STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
DRAFT PROTESTED REPORT OF EXAMINATION
To Appropriate Public Waters

PRIORITY DATE	APPLICATION NO.		
November 3, 1992	G1-26821		

NAME		
City of Blaine (Department of Public Works)		
ADDRESS/STREET	CITY/STATE	ZIP CODE
1200 Yew Avenue	Blaine, WA	98230-9261

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Groundwater (Well PW-1R)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND (cfs)	MAXIMUM GALLONS PER MINUTE (gpm)	MAXIMUM ACRE FEET PER YEAR (ac-ft/yr)
	450	720

TYPE OF USE & PERIOD OF USE
Municipal supply – continuous

SPECIAL REMARKS

LOCATION OF DIVERSION/WITHDRAWAL

SOURCE	PARCEL	LATITUDE	LONGITUDE	QTR/QTR	SECTION	TOWNSHIP	RANGE
Well PW-1R	400104474340	48.98421	122.68342	NE1/4 SE1/4	4	T40N	R1E

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

The place of use of this water right is the service area described in the Water System Plan approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

Attachment 1 shows the location of the place of use and point of withdrawal.

DESCRIPTION OF PROPOSED WORKS

The City of Blaine project consists of the use of groundwater well PW-1R for municipal water supply to the City of Blaine. The well is located within the City of Blaine Ground Water Management Area (GWMA), a 30-square-mile area in the northwest portion of Whatcom County. Well PW-1R is located on a concrete pad within the southwestern portion of the City of Blaine Watershed. Well PW-1R is constructed to a depth of 733 feet below ground surface (feet bgs) and screened from 706 to 726 feet bgs. The well is 12 inches in diameter with an 8-inch diameter well screen.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE	COMPLETE PROJECT BY THIS DATE	WATER PUT TO FULL USE BY THIS DATE
Already begun	December 31, 2024	December 31, 2029

PROVISIONS

1. Meter Installation
An approved measuring device shall be installed and maintained on the source authorized by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use," WAC 173-173. See http://www.ecy.wa.gov/programs/wr/measuring/measuringhome.html

2. Metering Rule Description And Petition Info
WAC 173-173 describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition the Department of Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document titled "Water Measurement Device Installation and Operation Requirements." See http://www.ecy.wa.gov/programs/wr/measuring/measuringhome.html

3. Record Water Use, Report Annually
Water use data shall be recorded daily. The maximum monthly rate of withdrawal and the monthly total volume shall be submitted to the Department of Ecology by January 31 of each calendar year. Water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/.

4. Authority To Access Project
Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times to the project location, and to inspect at reasonable times, records of water use, the point of withdrawal, the measuring device, and the associated distribution system for compliance with water law.

5. No Impairment of Existing Rights
This authorization to make use of public waters of the state is subject to existing rights, including any existing rights held by the United States for the benefit of Tribes under treaty or settlement.

6. Well Tag
The well shall be tagged with a Department of Ecology unique well identification number. This tag shall remain attached to the well. When submitting water measuring reports, please reference this tag number.

7. Seawater Intrusion
Chloride and conductivity measurements as well as depth to static water level (pump off), measured from the top of the well casing, shall be made in April and August. The chemical analysis shall be performed by a state-accredited laboratory. A copy of the laboratory results for all sampling events and the depth to static water level shall be submitted by January 31 of each year to the Department of Ecology, Northwest Regional Office, Bellevue, Washington. For record keeping, please include the water right number on all copies. If pumping from the well authorized by this water right causes chloride concentrations to show an increasing trend, immediate action shall be required to prevent concentrations from increasing. These actions include, but are not limited to, reducing the instantaneous withdrawal rate (gpm) of the well, lowering the annual quantity removed from the well, altering the pumping cycle, turning off the well, or drilling additional wells. If chloride concentrations continue to increase, even after corrective measures are taken, the permit holder shall relinquish the option to perfect additional allocated quantities regardless of the stage of development.

8. Proof of Appropriation
The City shall file the notice of Proof of Appropriation of water (under which the certificate of water right is issued) when the permanent distribution system has been constructed and the quantity of water required by the project has been put to full beneficial use. The certificate will reflect the extent of the project perfected within the limitations of this report. Elements of a proof inspection may include, as appropriate, the source(s), system instantaneous capacity, beneficial use, annual quantity, place of use, and satisfaction of provisions.

9. Health Approval Required
Prior to any new construction or alterations of a public water supply system, the State Board of Health rules require public water supply owners to obtain written approval from the Office of Drinking Water of the Washington State Department of Health. Please contact the Office of Drinking Water at Northwest Drinking Water Operations, 20435 72nd Avenue S, Suite 200, K17-12, Kent, WA 98032-2358, (253) 396-6750, prior to beginning (or modifying) your project.

FINDINGS OF FACT AND ORDER

Upon reviewing the investigator's report, I find all facts relevant and material to the subject application have been thoroughly investigated. Furthermore, I concur with the investigator that water is available from the source in question, the purpose of use is beneficial, there will be no impairment of existing rights, and there will be no detriment to the public interest.

Therefore, I order APPROVAL of Application No. G1-26821, subject to existing rights and the provisions listed above.

You have a right to appeal this ORDER. To appeal this you must:

- File your appeal with the Pollution Control Hearings Board within 30 days of the "date of receipt" of this document. Filing means actual receipt by the Board during regular office hours.
- Serve your appeal on the Department of Ecology within 30 days of the "date of receipt" of this document. Service may be accomplished by any of the procedures identified in WAC 371-08-305(10). "Date of receipt" is defined at RCW 43.21B.001(2).

Be sure to do the following:

- Include a copy of this document that you are appealing with your Notice of Appeal.
- Serve and file your appeal in paper form; electronic copies are not accepted.

1. To file your appeal with the Pollution Control Hearings Board

Mail appeal to:		Deliver your appeal in person to:
The Pollution Control Hearings Board P.O. Box 40903 Olympia, WA 98504-0903	OR	The Pollution Control Hearings Board 4224 – 6th Ave SE Rowe Six, Building 2 Lacey, WA 98503

2. To serve your appeal on the Department of Ecology

Mail appeal to:		Deliver your appeal in person to:
The Department of Ecology Appeals Coordinator P.O. Box 47608 Olympia, WA 98504-7608	OR	The Department of Ecology Appeals Coordinator 300 Desmond Drive SE Lacey, WA 98503

3. And send a copy of your appeal to:

Jacqueline Klug
Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008

For additional information visit the Environmental Hearings Office Website: http://www.eho.wa.gov. To find laws and agency rules visit the Washington State Legislature Website: http://www1.leg.wa.gov/CodeReviser.

Signed at Bellevue, Washington, this _____ day of _____ , 2010.

_____
Jacqueline Klug
Acting Section Manager
Water Resources Program
Northwest Regional Office

Legal Requirements

Public Notice (RCW 90.03.280)

A public notice of the application must be published in a local newspaper once a week for two consecutive weeks (RCW 90.03.280). Public notice of application G1-26821 was published in *The Westside Record-Journal* during the weeks of March 17 and 24, 1993 (see Attachment 2).

State Environmental Policy Act (SEPA)

The subject water right is categorically exempt under SEPA [WAC 197-11-305 and WAC 197-11-800(4)] because the instantaneous quantity is less than the threshold of 2,250 gallons per minute (gpm).

Consultation with the Department of Fish and Wildlife

The Washington State Department of Fish and Wildlife was notified of this application (RCW 77.57.020). No comments were received.

Determinations

Chapters 90.03 and 90.44 RCW authorize the appropriation of public water for beneficial use and describe the process for obtaining water rights. Laws governing the water right permitting process are contained in RCW 90.03.250 through 90.03.340 and RCW 90.44.050. In accordance with RCW 90.03.290, determinations must be made on the following four criteria in order for an application for water rights to be approved:

- Water must be available;
- There must be no impairment of existing rights;
- The water use must be beneficial; and
- The water use must not be detrimental to the public interest.

Background

Project Description

The City of Blaine (City) filed water right application G1-26821 in cooperation with Birch Bay Water and Sewer District (District) requesting a groundwater right to meet projected future municipal demand. Under the proposed project, groundwater will be withdrawn from well PW-1R, located within the City's GWMA, a 30-square-mile area in the northwest portion of Whatcom County (Attachment 1). Details regarding the requested right are summarized in the table below.

Application	Priority Date	Source	Well #	Depth (ft)	Township	Range	Section	Qi (gpm)	Qa (ac-ft/yr)
G1-26821	11/13/1992	Groundwater	PW-1R	733	40N	1E	4	450	720

A map showing the location of well PW-1R and the proposed place of use is provided in Attachment 1.

This application is one of seven applications submitted by the City and/or District between November 1992 and February 2007 in order to meet municipal supply needs. No applications by the City and District are senior to this application, although City application G1-26820 has the same priority date as G1-26821. Water right applications, existing rights, and associated wells owned by the City and District are summarized on Attachment 3.

