File NR CG1-26398C@1
WR Doc ID 6269346

DEPARTMENT OF ECOLOGY
State of Washington

State of Washington
DRAFT PROTESTED REPORT OF EXAMINATION FOR CHANGE FOR A PUBLIC HEALTH & SAFETY APPLICATION

Change of Water Right Requested: Add 2 Points of Withdrawal

PRIORITY DATE	WATER RIGHT NUMBER
October 24, 1991	CG1-26398C@1

MAILING ADDRESS	SITE ADDRESS (IF DIFFERENT)
CITY OF SUMAS 433 CHERRY STREET SUMAS WA 98295	

Total Quantity Authorized for Withdrawal

WITHDRAWAL RATE	UNITS	ANNUAL QUANTITY (AF/YR)
860	GPM	1376

The total withdrawal from all authorized wells must not exceed the instantaneous and annual quantities listed above.

Quantities withdrawn under G1-23698 and G1-26398 (this right) shall not exceed 1660 gallons per minute and 1825.0 acre-feet per year. Due to hydraulic continuity, Johnson Creek shall be augmented at a rate of 18 gpm for every 100 gpm withdrawn under G1-23698 and G1-26398. Stream augmentation is to occur simultaneously as the water is withdrawn. Stream augmentation shall occur as near to the utilized point(s) of withdrawal as feasible.

Purpose

	WITHDRAWAL RATE			ANNUAL QUANTITY (AF/YR)		
PURPOSE	ADDITIVE	NON-ADDITIVE	UNITS	ADDITIVE	NON-ADDITIVE	PERIOD OF USE (mm/dd)
Municipal and mitigation	860		GPM	1376		01/01 - 12/31

IRRIGATED ACRES		PUBLIC WATER SYSTEM INFORMATION	
ADDITIVE	NON-ADDITIVE	WATER SYSTEM ID	CONNECTIONS
		84870B	

Source Location

COUNTY	WATERBODY	TRIBUTARY TO	WATER RESOURCE INVENTORY AREA
WHATCOM	GROUNDWATER	SUMAS RIVER	1-NOOKSACK

SOURCE	STATUS	PARCEL	WELL TAG	TWP	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
KRW Well 2	M/E	4104334412930000	AGK373	41N	04E	33	SENE	49.000695	-122.289418
KRW Well 2R	A	4104334412930000	BCS869	41N	04E	33	SENE	49.000671	-122.289435
KRW Well 3	A	4104334412930000	ACK313	41N	04E	33	SENE	49.000880	-122.289520
KRW Well 4	M/E	4104334412930000	AGK337	41N	04E	33	SENE	49.000770	-122.288880
KRW Well 4R	A	4104334412930000	ACR785	41N	04E	33	SENE	49.000770	-122.288890
KRW Well 5	A	4104334412930000	AGK361	41N	04E	33	SENE	49.000605	-122.289033
MRW Well 1	A	4104331061080000	AGK351	41N	04E	33	SWSW	48.994530	-122.302120
MRW Well 2	M/E	4104331061080000	AGF270	41N	04E	33	SWSW	48.995950	-122.302180
MRW Well 3	A	4104331061080000	AGK357	41N	04E	33	SWSW	48.995760	-122.302208
MWA Well 2	A	4004074943620000	ABO392	40N	04E	07	SENE	48.973667	-122.331554
MWA Well 3	A	4004074943620000	AGO439	40N	04E	07	SENE	48.973650	-122.331517

Sources: KRW – Kneuman Road Wellfield (City of Sumas), MRW- May Road Wellfield (City of Sumas), MWA – Meadowbrook Water Association

Status: M- monitoring, E- emergency, A- active

Place of Use (See Attached Map)

LEGAL DESCRIPTION OF AUTHORIZED PLACE OF USE

The place of use (POU) of this water right is the service area described in the most recent City of Sumas Water System Plan approved by the Washington State Department of Health, so long as the water system is and remains in compliance with the criteria in RCW 90.03.386(2). RCW 90.03.386 may have the effect of revising the place of use of this water right.

