RELEASED:

GRANTOR/BORROWER (LAST NAME FIRST, FIRST NAME AND INITIALS):

Prime West Development

ADDITIONAL NAMES LISTED ON PAGE _____ OF DOCUMENT.

GRANTEE/ASSIGNEE/BENEFICIARY (LAST NAME FIRST, FIRST NAME AND INITIALS):

Public

ADDITIONAL NAMES LISTED ON PAGE _____ OF DOCUMENT.

LEGAL DESCRIPTION (ABBREVIATED: I.E. LOT, BLOCK, PLAT OR SECTION, TOWNSHIP, RANGE)

SP 76-083
SE 1/4 Sec. 8 Twp 12 R 2W

COMPLETE LEGAL DESCRIPTION IS LISTED ON PAGE _____ OF DOCUMENT.

ASSESSOR'S TAX PARCEL NUMBER(S)

015006-004-002

THE AUDITOR/RECORDER WILL RELY ON THE INFORMATION PROVIDED ON THIS FORM. THE STAFF WILL NOT READ THE DOCUMENT TO VERIFY THE ACCURACY OR COMPLETENESS OF THE INDEXING INFORMATION PROVIDED HEREIN.

DECLARATION OF COVENANT

I (we) the undersigned, owner(s) in fee simple of the land described herein, hereby declare this covenant and place same on record.

I (we) the grantor(s) herein, am (are) the owner(s) in fee simple of (an interest in) the following described real estate situated in Lewis County, State of Washington; to wit:

Lewis County Short Plat # SP 96-013

on which the grantor(s) owns and operates a well and waterworks supplying water for public use located on said real estate, at:

125' West of the Common Corner of Lots 3-1, 3-2, 3-3 & 3-4
on the Common Line Between Lots 3-3 and 3-4

and grantor(s) is (are) required to keep the water supplied from said well free from impurities which might be injurious to the public health.

It is the purpose of these grants and covenants to prevent certain practices hereinafter enumerated in the use of said grantor(s) water supply.

NOW, THEREFORE, the grantor(s) agree(s) and covenant(s) that said grantor(s), his (her) (their) heirs, successors and assigns will not construct, maintain, or suffer to be constructed or maintained upon the said land of the grantor(s) and within 100 (One Hundred) feet of the well herein described, so long as the same is operated to furnish water for public consumption, any potential source of contamination, such as septic tanks and drainfields, sewerlines, underground storage tanks, roads, railroad tracks, vehicles, structures, barns, feed stations, grazing animals, enclosures for maintaining fowl or animal manure, liquid or dry chemical storage, herbicides, insecticides, hazardous waste, or garbage of any kind or description.

These covenants shall run with the land and shall be binding to all parties having or acquiring any right, title, or interest in the land described herein or any part thereof, and shall inure to the benefit of each owner thereof.

WITNESS _____ hand _____ this 19th day of Dec., 1996.

V.P. PRIMEWEST DEVELOPMENT (Seal)

_____ (Seal)

Grantor(s)

State of Washington
County of Skagit

I, the undersigned, a Notary Public in and for the above named County and State, do hereby certify that on this 19th day of December, 1996, personally appeared before me Eric Sweard to me known to be the individual described in and who executed the within instrument, and acknowledge that he (they) signed and sealed the same as free and voluntary act and deed, for the uses and purposes therein mentioned.

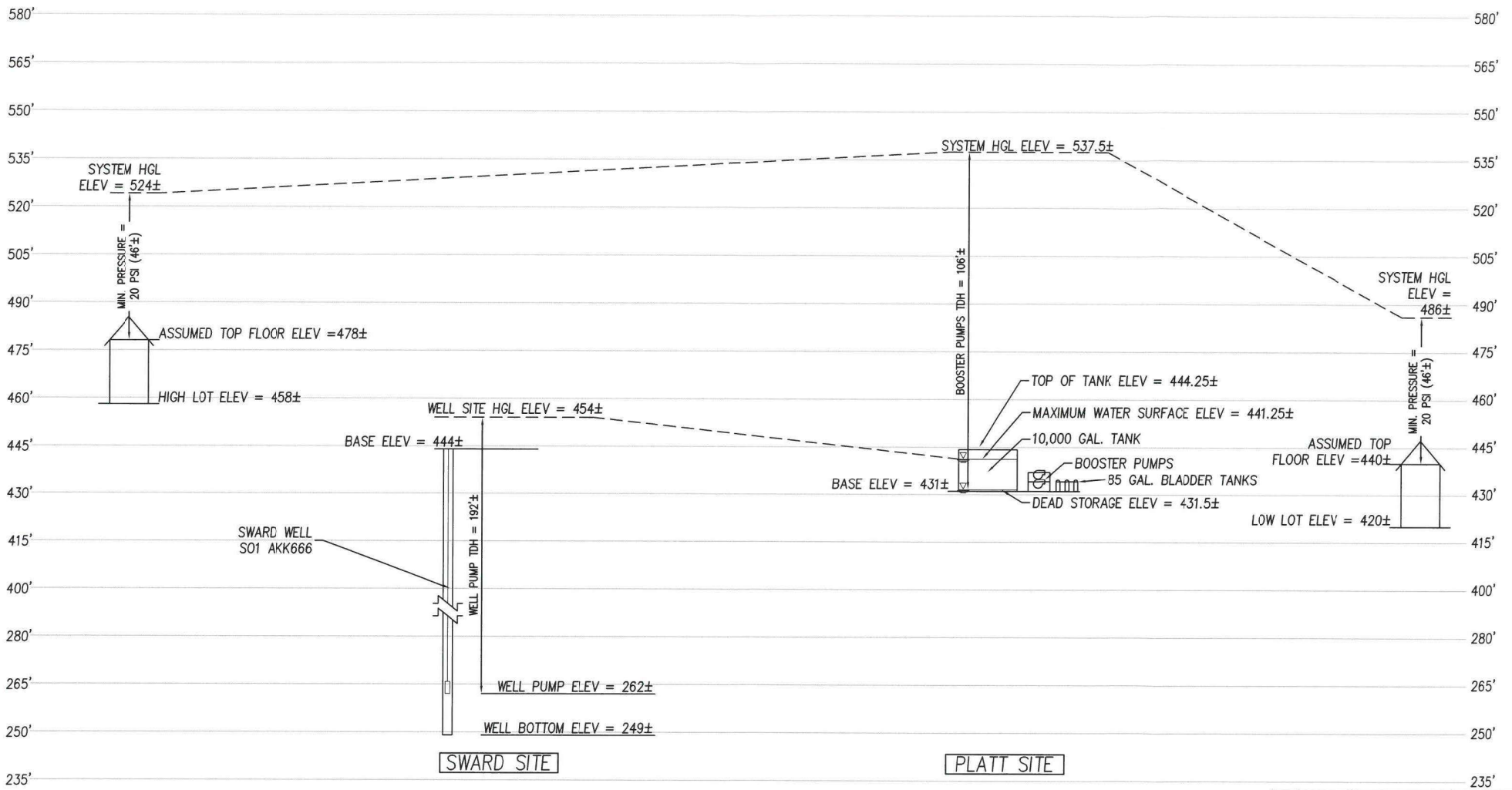
GIVEN under my hand and official seal the day and year last above written.

STACEY JO STEVENSON NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES MAR. 15, 2000

_____
Notary Public in and for the State of Washington, residing at
Mt Vernon
My Commission Expires: 3-15-00

48

3013769
Page: 2 of 2
01/02/97 01:52P
Lewis Co, WA
COV $9.00



SWARD WATER SYSTEM

PROPOSED SOURCE OF SUPPLY FACILITY SCHEMATIC

DOH ID# 06046H

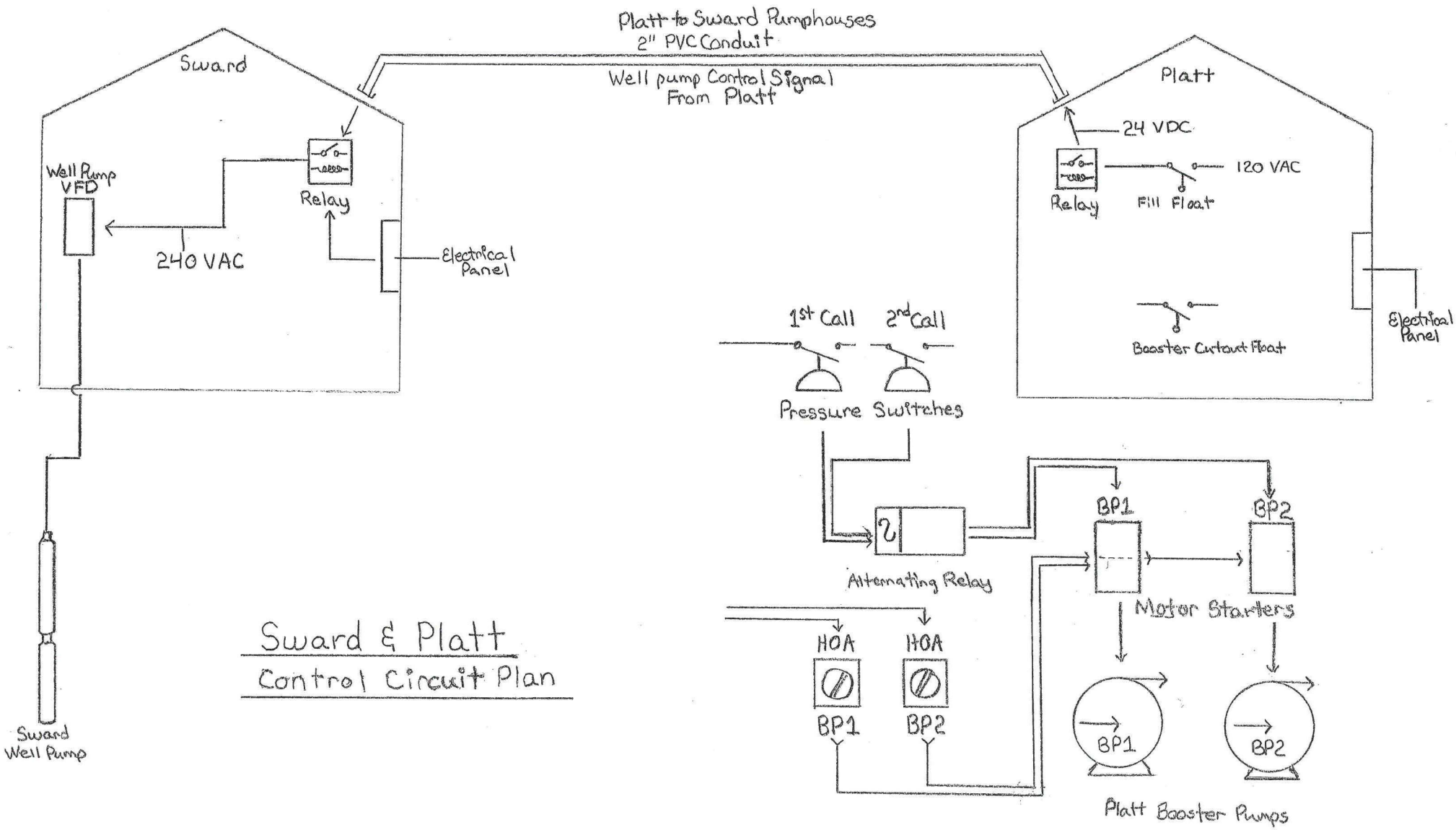
VERT. SCALE: 1" = 30'

HOR. SCALE: NTS

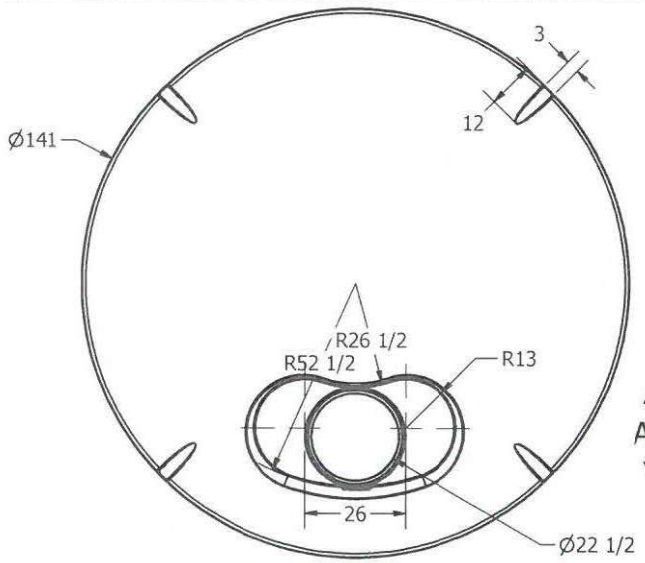
33548

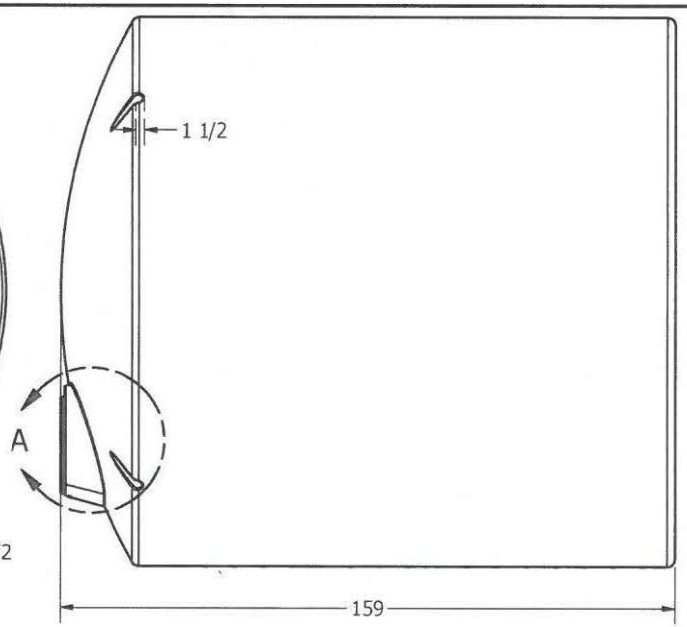
Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

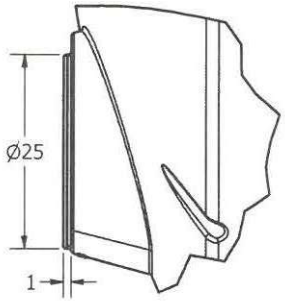
I:\33548\Work\Exhibit\33548_Facility Schematic.dwg
33548


Platt to Sward Pumphouses
2" PVC Conduit
Well pump Control Signal
From Platt
Sward
Well Pump
VFD
Relay
240 VAC
Electrical
Panel
Sward
Well Pump
Platt
24 VDC
Relay
120 VAC
Fill Float
Booster Cutout Float
Electrical
Panel
1st Call
2nd Call
Pressure Switches
Alternating Relay
BP1
BP2
Motor Starters
HOA
HOA
BP1
BP2
BP1
BP2
Platt Booster Pumps
Sward & Platt
Control Circuit Plan

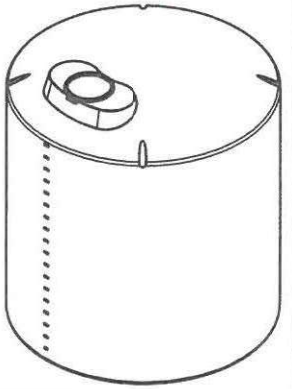
REVISION HISTORY			
REV	DESCRIPTION	DATE	AUTHOR
A	REVISED MANWAY FOR 22 LID	8/11/2009	Jerry Paulson

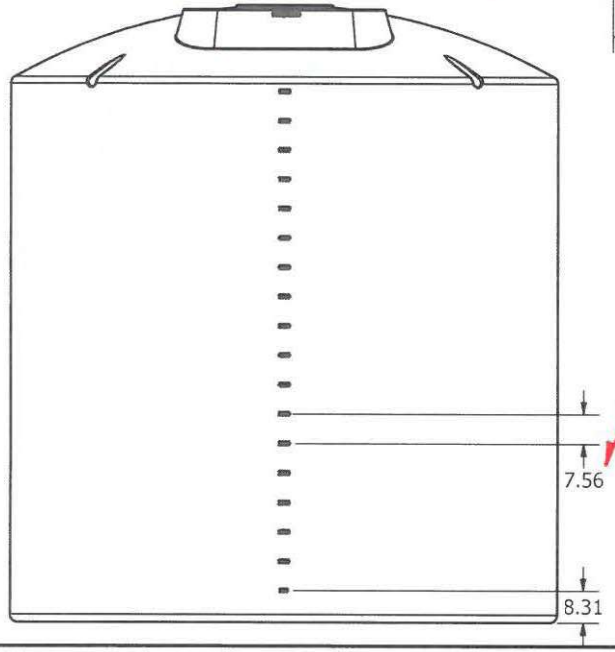






DETAIL A
SCALE 1 / 16





STORAGE VOLUMES CALCULATED ASSUMING 500 GALLONS PER 7.56" (66.14 GAL/INCH). SEE CONSTRUCTION PLANS FOR DESIGN VOLUMES.

DRAWN	Jerry Paulson	12/19/2006
CHECKED		
QA		
MFG		
APPROVED		

NORWESCO, INC., ST. BONIFACIUS, MN

TITLE

10000 GALLON VERTICAL TANK

SIZE		DWG NO	REV
B			A

SCALE: 1/32 SHEET 1 OF 1

Washington State Department of Health
Environmental Health Programs
Division of Drinking Water

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

RETURN TO: Southwest Regional Office POB 87423 Olympia WA 98504-7823

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
06046 H	SWARD – 278	LEWIS	A	Comm.