Well PW-1R is located approximately 2.4 miles east of the City of Blaine within the City of Blaine Watershed. The Watershed is located within a forested rural area; however, private residences are located adjacent to the watershed boundary. The water right will be used to provide an additional municipal water resource to the City of Blaine.

In a letter dated January 22, 1992, the Lummi Indian Business Council (LIBC) formally protested several applications for water rights, including G1-26821. The LIBC noted that the well for this water right application is located in close proximity to Dakota Creek. According to the LIBC, the stream is significant for fish production and frequently suffers from periods of low discharge that damage these already stressed fishery resources. The LIBC contends that additional withdrawals from wells in hydraulic communication with the stream would further reduce streamflow.

Priority Processing/Cost Reimbursement

This application is being processed by AMEC Geomatrix, Inc. (AMEC), pursuant to a cost-reimbursement agreement with the Department of Ecology. Within the scope of the agreement, the following applications are also being processed.

Owner	Well ID	Application	Priority Date	Depth (ft bgs)	Qi (gpm)	Qa (ac-ft/yr)
City and District Applications						
City	PW-2	G1-26820	11/13/1992	700	200	320
District	PW-2D	G1-28046	8/3/1999	700	500	806
City	PW-5.1	G1-28481	2/21/2007	805	713	793
Other Senior Applications						
Loop	DW-4	G1-27303	9/1/1993	60	15	--
Loomis Trail	IW-3	G1-25958	11/1/1990	526	300	--
Marquis	N/A	G1-25291	8/23/1998	250	200	--

Investigation

The City of Blaine and the Birch Bay Water and Sewer District currently provide municipal water to 13,270 people (AESI, 2008). Of this population, 5,550 are located within the City's service area, 7,350 within Birch Bay Water and Sewer District (District), and 420 in Bell-Bay Jackson Water Association service area.

Attachment 1 provides a map showing locations of wells belonging to the City and District. Attachment 3 provides a list of City wells and existing water rights. Eleven production wells are currently the source of potable water for the City. These wells (PW-1, PW-3R, PW-4, PW-4.1, PW-5, PW-5.1 [an additional point of withdrawal for the water right associated with PW-5], PW-6, PW-7, PW-8, PW-8.1, and PW-9.1) are all located within the city limits and the city watershed. In addition, the City has acquired a water right permit for well PW-9 (G1-26822P), which requires that production well PW-3 be decommissioned.

The City has estimated that the population base of the three combined water systems will approximately double within the next 20 years to 24,000 people (AESI, 2008). Accordingly, the City and District have stated that they are exploring for and developing new groundwater resources located within the City's GWMA. Jointly, the City and District have applied for additional water rights for PW-1R (this application), PW-2 (G1-26820), and newly installed production well PW-5.1 (G1-28481). The District has also separately applied for a water right for production well PW-2D (G1-28046).

Proposed Use

The City filed water right application G1-26821 on November 13, 1993, requesting a groundwater right to withdraw a Qi of 450 gallons per minute (gpm) and a Qa of 720 acre feet per year (ac-ft/yr) to meet projected future municipal demand. Under the proposed project, groundwater will be withdrawn from well PW-1R.

Other Rights Appurtenant to the Place of Use

Senior water rights within the place of use or the same source of water as well PW-1R were identified. A total of 58 certificates, permits, claims, or applications recommended for approval (as part of this cost-reimbursement project) were identified. The areal extent of influence for PW-5.1 and PW-2D are shown on Attachment 1. The radius of influence for PW-1R is expected to lie within that determined for PW-5.1 due to its close proximity to PW-5.1 and the comparatively lower Qi and Qa claimed for PW-1R.

Attachment 3 provides a table of all other rights appurtenant to the place of use belonging to the City or District.

Attachment 4 provides a table of senior certificates, permits, or applications recommended for approval, identified within the potential areal extent of influence of PW-1R and belonging to other parties. Only one senior certificate, belonging to Ivan Welch, was identified. The well for this right is not in the same aquifer as PW-2.

In addition, a total of 29 water right claims were identified within the potential areal extent of influence of well PW-1R. These claims are tabulated in Attachment 5. To the extent feasible, claim owners were contacted in order to identify the location of the well and the source of water associated with the claim, as well as to determine whether the water is in use. Claims confirmed to be active and claims that could not be confirmed as appurtenant to the same source of water as well PW-1R, or that could not be identified as still in use, are indicated on Attachment 5.

Relationship of New and Existing Rights

The right addressed in this Report of Examination will represent a primary water right and will be used as needed, simultaneously with the City's and the District's other existing water rights, to meet demand. The right has been applied for due to the need for additional quantities of water to meet a growth in municipal demand. The 20-year growth projection of the City of Blaine estimates that the number of equivalent residential units (ERUs) in the municipal water supply area will approximately double from 10,085 to 19,225 by 2029. Rights currently held by the City/District (Qa) allow the municipal water system to produce 2,560 ac-ft/yr, meeting the current average daily water demand of 2,130 ac-ft/yr. Based on ERU water use and the City's growth projection, average daily water demand will exceed this capacity in approximately 2015, when demand will exceed 2,600 ac-ft/yr. Additionally, based on currently installed capacity and currently held rights, the City/District can now produce a maximum of 3,050 gpm (Qi). Currently maximum demand in the supply area is 2,641 gpm. This demand is projected to climb to 3,153 gpm by 2014, exceeding installed capacity (Attachment 6).

The City/District applications associated with this cost-reimbursement agreement will enable the City/District to increase municipal supply capacity to a Qa of 3,966 ac-ft/yr and a Qi of 4,500 gpm by 2012. The city has also applied for four additional rights to meet the 20-year projected demand of 4,110 ac-ft/yr and 5,097 gpm by 2029, but those applications are not included in this cost-reimbursement agreement.

The proposed new right has been confirmed to share the same source of water as eight additional existing water rights, including claims and senior applications, in the area. These include all rights belonging to the City and District associated with wells screened in the Deep Aquifer (Attachment 3) and the two active claims confirmed to be associated with wells screened in the Deep Aquifer (Westman Claim G1-115694CL and Goff Claim G1-115337CL) (Attachment 5). The new right may also share the same source of water as an additional 17 senior claims for which the source of water or the continued use of the well could not be confirmed (Attachment 5).

Site Visit

A site visit for well PW-1R was conducted on October 16, 2009. The concrete pad for PW-1R is located adjacent to one of the gravel roads located within the Blaine Watershed. Photographs of the well and the concrete pad are provided in Attachment 7.

Hydrologic/Hydrogeologic Evaluation

Information in this section on regional and local geology is summarized primarily from AESI, 2008. Hydrologic and hydrogeologic information in this section is summarized from various consultant reports (Shannon and Wilson, 1975; EMCON, 1995; Golder, 1992, 1995, 1996, 1998; GeoEngineers, 2000, 2001; Piteau Associates Engineering, Ltd., 2000; and AESI, 2008).

Regional Geology

The GWMA is located in the area known as the Fraser-Whatcom Lowlands, which represent the landward extension of the Georgia Basin. The Fraser-Whatcom Lowlands are located within the transborder region of the United States and Canada and are bounded by the Coast Mountains in British Columbia, the Cascade Mountains, and the Strait of Georgia. The geologic depression of the Georgia Basin developed beginning in the late Mesozoic in response to tectonic activity, which formed mountain ranges (such as the Cascade and Coast ranges) separated by basins (such as the Georgia Basin). Large volumes of sediment derived from mountain erosion were deposited in the basins and subsequently lithified to form the Eocene-age Chuckanut and Huntington Formations, which form the bedrock in much of the area.

Pleistocene glaciation subsequently eroded and modified this bedrock surface, forming hills and valleys, including a major structural trough trending generally north-south and located beneath the GWMA. This structural trough is over 1,100 feet deep near Blaine. Over the last 1.8 million years, the trough has been filled by marine, glacial, and nonglacial sediments associated with Quaternary glacial and nonglacial events. Glacial advance and retreat have resulted in isostatic adjustments in land surface and fluctuations of shoreline elevation by as much as 650 feet.

Marine invasions resulting from these fluctuations led to the deposition of Quaternary marine, glaciomarine, and deltaic sediment in complex association with glacial, glaciofluvial, and ice contact sediments.

Topography of the Fraser-Whatcom Lowlands is dominated by gently rolling upland (such as the Boundary Upland) separated by relatively flat-bottomed valleys. The Fraser River is the primary surface drainage. Additional drainages include the Campbell, Nicomekl, and Serpentine Rivers in Canada and the Nooksack and Sumas Rivers in Whatcom County.

Local Geology

Depth to bedrock varies from 300 to 400 feet bgs near the southwest portion of the GWMA, to greater than 1,100 feet bgs near the United States/Canada border. Well PW-1R and six deep City and District water supply wells (PW-1, PW-2, PW-3R, PW-5.1, PW-8.1, and PW-2D) were drilled to depths ranging from 700 to 858 feet bgs, and none encountered bedrock.