Description of Proposed Works

Under the existing subject right, the City of Sumas operates the Kneuman Road Wellfield consisting of four active production wells (and two monitoring/emergency wells) and the May Road Wellfield consisting of two production wells (and one monitoring/emergency well). The proposal here is to add two additional points of withdrawal, owned by the Meadowbrook Water Association, in order to supply water to the high nitrate areas located to the south of Sumas.

The City of Sumas water system is an approved Washington Department of Health (DOH) Group A Community System. Its system ID number is 84870B. It currently holds a DOH green operating permit. Systems in this category are considered adequate for existing uses and for adding new service connections up to the number of approved service connections.

Development Schedule

BEGIN PROJECT	COMPLETE PROJECT	PUT WATER TO FULL USE
January 1, 2017	January 1, 2020	January 1, 2030

How often must water use be measured?

How often must water use be measured?	Weekly
How often must water use data be reported to Ecology?	Annually (Jan 31)
What volume should be reported?	Total Annual Volume
What rate should be reported?	Annual Peak Rate of Withdrawal (gpm)

Provisions

1. Wells, Well Logs and Well Construction Standards

All wells constructed in the state must meet the construction requirements of WAC 173-160 titled "Minimum Standards for the Construction and Maintenance of Wells" and RCW 18.104 titled "Water Well Construction". Any well which is unusable, abandoned, or whose use has been permanently discontinued, or which is in such disrepair that its continued use is impractical or is an environmental, safety or public health hazard must be decommissioned.

All wells must be tagged with a Department of Ecology unique well identification number. If you have an existing well and it does not have a tag, please contact the well-drilling coordinator at the regional Department of Ecology office issuing this decision. This tag must remain attached to the well. If you are required to submit water measuring reports, reference this tag number.

2. **Meter Installation**

An approved measuring device shall be installed and maintained for each 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

3. **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

4. **Record Water Use Weekly, Report Annually**

Water use data shall be recorded weekly. The maximum monthly rate of withdrawal and the monthly total volume shall be submitted to the Department of Ecology by January 31st 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/.

5. **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, points of withdrawal, measuring devices, and associated distribution systems for compliance with water law.

6. **Streamflow Augmentation**

Johnson Creek or its tributaries shall be augmented at a rate of 18 gpm for every 100 gpm withdrawn under G1-23698 and G1-26398. Stream augmentation is to occur simultaneously as the water is withdrawn. Stream augmentation shall occur as near to the utilized point(s) of withdrawal as feasible.

7. 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. If impairment does occur, the City will be required to diminish or cease pumping, or mitigate for this impairment.

8. Issuance of Superseding Certificate

The City shall submit written notification to Ecology's Northwest Regional Office when it has effectuated the approved changes (as needed) and is ready to obtain a superseding certificate. This notification shall include a description of work accomplished to "perfect" the attribute of change (points of withdrawal) to be included in the superseding certificate. No "re-perfection" of water use is necessary in order for the City to obtain a superseding certificate.

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 operators 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.

10. Easement and Right-of-Way

The water source and/or water transmission facilities are not wholly located upon land owned by the applicant. Issuance of a water right change authorization by this department does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtaining such a right is a private matter between applicant and owner of that land.

11. Water Use Efficiency

The water right holder is required to maintain efficient water delivery systems and use of up-to-date water conservation practices consistent with RCW 90.03.005.

Findings of Facts

Upon reviewing the investigator's report, I find all facts, relevant and material to the subject application, have been thoroughly investigated. Furthermore, I find the change of water right as recommended will not be detrimental to existing rights nor the public welfare, the combined total withdrawal from the original and additional wells will not enlarge the right conveyed by the original certificate, and the added points of withdrawal will tap the same body of public groundwater as the original wells.

Therefore, I ORDER the requested change to add points of withdrawal, under Change Application CG-26398@1, be approved subject to existing rights and the provisions specified above.

Your Right To Appeal

You have a right to appeal this Order to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of the Order.

File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.

- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.
- You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW Ste 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Signed at Bellevue, Washington, this _____ day of _____ 2014.

_____

Jerry Liszak, LHG, Acting Section Manager

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.