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. Owner Number:
KIMBERLY S. GUBBE [COMPLIANCE DIRECTOR]	PUD NO 1 OF THURSTON COUNTY	
1230 RUDDELL RD. SE.	JOHN G. WEIDENFELLER [GENERAL MANAGER]	
LACEY, WA 98503	1230 RUDDELL RD. SE.	
	LACEY, WA 98503	
STREET ADDRESS IF DIFFERENT FROM ABOVE	STREET ADDRESS IF DIFFERENT FROM ABOVE	
ATTN	ATTN	
ADDRESS	ADDRESS	
CITY STATE ZIP	CITY STATE ZIP	

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone: (360) 357-8783 X125		Owner Daytime Phone: (360) 357-8783	
Primary Contact Evening Phone: (360) 688-0827		Owner Evening Phone: (360) 791-1739	
Primary Contact Mobile/Cell Phone:		Owner Mobile/Cell Phone:	
Fax: (360) 357-1172	E-mail: kgubbe@thurstonpud.org	Fax (360) 357-1172	E-Mail: jweidenfeller@thurstonpud.org

WAC 246-290-420(1) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY – SMA (check only one)

- ☐ Not applicable (Skip to #12)
- ☒ Owned and Managed — SMA NAME: PUD No. 1 of Thurston County — SMA Number: 147
- ☐ Managed Only
- ☐ Owned Only

12. WATER SYSTEM CHARACTERISTICS (mark ALL that apply)

☐ Agricultural	☐ Hospital/Clinic	☒ Residential
☐ Commercial / Business	☐ Industrial	☐ School
☐ Day Care	☐ Licensed Residential Facility	☐ Temporary Farm Worker
☐ Food Service/Food Permit	☐ Lodging	☐ Other (church, fire station, etc.):
☐ 1,000 or more person event for 2 or more days per year	☐ Recreational / RV Park	

13. WATER SYSTEM OWNERSHIP (mark only one)

☐ Association	☐ County	☐ Investor	☒ Special District
☐ City / Town	☐ Federal	☐ Private	☐ State

14. STORAGE CAPACITY (gallons): 10,000

15. SOURCE NUMBER	16 SOURCE NAME (LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE)	17. INTERTIE SYSTEM ID NUMBER	18. SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	19. USE: PERMANENT	SEASONAL	EMERGENCY	20 SOURCE METERED	21. TREATMENT: NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	22. DEPTH (OPEN INT / FEET)	23. CAPACITY (GALLONS PER MINUTE)	24. SOURCE LOCATION: ¼, ¼ SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	WELL #1 AKK666		X										X			Y	X						182	5	SE NW	08	12N	02W

If this water system serves 100 OR MORE single-family residences, please enter the total number of service connections on line 25, then skip to lines 29, 35 and 36. If this water system serves LESS THAN 100 single-family residences, complete entire form.	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)			
A. Full Time Single Family Residences (Occupied 180 days or more per year)	10		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	0		
B. Full Time Residential Units in Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
C. Part Time Residential Units in Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services (Campsites, RV Sites, Spigots, etc.)	0		
B. Institutional, Commercial or Industrial Services	0		
28. TOTAL SERVICE CONNECTIONS			

29. FULL-TIME RESIDENTIAL POPULATION
A. How many residents are served by this system 180 or more days per year? 28

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												
31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month are they present?												
32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students, daycare children and/or employees are present each month?												
B. How many days per month are they present?												

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	1	1	1	1	1	1	1	1	1	1	1	1

34. GROUP B NITRATE SCHEDULE *This will be suppressed for all Group A systems*	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS

35. Reason for Submitting WFI: *(To be completed by system submitting form – not a Sentry feed)*

☒ **Update-Change** ☐ **Update-No Change** ☐ **Inactivate** ☐ **Re-Activate** ☐ **Name change** ☐ **New System** ☐ **Other** _____

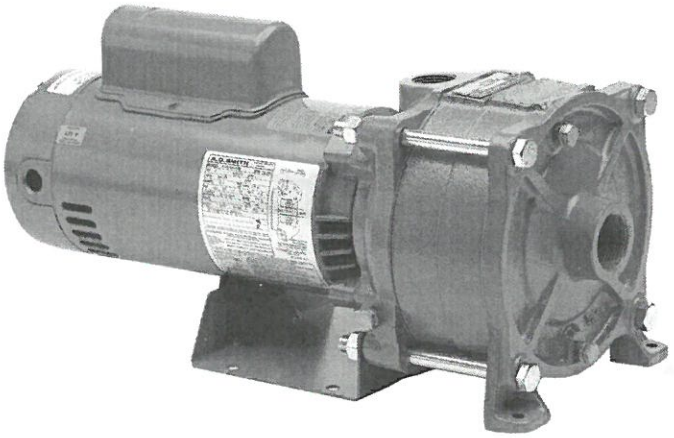
36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: Douglas Piehl **DATE:** 1/7/2022

PRINT NAME: Douglas Piehl **TITLE:** District Engineer

PLATT

TECHNICAL BROCHURE
BHSC



HSC

MULTI-STAGE CENTRIFUGAL PUMP

GOULDS
WATER TECHNOLOGY
a xylem brand

FEATURES

- **Multi-stage Design:** Provides steady, quiet and vibration-free operation for years of trouble-free service.
- **Impellers:** 20% glass-filled thermoplastic precision molded for high efficiencies.
- **Compact Design:** Close-coupled, space saving design provides easy installation. Flexible coupling and bedplate not required.
- **Mounting:** Can be mounted in vertical or horizontal position.
- **Stainless Steel Pump Shaft:** Hex design provides positive drive for impellers and eliminates clearance adjustments.
- **Corrosion Resistant:** Stainless steel wear rings and coverplates. Electro-coated paint process applied inside and out and then baked on.
- **O-rings:** Throughout for positive sealing.
- **Easy to Service:** Can be taken apart for service by removing four bolts.
- **Motor:** Close coupled design. Ball bearings carry all radial/axial thrust loads. Designed for continuous operation. All ratings are within working limits of the motor. Available from ¾ - 3 HP.

AGENCY LISTING

Tested to UL778

SINGLE AND THREE PHASE MODELS

HP	Stages	Order Numbers – ODP Motor	
		1Ø Model	3Ø Model
¾	2	HSC07	HSC07B
1	2	HSC10	HSC10B
1½	2	HSC15	HSC15B
2	3	HSC20	HSC20B
3	3	HSC30	HSC30B

APPLICATIONS

Specifically designed for the following uses:

- Water circulation
- Booster service
- Liquid transfer
- Spraying systems
- Jockey pump service
- General purpose pumping

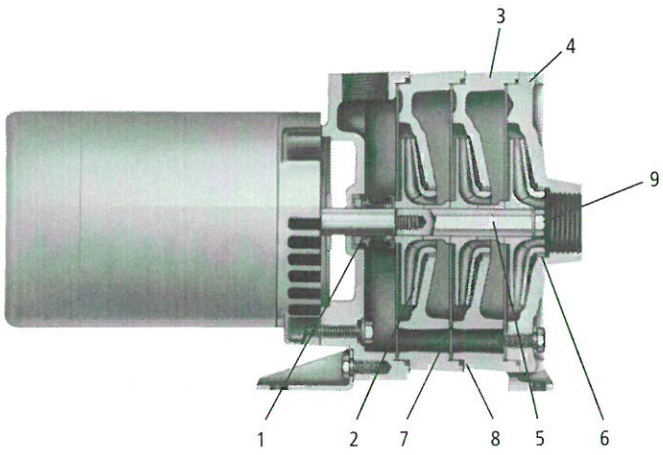
SPECIFICATIONS

Pump

- Capacities: to 50 GPM
- Pressures: to 100 PSI (230 feet)
- Pipe connections: 1¼" suction, 1" discharge
- Temperatures: to 180°F (82°C) maximum
- Maximum working pressure: 125 PSI
- Rotation: right hand, ie; clockwise when viewed from motor end.

Motor

- NEMA standard, ¾ - 1½ HP, 115/230 V; 2 and 3 HP, 230 V, 60 Hz.
- Single phase ODP (standard)
- Three phase available
- 3500 RPM, ODP motors standard
- Built-in overload with automatic reset
- Capacitor type
- Stainless steel shaft
- TEFC and Explosion-proof motors available. See price book.



COMPONENTS

Item No.	Description
1	Mechanical seal
2	Impellers
3	Intermediate stage
4	Casing
5	Stainless steel hex shaft
6	Stainless steel wear rings
7	Stainless steel cover plates
8	O-ring seals
9	Impeller bolt and washer

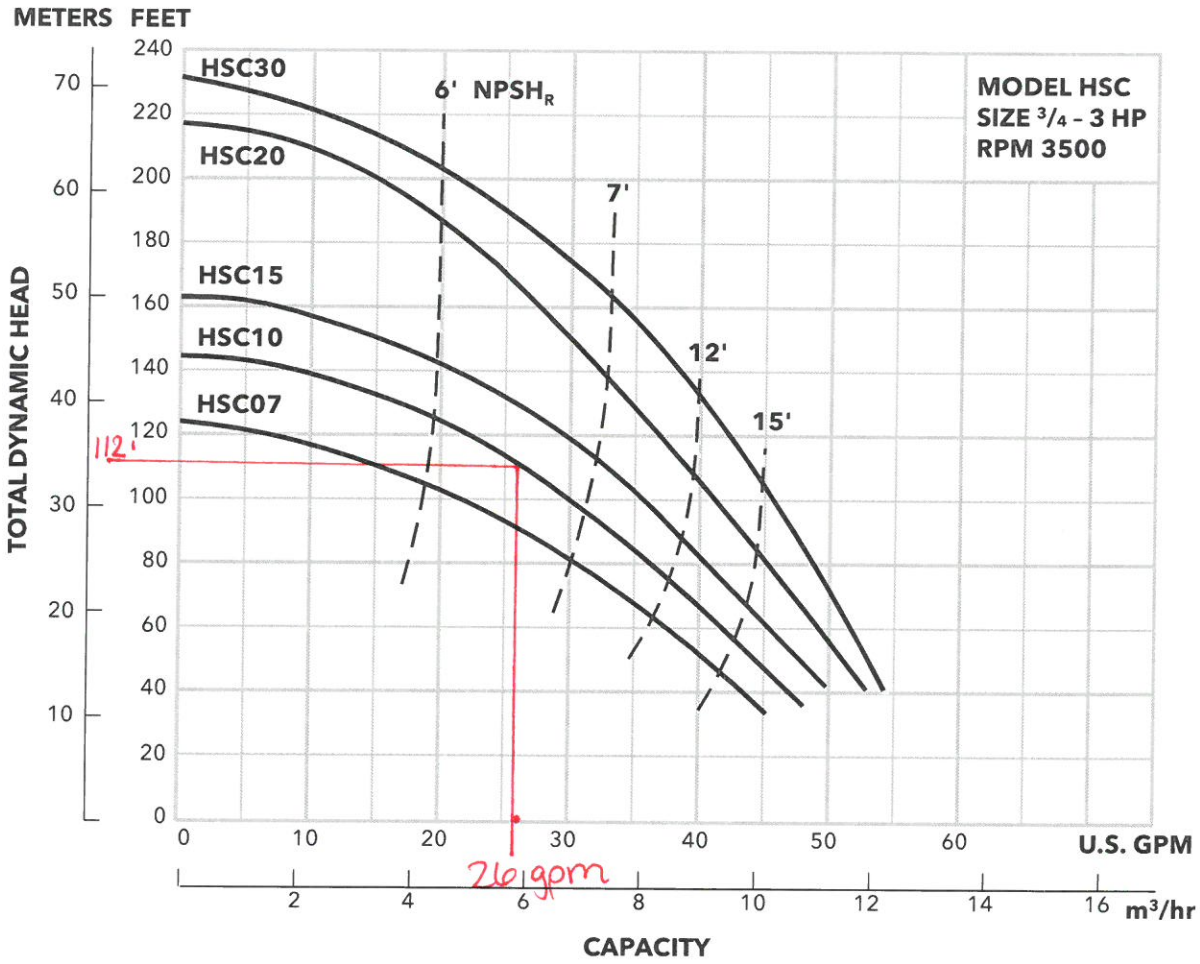
PLATT

DIMENSIONS AND WEIGHTS

Model	HP	Length	Width	Height	Weight (lbs.)
HSC07	¾	15	8	9	53
HSC10	1	16	8	9	58
HSC15	1½	17	8	9	72
HSC20	2	19.7	8	9	75
HSC30	3	19.1	8	9	85

(All dimensions are in inches and weight in lbs. Do not use for construction purposes.)

PERFORMANCE CURVE



TO CONVERT FEET OF WATER TO PSI - DIVIDE FEET BY 2.31

PLATT

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

xylem
Let's Solve Water

Xylem, Inc.
2881 East Bayard Street Ext., Suite A
Seneca Falls, NY 13148
Phone: (800) 453-6777
Fax: (888) 322-5877
www.xyleminc.com/brands/gouldswatertechnology

SWARD #278 Water System

Number of 85 Gal. Bladder Tanks Required 3

Bladder Tank Sizing Equation

$$T_S > \frac{(R)(Q_P)}{(N_C)(V_B)} = 3.0$$

Where:

$$R = \frac{15(P_1+14.7)(P_2+14.7)}{(P_1-P_2)(P_2+9.7)} = 58.1$$

VALUES
P_1 = 55
P_2 = 35
N_C = 6
Q_P = 26
V_B = 85

P_1, P_2 Pressures selected for system operation in psig (not absolute pressures).

P_1 P_1 corresponds to the pump off pressure.

P_2 P_2 corresponds to the pump on pressure.

N_C The pump operating cycles per hour. 6 cycles per hour or a larger value when justified and documented by pump manufacturer.

Q_P The pump delivery capacity in gallons per minute at the midpoint of the selected pressure range. This will be determined by pump curves and tables. If this value is not used, the Q_P that occurs at P_2 (pump on) **must** be used.

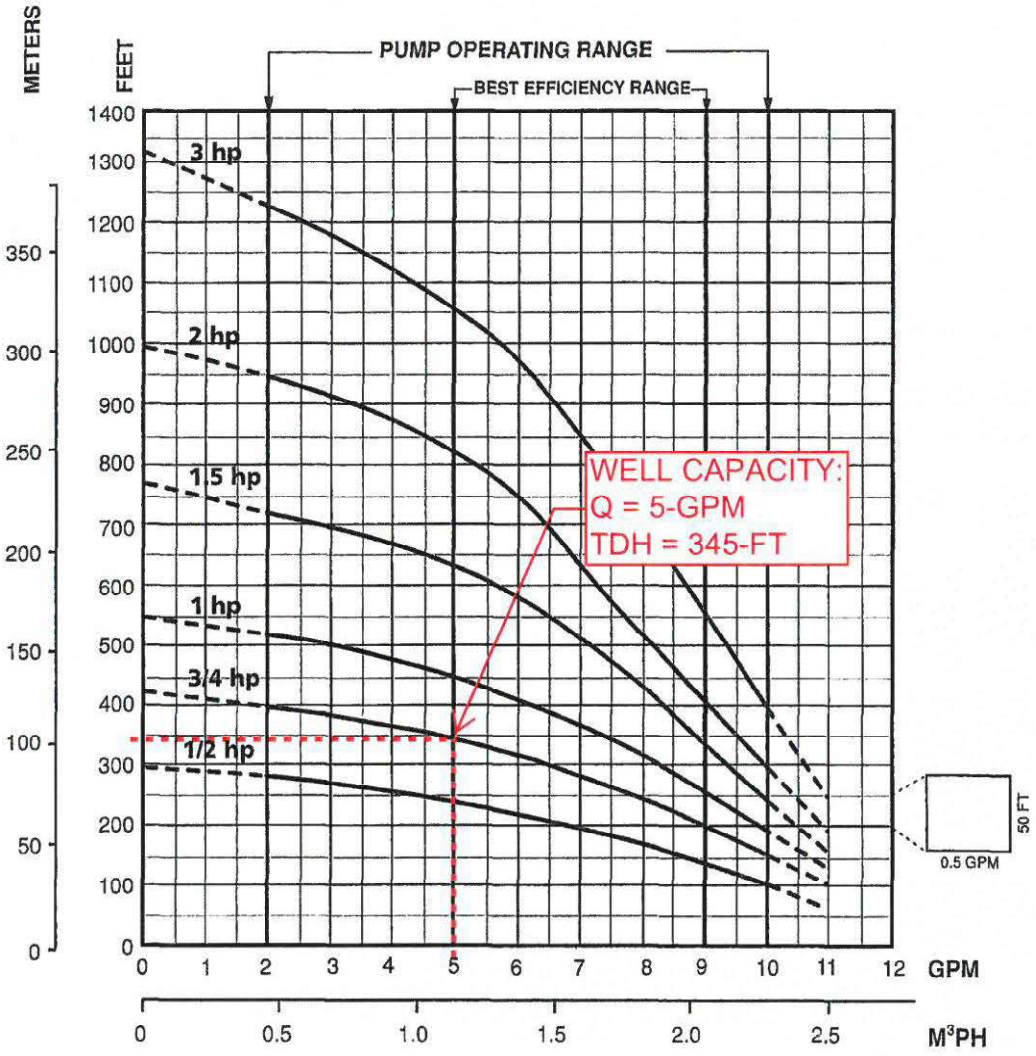
V_B The volume of an individual bladder tank, in gallons

T_S Number of bladder tanks of size V_B

PROPOSED SWARD
WELL PUMP

Submersible Pumps

4" Tri-Seal Pumps - 7 GPM



Capacities in U.S. Gallons per Minute

HP	PSI	Depth to Pumping Water Level, or Lift, in Feet. Shaded Areas Indicate Most Efficient Performance																									
		100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400												
3	0			10	9	9	8	7	7	6	5	4	2														Shut-off 1310 ft.
	20		10	9	9	8	8	7	6	6	5	3															
	30		10	9	9	8	8	7	6	6	4	3															
	40		10	9	9	8	7	7	6	5	4																
	50	10	10	9	8	8	7	7	6	5	4																
	60	10	10	9	8	8	7	7	6	5	3																
	80	10	9	8	8	7	7	6	5	4	2																
Shut-off PSI		523	480	437	394	350	307	264	221	177	134	91	48														

Notes: 1. Performance shown does not include friction loss in the drop pipe. 2. All performance data is based on rated motor nameplate voltage.