The GWMA is underlain by several hundred feet of Quaternary glacial and nonglacial sediments deposited during the last 1.8 million years, including Sumas glacial deposits, Everson interglacial deposits, Vashon glacial deposits, Olympia nonglacial deposits, and older undifferentiated glacial and nonglacial deposits. Starting at ground surface, these deposits consist of the following.

- Sumas Glacial Outwash (Qgos). This deposit consists of a thin layer of glacial outwash, composed of loose, moderately to well-sorted sand and gravel with some silt. The outwash is generally a few tens of feet thick in the GWMA but may be deeper toward the eastern portion of the Boundary Upland.
- Sumas Glacial Outwash / Everson Emergence (beach) deposits (Qgo/Qgomee). These deposits consist of loose, moderately to well-sorted gravel and sand with local boulders. They are generally less than 25 feet thick.
- Everson Glaciomarine Drift (Qgdme). These deposits consist of glaciomarine drift, a low-permeability deposit composed of an unsorted mixture of blue-gray, fossiliferous, pebbly silt and clay with till-like mixtures; marine clay; deltaic sand and gravel; and fluvial clay, silt, sand, and gravel.
- Vashon Glacial Till/Vashon Advance Outwash (Qgt/Qga). These deposits are grouped based on provenance as follows:
  - Vashon Glacial Till: These sediments consist of lodgement till, a complex mixture of sand, gravel, and silt deposited at the base of the advancing Vashon ice sheet.
  - Vashon Advance Outwash: These sediments consist of silt, fine sand, and clay, which were deposited in proglacial, fluvial (river or stream) and lacustrine (lake) environments.
- Olympia Nonglacial deposits (Qco). These deposits, interpreted to have been deposited in a meandering river environment, may be more than 200 feet thick below the GWMA. They are grouped based on grain size and texture as follows:
  - Coarse grained: These sediments appear to consist of relatively permeable sand and silty sand with some lenses of gravel and silt.
  - Fine grained: These sediments appear to consist of a relatively thick sequence of low-permeability silt and silty sand with lenses of fine sand.
- Older Undifferentiated glacial and nonglacial deposits (Qo). These deposits, considered effectively one unit by AESI (2008), consist of marine sediments, glacial deposits of the Double Bluff and Possession glacial events, nonglacial Whidbey Formation sediments, and older glacial/nonglacial sediments. They consist of sand, gravel, silty till, and some silt, clay, and peat.
- Bedrock (B). Bedrock in the area is expected to consist of the Eocene-age Chuckanut and Huntington Formations. Throughout most of the area, depth to bedrock is generally several hundred to more than 1,000 feet bgs.

The coarse-grained Sumas Glacial Outwash/Everson Emergence (Qgos/Qgomee), Vashon Glacial Till/Vashon Advance Outwash (Qgt/Qga), Olympia Nonglacial (Qco) (coarse grained), and Older Undifferentiated glacial and nonglacial (Qo) deposits form the principal aquifers beneath the GWMA, although the Sumas Glacial Outwash/Everson Emergence deposits are generally too thin and discontinuous to be considered significant aquifers for more than household use. The Everson Glaciomarine Drift (Qgdme) and Olympia Nonglacial (Qco) (Fine grained) deposits form aquitards between the coarse-grained aquifer deposits.

Groundwater Occurrence and Flow

Well PW-1R is located in an area of the Fraser-Whatcom Lowlands that includes the Blaine Watershed and the City's GWMA. The region is underlain by three major water-bearing units, which are identified as the Perched, Intermediate, and Deep Aquifer Systems.

- **Perched Aquifer:** This system is found predominantly within Sumas Glacial Outwash (Qgos) and Everson Beach Deposits (Qgomee) located beneath the Boundary Upland. Perched conditions have developed due to underlying low-permeability sediments associated with the Everson Glaciomarine Drift deposit (Qgdme). Water-bearing zones within the overlying outwash and beach deposits generally possess low to moderate permeability but may adequately provide water for domestic purposes. Shallow groundwater infiltration due to precipitation is the primary source of recharge to the perched system.
- **Intermediate Aquifer:** This system is located from approximately 50 to 250 feet above mean sea level (MSL) within permeable layers of the Vashon Glacial (Qgt/Qga) and Olympia Nonglacial deposits (Qco) and is a major water supply source for many wells in the area. These deposits may thin and occur only intermittently with increasing distance from the Boundary Upland. The Intermediate Aquifer is separated from the Perched Aquifer by the Everson Glaciomarine Drift deposit (Qgdme) except near the Canadian border, where the drift deposits may be absent. Consequently, the aquifer is considered semiconfined. The base of the Intermediate Aquifer coincides with low-permeability Olympia Nonglacial sediments (Qco). Recharge to the Intermediate Aquifer occurs in the Boundary Upland through vertical infiltration of precipitation as well as vertical percolation from the overlying Perched Aquifer. Groundwater in the Intermediate Aquifer flows in a radial direction away from the Boundary Upland and ultimately discharges to seawater. Other secondary discharge points may include wells and Dakota Creek at lower ground surface elevations.
- **Deep Aquifer**: This system is located in permeable sediments of older, undifferentiated glacial and nonglacial deposits from approximately 200 to 300 feet below MSL. Regionally, the aquifer likely extends to the north and northeast into Canada and to the south and southwest beneath Drayton Harbor and Birch Bay. The Deep Aquifer is overlain by approximately 100 to 300 feet of lower permeability Olympia Nonglacial sediments, which separate the Intermediate and Deep Aquifer systems. Some wells screened within the Deep Aquifer and located at lower elevations, such as valley floors, are flowing artesian wells (AESI, 2008). In the southwestern portions of the project area, the overlying confining Olympia Nonglacial sediments may be thinner, such that the Deep Aquifer becomes semiconfined and communicates with the overlying Intermediate Aquifer. Recharge to the Deep Aquifer likely occurs north of the United States/Canada border in the highland areas of British Columbia, Canada. Groundwater in the Deep Aquifer flows to the southwest beneath the study area and likely discharges to seawater in the Strait of Georgia.

Well PW-1R is screened in the Deep Aquifer from 706 to 728 feet bgs (519 to 539 feet below MSL).

Impairment Considerations

It is expected that new withdrawals by the applicants related to well PW-1R would be dominantly from the Qo deposits, also referred to as the Deep Aquifer. Available data for the Deep Aquifer, including results of aquifer pump tests and groundwater chemical data analyses, were reviewed to quantify hydrogeologic properties that can be used to address possible impacts on water resources or impairment of other rights.

Hydrogeologic Properties

Longer duration pump tests conducted for wells located in the study area indicate that the transmissivity of the Deep Aquifer ranges from approximately 1,000 square feet per day (feet^2/day) to 5,500 feet^2/day (AESI, 2008). Storativity values calculated from pump test data range from 0.00049 to 0.005. In confined aquifers, storativity values generally range from 0.001 to 0.00001 (Schwartz and Zhang, 2003), indicating that the Deep Aquifer generally behaves as a confined unit but may possess areas where the overlying aquitard is discontinuous or leaky. Groundwater chemical data (discussed below) also suggest separation between the Deep and Intermediate Aquifers in the area of PW-1R.

Area of Influence

To determine the area of influence for wells associated with the City's application, a 24-hour constant-rate pump test was conducted at well PW-5.1 by AESI in 2007. Results of the pump test suggest that the radius of influence associated with a groundwater extraction rate of 1,260 gpm from the Deep Aquifer would cover a distance of roughly 6,000 feet (AESI, 2007b). This area of influence is depicted in Attachment 1. The radius of influence for PW-1R is anticipated to be less than the distance determined for PW-5.1 due to the comparatively lower Qi (450 gpm) claimed for PW-1R.

A summary of anticipated water level drawdown due to pumping and well interference effects is presented in Attachment 8. Total water level drawdown resulting from a groundwater extraction rate of 450 gpm at PW-1R, including interference effects from wells PW-2, PW-3R, and PW-5.1, is approximately 328 feet (AESI, 2008). Pumping from PW-1R is anticipated to result in additional drawdown of 40 feet, 30 feet, and 5 feet in wells PW-2, PW-3R, and PW-5.1, respectively. The remaining height of the water column above the screen intervals in PW-2,

PW-3R, and PW-5.1 would be roughly 382, 237, and 274 feet, respectively (AESI, 2008). Because these estimates are based upon a one-day pump test, the magnitude of drawdown would likely be greater in both the extraction well and surrounding wells after longer periods of pumping.

The proposed pumping associated with well PW-1R is not expected to cause adverse well interference effects in wells screened within the overlying Intermediate Aquifer. In the area of PW-1R, the Deep Aquifer is isolated from the overlaying aquifer units by a thick sequence of relatively impermeable silts and clays associated with fine-grained Qco deposits. Lithologic descriptions from borings in the vicinity of PW-1R suggest the confining unit is overlain by several hundred feet of lower permeability silts and clay. Additionally, for wells in the Blaine watershed, groundwater chemistry of samples collected in the Deep Aquifer differs from chemistry of samples from the Intermediate Aquifer, suggesting hydraulic separation (see below).