INVESTIGATOR'S REPORT
Buck Smith, Senior Hydrogeologist, Department of Ecology
Water Right Control Number CG1-26398C@1
City of Sumas

BACKGROUND

This report serves as the written findings of fact concerning water right application for change CG1-26398C@1. The existing water right attributes and proposed attributes are listed in Table 1 below.

Table 1
EXISTING Water Right Attributes

Water Right Owner:	City of Sumas
Priority Date:	10/24/1991
Place of Use Description:	The place of use of this water right is the service area described in the latest 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 RCW 90.03.386(2) are met.

County	Waterbody	Tributary To	WRIA
Whatcom	Groundwater		1-Nooksack

Purpose	Rate	Unit	Ac-ft/yr	Begin Season	End Season
Municipal supply & mitigation	860	GPM	1376	January 1	December 31

SOURCE	PARCEL	WELL TAG	TWP	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
KRW Well 1	4104334412930000	AGK347	41N	04E	33	NENE	49.000590	-122.288985
KRW Well 2	4104334412930000	AGK373	41N	04E	33	NENE	49.000695	-122.289418
KRW Well 2R	4104334412930000	BCS869	41N	04E	33	NENE	49.000671	-122.289435
KRW Well 3	4104334412930000	ACK313	41N	04E	33	NENE	49.000880	-122.289520
KRW Well 4	4104334412930000	AGK337	41N	04E	33	NENE	49.000770	-122.288880
KRW Well 4R	4104334412930000	ACR785	41N	04E	33	NENE	49.000770	-122.288890
KRW Well 5	4104334412930000	AGK361	41N	04E	33	NENE	49.000605	-122.289033
MRW Well 1	4104331061080000	AGK351	41N	04E	33	SWSW	48.994530	-122.302120
MRW Well 2	4104331061080000	AGF270	41N	04E	33	SWSW	48.995950	-122.302180
MRW Well 3	4104331061080000	AGK357	41N	04E	33	SWSW	48.995760	-122.302208

Sources: KRW – Kneuman Road Wellfield, MRW- May Road Wellfield

REQUESTED Water Right Attributes

Applicant Name:	City of Sumas
Date of Application:	7/14/2014
Place of Use	Same as above

County	Waterbody	Tributary To	WRIA
Whatcom	Groundwater		1-Nooksack

Purpose	Rate	Unit	Acre-feet/yr	Begin Season	End Season
Municipal supply & mitigation	860	GPM	1376	January 1	December 31

SOURCE	PARCEL	WELL TAG	TWP	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
KRW Well 2	4104334412930000	AGK373	41N	04E	33	SENE	49.000695	-122.289418
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KRW Well 3	4104334412930000	ACK313	41N	04E	33	SENE	49.000880	-122.289520
KRW Well 4	4104334412930000	AGK337	41N	04E	33	SENE	49.000770	-122.288880
KRW Well 4R	4104334412930000	ACR785	41N	04E	33	SENE	49.000770	-122.288890
KRW Well 5	4104334412930000	AGK361	41N	04E	33	SENE	49.000605	-122.289033
MRW Well 1	4104331061080000	AGK351	41N	04E	33	SWSW	48.994530	-122.302120
MRW Well 2	4104331061080000	AGF270	41N	04E	33	SWSW	48.995950	-122.302180
MRW Well 3	4104331061080000	AGK357	41N	04E	33	SWSW	48.995760	-122.302208
MWA Well 2	4004074943620000	ABO392	40N	04E	07	SENE	48.973667	-122.331554
MWA Well 3	4004074943620000	AGO439	40N	04E	07	SENE	48.973650	-122.331517

Sources: KRW – Kneuman Road Wellfield (City of Sumas), MRW- May Road Wellfield (City of Sumas), MWA – Meadowbrook Water Association Wellfield
KRW Well 1 has been decommissioned

Legal Requirements for the Requested Change

The following is a list of requirements that must be met prior to authorizing the proposed change to add points of withdrawal.

Public Notice

RCW 90.03.280 requires that notice of a water right application be published once a week, for two consecutive weeks, in a newspaper of general circulation in the county or counties where the water is to be withdrawn and used. Notice of this application was published in the *Lynden Tribune* on August 20 and 27, 2014.