PROPOSED SWARD WELL PUMP

Submersible Pumps

4" Tri-Seal Pumps - 7 GPM

	GPM	HP	Stg.	Volts	2-Wire			3-Wire			
					PMA Model	Order No.	Motor	PMA Model	Order No.	Motor	Control Box
Plastic	7	1/2	7	115	7FA05P4-2W115	93780705	2445049004S	7FA05P4-3W115	93780730	2145049004S	2801044915
		1/2	7	230	7FA05P4-2W230	93780710	2445059004S	7FA05P4-3W230	93780735	2145059004S	2801054915
		3/4	10	230	7FA07P4-2W230	93780715	2445079004S	7FA07P4-3W230	93780740	2145079004S	2801074915
		1	13	230	7FA1P4-2W230	93780720	2445089003S	7FA1P4-3W230	93780745	2145089003S	2801084915
		1.5	18	230	7FA15P4-2W230	93780725	2443099004S	7FA15P4-3W230	93780750	2143099004S	2823008110
Stainless Steel	7	1/2	7	115	7FA05S4-2W115	93810705	2445049004S	7FA05S4-3W115	93810730	2145049004S	2801044915
		1/2	7	230	7FA05S4-2W230	93810710	2445059004S	7FA05S4-3W230	93810735	2145059004S	2801054915
		3/4	10	230	7FA07S4-2W230	93810715	2445079004S	7FA07S4-3W230	93810740	2145079004S	2801074915
		1	13	230	7FA1S4-2W230	93810720	2445089003S	7FA1S4-3W230	93810745	2145089003S	2801084915
		1.5	18	230	7FA15S4-2W230	93810725	2443099004S	7FA15S4-3W230	93810750	2143099004S	2823008110

Stainless Steel - Pump End Assemblies Only

GPM	HP	Stg.	PE Model	Order No.
7	1/2	7	7FA05S4-PE	93820705
	3/4	10	7FA07S4-PE	93820710
	1	13	7FA1S4-PE	93820715
	1.5	18	7FA15S4-PE	93820720
	2	24	7FA2S4-PE	93820725
	3	32	7FA3S4-PE	93820730

Plastic - Pump End Assemblies Only

GPM	HP	Stg.	PE Model	Order No.
7	1/2	7	7FA05P4-PE	93790705
	3/4	10	7FA07P4-PE	93790710
	1	13	7FA1P4-PE	93790715
	1.5	18	7FA15P4-PE	93790720

Notes: Discharge is 1-1/4" NPT. Maximum diameter across cable guard is 3.90" on all models.

Capacities in U.S. Gallons per Minute

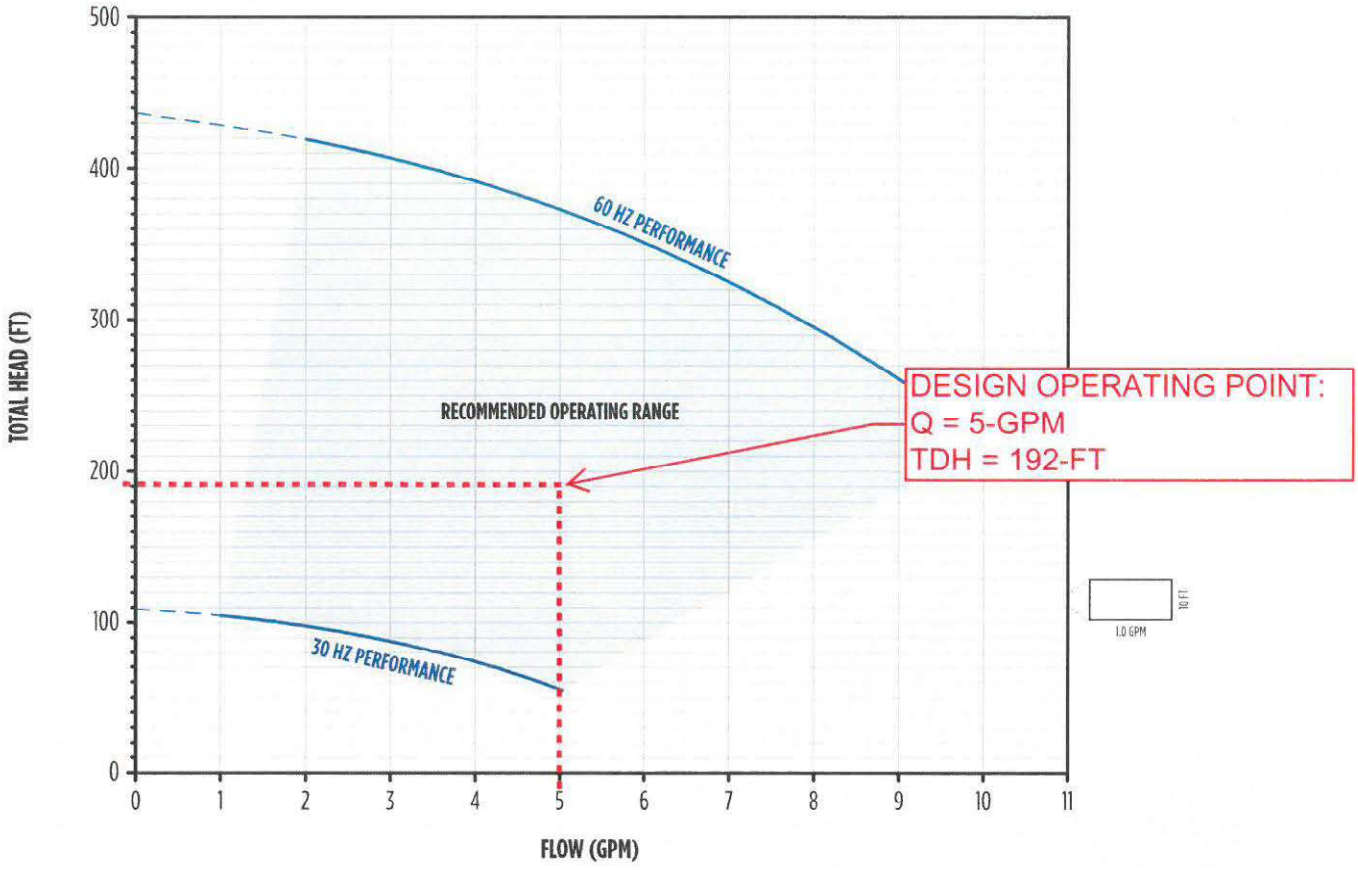
HP	PSI	Depth to Pumping Water Level, or Lift, in Feet. Shaded Areas Indicate Most Efficient Performance																							
		20	40	60	80	100	120	140	160	180	200	240	260	300	360	400	440	480	500	600	700	800	900	1000	
1/2	0				10	10	9	9	8	7	6	5	4												Shut-off 300 ft.
	20		10	9	9	8	8	7	6	5	4														
	30	10	9	9	8	7	7	6	5	4	3														
	40	9	9	8	8	7	6	5	4	3															
	50	9	8	7	7	6	5	4	3																
	60	8	7	6	6	5	4	3																	
	80	6	5	4	3																				
	Shut-off PSI	121	112	103	95	86	77	69	60	52	43	26	17												
3/4	0						10	10	9	9	9	8	7	6	4										Shut-off 422 ft.
	20			10	10	10	9	9	8	8	7	6	6	4											
	30		10	10	10	9	9	8	8	7	7	6	5	3											
	40	10	10	10	9	9	8	8	7	7	6	5	4												
	50	10	9	9	9	8	8	7	7	6	6	4	3												
	60	9	9	9	8	8	7	7	6	6	5	3													
	80	8	8	8	7	6	6	5	5	4	3														
	Shut-off PSI	174	165	156	148	139	130	122	113	104	96	78	70	52	26										
1	0							10	10	10	9	9	8	8	7	6	5	3	3						Shut-off 544 ft.
	20					10	10	10	9	9	9	8	8	7	6	5	3								
	30			10	10	10	10	9	9	9	8	8	7	6	5	4									
	40		10	10	10	10	9	9	9	8	8	7	7	6	4	3									
	50	10	10	10	10	9	9	9	8	8	8	7	6	5	3										
	60	10	10	9	9	9	9	8	8	8	7	6	6	5	3										
	80	9	9	9	8	8	8	7	7	7	6	5	5	3											
	Shut-off PSI	226	218	209	200	192	183	174	166	157	148	131	123	105	79	62	45	27	18						
1.5	0								10	10	10	9	9	9	8	8	7	7	7	5	2				Shut-off 765 ft.
	20						10	10	10	10	9	9	9	8	8	7	7	6	6	4					
	30				10	10	10	10	10	9	9	9	9	8	8	7	7	6	6	3					
	40			10	10	10	10	9	9	9	9	9	8	8	7	7	6	6	5	3					
	50		10	10	10	10	9	9	9	9	9	8	8	8	7	6	6	5	5						
	60	10	10	10	10	9	9	9	9	8	8	8	8	7	7	6	6	5	4						
	80	10	10	9	9	9	9	9	8	8	8	8	7	7	6	5	5	4	3						
	Shut-off PSI	322	313	305	296	287	279	270	261	253	244	227	218	201	175	158	140	123	114	71	28				
2	0									10	10	10	10	9	9	9	8	8	8	7	6	5	3		Shut-off 995 ft.
	20							10	10	10	10	10	9	9	9	8	8	7	7	6	6	4			
	30						10	10	10	10	10	9	9	9	8	8	8	7	7	6	5	4			
	40					10	10	10	10	10	9	9	9	9	8	8	7	7	7	6	5	3			
	50				10	10	10	10	10	9	9	9	9	8	8	8	7	7	7	6	5	3			
	60			10	10	10	10	10	9	9	9	9	9	8	8	7	7	7	7	6	4				
	80	10	10	10	10	10	9	9	9	9	9	9	8	8	7	7	7	6	6	5	3				
	Shut-off PSI	421	412	404	395	386	378	369	360	352	343	326	317	300	274	257	239	222	213	170	127	84	40		

PROPOSED SWARD
WELL PUMP WITH VFD

SubDrive

MONODRIVE 7 GPM (0.75 HP PUMP END, 0.75 HP MOTOR)

7-3WQP-0.75HP



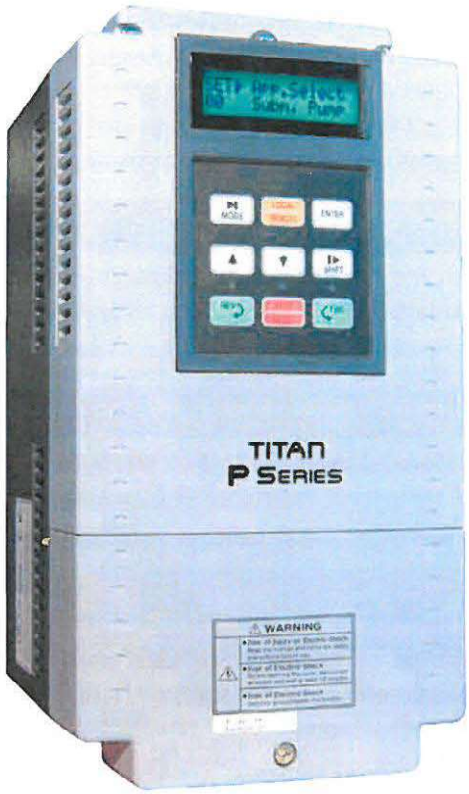
HP	PSI	Depth to Pumping Water Level, or Lift (in feet)															
		0	20	40	60	80	100	120	140	160	180	200	240	280	320	360	400
.75	0										11	11	10	8	7	6	4
	10								11	11	10	10	9	8	6	5	2
	20							11	11	10	10	9	8	7	5	3	0
	30						11	11	10	10	9	9	8	6	4	1	0
	40					11	11	10	10	9	9	8	7	5	3	0	
	50				11	11	10	10	9	9	8	7	6	4	0		
	60			11	11	10	10	9	8	8	7	6	5	2	0		
	70	11	11	10	10	9	9	8	8	7	6	6	3	0			
	80	11	10	10	9	9	8	8	7	6	5	4	1	0			
Shut-off psi		190	181	173	164	155	147	138	129	121	112	103	86	69	52	34	17

NOTE: Running outside of 'Recommended Operating Range' for short periods of time is permissible.

P-SERIES VFD (VARIABLE FREQUENCY DRIVE)

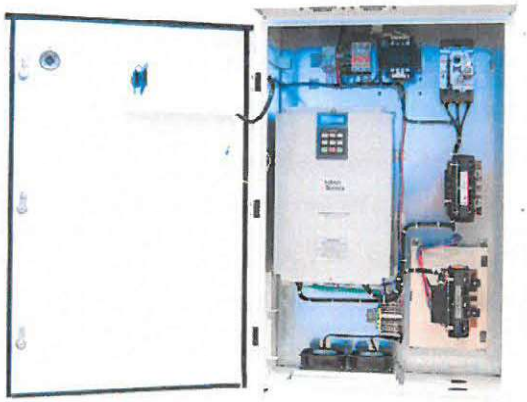
VARIABLE SPEED CONTROL IS JUST THE BEGINNING

Everyone knows variable frequency drives save you money by varying motor speed to match demand. Our automatic energy savings mode minimizes losses by optimizing the output power for higher efficiency. Under low load conditions, Sleep Mode deactivates the drive and its output – then awakens and reactivates output when demand rises to unlock additional savings. It also extends the life of the equipment.



STANDARD FEATURES (ENCLOSED DRIVES)

- Selectable V/F, sensorless vector control
- For outdoor and/or wash down applications
- Rainproof NEMA 3R enclosure reduces thermal absorption with white, solar reflective finish and filtered cooling fans
- Standard VFD package is rated for 110 °F ambient temperature in non-direct sunlight.
- Additional application-specific protective devices included (i.e. line reactors, load reactors, and dV/dT filter)
- Franklin FastApp™ Firmware
  - Quick and easy set-up for submersible and centrifugal packages
  - Display uses pump specific terminology
- Pump Specific Protection and Features
  - Broken pipe detection
  - Dry-well/Underload detection with well refill timer
  - Pipe fill (Pre-PID) - VFD ramps up to Pre-PID frequency and fills pipes without pressurizing system and hydraulic surges
  - Sleep mode and wake up functions with pressure boost
  - Automatic energy savings mode
  - Flying start protection prevents trips, rough starts, and drive damage from regenerative power due to heavy inertia rotation
- Custom Packages Available
  - Alternative enclosure options (NEMA 1, NEMA 12, NEMA 4X)
  - Multi-motor/pump packages
  - Customizable control options



NO NEED FOR
ROTO-PHASE CONVERTERS!

FRANKLIN CONTROL SYSTEMS

P-SERIES VFD (VARIABLE FREQUENCY DRIVE)

EASY START-UP WITH FASTAPP PROGRAMMING

Franklin Control Systems drive packages come pre-programmed for submersible or surface motors with pre-set parameters based on your specific application. To watch a start-up video of the basic wiring and programming of a P-Series VFD for a submersible application, scan the QR code below or go to www.franklin-controls.com.

ANY JOB, ANY ENVIRONMENT

From corrosive environments to long motor leads to soaring temperatures, we can engineer a panel to fit nearly any application in any location. Our standard packages usually fit the bill, but if your job poses unique challenges, our engineers are up to the task.

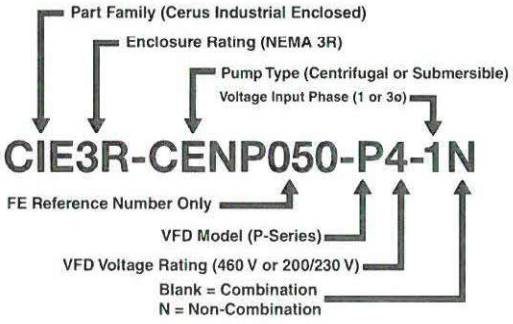
1- TO 3-PHASE CONVERSION

Franklin has solutions for 230 V or 460 V, 1Ø to 3Ø conversion - no need for a roto-phase converter and pump starter combo. By doubling the hp of your motor to size your VFD (20 hp motor = 40 hp VFD), the conversion is complete. All you need is one Franklin VFD.

NEW & IMPROVED FEATURES

- Alternating Lead-Lag Control - Two motors, no external PLC needed
- Dual Demand Control - Drive senses when to switch to second set point on applications feeding two systems
- Adaptive Dry Well Protection - Automatic determination of well recovery time
- Water Lubrication Timer
- Auxiliary Timer
- No Flow Protection
- Screen Cleaning
- Backspin Timer
- Pipe Leak (Cycling Protection)
- Speed Limit by VFD Temperature (to avoid overheat nuisance trips)
- Motor Overheat Protection
- Relay Activated by Analog Level
- Speed Limit by Well Water Level
- Two-transducer redundancy

PART NUMBER ANATOMY



Scan for start-up video

FRANKLIN CONTROL SYSTEMS

P-SERIES VFD STAND ALONE - ORDERING & SIZING INFORMATION

STAND ALONE DRIVE (200-230 V)

Single-Phase & Three-Phase

MODEL NO.	OUTPUT MAX AMPS		3% LINE REACTOR **
	1Ø	3Ø	MODEL NO.
CI-007-P2	12	24	KDRULB23LE01
CI-010-P2	16	32	KDRULD25LE01
CI-015-P2	24	46	KDRULD24LE01
CI-020-P2	32	60	KDRULD26LE01
CI-025-P2	37	74	KDRULC22LE01
CI-030-P2	46	88	KDRULF24LE01
CI-040-P2	60	115	KDRULF25LE01

NOTES: Phase refers to incoming power, not motor.

The drive MUST BE sized according to the motor manufacturer's maximum amperage draw. Upsize VFD for ambient temperature compensation (see VFD specs for temperature rating).

*** 3% Line Reactors are sold separately from stand alone drives.*

STAND ALONE DRIVE (480 V)

Single-Phase & Three-Phase

MODEL NO.	OUTPUT MAX AMPS		3% LINE REACTOR**
	1Ø	3Ø	MODEL NO.
CI-007-P4	6	12	KDRULA4LE01
CI-010-P4	8	16	KDRULA5LE01
CI-015-P4	12	24	KDRULB2LE01
CI-020-P4	16	30	KDRULB1LE01
CI-025-P4	19	39	KDRULD1LE01
CI-030-P4	24	45	KDRULD2LE01
CI-040-P4	30	61	KDRULC1LE01
CI-050-P4	39	75	KDRULF2LE01
CI-060-P4	45	91	KDRULF4LE01
CI-075-P4	55	110	KDRULF3LE01
CI-100-P4	75	152	KDRULH3LE01
CI-125-P4	91	183	KDRULH2LE01
CI-150-P4	110	223	KDRULH1LE01
CI-200-P4	152	264	KDRULG3LE01
CI-250-P4	183	325	KDRULG1LE01
CI-350-P4	223	432	KDRULJ2LE01
CI-400-P4	264	547	KDRULJ1LE01

NOTES: Phase refers to incoming power, not motor.

The drive MUST BE sized according to the motor manufacturer's maximum amperage draw. Upsize VFD for ambient temperature compensation (see VFD specs for temperature rating).

*** 3% Line Reactors are sold separately from stand alone drives.*

P-SERIES VFD STAND ALONE - ORDERING & SIZING INFORMATION

STAND ALONE DRIVE (600 V, 3Ø)

MODEL NO.	OUTPUT MAX AMPS	3% LINE REACTOR **
	3Ø	MODEL NO.
CI-007-P6	9	KDRULA48LE01
CI-010-P6	12	KDRULA49LE01
CI-015-P6	17	KDRULA45LE01
CI-020-P6	23	KDRULB44LE01
CI-025-P6	27	KDRULB43LE01
CI-030-P6	34	KDRULD42LE01
CI-040-P6	43	KDRULC43LE01
CI-050-P6	55	KDRULC44LE01
CI-060-P6	64	KDRULF46LE01
CI-075-P6	80	KDRULF47LE01
CI-100-P6	104	KDRULF45LE01
CI-125-P6	128	KDRULH43LE01

** Phase refers to incoming power, not motor.*

*** 3% Line Reactors are sold separately from stand alone drives.*

NOTE: The drive MUST BE sized according to the motor manufacturer's maximum amperage draw. Upsize VFD for ambient temperature compensation (see VFD specs for temperature rating).