Water Quality

Geochemical characteristics of groundwater located beneath the GWMA have been investigated extensively in studies by AESI (2007a, 2007b), GeoEngineers (2000, 2001), EMCON (1995), and Golder (1992, 1995, 1996 and 1998). A Technical Report by AESI (2008) provides a summary of prior studies.

The three aquifers underlying the GWMA present distinct ion chemistry signatures in the area of PW-1R (summarized by AESI, 2008).

- Perched aquifer: Water chemistry in the Perched Aquifer (obtained from a well installed 23 feet bgs) is classified as a bicarbonate type without a dominant cation.
- Intermediate aquifer: Water chemistry in the Intermediate Aquifer (obtained from 20 wells with depths ranging from 70 feet bgs to 303 feet bgs) is classified as a bicarbonate type with a slight trend toward calcium as a dominant cation. Water in this aquifer differs from water in the Perched Aquifer by having lower chloride content and higher calcium content.
- Deep aquifer: Water chemistry in the Deep Aquifer (obtained from seven wells screened from 530 feet bgs to 858 feet bgs) is classified as a sodium bicarbonate type. More variability in water composition is observed in the Deep Aquifer wells than in the Intermediate Aquifer wells.

The differences in groundwater ion chemistry signatures between the aquifers at and near the location of PW-1R suggest that little hydraulic communication exists between them. This conclusion is supported by the presence of a thick layer of low-permeability sediments expected to be present between the aquifers.

However, near the southwestern portion of the GWMA, similarity in water chemistry was observed between a well screened in the Intermediate Aquifer (the Loop well; also referred to as DW-4) and deep District well PW-2D. Following a pump test conducted on well PW-2D, GeoEngineers (2001) also estimated that 2 feet of drawdown would occur in the Loop well during long-term operation of well PW-2D. This similarity in chemistry coupled with pump test results indicates that some hydraulic connectivity is present between the deep and Intermediate Aquifers in the southwestern area of the GWMA. The low-permeability Qco sediments may be thinner in this area and create semiconfined conditions in the Deep Aquifer.

Surface Water Influence

Surface waters in the area (Dakota Creek and California Creek) are considered to be administratively closed (see WAC 173-501) to further withdrawals above the tidally influenced zone (determined to be the reaches of the creek lower than 3.34 feet above MSL). Golder Associates determined the location of the point of closure for Dakota Creek by surveying the creek bed (Golder, 1995). This point lies upstream of the potential zone of influence for well PW-1R. To determine the point of closure of California Creek, AESI conducted a study on behalf of the City and District for the purposes of this Report of Examination (ROE). AESI's (2009) report is included as Attachment 9. The point of closure determined by the study also lies upstream of the potential zone of influence of well PW-1R. No impact to Dakota Creek or California Creek in administratively closed areas is therefore anticipated from the operation of well PW-1R.

During the water right application process by the City and District for well PW-1R, the Lummi Indian Business Council had expressed concerns that PW-1R could capture recharge to the lower reaches of Dakota Creek below the zone of administrative closure, potentially causing impacts to fish habitat. Significant hydraulic connectivity, however, between surface waters and the Deep Aquifer in the area of PW-1R is considered unlikely due to multiple confining units separating these hydrologic bodies.

Potential for Impairment

Pump tests of well PW-5.1 suggest that significant water level drawdown may occur within the Deep Aquifer at and near the location of well PW-1R. However, many hundreds of feet of drawdown are available in this aquifer, and pump tests suggest that approximately 258 feet of drawdown would remain available in the Deep Aquifer following withdrawals.

Withdrawals from PW-1R are therefore not expected to interrupt or interfere with the availability of water to an adequately constructed groundwater withdrawal facility of an existing right. An adequately constructed groundwater withdrawal facility is one that (a) is constructed in compliance with well construction requirements and (b) fully penetrates the saturated zone of an aquifer or withdraws water from a reasonable and feasible pumping lift.

No impact to surface waters, including Dakota Creek and California Creek, in administratively closed areas is thus expected from operation of this well (see previous section).

In a letter dated January 22, 1992, sent to Ecology, the Lummi Indian Business Council expressed concerns that groundwater withdrawals could affect treaty-related resources including impacts to surface water flow within the associated watershed. Hydraulic connectivity between surface waters and the Deep Aquifer is considered unlikely since multiple confining units separate these hydrologic bodies.

Because well PW-1R is screened within a few miles of the seawater bodies of Birch Bay and Drayton Harbor at an elevation below sea level, a potential for seawater intrusion is present. Water quality was reviewed by AESI (2008) for City wells PW-1, PW-1R, PW-2, PW-3R, and PW-5.1 and for District well PW-2D. The data indicate that chloride concentrations in the Deep Aquifer range from about 10 milligrams per liter (mg/L) to 50 mg/L, with an average of 20-30 mg/L. Ecology typically rates the risk of seawater intrusion based on the chloride concentration of the groundwater: groundwater with chloride concentration of 0-100 mg/L is considered to be at low risk, 101-200 mg/L is considered to be medium risk, and above 200 mg/L is considered to be high risk (Jerry Liszak, 2009, personal communication). No seawater intrusion problem appears to be ongoing at these wells as a result of pumping.

No other potential for degradation of the quality of source water was identified at well PW-1R.

Water Availability

In assessing water availability for appropriation, this report distinguishes between physical and legal water availability**.**

Physical availability

Total available drawdown in the Deep Aquifer at well PW-1R has been identified as 586 feet (AESI, 2008; Attachment 8). The total anticipated drawdown during operation of this well, including interference effects from wells PW-2, PW-3R, and PW-5.1 is 328 feet, leaving 258 feet of drawdown still available at the location of PW-1R. Water is therefore considered physically available for appropriation at this location.

Legal availability

Water to be captured by well PW-1R would naturally discharge to the salt water of Drayton Harbor. No impact to surface (fresh) water, including Dakota Creek and California Creek, in administratively closed areas is expected to occur from operation of this well. Therefore, water is legally available for appropriation.

Public Interest Considerations

RCW 90.03.290 requires that a proposed appropriation not be detrimental to the public interest. It is not necessary that an application advance the public interest, but it cannot be adverse to it. While the public interest is not explicitly defined in statute, various statutes contain expressions of the public interest and constitute factors that are suitable for consideration in determining whether there would be detriment to the public interest.

The following considerations were examined during this investigation.

- No seawater intrusion is anticipated due to operation of PW-1R. Chloride concentrations within this well have been identified at levels considered to correspond to a low risk for seawater intrusion by the Department of Ecology. Although, biannual monitoring and reporting will be required.
- No impacts to water quality parameters, including temperature, are anticipated in hydraulically connected surface water. The Deep Aquifer is separated from overlying aquifers and surface flow by a confining layer several hundred feet thick. Similarly, no impacts to perennial base flows, closed stream reaches, aquatic habitat, recreation, or navigation uses are anticipated.
- The use of water by the City and District are anticipated to result in a beneficial impact to the public interest regarding population growth, economic development, and human health by promoting the regional public supply system and providing additional domestic water supply.
- The use is considered consistent with water resource fundamental principles of Chapter 90.54 RCW.

Mitigation

No mitigation plans were developed or identified as needed to avoid detrimental impacts to the public interest or impairment of existing water rights.

Consideration of Protests and Comments

In response to the PW-1R water right application process, the Lummi Indian Business Council (LIBC) submitted a letter of protest. The LIBC expressed concern that PW-1R could capture recharge to the lower reaches of Dakota Creek and California Creek below the zone of administrative closure, potentially causing impacts to treaty-reserved resources. Ecology responded to the LIBC stating that the protest against the PW-1R water right application had been acknowledged and made a matter of public record.

Based on a review of available hydrologic datasets, significant hydraulic connectivity between surface waters and the Deep Aquifer in the area of PW-1R is considered unlikely due to multiple confining units separating these hydrologic bodies. Therefore, the scenario suggested by LIBC is considered improbable given evidence of hydraulic separation between the Deep Aquifer and surficial water bodies.

Conclusions

In accordance with RCW 90.03.290, determinations have been made and are summarized below on the four criteria for a water right application to be approved.

Water must be available

Water for this water right is considered to be physically available, as sufficient drawdown is present in the Deep Aquifer in which well PW-1R will be screened to supply both the requested withdrawal quantity and for withdrawals associated with senior rights located in the Deep Aquifer. Based on pump tests, a minimum of approximately 258 feet of drawdown is expected to remain available within the aquifer.

No legal constraints to the use of water by this right were identified, and the water is considered legally available.

There must be no impairment of existing rights

Due to sufficient drawdown available within the Deep Aquifer, withdrawals from PW-1R are not expected to interrupt or interfere with the availability of water to an adequately constructed groundwater withdrawal facility of an existing right.