Consultation with the Department of Fish and Wildlife

The Department of Ecology must give notice to the Washington Department of Fish and Wildlife (WDFW) of applications to divert, withdraw, or store water. On November 26, 2014, Mr. Steve Boessow, WDFW Water Rights Biologist, was notified via email of the subject application for change. On December 4, 2014, Mr. Boessow sent the following response:

> *Based on impacts to fish and/or wildlife and the habitat they rely on, and pursuant to Chapter 77.57.020 RCW, WDFW does not oppose the issuance of this application. There will be no increase in the Qi or Qa, so no new impacts should be observed.*

State Environmental Policy Act (SEPA)

A water right application is subject to a SEPA threshold determination (i.e., an evaluation whether there are likely to be significant adverse environmental impacts) if any one of the following conditions are met.

(a) It is a surface water right application for more than 1 cubic foot per second, unless that project is for agricultural irrigation, in which case the threshold is increased to 50 cubic feet per second, so long as that irrigation project will not receive public subsidies;
(b) It is a groundwater right application for more than 2,250 gallons per minute;
(c) It is an application that, in combination with other water right applications for the same project, collectively exceed the amounts above;
(d) It is a part of a larger proposal that is subject to SEPA for other reasons (e.g., the need to obtain other permits that are not exempt from SEPA);
(e) It is part of a series of exempt actions that, together, trigger the need to do a threshold determination, as defined under WAC 197-11-305.

Because this application does not meet any of these conditions, it is categorically exempt from SEPA and a threshold determination is not required.

Water Resources Statutes and Case Law

RCW 90.03.380(1) states that a water right that has been put to beneficial use may be changed. The point of diversion or withdrawal, place of use, and purpose of use may be changed if it would not result in harm or injury to other water rights.

The Washington Supreme Court has held that Ecology, when processing an application for change to a water right, is required to make a tentative determination of extent and validity of the claim or right. This is necessary to establish whether the claim or right is eligible for change. *R.D. Merrill v. PCHB* and *Okanogan Wilderness League v. Town of Twisp.*

RCW 90.44.100 allows Ecology to change a groundwater certificate to allow the user to add additional wells at a new location outside of the location of the original wells, if:

(a) The additional wells tap the same body of public ground water as the original well. RCW 90.44.100(2)(a),
(b) When the additional wells are included, the user may continue to use the original wells, but the combined total withdrawal from all wells shall not enlarge the right conveyed by the original certificate. RCW 90.44.100(2)(c), and
(c) Other existing rights shall not be impaired. RCW 90.44.100(2)(d).

Indicators that wells tap the *same body of public groundwater* include:

(a) Hydraulic connectivity,
(b) Common recharge (catchment) area,
(c) Common flow regime, and

(d) Geologic materials that allow for storage and flow, with recognizable boundaries or effective barriers to flow.

Priority Processing

On July 8, 2014, this office received a letter from Robert E. James, Manager, Washington State Department of Health, Northwest Drinking Water Operations. Mr. James requested priority processing of the City of Sumas change application as per WAC 173-152-050(1)(c) to allow Sumas to provide water to the Northwood Water Association, the Northwood Park Water Association, and potentially several other water associations within the neighboring nitrate contaminated area. This request was approved by Jerry Liszak, Acting Section Manager, Water Resources Program, Northwest Regional Office.

Consultation with the Lummi Nation and Nooksack Tribe

The Lummi Nation and the Nooksack Tribe were notified of the subject change application. The Lummi Indian Business Council (LIBC) sent a letter dated July 30, 2014. In that letter the LIBC identified that it was concerned about the existing and future potential impacts on instream flows. It indicated that all withdrawals within Water Resources Inventory Area (WRIA) 1 have the capacity to adversely impact the rights of the Lummi Nation. The Nooksack Tribe did not provide comments.

INVESTIGATION

On October 2, 2014, this report writer met at Sumas City Hall with Rod Fadden (Sumas Public Works Director), Dave Olson (Water System Services, Inc.), and Charles Lindsay (Associated Earth Sciences, Inc.). We discussed the subject application for change request, the history and operation of the Sumas system, regional and area hydrogeology, and then visited each of the existing and requested points of withdrawal.