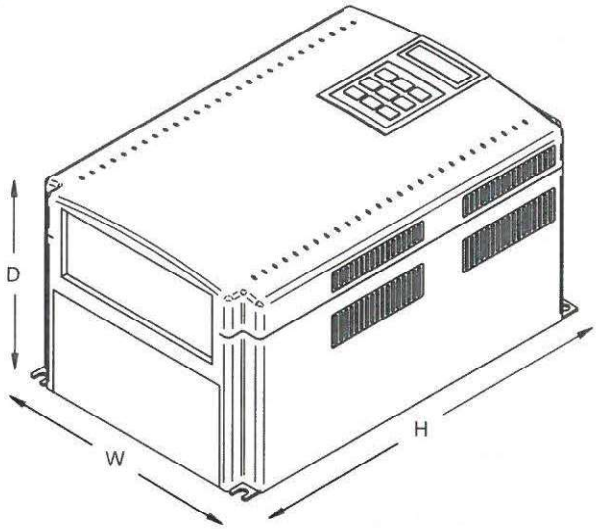
FRANKLIN CONTROL SYSTEMS

P-SERIES VFD STAND ALONE - DIMENSIONS

SUBMERSIBLES

P-SERIES DRIVE	H	W	D
CI-007-P2	11.18	5.91	6.16
CI-007-P4			
CI-007-P6	13.98	7.87	7.19
CI-010-P2	11.18	7.87	7.16
CI-010-P4			
CI-010-P6	13.98	7.87	7.19
CI-015-P2	11.18	7.87	7.16
CI-015-P4			
CI-015-P6	13.98	7.87	7.19
CI-020-P2	15.16	9.84	7.91
CI-020-P4			
CI-020-P6	15.16	9.84	7.91
CI-025-P2	15.16	9.84	7.91
CI-025-P4			
CI-025-P6	15.16	9.84	7.91
CI-030-P2	18.11	11.97	9.21
CI-030-P4			
CI-030-P6	18.11	11.97	9.21
CI-040-P2	18.11	11.97	9.21
CI-040-P4			
CI-040-P6	18.11	11.97	9.21
CI-050-P4	25.28	11.81	10.46
CI-050-P6	25.28	11.81	11.52
CI-060-P4	25.28	11.81	10.46
CI-060-P6	25.28	11.81	11.52
CI-075-P4	25.28	11.81	11.52
CI-075-P6	25.28	11.81	11.52
CI-100-P4	30.22	14.57	13.29
CI-100-P6	30.22	14.57	13.29
CI-125-P4	30.22	14.57	13.29
CI-125-P6	30.22	14.57	13.29
CI-150-P4	30.87	20.08	16.64
CI-150-P6	30.87	20.08	16.64
CI-200-P4	30.87	20.08	16.64
CI-250-P4	33.9	20.08	16.64
CI-350-P4	42.44	27.17	17.70
CI-400-P4			
CI-500-P4	44.9	30.4	17.4
CI-600-P4	51.3	36.3	19.5
CI-700-P4			

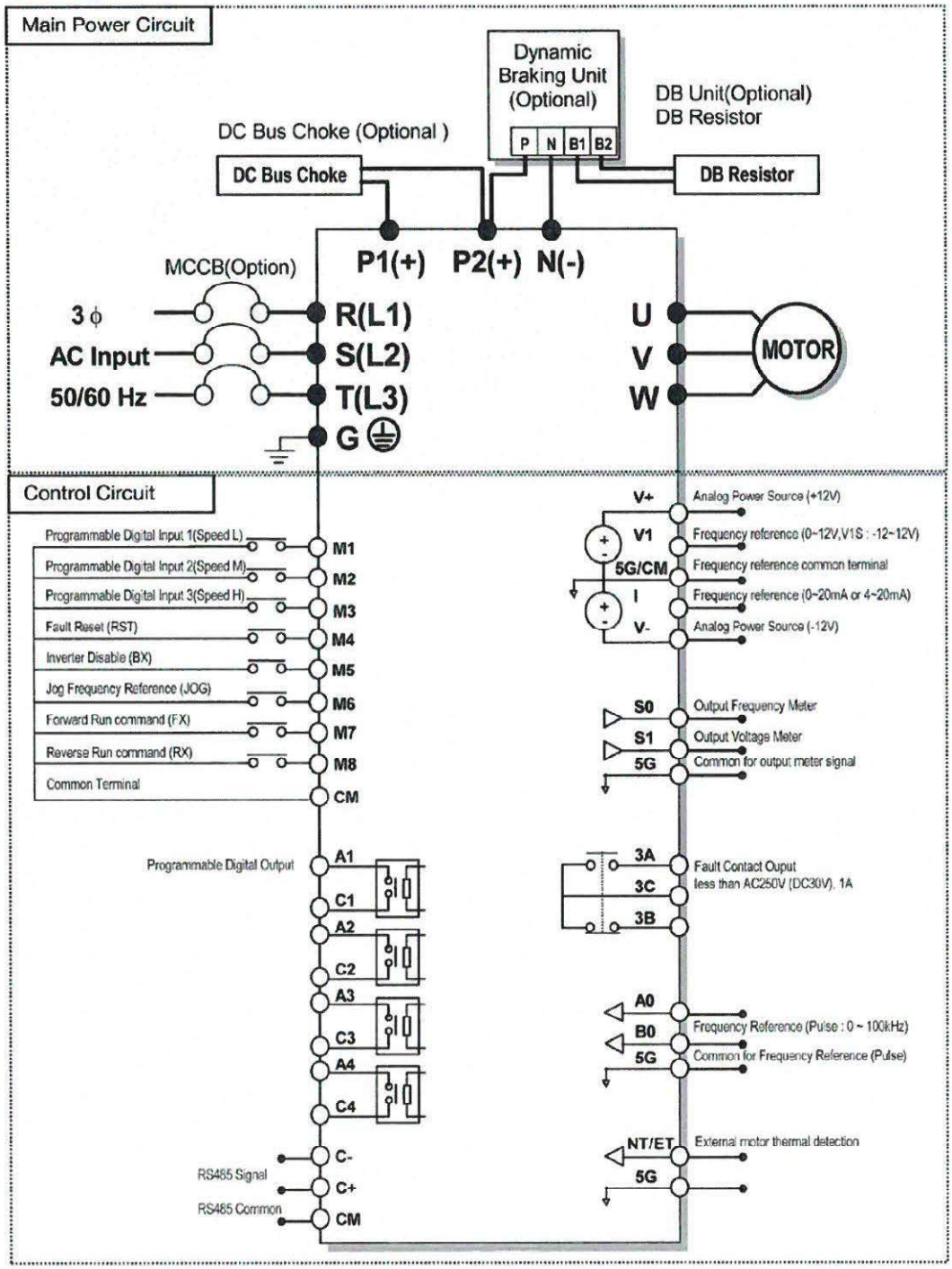
NOTE: All measurements in inches



** Line Reactors housed in separate UL/NEMA 1 Type Enclosure*

P-SERIES VFD STAND ALONE - WIRING DIAGRAM

5.5~90 KW (7.5~125 HP)



NOTES: 5G is common ground for analog input/output for 7.5-40 hp.
5G is common ground for analog meter output (S0, S1) and external motor thermal detection (ET).
Use terminal V1 for V1, V1S (0-12 V -12-12 V) input.
** For general reference only, not field wiring. Consult installation instructions.*

FRANKLIN CONTROL SYSTEMS

P-SERIES VFD STAND ALONE - SPECIFICATIONS

SPECIFICATIONS

OUTPUT RATINGS	
Voltage (V)	Three-phase, 200-230 V, Three-phase, 380-480 V, Three-phase 525-600 V
Frequency (Hz)	0-120 Hz
INPUT RATINGS	
Voltage (V)	Single- and three-phase, 200-230 V (-15%, +10%), single- and three-phase, 380-480 V (-15%, +10%), Three-phase 525-600 V (-15%,+10%)
Frequency (Hz)	50-60 Hz (±5%)
Input Power Factor	> .95 from no load to full load
OPERATION	
Drive Efficiency	> 96%
Control Method	V/F control, sensorless vector control
Frequency Setting Resolution	Digital reference: 0.01 Hz (below 99 Hz) & 0.1 Hz (100 Hz and over); Analog reference: 0.06 Hz at 60 Hz
Frequency Setting Accuracy	Digital: 0.01% of maximum output frequency; Analog: 0.1% of maximum output frequency
V/F Ratio	Linear, Square, User V/F
Overload Capacity	1 minute at 120%, 10 seconds at 150% (with inverse characteristic proportional to time)
Torque Boost	Auto, manual (0-15%)
Multi-Function Input Terminals	Total 8 inputs (programmable)
Analog Output	0-10 V linear
INPUT SIGNAL	
Operator Control	32-character LCD keypad, Terminals, ModBus-RTU communication Optional, ProfiBus-DP, DeviceNet, F-Net, BACnet, LonWorks
Frequency Setting	Analog: 0-10 V, 4-20mA, additional port for Sub-Board (0-10 V); Digital: Keypad, Communication
Start Signal	Forward, reverse
Multi-Step Operation	Setting up to 17 speeds (using multi-function terminal)
Multi-Step Accel/Decel Time	0.1-6000 seconds. Maximum 8 pre-defined steps using multi-function terminals
Operational Functions	DC braking, frequency limit, frequency jump, second motor function, slip compensation, reverse rotation prevention, auto restart, inverter bypass, auto-tuning, dual PID control
Emergency Stop	Stops output from inverter
Auto Operation	Operates from internal sequence by setting multi-function terminal (5 way x 8 step)
Jog	Jog operation
Fault Reset	Resets fault signal when protective function is active
OUTPUT SIGNAL	
Operational Status	Frequency detection, overload alarm, stall, overvoltage, undervoltage, inverter overheat, run, stop, constant speed, speed search, fault output, inverter bypass, auto-operation sequence
Indicator	Output frequency, output current, output voltage, DC voltage, output torque (output voltage: 0-10 V)
PROTECTIVE FUNCTIONS	
Trip	Overvoltage, undervoltage, overcurrent, inverter overheat, motor overheat, i/o-phase loss, fuse open, ground fault, external fault 1, 2, option fault, overload, speed command loss, hardware fault, communication error, etc.
Alarm	Stall, overload temperature sensor fault
OPERATING ENVIRONMENT	
Ambient Temperature	-10-40 °C (50 °C when derated 20%) or 14-104 °F (122 °F when derated 20%)
Storage Temperature	-20 -65 °C or -4-149.5 °F
Humidity	Less than 95% relative humidity maximum (non-condensing)
Vibration	Below 5.9m^2/sec (=0.6g)
Altitude	Max. 3,300 ft (1000 m): derate 1% for every additional 330 ft. Derating 20% allows for installation up to 10,000 ft
Application Site	Pollution degree 2. no corrosive gas, combustible gas, oil mist or dust

CARLYN HARLOW

From: Doyle Sanford <Doyle.Sanford@lewiscountywa.gov>
Sent: Tuesday, July 26, 2016 2:38 PM
To: CARLYN HARLOW
Cc: Mike Watilo
Subject: RE: Inquiry about Fire Flow Required for Single-Family Residences

Hello Carlyn,

We do not currently require fire flow for single family residences in unincorporated Lewis County, Per WAC 51-51-0313 ,R313 (Automatic sprinkler systems) of the IRC has not been adopted. In our rural county the fire flow comes from Tankers provided by the local fire districts. When and if that section is adopted we will allow fire suppression through NFPA 13R which runs off the domestic supply. If you have further questions feel free to contact me.

How-ever on a lighter note, if the system was large enough to provide water for hydrants that would be fantastic ☺

Thank you.

Doyle

Doyle D. Sanford
Building Official \ Fire Marshal
Lewis County Community Development
2025 NE Kresky Ave.
Chehalis, WA 98532

360.740.2696
doyle.sanford@lewiscountywa.gov

From: CARLYN HARLOW [mailto:HARLOW@ApexEngineering.net]
Sent: Monday, July 25, 2016 8:32 AM
To: Doyle Sanford
Subject: Inquiry about Fire Flow Required for Single-Family Residences

Mr. Sanford,

Apex is currently finalizing a WSP for Sward #278 Water System (ID #06046H) in Lewis County. The water system is owned and operated by Thurston County PUD. Does Lewis County require fire flow for single-family dwelling units in unincorporated areas of the County? Can you please provide an ordinance number or code reference which refers to Lewis County's fire flow requirements for the Sward #278 system? Feel free to call me at my work number below to discuss further.

Thank you,
Carlyn

Appendix B: Water Quality

COLIFORM MONITORING PLAN (CMP)
Sward #278

Single Source – No Treatment

System Information **Plan Date: 09/2016**

Water System Name **Sward #278**	**County** **Lewis**	**System I.D. Number** **06046H**
Name of Plan Preparer Kim Gubbe Thurston PUD	**Position** Director of Operations and Compliance	**Daytime Phone #** (360) 357-8783
Source: DOH Source Number, Source Name, Well Depth, Pumping Capacity	**S01 - Well #1**, AKK666, permanent use, 6" cases well, 203' deep w/ perforations from 182' - 195'. Capacity (WFI) 30 gpm, pumped from source w/ ¾ Goulds subpump controlled by float switches in reservoir.	
Storage: List and Describe	3,000 gallon storage tank	
Treatment: Source Number & Process	None	
Pressure Zones: Number and name	One	
Population by Pressure Zone	Population – 10 Connections: Active: 10 Approved: 10	
Number of Routine Samples Required Monthly by Regulation: One	**Number of Sample Sites Needed to Represent the Distribution System: Two**	
Source Address / Location:	**S01 - 100 Draws Lane Winlock WA Tax ID 015006004012**	

Routine, Repeat, and Triggered Source Sample Locations

Location/Address for **Routine Sample Sites**	Location/Address for **Repeat & Triggered Source Sample* Sites**
X1. 128 Quarry Lane	**1-1. Sample Site #1**
	1-2. 141 Quarry Lane
	1-3. 109 Draws Lane
	***RAW S01 – Well #1**
X2. 141 Quarry Lane	**2-1. Sample site #2**
	2-2. 140 Quarry Lane
	2-3. 109 Draws Lane
	***RAW S01 – Well #1**

* You should mark the lab slip for the source sample "RAW" in type of sample and request an analysis for *E coli* count. **You must sample every groundwater source that was in use when the original routine sample was collected**

Routine Sample Rotation Schedule

Month	Routine Site(s)	Month	Routine Site(s)
January	#1	July	#1
February	#2	August	#2
March	#1	September	#1
April	#2	October	#2
May	#1	November	#1
June	#2	December	#2

Important notes for Sample Collector:

Laboratory Information

Laboratory Name Water Management Laboratories Inc.	**Office Phone #** (253) 531-3121
Address 1515 80th St. E. Tacoma, WA 98404	**After Hours #** (253) 841-0732
Hours of Operation Monday – Friday 8a.m.- 5p.m. Saturday 9a.m. – 12p.m.	
Contact Name No specific contact	
Emergency Laboratory Name Same as above	**Office Phone #**
Address	**After Hours #**
Hours of Operation	
Contact Name	

E. coli-Present Sample Response

Distribution System *E. coli* Response Plan
If we have *E. coli* in our distribution system, we will immediately: 1. Call DOH. 2. See attached plan : *What To Do When We Get A Positive Fecal Or E.Coli Sample* 3. 4. 5.

E. coli Present Triggered Source Sample Response Plan
If we have *E. coli* in our source water, we will immediately: 1. Call DOH. 2. See attached plan : *What To Do When We Get A Positive Fecal Or E.Coli Sample* 3. 4. 5.

What To Do When We Get A Positive Fecal Or E-Coli Sample.

1. Call the agency that governs that system immediately of receiving the results.
   Group A's Pierce - NW Drinking Water, Carol Stuckey 253-395-6776
   Group A's Thurston, Lewis, Grays – SW Drinking Water, Sandy Brentlinger 360-236-3044.
   Group B's Pierce – Pierce Co. Environment Health, Michelle Harris, 253-798-7683
   Group B's Thurston – Thurston Co. Environmental Health, Sara Brallier, 360-867-2629
   Group B's Lewis – Lewis Co. Environmental Health, Sue Kennedy, 360-740-2691
   Group B's Grays Harbor – Grays Harbor Environmental Health, Jeff Nelson 360-249-4413
   Group B's Mason – Mason Co. Environmental Health, Stephanie Kenny, 360-427-9670

2. Work with agency, we could put the customers on boil water now or wait until the next tests come back. I usually put them on boil water now. Distribute door hangers at this time with a copy of the Acute mcl attached.
   K:\FORMS\Mandatory Language Forms\Acute Coliform MCL
   K:\FORMS\Mandatory Language Forms\Boil Water Advisory Door Hanger

3. Fax form and door hanger to agency after it has been hand delivered to the customers.

4. Take the repeat samples with in 24 hours and run a 24 hour test on them.
   Group A's four samples – follow the Coliform Monitoring Plan. If more than 1 well was in operations then a raw sample from each will need to be taken, plus the four repeats (which should include one well).

   Group B's two samples – should be taken from the same sample site as routine plus a well sample.

5. Access the system; try to find where the contamination is coming from. Are there any bad tanks, what does the well head look like, what activity is going on around the well.

6. Call lab in 24 hours from time sample was taken if fax has not been received yet. Confirm that samples were good or bad.