The water use must be beneficial

Municipal water supply is considered a beneficial use in accordance with RCW 90.54.020.

The water use must not be detrimental to the public interest

No considerations that are detrimental to the public interest were identified for the proposed use of well PW-1R.

Recommendations

Based on the above investigation and conclusions, I recommend application G1-26821 be approved in the amounts and within the limitations listed below and subject to the provisions noted on page 2.

Purpose of Use and Authorized Quantities

The amount of water recommended is a maximum limit, and the water user may only use that amount of water within the specified limit that is reasonable and beneficial:

- 450 gpm
- 720 acre-feet per year
- municipal supply

Point of Withdrawal

NE¼ SE¼, Section 4, Township 40N, Range 1 E, W.M.

Place of Use

As described on Page 1 of this Report of Examination.

Report by: _____

Dave Haddock, LG, LHG
AMEC Geomatrix

_____ _____

Date Licensed Geologist/Hydrogeologist No. 1790

Reviewed by: _____

Buck Smith, LG, LHG
Department of Ecology
Water Resources Program

_____ _____

Date Licensed Geologist/Hydrogeologist No. 1479

If you need this publication in an alternate format, please call the Water Resources Program at 425- 649-7000. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

References

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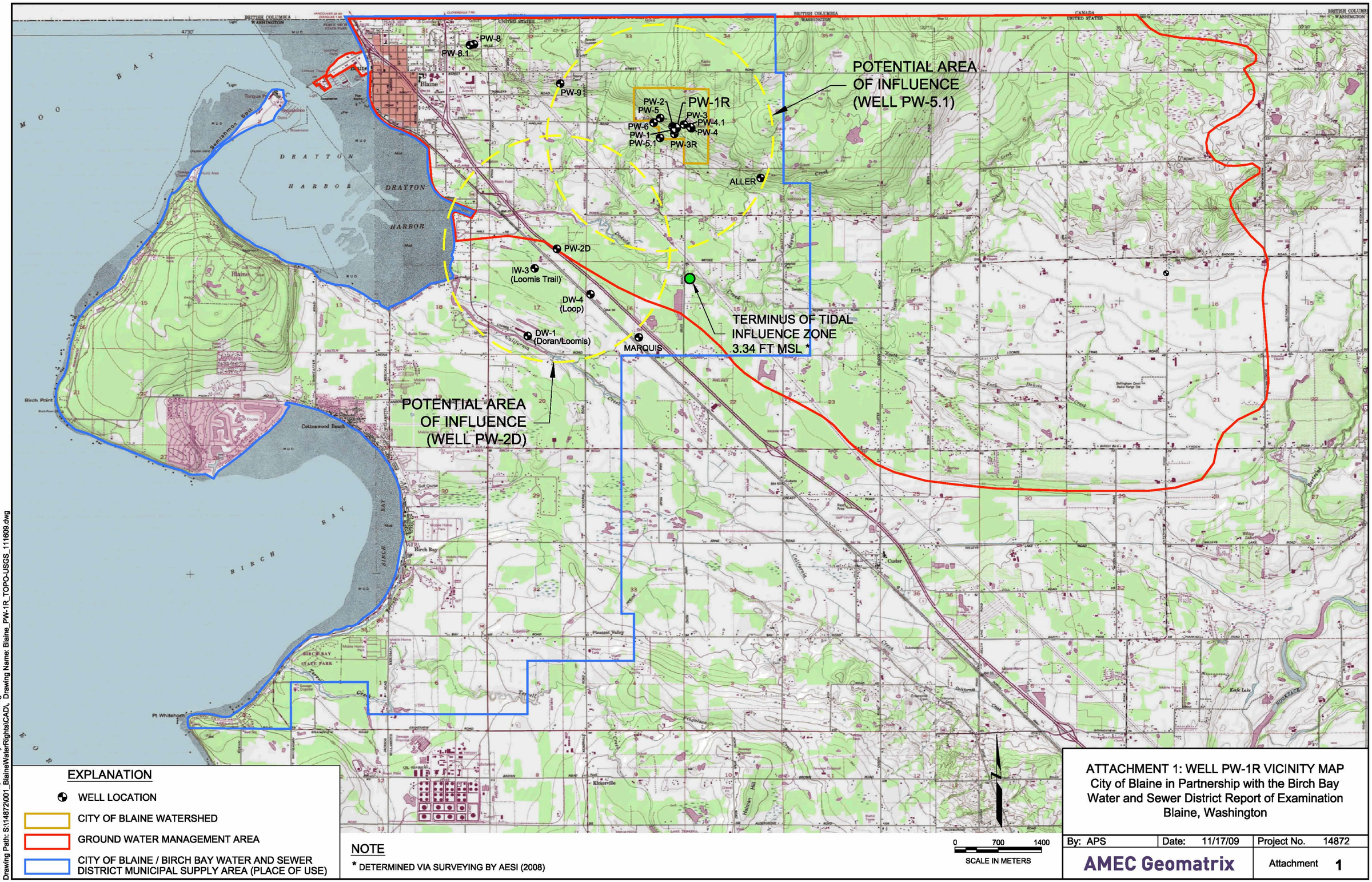

POTENTIAL AREA OF INFLUENCE (WELL PW-5.1)
PW-8
PW-8.1
PW-9
PW-2
PW-5
PW-1R
PW-3
PW-4.1
PW-6
PW-4
PW-1
PW-5.1
PW-3R
ALLER
PW-2D
IW-3 (Loomis Trail)
DW-4 (Loop)
DW-1 (Doran/Loomis)
MARQUIS
TERMINUS OF TIDAL INFLUENCE ZONE 3.34 FT MSL *
POTENTIAL AREA OF INFLUENCE (WELL PW-2D)
DRAYTON HARBOR
BIRCH BAY
Blaine
Birch Point
Cottonwood Beach
Birch Bay
Pt. Whitehorn
Pleasant Valley
Custer
Kickerville
EXPLANATION
WELL LOCATION
CITY OF BLAINE WATERSHED
GROUND WATER MANAGEMENT AREA
CITY OF BLAINE / BIRCH BAY WATER AND SEWER DISTRICT MUNICIPAL SUPPLY AREA (PLACE OF USE)
NOTE
* DETERMINED VIA SURVEYING BY AESI (2008)
0 700 1400
SCALE IN METERS
ATTACHMENT 1: WELL PW-1R VICINITY MAP
City of Blaine in Partnership with the Birch Bay Water and Sewer District Report of Examination
Blaine, Washington
By: APS
Date: 11/17/09
Project No. 14872
AMEC Geomatrix
Attachment 1
Plot Date: 11/17/09 - 9:30am. Plotted by: adam.stenberg
Drawing Path: S:\14872\001_BlaineWaterRights\CAD\, Drawing Name: Blaine_PW-1R_TOPO-USGS_111609.dwg

ATTACHMENT 2

Public Notice Documentation

AFFIDAVIT OF PUBLICATION

RECEIVED
APR 14 1993
DEPT. OF ECOLOGY

NOTICE OF APPLICATION
TO APPROPRIATE
PUBLIC WATERS

TAKE NOTICE:

That CITY OF BLAINE of BLAINE, WASHINGTON on 11-13-92 under Application No. G1-26821 filed for permit to appropriate public waters, subject to existing rights, from WELL NO 1 in the amount of 450 GALLONS PER MINUTE each year, for MUNICIPAL SUPPLY - YEAR AROUND AS NEEDED.

The source of the proposed appropriation is located within NE1/4 SE1/4 of Section 4, Township 40 N., Range 1E W.M., in WHATCOM, County.

Protests or Objections to approval of this application must include a detailed statement of the basis for objections: protests must be accompanied by a two dollar ($2.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from March 24, 1993.

Department of Ecology
Northwest Regional Office;
3190 - 160TH SE;
Bellevue, WA 98008
Published Mar. 17 & 24, 1993
(B669).

HH:2 OK
4/23/93 SB

STATE OF WASHINGTON,
COUNTY OF WHATCOM

Elaine M. Westhoff, being first sworn on oath, disposes and says that she/he is the principal clerk of THE WESTSIDE RECORD-JOURNAL, a weekly newspaper in the county of Whatcom, state of Washington. That said newspaper is a legal newspaper and has been approved as a legal newspaper by order of the Superior Court in the county in which it is published and it is now and has been for more than six months prior to the date of the publications hereinafter referred to, published in the English language continually as a weekly newspaper in Whatcom County, Washington, and it is now and during all of said time was printed in an office maintained at the aforesaid place of publication of said newspaper.

That the annexed is a true copy of a legal notice as it was published in regular issues (and not in supplement form)

of said newspaper once each week for a period of 2 consecutive weeks, commencing on the

17th day of March, 19 93, and ending on the

24th day of March, 19 93, both dates inclusive, and that such newspaper was regularly distributed to its paid subscribers during all of said period. That the full amount of the fee charged for the foregoing publication is the sum of $ 83.20 which amount has been paid in full, at the rate of $ 10.40 per column inch.