Application for Change Request

Ground certificate G1-26398C is for continuous municipal supply and mitigation use within the City of Sumas service areas, as described in their Washington State Department of Health (DOH) approved Water System Plan. The primary goal of the City's change application is to add two Meadowbrook Water Association (MWA) production wells (wells 2 and 3); located in the MWA Van Buren Road wellfield as additional points of withdrawal to the subject right. This will allow City water to be pumped from the MWA Van Buren Road wells as the source of supply for the customers currently served by Northwood Water Association and Northwood Park Water Association. These two water systems currently pump groundwater that has been contaminated with high concentrations of nitrate that exceed the primary Maximum Contaminant Level of 10 mg/L. These systems have signed compliance agreements with DOH directing them to lower the nitrate concentration in their drinking water.

The City has been working with Whatcom County PUD No. 1 and other water associations in North Whatcom County to address this high priority drinking water problem. After multiple feasibility studies and pursuing various alternatives, Northwood Water Association and the Northwood Park Water Association believe obtaining water from Sumas is the only remaining viable course of action. If the proposed water right change is approved, the City will enter into an agreement with the MWA to allow the association to withdrawal ground water under water right G1-26398C from the MWA Van Buren Road wellfield for service to these high nitrate systems.

History of Water Use

Early settlement of Sumas began in the late 1800s. It was supported by the presence of springs at the toe of the glacial upland immediately northwest of town, near the site of the current Kneuman Road Wellfield. A diversion box was used to collect spring water and guide it into a ditch heading east along Kneuman Road to town. Eventually a small reservoir was built atop Moe's Hill, and a pump station was used to pump water from the ditch to the reservoir. Over time, a larger 155,000 gallon reservoir was installed and the ditch was replaced by an asbestos-concrete (AC) pipeline.

The early growth of Sumas was dependent upon timber and mining booms in the immediate area. By the early 1900s the population of Sumas swelled to about 2500. Historical turn-of-the-century plats extended over a much wider area than the existing developed town. By the 1920s the mining and timber booms had concluded and Sumas shrank to a size of less than 700 people. Throughout the mid-1900s, Sumas maintained a stable population and thrived upon border-related commerce and agricultural-related services.

Provision of water to surrounding dairy farms began during the middle part of the century. Between 1959 and 1971, four wells (in the Kneuman Road Wellfield) were drilled and water was supplied to the City of Nooksack and the rural area to the south. Sumas and the rural area to the east were also supplied from the wells, and everyday use of the spring diversion box was discontinued. (The spring diversion box can be reactivated in emergency situations.) In 1982, the existing 500,000 gallon reservoir was installed.

In the mid-1980s Sumas began to pursue industrial development. The existence of adequate water, coupled with the border crossing and the confluence of transportation infrastructure (Burlington Northern Santa Fe Railroad, State Route (SR) 9, SR 547, SR 546, British Columbia Highway 11, the Trans-Canada Highway, and two major cross-border natural gas pipelines) fostered the development of several industrial sites, including a truck-rail reload facility, a gas-fired cogeneration plant with associated lumber kiln, and a shingle-manufacturing facility. To support the needs of the new industries, a fifth well was drilled in 1992 at the Kneuman Road Wellfield. And, the May Road Wellfield was purchased from the City of Lynden and outfitted with two new wells (for a total of three production wells and one observation well).

Recent industrial growth has brought increased demand for housing. More industrial growth is expected, and more residential and commercial growth will also follow. The City of Sumas comprehensive plan envisions a town of about 1,600 people by the year 2018. Sumas currently has four wholesale customers: the City of Nooksack, the Nooksack Valley Water Association (NVWA), and the Sumas Rural Water Association (SRWA), all of which purchase potable water, and an electric co-generation facility that purchases non-potable water.

The subject right was originally issued for industrial supply and mitigation. Its purpose of use was changed in 2010 to municipal supply and mitigation. Its place of use was changed to the City's municipal service area. And, the authorized point of withdrawal was also changed to include the Kneuman Road Wellfield. The right originally issued just for the May Road Wellfield. The mitigation requirement of 18 gpm for every 100 gpm withdrawn under G1-23698 and G1-26398 was not altered. Stream augmentation is to occur simultaneously as the water is withdrawn.