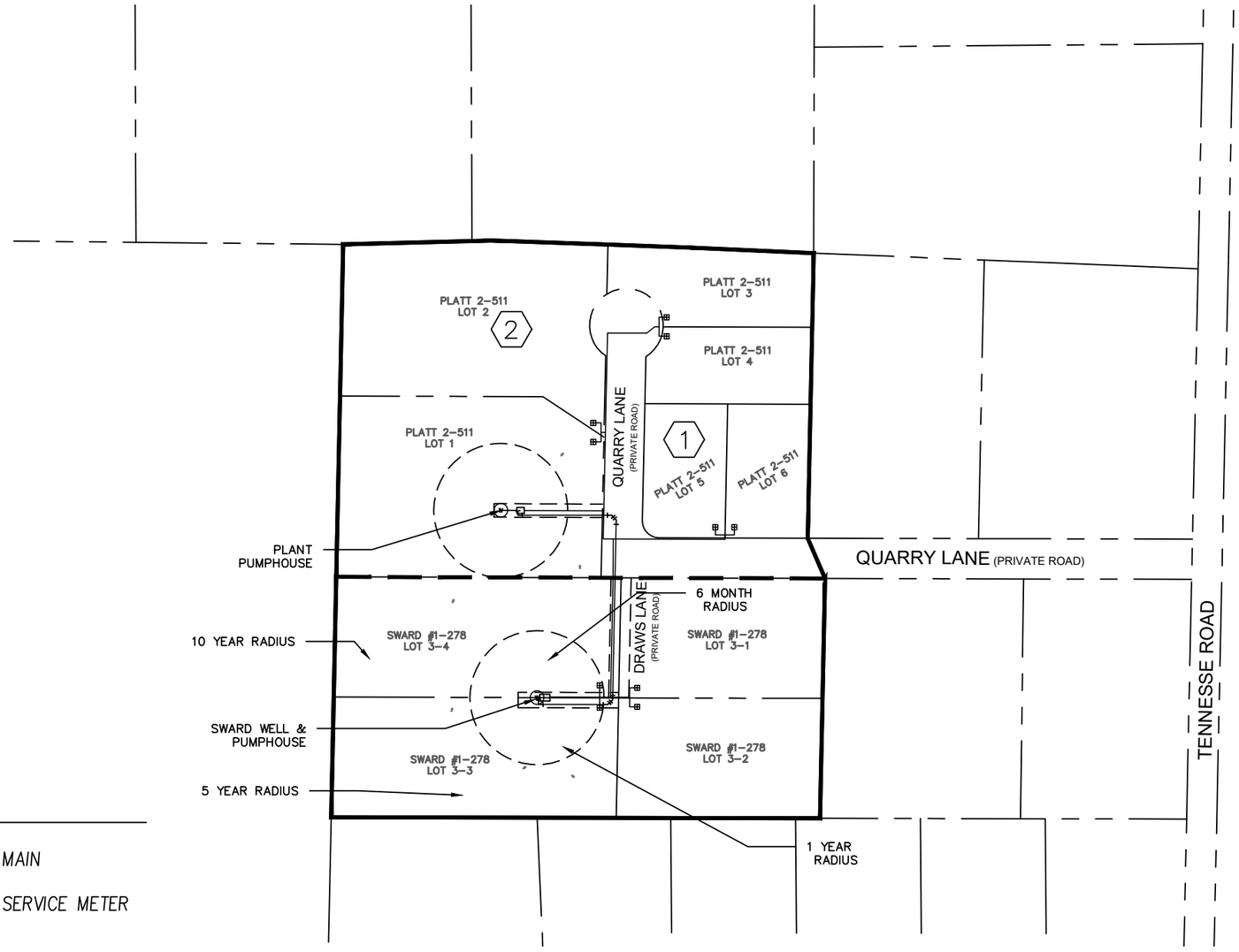
7. If samples are negative take another round of samples, immediately. Run another 24 hour test. If next round are also negative lift the boil water notice.

8. If one of the samples comes back positive and we haven't found the problem then we should start continuous temporary chlorination of the system and notify the customers by door hanger of the chlorination.

9. Once the chlorine is throughout the system then we need to take two rounds of repeat samples to lift the boil water.

THURSTON PUD
SWARD - PLATT
COLIFORM MONITORING MAP

GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.



LEGEND

- EXISTING WATER MAIN
- EXISTING WATER SERVICE METER
- (W) EXISTING WELL
- EXISTING LOT LINE
- EXISTING EASEMENT
- EXISTING SERVICE AREA
- PROPOSED SERVICE AREA BOUNDARY

SAMPLE LOCATIONS

1. 128 QUARRY LANE
2. 141 QUARRY LANE

SWARD
WATER SYSTEM
COLIFORM MONITORING MAP

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

NOTE:
THE BOUNDARY AND SITE LAYOUT INFORMATION SHOWN HERON WAS TAKEN FROM PUBLIC AND PRIVATE DOCUMENTS AND SHOULD NOT BE RELIED ON FOR ACCURACY.

33548

I:\33548\Work\Plotsheet\33548-SYSTEM MAPS.dwg
10/04/2016

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

INORGANIC CHEMICALS (IOC's) REPORT For LEAD & COPPER

System ID No.: 06046H	System Name: Sward - 278	
DOH Source No: S93 (LCR)	Sample Type: B	Sample Purpose: C
Date Received: 05-31-16	Date Reported: 06-17-16	Supervisor: JM
Date Analyzed: 06-16-16	Analyst: JMB	Group: A
County: Lewis		Sample Location: (see table below)
Send To: Thurston PUD 921 Lakeridge Way, Suite 301 Olympia, WA 98502	Bill To: AT3828R	

DOH #	23 (Copper)	9 (Lead)
State Reporting Level (SRL)	0.02 mg/L	0.001 mg/L
Action Level (AL)	1.3 mg/L	0.015 mg/L
Test Method	200.8	200.8

Lab Sample No.	Date Collected	Site/Location	Copper (mg/L)	Lead (mg/L)
08959393	05-25-16	140 Quarry	0.03	0.002
08959394	05-27-16	108 Draws Lane	0.07	0.002
08959395	05-26-16	135 Quarry	0.04	0.001
08959396	05-25-16	109 Draws Lane	0.04	0.001
08959397	05-27-16	118 Quarry	0.04	0.003

NOTES:

1mg/L is equivalent to 1 ppM

AL (Federal Action Levels): are 0.015 mg/L for Lead and 1.3 mg/L for Copper. If the concentrations exceed these levels, contact your regional DOH office for further information.

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

NA (Not Analyzed): In the RESULTS column indicates this compound was not included in the current analysis.

< : Indicates less than.

Comments: **08961387**
Lead & Copper

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

SYNTHETIC ORGANIC CHEMICALS (SOC's) ANALYSIS REPORT
EPA TEST METHOD - EPA 525.2
WA DOH TEST PANEL: PEST1

System ID No.: 06046H	System Name: Sward - 278	
Lab/Sample No.: 08984977	Date Collected: 05/24/16	DOH Source No.: S01
Multiple Source Nos.: N/A	Sample Type: B	Sample Purpose: C
Date Received: 05/24/16	Date Analyzed: 06/02/16	Analyst: LHL
Date Extracted: 05/26/16	Date Reported: 06/03/16	Supervisor: JMB
County: Lewis	Group: A	
Sample Location: Pumphouse		
Send To: Thurston PUD #1 921 Lakeridge Way SW, Suite 301 Olympia, WA 98502	Remarks:	

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA REGULATED						Trigger?	MCL?
33	Endrin	ND	ug/L	0.05	0.05	2	NO	NO
34	Lindane (BHC-gamma)	ND	ug/L	0.04	0.04	0.2	NO	NO
35	Methoxychlor	ND	ug/L	10	10	40	NO	NO
36	Toxaphene[1]	ND	ug/L	1	1	3	NO	NO
117	Alachlor	ND	ug/L	0.4	0.4	2	NO	NO
119	Atrazine	ND	ug/L	0.5	0.5	3	NO	NO
120	Benzo(a)pyrene	ND	ug/L	0.04	0.04	0.2	NO	NO
122	Chlordane (total)[1]	ND	ug/L	0.4	0.4	2	NO	NO
124	Di(ethylhexyl)adipate	ND	ug/L	1.3	1.3	400	NO	NO
125	Di(ethylhexyl)phthalate	ND	ug/L	1.3	1.3	6	NO	NO
126	Heptachlor	ND	ug/L	0.09	0.09	0.4	NO	NO
127	Heptachlor epoxide	ND	ug/L	0.1	0.1	0.2	NO	NO
128	Hexachlorobenzene	ND	ug/L	0.5	0.5	1	NO	NO
129	Hexachlorocyclopentadiene	ND	ug/L	0.5	0.5	50	NO	NO
133	Simazine	ND	ug/L	0.15	0.15	4	NO	NO
134	Pentachlorophenol	ND	ug/L	0.2	0.2	1	NO	NO
153	PCB (as total arochlors)[1]	ND	ug/L	0.2			NA	NA
173	Arochlor 1221[1]	ND	ug/L	100			NA	NA
174	Arochlor 1232[1]	ND	ug/L	2.5			NA	NA
175	Arochlor 1242[1]	ND	ug/L	1.5			NA	NA
176	Arochlor 1248[1]	ND	ug/L	0.5			NA	NA
177	Arochlor 1254[1]	ND	ug/L	0.5			NA	NA
178	Arochlor 1260[1]	ND	ug/L	1.0			NA	NA
180	Arochlor 1016[1]	ND	ug/L	0.4			NA	NA
	EPA UNREGULATED							
121	Butachlor	ND	ug/L	0.4			NA	NA
123	Dieldrin	ND	ug/L	0.1			NA	NA
130	Metolachlor	ND	ug/L	1			NA	NA
131	Metribuzin	ND	ug/L	0.2			NA	NA
132	Propachlor	ND	ug/L	0.1			NA	NA
254	Fluorene	ND	ug/L	0.2			NA	NA
179	Bromacil	ND	ug/L	0.2			NA	NA

$30

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

SYNTHETIC ORGANIC CHEMICALS (SOC's) ANALYSIS REPORT
EPA TEST METHOD - EPA 515.1
WA DOH TEST PANEL: HERB1

System ID No.: 06046H	System Name: Sward - 278	
Lab/Sample No.: 08984977	Date Collected: 05/24/16	DOH Source No.: S01
Multiple Source Nos.: N/A	Sample Type: B	Sample Purpose: C
Date Received: 05/24/16	Date Analyzed: 06/02/16	Analyst: RL
Date Extracted: 06/01/16	Date Reported: 06/03/16	Supervisor:
County: Lewis	Group: A	
Sample Location: Pumphouse		
Send To: Thurston PUD #1 921 Lakeridge Way SW, Suite #301 Olympia, WA 98503	Remarks:	

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA REGULATED						Trigger?	MCL?
37	2,4 - D	ND	ug/L	0.5	0.5	70	NO	NO
38	2,4,5 - TP (Silvex)	ND	ug/L	1.0	1.0	50	NO	NO
134	Pentachlorophenol	ND	ug/L	0.20	0.20	1	NO	NO
137	Dalapon	ND	ug/L	5.0	5.0	200	NO	NO
139	Dinoseb	ND	ug/L	1.0	1.0	7	NO	NO
140	Picloram	ND	ug/L	0.5	0.5	500	NO	NO
	EPA UNREGULATED							
135	2,4 - DB	ND	ug/L	1.0				
138	Dicamba	ND	ug/L	0.2				
223	Acifluorfen	ND	ug/L	2.0				
224	Chloramben	ND	ug/L	0.2				
225	DCPA Acid Metabolites (A)	ND	ug/L	0.1				
226	3,5-Dichlorobenzoic Acid	ND	ug/L	0.5				
228	4 - Nitrophenol	ND	ug/L	0.5				

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water response level.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): In the RESULTS column indicates this compound was not included in the current analysis.

ND (Not Detected): In the RESULTS column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

< : Indicates less than.

Comments:

Method 515.1: Herbicides

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

VOLATILE ORGANIC CHEMICALS (VOC's) ANALYSIS REPORT
EPA TEST METHOD - EPA 524.2
WA DOH TEST PANEL: VOC1

System ID No.: 06046H	System Name: Sward 278	
Lab/Sample No.: 08975997	Date Collected: 05/24/16	DOH Source No.: S01
Multiple Source Nos.: N/A	Sample Type: B	Sample Purpose: C
Date Received: 05/24/16	Date Analyzed: 05/26/16	Analyst: LHL
	Date Reported: 05/26/16	Supervisor: LHL
County: Lewis	Group: A	
Sample Location: Pumphouse		
Send To: Thurston PUD 921 Lakeridge Way SW, Suite 301 Olympia, WA 98502		Remarks:

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA REGULATED						Trigger?	MCL?
45	Vinyl Chloride	ND	ug/L	0.5	0.5	2	NO	NO
46	1,1 - Dichloroethylene	ND	ug/L	0.5	0.5	7	NO	NO
47	1,1,1 - Trichloroethane	ND	ug/L	0.5	0.5	200	NO	NO
48	Carbon Tetrachloride	ND	ug/L	0.5	0.5	5	NO	NO
49	Benzene	ND	ug/L	0.5	0.5	5	NO	NO
50	1,2 - Dichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
51	Trichloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
52	1,4 - Dichlorobenzene	ND	ug/L	0.5	0.5	75	NO	NO
56	Dichloromethane	ND	ug/L	0.5	0.5	5	NO	NO
57	trans-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	100	NO	NO
60	cis-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	70	NO	NO
63	1,2 - Dichloropropane	ND	ug/L	0.5	0.5	5	NO	NO
66	Toluene	ND	ug/L	0.5	0.5	1000	NO	NO
67	1,1,2 - Trichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
68	Tetrachloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
71	Chlorobenzene	ND	ug/L	0.5	0.5	100	NO	NO
73	Ethylbenzene	ND	ug/L	0.5	0.5	700	NO	NO
76	Styrene	ND	ug/L	0.5	0.5	100	NO	NO
84	1,2 - Dichlorobenzene	ND	ug/L	0.5	0.5	600	NO	NO
95	1,2,4 - Trichlorobenzene	ND	ug/L	0.5	0.5	70	NO	NO
160	Total Xylenes	ND	ug/L	0.5	0.5	10000	NO	NO
74	m/p Xylenes (MCL for Total)	ND	ug/L	0.5	0.5		NO	
75	o - Xylene (MCL for Total)	ND	ug/L	0.5	0.5		NO	
	TRIHALOMETHANES							
27	Chloroform	ND	ug/L	0.5	0.5		NO	
28	Bromodichloromethane	ND	ug/L	0.5	0.5		NO	
29	Chlorodibromomethane	ND	ug/L	0.5	0.5		NO	
30	Bromoform	ND	ug/L	0.5	0.5		NO	
31	TOTAL Trihalomethanes	ND	ug/L	NA	NA	80		NO

Water Management Laboratories, Inc.
1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA UNREGULATED (Continued)						Trigger?	MCL?
53	Chloromethane	**ND**	ug/L	0.5	0.5		NO	
54	Bromomethane	**ND**	ug/L	0.5	0.5		NO	
58	1,1 - Dichloroethane	**ND**	ug/L	0.5	0.5		NO	
72	1,1,1,2 - Tetrachloroethane	**ND**	ug/L	0.5	0.5		NO	
78	Bromobenzene	**ND**	ug/L	0.5	0.5		NO	
79	1,2,3 - Trichloropropane (Confirm by 504.1)	**ND**	ug/L	0.5	0.5		NO	
81	o - Chlorotoluene	**ND**	ug/L	0.5	0.5		NO	
85	Fluorotrichloromethane	**ND**	ug/L	0.5	0.5		NO	
86	Bromochloromethane	**ND**	ug/L	0.5	0.5		NO	
89	1,3,5 - Trimethylbenzene	**ND**	ug/L	0.5	0.5		NO	
91	1,2,4 - Trimethylbenzene	**ND**	ug/L	0.5	0.5		NO	
92	s - Butylbenzene	**ND**	ug/L	0.5	0.5		NO	
93	p - Isopropyltoluene	**ND**	ug/L	0.5	0.5		NO	
94	n - Butylbenzene	**ND**	ug/L	0.5	0.5		NO	
96	Naphthalene	**ND**	ug/L	0.5	0.5		NO	
102	EDB (Confirm by 504.1)	**ND**	ug/L	0.5	0.5		NO	
103	DBCP (Confirm by 504.1)	**ND**	ug/L	0.5	0.5		NO	
162	Dichlorodifluoromethane	**ND**	ug/L	0.5	0.5		NO	
N/A	MTBE	**ND**	ug/L	0.5	0.5		NO	

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level may need to take additional samples. Contact your regional DOH office for further information.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): In the RESULTS column indicates this compound was not included in the current analysis.

ND (Not Detected): In the RESULTS column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

< : Indicates less than.

Comments:

Method 524.2: VOC's

Washington State Department of Health
Environmental Public Health
Office of Drinking Water

Water Quality Monitoring Schedule

System: SWARD - 278
Contact: Kimberly S Gubbe
SMA ID: 147

PWS ID: 06046 H
Group: A - Comm
SMA Name: THURSTON PUD

Region: SOUTHWEST
County: LEWIS

NOTE: To receive credit for compliance samples, you must fill out laboratory and sample paperwork completely, send your samples to a laboratory accredited by Washington State to conduct the analyses, AND ensure the results are submitted to DOH Office of Drinking Water. There is often a lag time between when you collect your sample, when we credit your system with meeting the monitoring requirement, and when we generate the new monitoring requirement.

Coliform Monitoring Requirements

	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017
Coliform Monitoring Population	28	28	28	28	28	28	28	28	28	28	28	28
Number of Routine Samples Required	1	1	1	1	1	1	1	1	1	1	1	1

- Collect samples from representative points throughout the distribution system.
- Collect required repeat samples following an unsatisfactory sample. In addition, collect a sample from each operating groundwater source.
- For systems that chlorinate, record chlorine residual (measured when the coliform sample is collected) on the coliform lab slip.

Chemical Monitoring Requirements

Distribution Monitoring

Test Panel/Analyte	*# Samples Required*	*Compliance Period*	*Frequency*	*Last Sample Date*	*Next Sample Due*
Lead and Copper	5	Jan 2016 - Jun 2016	standard - 6 month	05/27/2016	
Lead and Copper	5	Jul 2016 - Dec 2016	standard - 6 month	05/27/2016	***Nov 2016***
Lead and Copper	5	Jul 2016 - Dec 2016	standard - 6 month	05/27/2016	***Sep 2016***
Asbestos	1	Jan 2011 - Dec 2019	standard - 9 year		Aug 2017

Water Quality Monitoring Schedule

Notes on Distribution System Chemical Monitoring

For *Lead and Copper*:
- Collect samples from the COLD WATER side of a KITCHEN or BATHROOM faucet that is used daily.
- Before sampling, make sure the water has sat unused in the pipes for at least 6 hours, but no more than 12 hours (e.g. overnight).
- If you are sampling from a faucet that has hot water, make sure cold water is the last water to run through the faucet before it sits overnight.
- If your sampling frequency is annual or every 3 years, collect samples between June 1 and September 30.

For *Asbestos:* Collect the sample from one of your routine coliform sampling sites in an area of your distribution system that has asbestos concrete pipe.