Elaine M. Westhoff

Subscribed and sworn to before me this 2nd day of April, 19 93

Thomas L. George
Notary Public in and for the State of Washington, residing at Ferndale.

Westside
RECORD-JOURNAL
P. O. Box 38, Ferndale, WA 98248
(206) 384-1411 / (206) 671-9083
(FAX same as above numbers)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

NOTICE OF APPLICATION TO APPROPRIATE PUBLIC WATERS

TAKE NOTICE:

That CITY OF BLAINE

of BLAINE, WASHINGTON on 11-13-92 under

Application No. G1-26821 filed for permit to appropriate public waters, subject to existing rights,

from WELL NO. 1

in the amount of 450 GALLONS PER MINUTE

each year, for MUNICIPAL SUPPLY - YEAR ROUND AS NEEDED

The source of the proposed appropriation is located within NE¼ SE¼

of Section 4, Township 40 N., Range 1EWM W.M., in WHATCOM County.

Protests or objections to approval of this application must include a detailed statement of the basis for objections; protests must be accompanied by a two dollar ($2.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from

(Last date of publication to be entered above by publisher)

Department of Ecology
Northwest Regional Office;
3190 - 160th SE;
Bellevue, WA 98008

NOTICE

ECY 040-1-1
Rev. 2-79

ATTACHMENT 3

SENIOR WATER RIGHTS APPURTENANT TO THE PLACE OF USE, CITY/DISTRICT

City of Blaine in Partnership with Birch Bay Water and Sewer District Report of Examination
Blaine, Washington

Owner [1]	Well ID	Claim	Certificate	Permit	Application	Priority Date	Depth (ft bgs)	Aquifer	Qi (gpm)	Qa (ac-ft/yr)	Additional Information
City	PW-1	300037	--	--	--	1926	746	D	800	1,290	Originally drilled in 1926, redrilled in 1992, city has filed a claim for a vested right.
City	PW-1R	--	--	--	G1-26821	11/1992	733	D	450	720	--
City	PW-2	--	--	--	G1-26820	11/1992	700	D	200	320	--
City	PW-3	(2)	(2)	(2)	(2)	(2)	75	I	(2)	(2)	Has well casing problem, currently pumping 210 gpm.
City	PW-3R		3912-A	4815		12/1958	858	D	500	800	--
City	PW-4	--	5315-A	7252	--	5/1965	98	I	400	640	*Qa supplemental to existing rights, limits total system Qa to 2240 afy.*
City	PW-4.1						108	I			
City	PW-5	--	G1-22483C	G1-22483P	--	4/1975	320	I	450	726	**Qa totally supplemental to existing rights.*
City	PW-5.1	--					820	D			
City	PW-5.1	--	--	--	G1-28481	2/21/2007	820	D	1,100	850	--
City	PW-6	(3)	(3)	(3)	(3)	(3)	261	I	(3)	(3)	--
City	PW-7	--	5917-A	1861	--	7/1951	247	I	320	448	Used for peaking purposes only, has H2S, iron and manganese problems.
City	PW-8	--	6916-A	9714	--	5/1969	200	I	300	288	Currently has a plugged screen, capable of producing 300 gpm, **Qa supplemental.*
City	PW-8.1						760 [4]	I			
City	PW-9	--	--	G1-26822P	--	11/1992	303	I	200	320	--
District	PW-2D	--	--	--	G1-28046	8/1999	700	D	500	806	--

Notes
1. City = City of Blaine; District = Birch Bay Sewer and Water District.
2. Replaced by well 3R. Well PW-3 is planned to be decommissioned.
3. PW-6 is an exempt well.
4. Indicates total depth of boring. Final screen was installed at a depth of 280 feet bgs, with steel casing and bentonite grout installed in deeper portions of boring (Associated Earth Sciences, Inc., 2007a, Installation and Testing of Production Well 8.1, prepared for City of Blaine Public Works Department and Birch Bay Water and Sewer District, October 24).

Abbreviations

ac-ft/yr = acre feet per year
D = Deep Aquifer
ft bgs = feet below ground surface
gpm = gallons per minute
I = Intermediate Aquifer
Qa = Annual withdrawal
Qi = Instantaneous withdrawal

ATTACHMENT 4

RELEVANT WATER RIGHT CERTIFICATES AND APPLICATIONS

City of Blaine in Partnership with Birch Bay Water and Sewer District Report of Examination
Blaine, Washington

Owner	Well ID	Certificate/ Application	Priority Date	Depth (ft bgs)	Aquifer	Qi gpm	Qa ac-ft/yr
Ivan W. Welch	--	G1-*08985CWRIS	10/2/1967	85	I	10	1

Abbreviations
-- = Not specified
ac-ft/yr = acre-feet per year
ft bgs = feet below ground surface
gpm = gallons per minute
I = Intermediate Aquifer
Qa = Annual withdrawal (requested)
Qi = Instantaneous withdrawal (requested)

ATTACHMENT 5

RELEVANT WATER RIGHT CLAIMS

City of Blaine in Partnership with Birch Bay Water and Sewer District Report of Examination
Blaine, Washington

Claim	Owner	Date of Filing	Initial Use	Depth (ft bgs)	Aquifer	Township/ Range/Section	Qi (gpm)	Qa (acre-ft/yr)
Active								
G1-159968CL	MUTCH JAMES P [1]	4/5/1974	--	17	Perched	40.0N 01.0E 09	E	E
G1-135094CL	HELMS CHARLES L [2]	6/26/1974	--	30-40	Intermediate	40.0N 01.0E 04	13	2
G1-115694CL	WESTMAN GAY & WESTMAN	6/10/1974	1917	700	Deep	40.0N 01.0E 08	10	10
G1-115337CL	GOFF WILLIAM L	6/17/1974	--	358	Deep	40.0N 01.0E 04	E	E
G1-088465CL	NELSON GERALD L. [3]	5/6/1974	--	128	Intermediate	40.0N 01.0E 03	E	E
G1-159047CL	LEER EMMETT A & HILDA	6/21/1974	--	23	Perched	41.0N 01.0E 33	E	E
Unconfirmed [4]								
G1-163297CL	WOLTEN DAVID E	6/27/1974	1936	--	--	40.0N 01.0E 10	20	none
G1-158327CL	KENISON MABEL	6/28/1974	--	--	--	40.0N 01.0E 08	100 per well	E
G1-146190CL	SCHMIDT HAROLD M & LOIS	6/28/1974	--	--	--	40.0N 01.0E 03	E	E
G1-138712CL	FOWNES WILLIAM J /FOWNES CONSTRUCTION CO, LTD	5/29/1974	--	44	Intermediate	40.0N 01.0E 03	E	E
G1-123655CL	STADSVOLD THORNALD W & MARGARET B.	6/27/1974	--	--	--	40.0N 01.0E 09	E	E
G1-123651CL	LINDBERG CARL	5/4/1974	--	--	--	40.0N 01.0E 05	E	E
G1-107866CL	ANTHONY GORDON & JOYCE [5]	6/20/1974	--	--	--	40.0N 01.0E 10	E	E
G1-096038CL	LEIGHTON JOHN A	6/4/1974	--	--	--	40.0N 01.0E 10	E	E
G1-072538CL	RICHARDSON WELDON H. [6]	3/16/1974	--	--	--	40.0N 01.0E 04	E	E
G1-072394CL	PENDLETON GORDON					40.0N 01.0E 10	E	E
G1-064654CL	SCHULTZ EMIL S.	2/20/1974	--	--	--	40.0N 01.0E 09	E	E
G1-059533CL	MARTIN ROBERT D. & DOROTHY P.	2/4/1974	--	--	--	40.0N 01.0E 09	E	E
G1-053273CL	HINDERLIE DONALD M.	1/2/1974	1881	--	--	40.0N 01.0E 03	9	1
G1-042067CL	SEIMEARS WORTH	10/4/1973	--	--	--	40.0N 01.0E 09	E	E
G1-040682CL	SEIMEARS JESSE L.	9/6/1973	--	--	--	40.0N 01.0E 09	E	E
G1-034727CL	EDEN GEORGE H.	8/5/1973	--	--	--	40.0N 01.0E 04	E	E
G1-027667CL	SEIMEARS WORTH	4/19/1973	1930	--	--	40.0N 01.0E 09	10	10
G1-027228CL	ABSHIRE D. LESLIE	4/15/1973	--	--	--	40.0N 01.0E 09	6	2 (or 50,000 gall)
G1-082134CL	MORINO E. JOE & ALICE	4/3/1974	--	--	--	41.0N 01.0E 33	E	E

ATTACHMENT 5

RELEVANT WATER RIGHT CLAIMS

City of Blaine in Partnership with Birch Bay Water and Sewer District Report of Examination
Blaine, Washington