This certificate is in good standing at its full face value. This office received a Proof of Appropriation form (attesting to full beneficial use) from the City of Sumas on October 14, 2009. A proof examination was conducted on October 28, 2009, confirming full beneficial use of groundwater permit G1-26398P. On December 7, 2009, a final certificate of water right was issued for the full beneficial use (perfected) quantities.

Operations of the City of Sumas System

Sources

The City's main source of potable water is the Kneuman Road Wellfield (aka Sumas Wellfield), which contains four active and two monitoring/emergency wells. Although artesian flow conditions exist at each well, submersible pumps or booster pumps are installed to achieve adequate volume and pressure. The wells supply two distinct distribution zones. Two of the wells (wells 2R & 3) are used to supply wholesale customers south of town, including the Nooksack Valley Water Association (NVWA) and the City of Nooksack. The other two wells (wells 4R & 5) supply Sumas itself and the Sumas Rural Water Association (SWRA), which is located east of town. The two distribution zones normally operate independently, but an intertie is available to allow emergency supply from one system to another.

Sumas also operates the May Road Wellfield, which taps the same aquifer as the Kneuman Road Wellfield. There are currently two wells (wells 1 & 3) in use at the May Road Wellfield. Well 1 is tied into the Sumas distribution system. Well 3 serves industrial customers. Well 2 is a monitoring well.

Storage

As mentioned previously, Sumas owns a 500,000 gallon reservoir located at the top of Moe's Hill. A second 500,000 gallon reservoir was built in 2001 next to the existing reservoir and is owned by the SRWA. Storage within the Nooksack/NVWA zone is accomplished at reservoirs jointly owned by those entities.

Distribution

Within the city limits is a distribution system consisting of 94,000 linear feet of pipe ranging from 1 to 12 inches in diameter. Major lines lead from the Kneuman Road Wellfield along the Canadian border to the reservoir and along Barbo Road and Halverstick Road to the south end of Cherry Street. A network of smaller pipes distributes water throughout the developed part of town.

City of Sumas well descriptions

- *Kneuman Road Wellfield well 1* - This well has been decommissioned.
- *Kneuman Road Wellfield well 2* – This well is currently being used as a monitoring well.
- *Kneuman Road Wellfield wells 2R & 3* – These two wells flow freely through a manifold to the pumphouse pressurizing the Nooksack/NVWA system. A group of manually operated booster pumps is used to regulate the rate of withdrawal from the wells. The maximum sustainable pumping rate is 500 gpm. If pumped at a greater rate, the cone of depression becomes so deep as to allow excessive air to enter the perforated portions of the casings.
- *Kneuman Road Wellfield well 4* - This well exhibited sand buildup after 28 years of use. It is now being used as a monitoring well.

- *Kneuman Road Wellfield well 4R* - This is the newest well in the field, drilled in 1997. This well pumps to the 10-inch line serving the Sumas/SRWA distribution system. A pump test conducted by Robinson & Noble indicates the well can sustain a yield of 1,200 gpm, presuming all other wells in the field are operating under normal production conditions. The well is outfitted with a submersible pump capable of pumping 810 gpm against the prevailing head (i.e., reservoir almost full). The submersible pump was completely rebuilt in 1997, when it was moved from well 4 to well 4R.

- *Kneuman Road Wellfield well 5* - This well pumps to the 10-inch line serving the Sumas/SRWA distribution system. A pump test conducted by Robinson & Noble indicates the well can sustain a yield of 1,100 gpm, presuming all other wells in the field are operating under normal production conditions. The well is outfitted with a submersible pump capable of pumping 860 gpm against the prevailing head (i.e., reservoir almost full). The submersible pump was new in 1992. All components of this well are in good condition.

- *May Road Wellfield well 1* - This well was drilled in 1992. It is outfitted with a submersible pump capable of pumping 200 gpm against the prevailing head. All components of this well are in good condition.