Source Monitoring

- Collect 'source' chemical monitoring samples from a tap after all treatment (if any), but before entering the distribution system.
- Washington State grants monitoring waivers for various test panels /analytes. Please note that we may require some monitoring as a condition of some waivers. We have granted complete waivers for dioxin, endothal, glyphosate, diquat, and insecticides.

Washington State Department of Health
Environmental Public Health
Office of Drinking Water

Water Quality Monitoring Schedule

Source S01	*WELL #1 AKK666*	*Well*	*Use - Permanent*	*Susceptility - Not Rated*	
Test Panel/Analyte	*# Samples Required*	*Compliance Period*	*Frequency*	*Last Sample Date*	*Next Sample Due*
Nitrate	1	Jan 2016 - Dec 2016	standard - 1 year	01/27/2014	***Mar 2016***
Complete Inorganic (IOC)	1	Jan 2014 - Dec 2016	standard - 3 year		
Volatile Organics (VOC)	1	Apr 2016 - Jun 2016	initial - quarterly	05/24/2016	
Volatile Organics (VOC)	1	Jul 2016 - Sep 2016	initial - quarterly	05/24/2016	***Sep 2016***
Volatile Organics (VOC)	1	Oct 2016 - Dec 2016	initial - quarterly	05/24/2016	***Oct 2016***
Herbicides	1	Apr 2016 - Jun 2016	initial - quarterly	05/24/2016	
Herbicides	1	Jul 2016 - Sep 2016	initial - quarterly	05/24/2016	***Sep 2016***
Herbicides	1	Oct 2016 - Dec 2016	initial - quarterly	05/24/2016	***Oct 2016***
Pesticides	1	Apr 2016 - Jun 2016	initial - quarterly	05/24/2016	
Pesticides	1	Jul 2016 - Sep 2016	initial - quarterly	05/24/2016	***Sep 2016***
Pesticides	1	Oct 2016 - Dec 2016	initial - quarterly	05/24/2016	***Oct 2016***
Soil Fumigants	0	Jan 2014 - Dec 2016	waiver - 3 year		
Gross Alpha	1	Jan 2016 - Mar 2016	initial - quarterly	05/24/2016	***Mar 2016***
Gross Alpha	1	Apr 2016 - Jun 2016	initial - quarterly	05/24/2016	
Gross Alpha	1	Jul 2016 - Sep 2016	initial - quarterly	05/24/2016	***Sep 2016***
Radium 228	1	Jan 2016 - Mar 2016	initial - quarterly	05/24/2016	***Mar 2016***
Radium 228	1	Apr 2016 - Jun 2016	initial - quarterly	05/24/2016	
Radium 228	1	Jul 2016 - Sep 2016	initial - quarterly	05/24/2016	***Sep 2016***

Water Quality Monitoring Schedule

Other Information

Other Reporting Schedules	Due Date
Submit Consumer Confidence Report (CCR) to customers and ODW (Community systems only):	07/01/2016
Submit CCR certification form to ODW (Community systems only):	10/01/2016
Submit Water Use Efficiency report online to ODW (Community and other municipal water systems only):	07/01/2016
Send notices of lead and copper sample results to the customers sampled:	10 days after you receive the laboratory results
Submit Certification of customer notification of lead and copper results to ODW:	60 days after you notify customers

Special Notes

None

Southwest Regional Water Quality Monitoring Contacts

For questions regarding chemical monitoring:	Sophia Petro: (360) 236-3046 or sophia.petro@doh.wa.gov
For questions regarding DBPs:	Sophia Petro: (360) 236-3046 or sophia.petro@doh.wa.gov
For questions regarding coliform bacteria and microbial issues:	Sandy Brentlinger: (360) 236-3044 or sandy.brentlinger@doh.wa.gov

Additional Notes

The information on this monitoring schedule is valid as of the date in the upper left corner on the first page. However, the information may change with subsequent updates in our water quality monitoring database as we receive new data or revise monitoring schedules. There is often a lag time between when you collect your sample and when we credit your system with meeting the monitoring requirement.

We have not designed this monitoring schedule to display all compliance requirements. The purpose of this schedule is to assist water systems with planning for most water quality monitoring, and to allow systems to compare their records with DOH ODW records. Please be aware that this monitoring schedule does not include constituents that require a special monitoring frequency, such as monitoring affiliated with treatment.

Any inaccuracies on this schedule will not relieve the water system owner and operator of the requirement to comply with applicable regulations.

If you have any questions about your monitoring requirements, please contact the regional office staff listed above.

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

VOLATILE ORGANIC CHEMICALS (VOC's) ANALYSIS REPORT
EPA TEST METHOD - EPA 524.2
WA DOH TEST PANEL: VOC1

System ID No.: 06046H	System Name: Sward - 278	
Lab/Sample No.: 08973297	Date Collected: 01/27/14	DOH Source No.: S01
Multiple Source Nos.: N/A	Sample Type: B	Sample Purpose: C
Date Received: 01/27/14	Date Analyzed: 01/28/14	Analyst: RL
	Date Reported: 01/29/14	Supervisor:
County: Lewis	Group: B	
Sample Location: Pumphouse		
Send To: Thurston PUD 921 Lakeridge Way SW, Suite 301 Olympia, WA 98502		Remarks:

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
							Trigger?	MCL?
	EPA REGULATED							
45	Vinyl Chloride	ND	ug/L	0.5	0.5	2	NO	NO
46	1,1 - Dichloroethylene	ND	ug/L	0.5	0.5	7	NO	NO
47	1,1,1 - Trichloroethane	ND	ug/L	0.5	0.5	200	NO	NO
48	Carbon Tetrachloride	ND	ug/L	0.5	0.5	5	NO	NO
49	Benzene	ND	ug/L	0.5	0.5	5	NO	NO
50	1,2 - Dichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
51	Trichloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
52	1,4 - Dichlorobenzene	ND	ug/L	0.5	0.5	75	NO	NO
56	Dichloromethane	ND	ug/L	0.5	0.5	5	NO	NO
57	trans-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	100	NO	NO
60	cis-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	70	NO	NO
63	1,2 - Dichloropropane	ND	ug/L	0.5	0.5	5	NO	NO
66	Toluene	ND	ug/L	0.5	0.5	1000	NO	NO
67	1,1,2 - Trichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
68	Tetrachloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
71	Chlorobenzene	ND	ug/L	0.5	0.5	100	NO	NO
73	Ethylbenzene	ND	ug/L	0.5	0.5	700	NO	NO
76	Styrene	ND	ug/L	0.5	0.5	100	NO	NO
84	1,2 - Dichlorobenzene	ND	ug/L	0.5	0.5	600	NO	NO
95	1,2,4 - Trichlorobenzene	ND	ug/L	0.5	0.5	70	NO	NO
160	Total Xylenes	ND	ug/L	0.5	0.5	10000	NO	NO
74	m/p Xylenes (MCL for Total)	ND	ug/L	0.5	0.5		NO	
75	o - Xylene (MCL for Total)	ND	ug/L	0.5	0.5		NO	
	TRIHALOMETHANES							
27	Chloroform	ND	ug/L	0.5	0.5		NO	
28	Bromodichloromethane	ND	ug/L	0.5	0.5		NO	
29	Chlorodibromomethane	ND	ug/L	0.5	0.5		NO	
30	Bromoform	ND	ug/L	0.5	0.5		NO	
31	TOTAL Trihalomethanes	ND	ug/L	NA	NA	80		NO

Water Management Laboratories, Inc.
1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA UNREGULATED (Continued)						Trigger?	MCL?
53	Chloromethane	ND	ug/L	0.5	0.5		NO	
54	Bromomethane	ND	ug/L	0.5	0.5		NO	
58	1,1 - Dichloroethane	ND	ug/L	0.5	0.5		NO	
72	1,1,1,2 - Tetrachlroroethane	ND	ug/L	0.5	0.5		NO	
78	Bromobenzene	ND	ug/L	0.5	0.5		NO	
79	1,2,3 - Trichloropropane (Confirm by 504.1)	ND	ug/L	0.5	0.5		NO	
81	o - Chlorotoluene	ND	ug/L	0.5	0.5		NO	
85	Fluorotrichloromethane	ND	ug/L	0.5	0.5		NO	
86	Bromochloromethane	ND	ug/L	0.5	0.5		NO	
89	1,3,5 - Trimethylbenzene	ND	ug/L	0.5	0.5		NO	
91	1,2,4 - Trimethylbenzene	ND	ug/L	0.5	0.5		NO	
92	s - Butylbenzene	ND	ug/L	0.5	0.5		NO	
93	p - Isopropyltoluene	ND	ug/L	0.5	0.5		NO	
94	n - Butylbenzene	ND	ug/L	0.5	0.5		NO	
96	Napthalene	ND	ug/L	0.5	0.5		NO	
102	EDB (Confirm by 504.1)	ND	ug/L	0.5	0.5		NO	
103	DBCP (Confirm by 504.1)	ND	ug/L	0.5	0.5		NO	
162	Dichlorodifluoromethane	ND	ug/L	0.5	0.5		NO	
N/A	MTBE	ND	ug/L	0.5	0.5		NO	

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level may need to take additional samples. Contact your regional DOH office for further information.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): In the RESULTS column indicates this compound was not included in the current analysis.

ND (Not Detected): In the RESULTS column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

< : Indicates less than.

Comments:

Method 524.2: VOC's

Please Print Plainly
USE HEAVY PEN
DO NOT WRITE IN SHADED AREAS

WATER MANAGEMENT LABORATORIES INC.
1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

INORGANIC CHEMICALS (IOCS) REPORT

*2,3

System ID No: 060046H | System Name: Sward - 278
Lab/Sample No: 08951079 | Date Collected: 01-27-14 | DOH Source No: S01
Multiple Source Nos: N/A | Sample Type: B | Sample Purpose: C
Date Received: 01-27-14 | Date Reported: 01.29.14 | Supervisor: JMB
County: Lewis | Date Digested: NA | Group: A (B) Other
Sample Location: pumphouse
Send Results & Bill To: Thurston PUD
921 Lakeridge Way SW, Suite 301
Olympia, WA 98502
Remarks: AT3828R

DOH#	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS Trigger?	EXCEEDS MCL?	Method	Analyst
	EPA REGULATED									
4	Arsenic	<0.001	mg/L	0.001	0.01	0.01	NO	NO	200.8	JMB
5	Barium	<0.01	mg/L	0.01	2	2			200.8	JMB
6	Cadmium	<0.0001	mg/L	0.0001	0.005	0.005			200.8	JMB
7	Chromium	<0.007	mg/L	0.007	0.1	0.1			200.8	JMB
11	Mercury	<0.0002	mg/L	0.0002	0.002	0.002			200.8	JMB
12	Selenium	<0.002	mg/L	0.002	0.05	0.05			200.8	JMB
110	Beryllium	<0.0003	mg/L	0.0003	0.004	0.004			200.8	JMB
111	Nickel	<0.005	mg/L	0.005	0.1	0.1			200.8	JMB
112	Antimony	<0.003	mg/L	0.003	0.006	0.006			200.8	JMB
113	Thallium	<0.001	mg/L	0.001	0.002	0.002			200.8	JMB
116	Cyanide	<0.01	mg/L	0.01	0.2	0.2			4500-CNF	RL
19	Fluoride	<0.2	mg/L	0.5	2	4			300.0	JGH
114	Nitrite - N	<0.1	mg/L	0.1	0.5	1			300.0	JGH
20	Nitrate - N	0.3	mg/L	0.2	5	10			300.0	JGH
161	Total Nitrate/Nitrite	<0.4	mg/L	0.5	5	10	↓	↓	300.0	JGH
	EPA REGULATED (Secondary)									
8	Iron	<0.1	mg/L	0.1	0.3	0.3	NO	NO	3111B	JMB
10	Manganese	<0.01	mg/L	0.01		0.05			200.8	JMB
13	Silver	<0.01	mg/L	0.1		0.1			200.8	JMB
21	Chloride	2	mg/L	20		250			300.0	JGH
22	Sulfate	3	mg/L	50		250			300.0	JGH
24	Zinc	<0.2	mg/L	0.2	5	5	NO	↓	200.8	JMB
	STATE REGULATED									
14	Sodium	7	mg/L	5					200.8	JMB
15	Hardness	33	mg/L	10					2340C	JGH
16	Conductivity	93	umhos/cm	70		700		NO	2510B	JGH
17	Turbidity	0.7	NTU	0.1					2130B	JGH
18	Color	<5.0	color units	15		15		NO	2120B	JGH
26	Total Dissolved Solids	NA	mg/L	100		500		—	2540C	—
	STATE UNREGULATED									
9	Lead	<0.001	mg/L	0.001					200.8	JMB
23	Copper	<0.02	mg/L	0.02					200.8	JMB

COMMENTS: FC28

Appendix C: Susceptibility Assessment, Wellhead Protection, and Contaminant Source Inventories

SWARD #278

Wellhead Protection Plan

August 2016

Developed by:

Kim Gubbe, Operations Manager, Thurston PUD

In cooperation with:

Table of Contents

I. Introduction

I-1. Background

Congress enacted the Safe Drinking Water Act (SDWA) in 1974 with the goal of providing safe drinking water to all users of public water supplies. The SDWA gave the U.S. Environmental Protection Agency (EPA) the authority to develop a uniform national drinking water program, and to establish national standards for known or suspected drinking water contaminants. The 1986 SDWA amendments authorized two new provisions for groundwater protection. One of these was the Wellhead Protection (WHP) program. The SDWA allows each state to design its own WHP program in order to maximize program effectiveness at the local level. Each state's WHP activities are designed to protect land areas surrounding public water supply wells in order to prevent groundwater contamination.

The Sate of Washington requires that all Group A water systems (those serving fifteen or more connections or twenty-five or more people) develop WHP plans, as stated in the Washington Administrative Code (WAC 246-290). The Washington Department of Health (DOH) has established requirements, guidelines and materials to aid water systems in the development of their WHP plans. In order to help systems comply with WHP requirements, Evergreen Rural Water of Washington provides on-site assistance to small water systems. This assistance is provided at no cost to water systems through funding provided by the DOH and EPA.

I-2. Purpose

The purpose of WHP is to provide an organized approach to effectively protect drinking water supplies from contamination. The program seeks to identify and manage potential contaminant sources near public water supply wells in order to prevent future contamination. WHP safeguards the health of community residents and avoids negative financial impacts associated with contamination. The costs of contamination typically include the investigation of sites, installing treatment facilities, and/or locating new water sources, to name just a few. In fact, Washington State health officials have identified nearly twenty different direct and indirect costs associated with well contamination. To avoid these costs and ensure a safe, quality water supply, we need to protect groundwater at its source. WHP is a straightforward and cost effective method of accomplishing this goal.

I-3. Plan Overview

This WHP report includes the following elements:

- A competed susceptibility assessment.
- Identification of the WHP zones.
- An inventory of potential contaminant sources and land use activities.
- A discussion of the management strategy.
- Contingency and emergency response planning.
- Supporting information and documentation.

Upon completion of these elements, a Group A water system is expected to meet or exceed the requirements of Washington State's WHP program.

II. Hydrology

II-1. Location

Sward #278 water system is located in Lewis County between Napavine and Winlock. The Sward #278 water system serves 10 connections with a population of approximately 25 residents. The surrounding area is rural residential with undeveloped areas and large residential lots.

II-2. Well System

The Sward #278 water system maintains one ground water source which is capable of producing excellent water. Water used for the system was metered an average of 443,920 gallons per year, from 2013 - 2015. For details on the well construction refer to Appendix A.

II-3. Hydrogeology

Detailed hydrogeologic information is unavailable for the area. In most cases however, we can use three readily available indicators to predict groundwater flow: interactions between groundwater and surface water, land forms, and local geology.

The Sward #278 well, withdraws water from a rotary drilled well in basalt rock as indicated in the well log. The well is in the Chehalis River basin that moves in a northwest flow. The surrounding geographic relief, and regional ground water maps do not suggest any particular local direction of flow in the aquifer. We believe that the well is drilled in the Lincoln formation and lucky to have a good source of water in quantity and quality. Reference – Geology and Ground-Water Resources of West-Central Lewis County, Washington by J.M. Weigle and B.L. Foxworthy.

II-4. Aquifer Susceptibility

Susceptibility is determined by conditions that affect the movement of groundwater, and thus contaminants, from the land surface into an aquifer. Susceptibility is a qualitative measure of how quickly and easily contamination at the surface can reach the groundwater supply. Vulnerability is directly related to a source's Susceptibility and the proximity of potentially hazardous activities, such as the use or storage of chemicals.

Confining units are critical to susceptibility determinations. In general, a confining unit is any earth material that does not readily transmit water. Typically layers of clay or shale may act as confining units, depending upon their thickness and lateral extent. When confining layers are present, wells are less susceptible to contamination because the layers impede the movement of contaminants from the land surface into underlying aquifers.

Thurston PUD has provided to DOH the Ground Water Contamination Susceptibility Assessment Survey Forms (Appendix B) for its Sward #278 well. S01 has not received a rating from the State DOH at this time. These ratings are based on several specific factors reported in the Susceptibility Assessment Survey. These factors include well depth, well seal, and the presence of confining units. The presence or condition of these factors can diminish the possibility that contaminants originating at the land surface could potentially affect the wells.

Washington State also uses the Susceptibility Assessment to classify the overall vulnerability of active wells. Vulnerability is composed of two factors: the physical susceptibility (as noted above) along with each source's risk of exposure to contaminants. The risk of exposure to contaminants is determined by whether or not contaminants were used in the area, or detected in the water supply.

III. Identification of the Wellhead Protection Areas

III-1. Background

Aquifer recharge occurs through the infiltration of precipitation and surface water in areas where the aquifer lies at or near the soil surface, or where confining units are thin or absent, permitting further infiltration into the aquifer. Ideally, all land areas that contribute recharge to the aquifer would be targeted for protection efforts. Unfortunately, the identification of precise recharge areas for wells is a technical and time-consuming process. Further, they can include vast areas, making them difficult to manage. To remedy these problems, the WHP program focuses protection efforts near the wellhead.

III-2. Methods

Several different methods may be used to determine the WHP areas. The most straightforward method accepted by the state is a calculated fixed radius (CFR). This method is also part of the Susceptibility Assessment, which is used to grant monitoring waivers. The CFR is an excellent preliminary WHP delineation method because it is easily implemented and inexpensive. Unfortunately, the CFR can over-simplify groundwater flow conditions and may or may not be very accurate depending upon site-specific conditions. Therefore, other more complex delineation methods such as computer modeling and hydrogeologic mapping are encouraged, but not required for small systems.