Claim	Owner	Date of Filing	Initial Use	Depth (ft bgs)	Aquifer	Township/ Range/Section	Qi (gpm)	Qa (acre-ft/yr)
Not Active / Not Valid								
G1-163295CL	WOLTEN DAVID E [7]	6/27/1974	3/1975	--	--	40.0N 01.0E 08	25	2
G1-053272CL	HINDERLIE DONALD M. [7]	1/2/1974	1973	--	--	40.0N 01.0E 03	9	1
G1-046464CL	BETTELLI JOE L. [8]	10/15/1973	--	--	--	40.0N 01.0E 05	E	E
G1-000710CL	GORZE MAYNARD A. [7,9]	7/6/1970	1970	--	--	40.0N 01.0E 09	5	2

Notes
1. This property was sold to the Eastman family. The Eastmans were contacted and confirmed that the right is in use.
2. This property was sold to Jacqueline M. Goodsir. Ms. Goodsir was contacted and confirmed that the right is in use.
3. This property was sold to James F. and Patricia Myers. The Myers were contacted and confirmed that the right is in use.
4. Except where otherwise noted, these claim owners could not be located to confirm well depth, location, and continued use.
5. Mr. Gordon indicated that this right is jointly owned by Bruce Mosher. Mr. Mosher could not be reached to confirm well details.
6. Mr. Richardson indicated that the property and claim were sold and that he is unaware of the current owner. The current owner could not be located.
7. Claim must have been put to initial use prior to 1945 in order to be considered a vested right.
8. This property was sold to Bruce K. and Patricia Vezzeti. The Vezzetis were contacted and indicated that they are unaware of any well located on the property and that the right is not in use.
9. Mr. Gorze indicated that this property and claim were sold to William Church. Mr. Church did not respond to contact attempts.

Abbreviations
-- = Not specified
acre-ft/yr = acre-feet per year
E = Exempt quantity
ft bgs = feet below ground surface
gpm = gallons per minute
Qa = Annual withdrawal claimed
Qi = Instantaneous withdrawal claimed

ATTACHMENT 6

City of Blaine Water Demand Factors and Projections

Table 3.2
CITY OF BLAINE
Water Demand Factors and Projections 2008 - 2029

Water Demand Factors

1 ERU = 190 ADD (gpd) (see Section 3.1.5)

MDD = 380 (gpd) (see Section 3.1.5)

PHD = (MDD/1440)[(1.6)(ERU)+225)]+18 (see DOH Eq. 5-3)

ERU = Equivalent Residential Unit
ADD = Average Day Demand
MDD = Maximum Day Demand
PHD = Peak Hour Demand

ac-ft/yr = acre feet per year
gpd = gallons per day
gpm = gallons per minute
Mg/yr = Million gallons per year
cf/yr = cubic feet per year

Water System Demand Projections

				ADD					MDD			peak hr dem. PHD
Year	# ERU	gpd	gpm	Mg/yr	ac-ft/yr	cf/yr	gpd	gpm	Mg/yr	ac-ft/yr	cf/yr	gpm
2008	10,085	1,901,486	1,320	694	2130	92,774,014	3,802,972	2,641	1,388	4260	185,548,027	4,094
2009	10,291	1,952,417	1,356	713	2187	95,258,970	3,904,835	2,712	1,425	4374	190,517,940	4,201
2010	10,575	2,006,323	1,393	732	2247	97,889,029	4,012,646	2,787	1,465	4494	195,778,057	4,315
2011	10,878	2,063,746	1,433	753	2312	100,690,719	4,127,492	2,866	1,507	4623	201,381,437	4,437
2012	11,208	2,126,486	1,477	776	2382	103,751,816	4,252,972	2,953	1,552	4764	207,503,632	4,569
2013	11,549	2,191,198	1,522	800	2454	106,909,136	4,382,396	3,043	1,600	4909	213,818,272	4,706
2014	11,966	2,270,218	1,577	829	2543	110,764,545	4,540,436	3,153	1,657	5086	221,529,090	4,873
2019	14,065	2,668,487	1,853	974	2989	130,196,192	5,336,974	3,706	1,948	5978	260,392,384	5,714
2024	16,540	3,138,626	2,180	1,146	3515	153,134,427	6,277,253	4,359	2,291	7031	306,268,853	6,706
2029	19,335	3,669,812	2,548	1,339	4110	179,051,129	7,339,625	5,097	2,679	8221	358,102,257	7,826

ATTACHMENT 7

PHOTOGRAPHS OF WELL PW-1R

City of Blaine in Partnership with Birch Bay Water and Sewer District
Report of Examination
Blaine, Washington

Photograph 1 General area surrounding well PW-1R.

Photograph 2 PW-1R well head.

ATTACHMENT 8

WELL INTERFERENCE EFFECTS [1]

City of Blaine in Partnership with Birch Bay Water and Sewer District Report of Examination
Blaine, Washington

Pumping Well	Requested Rate (gpm)	Expected Drawdown (feet)			
		PW-1R	PW-2	PW-3R	PW-5.1
PW-1R	450	265	40	30	5
PW-2	200	20	45	20	3
PW-3R	450	30	20	250	7
PW-5.1	1,260	13	14	16	350
Total (Rate/Drawdown)	2,360	328	119	316	365
Available Drawdown	--	586	501	553	639
Drawdown Remaining	--	258	382	237	274

Notes
1. Information summarized from Table 5-2 of the Technical Report (AESI, 2008).

Abbreviations
gpm = gallons per minute

ATTACHMENT 9

California Creek Tidal-Influenced Reach Report

September 9, 2009
Project No. EH080530A

Birch Bay Water & Sewer District
7096 Point Whitehorn Road
Birch Bay, Washington 98230-9675

City of Blaine
1200 Yew Street
Blaine, Washington 98230

Attention: Roger Brown – Birch Bay Water & Sewer District
Steve Banham – City of Blaine

Subject: Tidal-Influenced Reach
California Creek Watershed
Whatcom County, Washington

INTRODUCTION

The City of Blaine (City) and the Birch Bay Water & Sewer District (District) have applied to the Washington State Department of Ecology (Ecology) for additional water rights for existing production wells PW-1R (application G126821), PW-2 (application G126820), recently installed production well PW-5.1 (application G128481), and the District's production well (application (G128046). The water rights are being processed through Ecology's cost-reimbursement program. AMEC/Geomatrix has been assigned the task of evaluating the City/District water right applications. In their "Phase I Water Right Investigation Summary" (April 14, 2009), AMEC/Geomatrix determined that the potential area of influence for the City/District water right applications is the area shown on Figure 1. This area of influence represents where the proposed water right applications may impact other water rights and/or surface water flow in streams.

The lower portions of Dakota and California Creeks are located within the water right area of influence as designated by AMEC/Geomatrix (Figure 1). Dakota and California Creeks are closed to further surface water withdrawals upstream of the "influence of mean annual high tide at low instream flow levels to the headwaters" (WAC 173-501-030). This closure precludes the issuing of new ground/surface water rights in these areas without mitigation. The stream reach located downstream of the influence of "mean annual high tide" is generally referred to as the tidal-influenced reach and is not subject to the instream water right closure. The purpose of our services is to use the available information to reliably estimate the location of the upstream terminus of the tidal-influenced reach in California Creek and compare that reach to the water right application area of influence as estimated by AMEC/Geomatrix (Figure 1).

DISCUSSION AND RESULTS

General

The United States Army Corp of Engineers (COE, 2000) determined that the Mean High Water (mean annual high tide) elevation in Drayton Harbor is at an elevation of 3.45 feet NGVD, which is equal to 7.48 feet NAVD88. The point where the stream bed channel in Dakota and California Creeks becomes higher than the Mean High Water (MHW) elevation of 7.48 feet NAVD88 represents the upstream extent of the tidal-influenced reach of the stream in accordance with WAC 173-501-030. For the purposes of the evaluations presented in this report, we have assumed the most recent MHW elevation for Drayton Harbor as reported by the COE (2000).

In 2006, the United States Geological Survey (USGS) contracted Sanborn Map Company (Sanborn) to complete an aerial LiDAR (Light Detection and Ranging) survey of much of western Whatcom and Skagit Counties, including the Dakota and California Creek drainages (Sanborn, 2008). LiDAR is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target. The LiDAR data is collected with aircraft-mounted lasers capable of recording elevation measurements at a rate of 2,000 to 5,000 pulses per second and have a vertical precision of up to 15 centimeters (6 inches). In this application the LiDAR data, in the form of 3-dimensional positions of a dense set of mass points, was collected and analyzed to develop a LiDAR surface that represented detailed bare-earth topography in the project area. Sanborn reported LiDAR accuracy for this project of 37 centimeters (approximately 1.2 feet) in vegetated portions of the study area (Sanborn, 2008).

California Creek Evaluation

The LiDAR data was utilized to estimate the approximate location of the upstream extent of the tidal-influenced reach of California Creek in the following manner:

- The LiDAR data was used to develop a 6.28-foot NAVD88 elevation contour for the critical reach of California Creek. As previously discussed, the LiDAR data has a reported accuracy of +/- 1.2 feet. Therefore, the 6.28 contour represents an elevation that could range between a low of 5.08 feet and a high of 7.48 feet. It should be noted that the upper value of this error range for the 6.28-foot contour is equal to the critical MHW elevation of 7.48 feet.