Regardless of the method used, the state requires that the WHP areas include the sanitary control zone, along with the six month, one, five, and ten-year time of travel zones for groundwater. 'Time of travel' refers to the amount of time it would take for a particle of groundwater entering the aquifer at the boundary of the zone to reach the well after six months, one, five, or ten years of pumping.

III-3. Results

The CFR utilizes a volumetric flow equation to determine the WHPA radii:

$$r = \sqrt{Q\,t\,/\,\Pi\,n\,H}$$

Where:

Parameter	WHP Zone	S01		
r = calculated radius of protection zone (ft)	6 mo 1 year 5 year 10 year	58 82 182 257		
Q = pumping rate of well per year (cuft/yr)		59,348		
t = time of travel (years)		0.5,1,5,10		
Π = Pi		3.14		
n = estimated porosity (if unknown - 0.22)		.22		
H = Open interval or length of well screen (ft) ** use 10 ft if open borehole or spring		13		

The wellhead protection zones, 1, 5, and 10 year times of travel are included as Figure 1. Once again, it is important to emphasize that the WHPA demonstrated here is a useful planning tool, but may not represent actual groundwater capture zones for the wells. A more conclusive WHPA delineation would, however, require more specific information and additional financial resources that may not be available. Furthermore, developing an awareness of the system's contamination potential is of higher priority at this time.

IV. Potential Contaminant Source Inventory

IV-1. Methods

A field survey was conducted of the WHP zones in order to inventory potential sources of contamination and identify land use activities, which may pose threats to groundwater quality (Table 1). The planning team conducted windshield and walk-through surveys to identify potential contaminant sources. The type and location of all potential contamination sources identified were recorded on base maps of the WHPA (Figure 1).

IV-2. Results

Other than residential septic systems, no potential sources of contamination could be identified within the Sward #278 WHP Area.

The most direct pathway of contamination into an aquifer is through surface water seepage along well casings. Poorly sealed wells (both public and private) and wells with deteriorated (rusted and/or cracked) casings can allow surface water to migrate into pristine aquifers below. This is caused by inadequate well construction and pertains to both abandoned wells and wells currently in use.

Because of the quality of the construction of the Sward #278 well, proper maintenance and periodic inspection should minimize this threat of contamination.

V. Management Strategy

V-1. Sanitary Control Area

Of primary concern are impacts from activities within the sanitary control area of the well. This area should already be tightly controlled to minimize direct contamination of the wells. This area should also be managed to reduce the possibility of surface flows reaching the wells and traveling down the casing.

The well is located on private property. The well is secured safely inside a fence and is located adjacent to residential property.

V-2. Wellhead Protection Area

Because WHPA's typically include diverse land use areas, it is important citizens and businesses be informed that they can have a direct impact on the quality of groundwater. To accomplish this a public education campaign is required to inform WHP Area residents and businesses of the sensitivity of their location above the drinking water supply.

Residents have been mailed a letter (Appendix C) informing them about the sensitivity of their location with regards to their groundwater supply. These letter included information regarding the safe disposal of hazardous chemicals, the proper use of septic systems.

VI. Contingency Planning

VI-1. Alternative Supply

A contingency plan is needed in the event that a contamination event or natural disaster results in the temporary or permanent loss of any or all of the wells. The contingency plan identifies the amount of water required to sustain the community on a daily basis and the alternative sources of supply for both short term and long term emergencies. This also includes a firm understanding of the costs and difficulties of siting and drilling a replacement well.

The Sward #278 water system maintains one source well (S01) and the system maintains 3,200 gallons storage capacity. The system has no back-up power source and in the event of a power outage, will be without water also. In the event of well failure or aquifer contamination the water system has no backup water supply, and would be faced with well replacement. The system is aware of the expense and difficulty involved with siting, constructing and bringing a new well online. Thurston PUD and the community are prepared to undertake this process in the event of aquifer contamination or complete well failure. For an alternative supply until well replacement could be facilitated, trucking water from a neighboring water system is the only possibility. Neighboring systems have been contacted and are capable of providing an emergency supply. Trucking could be facilitated through a local dairy. The system will also contact the County Emergency Government Office for assistance.

VI-2. Emergency Response

As with anywhere, a hazardous spill event is possible within the Sward #278 WHPA. An incident/spill response notice (Appendix C) has been sent to local emergency responders and planning agencies notifying them of the location of Sward #278 WHPA and the potential contaminant sources. After assessing the water system's vulnerability, these agencies will evaluate whether changes in hazardous spill, disaster response, and future planning procedures are needed to adequately protect the Sward #278 water supply.

VII. Concluding Remarks

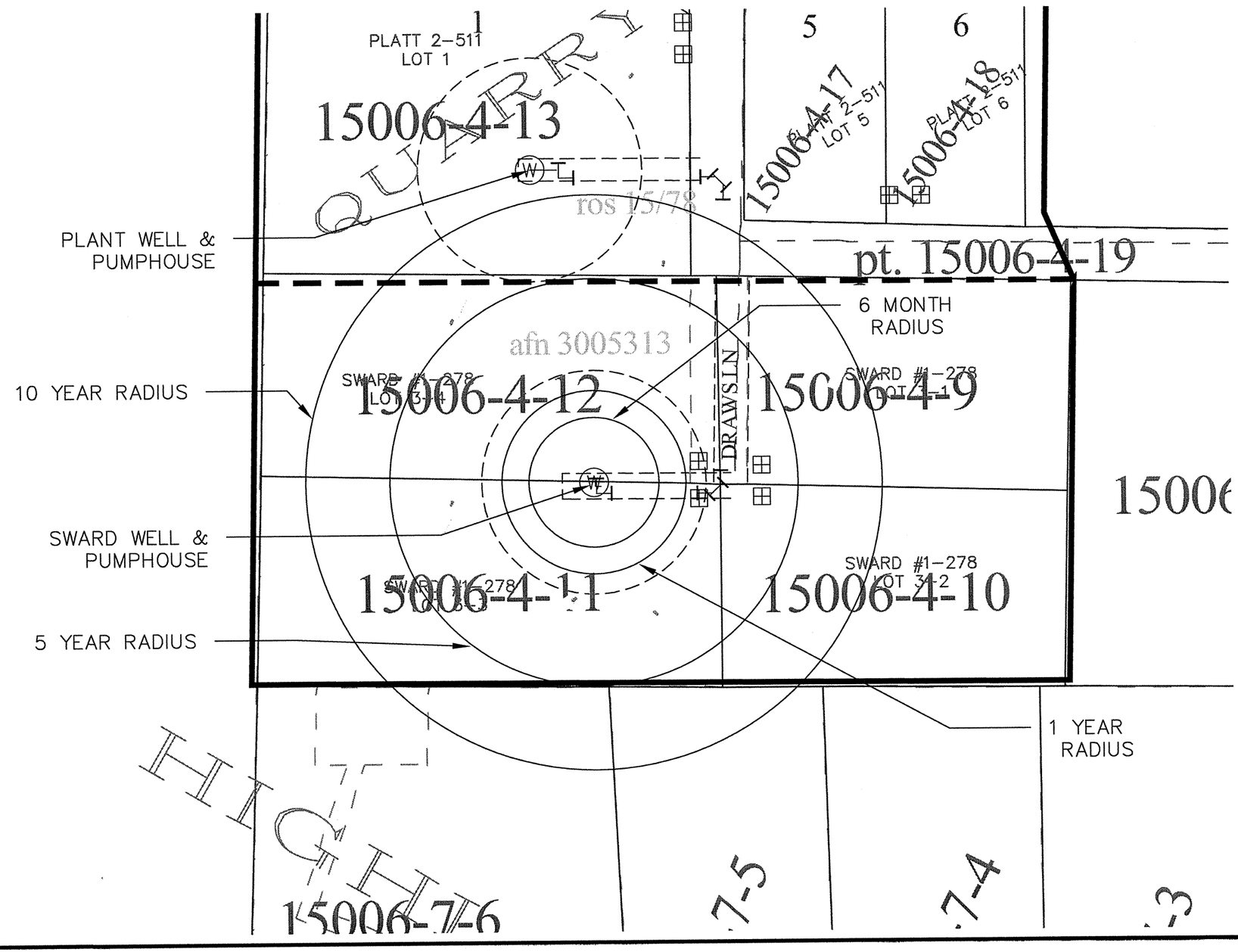
Sward #278 water system is in a good position to continue providing a safe and reliable drinking water supply. The community recognizes that the most effective way to protect their water supply is to prevent contamination. This plan serves the interests of Sward #278 residents by protecting their drinking water supply at minimal cost to consumers, while maintaining compliance with drinking water program regulations. With the continued dedication of the water operator and a heightened awareness of groundwater protection by residents and local businesses, Sward #278 is likely to have a clean, reliable water supply far into the future.

VIII. Figures

1. Wellhead Protection Area Map

THURSTON PUD
SWARD - PLATT
WATER SYSTEM CONSOLIDATION

GRAPHIC SCALE
100 0 50 100
1 inch = 100 ft.



SWARD - PLATT WATER SYSTEM
CALCULATED FIXED RADIUS MAP

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

NOTE:
THE BOUNDARY AND SITE LAYOUT INFORMATION SHOWN HERON WAS TAKEN FROM PUBLIC AND PRIVATE DOCUMENTS AND SHOULD NOT BE RELIED ON FOR ACCURACY.

33548

I:\33548\Work\Plotsheet\33548-SYSTEM MAPS.dwg
8/26/2016

IX. Appendices

Appendix A: Well Reports

Appendix B: Ground Water Contamination Susceptibility Assessment

Water Facilities Inventory

Appendix C: Potential Contaminant Source List

Notification Letters

Appendix D: Resource Contacts

Appendix A:

Well Report

Start Card No. W072230

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

UNIQUE WELL I.D. #

Water Right Permit No.

(1) OWNER: Name Prime West Development Inc. Address Mt. Vernon, WA.

(2) LOCATION OF WELL: County Lewis - SE 1/4 NW 1/4 Sec 8 T. 12 N. R. 2 W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Tennessee Rd. Winlock.

(3) PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) ____
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 203 feet. Depth of completed well 195 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 6" Diam. from +2 ft. to 53 ft.
Welded ☒ 4" Diam. from 35 ft. to 195 ft.
Liner installed ☒ ____ Diam. from ____ ft. to ____ ft.
Threaded ☐

Perforations: Yes ☒ No ☐
Type of perforator used Saw Cut
SIZE of perforations 1/4 in. by 2 in.
104 perforations from 182 ft. to 195 ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ____ Model No. ____
Type ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name N/A H.P. ____
Type: ____

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level 12 ft. below top of well Date 7-24-96
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ____
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ____
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest 30 gal./min. with stem set at 175 ft. for 1 hrs.
Artesian flow ____ g.p.m. Date 7-24-96
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL			FROM	TO
Top Soil	Brown	Soft	0	3
Clay	"	"	3	12
"	Gray	"	12	18
"	Brown	"	18	33
Sand & Gravel 25gpm	"	"	33	53
Basalt Rock	Black	Hard	53	113
Sandstone	Gray	Soft	113	123
Clay	Brown	"	123	177
Sand & Gravel WB	"	"	177	195
Sandstone	Gray	"	195	203

Work Started 7-22 19. Completed 7-24 19 96

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Moerke & Son's (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 1286 NW Maryland Chehalis

(Signed) Daniel L. Clayton (WELL DRILLER) License No. 2120

Contractor's Registration No. MOERKSSO2NS Date 7-29 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

SWARD #1 - 278
ID# 06046H

DEPARTMENT OF ECOLOGY
State of Washington

Well Tagging Form

Unique Well ID Tag Number: AKK 666

RECEIVED
MAY 04 2009
Washington State Department of Ecology

Use this form ONLY if an WELL REPORT IS FOUND (Attach the original well report to this form)

If a water well report is **NOT** available, please complete a "Water Well Report for an Existing Well" form. This form is available at Ecology's headquarters office by calling 360-407-6650 or e-mail: mbru461@ecy.wa.gov

Well Ownership, If Different From Well Report

First name	Last name
THURSTON PUD	
Street Address: 921 LAKERIDGE Way Suite 201	
City: Olympia	State: WA / Zip Code: 98502

Location of Well, If Different From Well Report

*Section, Township and Range are REQUIRED *

Well Address: 100 Draws Lane					
City: Winlock			County: Lewis		
¼ - ¼: SE	¼: NW	Section: 8	Township N.: 12N	Range: 2	☐ EWM or ☒ WWM (check one)
Latitude	Degrees		Minutes	Seconds	
Longitude	Degrees		Minutes	Seconds	

Elevation at land surface _____ ☐ feet ☐ meters *(check one)*

Well Characteristics

Location of Well Identification Tag: on well

D	C	B	A
E	F	G	H
M	L	K •	J
N	P	Q	R

Scale 1:24,000 (1" = 2,000')

Indicate the location of the well within the Section by drawing a dot at that point

Section 8

Comments

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appendix B:

Susceptibility Assessments
Water Facilities Inventory

Washington State Department of Health
Environmental Health Programs
Division of Drinking Water

Ground Water Contamination
Susceptibility Assessment Survey Form

Complete **one** form for **eac**h ground water source (well, well of a wellfield, spring, spring of a springfield) used in your water system (photocopy as necessary). Contact your regional WA DOH office if you need a copy of the Instruction Packet.

PART I: System Information

Well owner/manager: Public Utility District No. 1 of Thurston County

Water system name: Sward #278

County: Lewis

Water system ID number: 06046 Source number: S01

Well depth: 195 feet

Source name: WELL #1

WA well tag identification number: A K K - 6 6 6

❑ Well not tagged

Number of connections: 10 Population served: 25

Township: 12N Range: 2

Section: 8 ¼ ¼ Section: SE SE

Latitude/longitude (if available): 46°32'04" N / 122°57'12" W

How was latitude/longitude determined?

_____Global positioning device_____survey_____topographical map
_x___other: Google Earth

*Please see Instruction Packet for details and explanations of all questions in Parts II through V.

PART II: Well Construction and Source Information

1) Date well originally constructed: 7 / 24 / 96 month/day/year

Date well last reconstructed: ___/___/___month/day/year

❑ Information unavailable

2) Well driller: Moerke & Son's

1162 NW State Avenue, Chehalis, WA

❑ Well driller unknown

3) Type of well: x Drilled: ☒ rotary ❑ bored ❑ cable (percussion) ❑ Dug

___ other: ❑ spring(s) ❑ lateral collector (Ranney)

❑ driven ❑ jetted ❑ other:_____

4) Well report available ☒ Yes (attach copy to form) ❑ No

5) Average pumping rate: 30 (gallons/min)

Source of information Well log

If not documented, how was pumping rate determined?_____

❑ Pumping rate unknown

6) Is this source treated? No

If so, what type of treatment:

❑ disinfection ❑ filtration ❑ carbon filter ❑ air stripper ❑ other

Purpose of treatment (describe materials to be removed or controlled by treatment):

N/A

7) If source is chlorinated, is a chlorine residual maintained: ❑ Yes ❑ No N/A

Residual level:_____ (At the point closest to the source.)

PART III: Hydrogeologic Information

1) Depth to top of open interval: [check one]

❑ less than 20 ft ❑ 20-49ft ❑ 50-99ft ☒ 100-200ft ❑ greater than 200ft

❑ information unavailable

2) Depth to ground water (static water level):

☒ less than 20ft ❑ 20-49ft ❑ 50-100ft ❑ greater than 100ft

❑ flowing well/spring (artesian)

How was water level determined?

☒ well log ❑ other _____

❑ depth to ground water unknown

3) If source is a flowing well or spring, what is the confining pressure:

N/A psi (pounds per square inch) **or**

N/A feet above wellhead

4) If source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source: ❑ Yes ❑ No N/A

5) Wellhead elevation (height above mean sea level): 444 feet WGS 84

How was elevation determined? ❑ topographic map ❑ Drilling/Well Log ❑ altimeter

☒ other: Google Earth

❑ information unavailable

6) Confining layers: (This can be completed only for those sources with a drilling log, well log or geologic report describing subsurface conditions. Please refer to Instruction Packet for example.)

x evidence of confining layer(s) in well log

_____ no evidence of confining layer(s) in well log

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the **bottom** of the **lowest confining layer**? ☒ Yes ❑ No

❑ information unavailable

7) Sanitary setback:

❑ less than 100ft* ☒ 100-120ft ❑ 120-200 ft ❑ greater than 200ft

* If less than 100ft, describe the site conditions:

_____

_____

8) Wellhead construction:

❑ wellhead enclosed in a wellhouse

☒ controlled access (describe): private property, behind fence

_____

❑ other uses for wellhouse (describe): _____

_____

❑ no wellhead control

9) Surface seal:

☒ 18 ft

❑ greater than 18 ft

❑ less than 18 ft (no Department of Ecology approval)

❑ less than 18 ft (approved by Department of Ecology, include documentation)

❑ depth of seal unknown

❑ no surface seal

10) Annual rainfall (inches per year):

❑ less than 10 in/yr ❑ 10-25 in/yr ☒ greater than 25 in/yr

PART IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: 443,920 (gallons)

How was this determined?

☒ meter

☐ estimated: ☐ pumping rate (_____)
☐ pump capacity (_____)
☐ pumping rate and capacity (_____)

☐ other (describe):_____

2) Determined time of travel using:

☒ "Calculated Fixed Radius" estimate of ground water movement:
(see Instruction Packet)

☐ Alternate Numerical Model

6-month ground water travel time: 58 feet

1-year ground water travel time: 82 feet

5-year ground water travel time: 182 feet

10-year ground water travel time: 257 feet

Information available on length of screened/open interval?

☒ Yes ☐ No

Length of screened/open interval: 13 feet

3) Is there a river, lake, pond, stream, or other obvious surface water body within the 6- month time of travel boundary?

☐ Yes ☒ No (mark and identify on map)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the 6-month time of travel boundary?

☐ Yes ☒ No (mark and identify on map)

Comments:_____

_____

_____

_____

PART V: Assessment of Water Quality

1) **Regional sources of risk to ground water**:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five-year ground water travel time. If you do not know if one of the following is present, mark the "unknown" space.

	6-month	1-year	5-year	unknown
• likely pesticide application				
• stormwater injection wells				
• other injection wells				
• abandoned ground water well				
• landfills, dumps, disposal areas				
• known hazardous materials clean-up site				
• known water quality problems				
• population density less than 1 house/acre				
• residences commonly have septic tanks			X	
• Wastewater treatment lagoons				
• sites used for land application of waste				

Please include a map of the wellhead and time of travel areas with this form. Mark and identify on the map any of the risks listed above.