- The 6.28-foot elevation LiDAR-generated contour is observed to cross the California Creek stream channel in the southwest quarter of Section 21, Township 40 North, Range 1 East (Figure 1).

- LiDAR pulses do not penetrate water surfaces; therefore, topographic/elevation maps generated using LiDAR data reflect the top of the water surface in areas where water is present. Consequently, the area where the 6.28-foot contour crosses the California Creek stream channel represents the top of the water surface in the stream, not the base

of the stream channel. The point where the California Creek stream bed reaches the critical MHW elevation of 7.48 feet would be located some distance upstream from where the LiDAR-generated 6.28-foot contour crosses the stream channel.

- The 6.28 foot LiDAR-generated contour crosses the California Creek channel approximately 4,000 feet upstream of the water right area of potential impact designated by AMEC/Geomatrix (Figure 1).

Dakota Creek Comparison

Golder Associates, Inc. (Golder) previously determined that the upstream terminus of the tidal-influenced zone in Dakota Creek is located in the northwest corner of Section 15, Township 40 North, Range 1 East, upstream of the water right area of potential impact, as shown on Figure 1 (Golder, 1995). To establish this terminus point, Golder surveyed the elevation of the Dakota Creek stream channel and determined that the stream reach in the northwest corner of Section 15 was where the stream bed obtained an elevation of 7.37 feet NAVD88 (3.34 feet NGVD). It is unclear why Golder assumed an elevation of 7.37 feet for the MHW elevation, which is 0.11 feet lower than the MHW elevation currently reported by the COE. In their report, Golder referenced the MHW elevation used for their analyses to Ecology's Shorelands and Coastal Zone Management Program (Ecology, 1991). We were unable to obtain/review a copy of the Ecology Management Program document. It is possible that the COE has updated the MHW elevation for Drayton Harbor since 1991, which could account for the slight discrepancy between the two reported MHW elevations.

The methodology used to estimate the tidal-influenced upstream terminus point for California Creek was also applied to the Dakota Creek drainage as means of comparing the LiDAR estimated terminus to the terminus point field surveyed by Golder (Figure 1). As shown on Figure 1, the 6.28-foot LiDAR-generated contour crosses the Dakota Creek channel roughly 2,250 feet downstream of the Golder surveyed terminus point (elevation 7.37 feet NAVD88). This is consistent with what would be expected based on the accuracy and applicability of using the LiDAR data to estimate the stream bed elevation, as discussed previously.

CONCLUSIONS

- The upstream terminus of the tidal-influenced reach of California Creek, conservatively estimated using the LiDAR data, is located at least 4,000 feet upstream of the water right application area of influence estimated for the City/District water right applications (Figure 1).

- Because of the conservative nature of this analyses and the nature of the LiDAR data set, it is reasonable to conclude that the actual terminus of the tidal-influenced reach of California Creek is located a significant distance further upstream than where the LiDAR-generated 6.28-foot contour crosses the stream channel. Therefore, the City/District proposed water right applications will not have an impact on the administratively closed reach of California Creek.

- The upstream terminus of the tidal-influenced reach of Dakota Creek, as surveyed by Golder (1995), is located roughly 500 feet upstream of the area of influence estimate for the City/District water right applications. Therefore, the City/District proposed water right applications will not have an impact on the administratively closed reach of Dakota Creek.

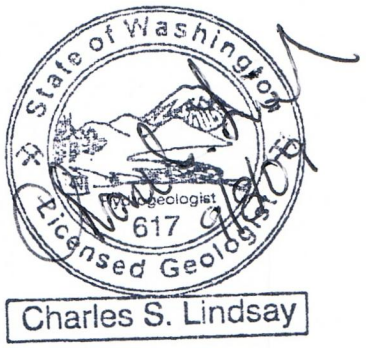
- Based on the current estimated MHW elevation of 7.48 feet, it appears that the upstream terminus point of the tidal-influenced reach of Dakota Creek is slightly further upstream than where indicated by Golder (1995). This is because Golder based the point of termination on a stream bed elevation that was slightly lower than the currently established MHW elevation of 7.48 feet.

CLOSURE

We have prepared this report for the use by the City of Blaine and Birch Bay Water & Sewer District in the evaluation of their pending water right applications. Our conclusions are based on our review and interpretation of information and data described in this report.

We have enjoyed providing the City and District continued service on this interesting project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Everett, Washington



Charles S. Lindsay, P.G., P.E.G., P.Hg.
Principal Geologist/Hydrogeologist

Attachment: Figure 1 - Tidal-Influenced Stream Reach Map

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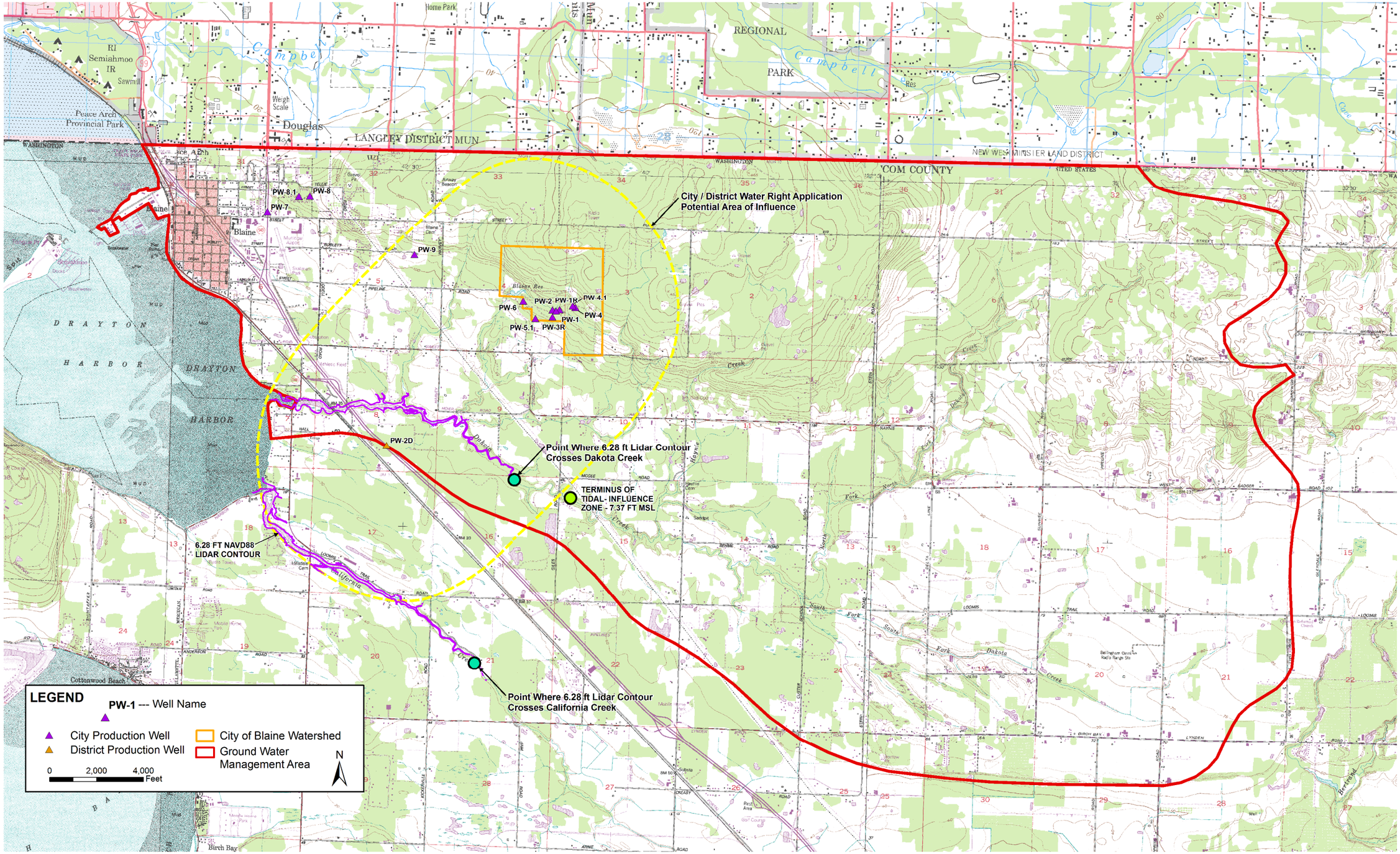

References: National Map Seamless Server Datacenter.

Associated Earth Sciences, Inc.

TIDAL-INFLUENCED STREAM REACH MAP
CITY OF BLAINE / BIRCH BAY WATER AND SEWER DISTRICT
WHATCOM COUNTY, WASHINGTON

FIGURE 1

DATE 9/09

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N:\EH080530A California Creek\LIDAR_contour11x17.mxd