If other recorded or potential sources of ground water contamination exist within the ten-year time of travel circular zone around your water supply, please describe:

N/A

2) **Source-specific water quality records**: For each type of test below, **mark the row that applies to the sample results for this source**. Consider all the sample results from the past 12 years. Maximum Contaminant Levels (MCLs) and State Advisory Levels (SALs) are noted next to the specific test and are listed in the Instruction Packet.

A. **Nitrate:** (Nitrate MCL = 10 mg/liter)

- ☐ Results greater than MCL
- ☒ less than 2 mg/liter nitrate
- ☐ 2-5 mg/liter nitrate
- ☐ greater than 5 mg/liter nitrate

B. **VOCs:** (VOC detection level is 0.5 ug/liter or 0.0005 mg/liter)

- ☐ Results greater than MCL or SAL
- ☐ VOCs detected at least once
- ☒ VOCs never detected
- ☐ VOC sampling records unavailable

C. **EDB/DBCP:**
(EDB MCL = 0.05 ug/l or 0.00005 mg/l. DBCP MCL = 0.2 ug/l or 0.0002 mg/l.)

- ☐ EDB/DBCP detected below MCL at least once
- ☐ EDB/DBCP detected above MCL at least once
- ☐ EDB/DBCP never detected
- ☐ EDB/DBCP tests required but not yet completed
- ☒ EDB/DBCP tests not required

D. **Other SOCs (Pesticides, Herbicides, or SOCs other than EDB/DBCP):**

- ☐ Other SOCs detected
  (pesticides, herbicides or other synthetic organic chemicals)
- ☒ Other SOC tests performed but none detected
  (list test methods in comments)
- ☐ Other SOC tests not performed

If any SOCs in addition to EDB/DBCP were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list test methods here: Pesticides, Herbicides

E. **Bacterial contamination:**

Any bacterial detection(s) in the past 3 years in samples taken from the source (not distribution sampling records)? ☒ Yes ☐ No

Any bacterial detection(s) in the past 3 years in the distribution system that have been attributed to the source? ☒ Yes ☐ No

Source sampling records for bacteria unavailable ☐ Yes ☐ No

PART VI: Geographic or Hydrologic Factors Contributing to a Non-Circular Zone of Contribution

The following questions will help identify those ground water sources which may not be accurately represented by the calculated fixed radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the 10-year time of travel zone of the CFR? (Does the largest circle extend over a stream, river, lake, up a steep hillside, and/or over a mountain or ridge?)

☐ Yes ☒ No

Describe with references to map produced in Part IV:

N/A

2) Aquifer Material:

A) Does the drilling log, well log or other geologic/engineering reports identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

☒ Yes ☐ No

B) Does the drilling log, well log or other geologic/engineering reports indicate that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

☒ Yes ☐ No

3) Is the source located in an aquifer with a high horizontal flow rate? (These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

☐ Yes ☒ No

4) Are there other high capacity wells (agricultural, municipal and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gal/min within…

	YES	NO	unknown
Less than 6-month travel time		x	
6 month—1 year travel time		x	
1—5 year travel time		x	
5—10 year travel time		x	

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within…

	YES	NO	unknown
Less than 1-year travel time		x	
1—5 year travel time		x	
5—10 year travel time		x	

Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the zone of contribution for this source. Where possible, reference them to locations on the map produced in Part IV.

No additional conditions affect the shape of the zone of contribution.

FORM COMPLETED BY:

Kim Gubbe, Thurston PUD — 8/22/2016

Print Name — Date

Signature

Appendix C:

Potential Contaminant Source List
Notification Letters

Sward #278 Water System

WHP Area Potential Contaminant Source List

Potential Contaminant Source	Address	Phone Number
Residential Septic System	All within WHPA	

This list was provided to the following agencies:

Washington State Department of Ecology
Lewis County Emergency Management
Local Fire District
Local Law Enforcement Officials and County Sheriff's Office

Letter of Notification - Wellhead Protection Plan

August 23, 2016

Dear Residents:

The Sward #278 water system is required by the Washington Department of Health to develop a wellhead protection plan. Wellhead protection involves protecting the land area surrounding our wells in order to prevent contamination of our drinking water supply. Sward #278 has one well located on Draws Lane. Part of the plan is this letter of notification to all potential sources of contamination to the well. Most of Sward #278 water customers live within the wellhead protection zones surrounding our well field, all which use septic systems (see map on other side).

This letter is intended to inform you of the location of our well and protection zone, and to serve as a reminder that any hazardous material put onto the ground or into your septic system has the potential of contaminating our drinking water supply. Some potentially harmful activities to avoid are…

- Improper use of a septic system (dumping paint, household cleaners, or solvents into your septic system).
- Dumping motor oil, gasoline, antifreeze or similar fluids onto the ground.
- Heavy use of fertilizers and pesticides.
- Dumping or burying garbage in the ground.

Any unwanted or unused household hazardous materials (like those mentioned above) can be disposed of at Lewis County Solid Waste Central Transfer Station – The Hazo Hut. Call 360-740-1221 for details, hours of operation, etc. You can also recycle your used motor oil at Lewis County Fire District #5 120 E Washington St, Napavine, WA 98532 during daylight hours.

We are fortunate to have a very good supply of high quality water. It should be everyone's intent to keep it that way for our continued good use, and for the ones that come along after us. Thank you for following these guidelines. If you have any questions about this matter, please feel free to contact Kim at Thurston PUD 360-357-8783.

TIPS TO AVOID SEPTIC SYSTEM TROUBLE:

- DO take leftover household chemicals to a hazardous waste collection center for disposal.
- DO practice water conservation. Repair dripping faucets and leaking toilets, run dishwashers and washing machines only when full.
- DO learn the location of your septic system and drain field.
- DON'T allow anyone to drive or park over any part of the system. Areas should be left undisturbed with only a mowed grass cover. Roots from nearby trees or shrubs may clog and damage your drain lines.
- DON'T use commercial septic tank additives. These products usually do not help and some may hurt your system in the long run.
- DON'T poison your system by pouring chemicals down the drain. They can kill the beneficial bacteria that treat your wastewater.

August 23, 2016

Letter of Notification: Wellhead Protection Plan

RE: SWARD #278 WATER SYSTEM ID #06046

Dear Emergency Responder:

Thurston PUD is developing a wellhead protection plan as required by the State Department of Health for the Sward #278 water system. As part of this plan, Thurston PUD must provide wellhead protection information to agencies responsible for incident/spill response procedures. Using the results of the susceptibility assessment and the findings of the wellhead protection area inventory, local emergency responders are asked to evaluate whether changes in incident/spill response procedures are needed to better protect groundwater within wellhead protection areas. As stated in the Wellhead Protection Program Guidance Document, "If a public water system's source water is determined to be vulnerable to surface activities, special procedures may need to be incorporated into local emergency response plans."

A map of the wellhead protection areas with potential contaminant sources are enclosed for your review. An acknowledgement of receipt of this information or a response from your office is not required as part of the wellhead protection plan documentation.

Thank you for your attention in this matter. If you have any questions about the plan, please feel free to contact me.

Sincerely,

Kim Gubbe
Director of Operations and Compliance
Thurston PUD
360-357-8783

August 23, 2016

Washington State Department of Ecology
Southwest Regional Office
PO Box 47600
Olympia, WA 98504-7600

Regarding: Abandoned wells

Dear Sir or Madam:

As part of the Sward #278 water system Wellhead Protection Plan, Thurston PUD is required to provide notification of the existence of abandoned wells within wellhead protection areas. We are unsure if there are any abandoned wells within the Sward #278 wellhead protection area.

The association is unaware of whether any wells which may be abandoned or inactive, have been properly closed according to DOE guidelines. We have enclosed a map depicting the location of the Sward #278 source well and the associated Wellhead Protection Area (WHPA). This map is intended to serve as a tool for you to manage the closure of any wells located on private property within our WHPA.

For additional information, please feel free to contact me at 360-357-8783.

Sincerely;

Kim Gubbe
Director of Operations and Compliance
Thurston PUD

August 23, 2016

Washington State Department of Ecology
Southwest Regional Office
PO Box 47600
Olympia, WA 98504-7600

Regarding: Sward #278 Water System's Wellhead Protection Area (WHPA)

Dear Sir or Madam:

As part of the Sward #278 Wellhead Protection Plan, the Association is required to provide notification of the WHPA boundary and the potential contaminant sources within that boundary. Please use the enclosed WHPA map and potential contaminant source list accordingly when considering future inspections and permitting for the storage, use, and disposal of hazardous materials within our WHPA.

Sincerely;

Kim Gubbe
Director of Operations and Compliance
Thurston PUD
360-357-8783

Appendix D: Resource Contacts

1. DOH regional planner and engineer

Jester Purtteman, P.E.
SW Drinking Water Regional Operations
PO Box 47823
Olympia, WA 98504-7823
360-236-3036

2. ECY Regional Office

Department of Ecology
300 Desmond Dr
Lacey, WA 98503
360-407-6000

3. County Health District

Lewis County
Environmental Health
351 N. North St
Chehalis, WA 98532
360-740-2691

4. County Fire District, Local Fire Department, County Emergency Response Unit, DOE Emergency Spill Response Unit.

DOE 24 Hour Spill Respond
SW Regional Office
360-407-6300

Lewis County Sheriff
345 West Main Street
Chehalis WA 98532
360-748-9286

Lewis County Fire District 15
609 NW Kerron St
Winlock WA 98596
360-785-4221

Lewis County Emergency Management
351 NW North Street
Chehalis WA 98532
(360) 740-1151

5. Evergreen Rural Water of WA

ERWoW
P.O. Box 2300
Shelton, WA 98584
360-462-9287

6. US EPA:

U.S. Environmental Protection Agency
Source Water Protection
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-1900

7. Any other agencies, companies, or individuals you feel may be helpful with protecting your drinking water. Include consultants and attorneys contracted by the water system.

Thurston PUD
921 Lakeridge Way SW Suite 301
Olympia, WA 98502
360-357-8783

Appendix D: Water System Hydraulic Analysis

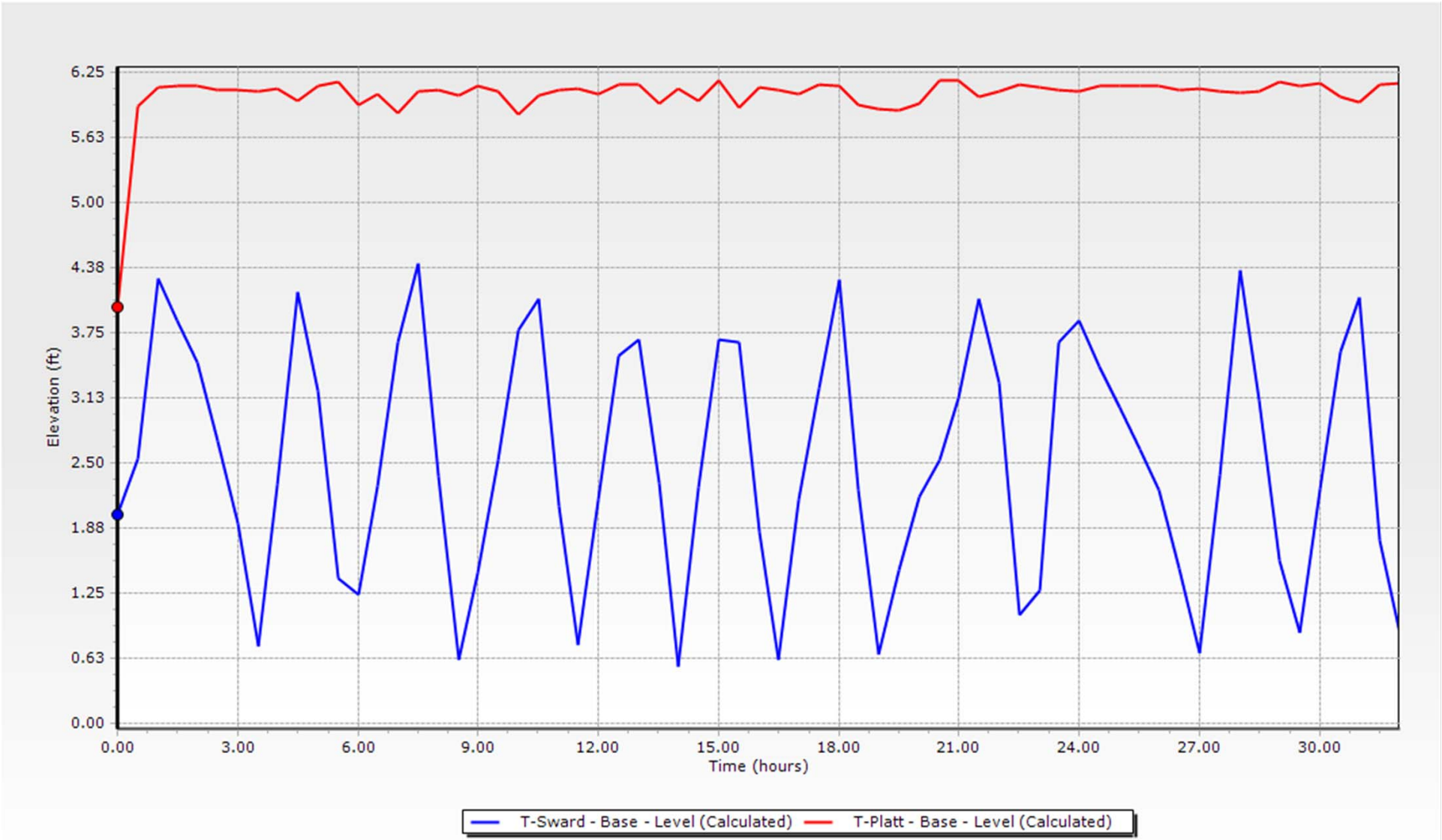
Sward Water System

4-2017 Analysis results

Sward Hydraulic System

Existing ERUs

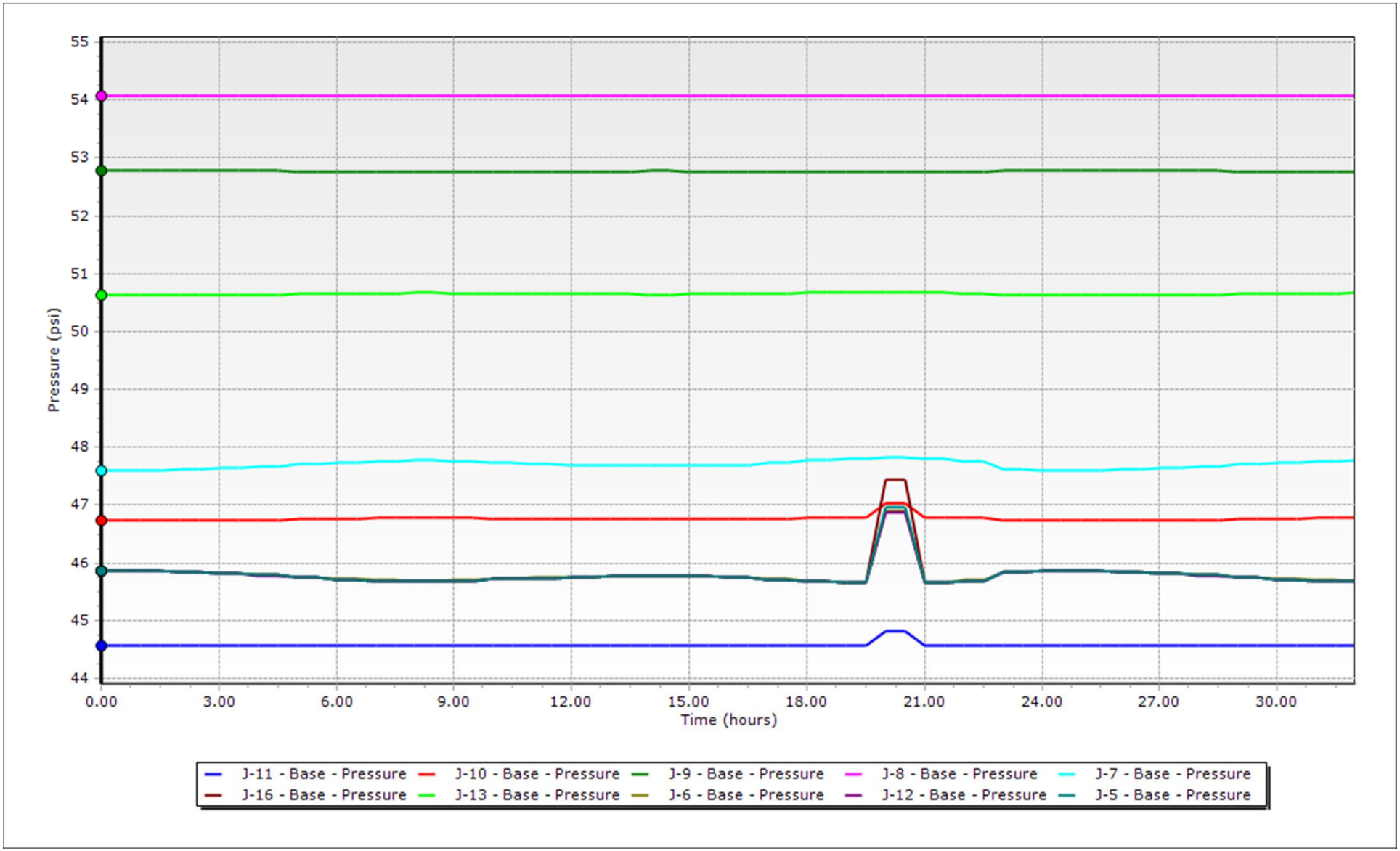
Tank Levels



Sward Hydraulic System

Existing ERUs

Junctions Pressures



Average day Curve

Start Time: 12:00:00 AM

Starting Multiplier: 0.500

Pattern Format: Stepwise

Hourly | Daily Factors | Monthly Factors

	Time from Start (hours)	Multiplier
1	1.000	0.500
2	2.000	1.000
3	3.000	1.500
4	4.000	1.800
5	5.000	2.200
6	6.000	2.500
7	7.000	2.700
8	8.000	2.800
9	9.000	2.700
10	10.000	2.450
11	11.000	2.300
12	12.000	2.100
13	13.000	2.000
14	14.000	1.900
15	15.000	2.000
16	16.000	2.100
17	17.000	2.500
18	18.000	2.800
19	19.000	3.000
20	20.000	3.200
21	21.000	3.000
22	22.000	2.700
23	23.000	1.000
24	24.000	0.500

Unit Demand | Library | Notes

Unit Demand: 0.81 gpm

Count Unit:

Report Population Equivalent?

Population Equivalent: 0 Capita