- *May Road Wellfield well 2* - This well was drilled in 1987 for the City of Lynden. A pump test conducted by Golder showed this well can sustain a yield of 500 gpm, not accounting for interference with other wells. There is currently no pump installed in the well. The 8-inch casing is capable of accommodating a submersible pump rated at 500 gpm.

- *May Road Wellfield well 3* - This well was drilled in 1992. A pump test conducted by Robinson & Noble showed the well can sustain a yield of 800 gpm, not accounting for interference with other wells. The well is outfitted with a submersible pump capable of pumping 800 gpm against the prevailing head. All components of this well are in good condition. Robinson & Noble calculated a maximum of 900 gpm can be withdrawn from wells 2 and 3 in combination, due to interference effects.

Other Existing Rights Held by the City of Sumas

Kneuman Road Wellfield (The total of the following rights is 2250 gpm and 1919 ac-ft/yr*)*

- Surface Water Certificate (SWC) 3427 – This certificate was issued for the diversion of 1.78 cubic feet per second, from an unnamed spring, tributary to the Sumas Creek (River) drainage. No annual quantity was specified. The purpose of use is listed as domestic supply. The priority date is March 14, 1946.
- Ground Water Certificate (GWC) 3485 – This certificate issued for 2250 gpm, 405 ac-ft/yr, from a well (now known as well 1). The annual quantity is based on a per capita consumption of 200 gallons a day (average of 0.9 ac-ft/yr per home) or a withdrawal of 405 ac-ft/yr for 450 homes, less any quantity diverted under the existing rights on the spring. The purpose of use is for municipal supply. The priority date is June 22, 1959.
- Ground Water Certificate G1-00063C – This certificate issued for 2250 gpm, 672 ac-ft/yr, from wells 2, 3, & 4. This right issued as a supplemental supply to SWC 3427 and GWC 3485. The total withdrawal from all sources was not to exceed 672 ac-ft/yr. The annual quantity was calculated at 0.224 ac-ft/yr per person (200 gallons per day per person) for the estimated 1990 population of 3,000. The purpose of use is for municipal supply. The priority date is July 15, 1971.

- Ground Water Certificate G1-24025C – This certificate issued for 2250 gpm, 598.8 ac-ft/yr, from wells 1-4. The instantaneous quantity was not increased above the 2250 gpm previously allocated. The annual quantity was increased by 598.8 ac-ft/yr, for a system total of 1270.8 ac-ft/yr (613.2 ac-ft/yr for domestic, 657.6 ac-ft/yr for dairy farms). The annual quantity was based on 0.1333 ac-ft/yr per person (119 gallons per day) for a population of 4600 and 4.8 ac-ft/yr per dairy (for 137 dairies) in the year 2000. The purpose of use is for municipal supply/dairy farming. The priority date is January 15, 1982.
- Ground Water Certificate G1-25171C – This certificate issued for 2250 gpm, 1919.0 ac-ft/yr, from wells 1-4. The instantaneous and annual quantities are supplemental to all previously existing rights (648.2 ac-ft/yr of the 1919.0 ac-ft/yr is new water). The new (additional) annual quantity was granted so the City of Sumas could supply water to the City of Everson. The purpose of use is for municipal supply/dairy farming. The priority date is January 20, 1988. Wells 2R and 5 have been added to this water right through the submittal of showing of compliance forms consistent with RCW 90.44.100(3).

May Road Well Field (Total of the following right and G1-26398C is 1660 gpm and 1825.0 ac-ft/yr)

- Ground Water Certificate G1-23698C – This certificate issued for 800 gpm, 449.0 ac-ft/yr, from the May Road wells 1 & 3. The annual quantity was calculated at 224 ac-ft/yr for domestic use (0.224 ac-ft/yr per person x 1000), plus 225 ac-ft/yr for dairy farming (4.5 ac-ft/yr per dairy x 50). The purpose of use is for municipal supply. The priority date is July 30, 1980.

Existing Rights Held by the Receiving Water Systems

The Meadowbrook Water Association currently holds the following rights:

- Ground Water Certificate 2519 – This certificate issued for 150 gpm, 102 ac-ft\yr, from a well in the NE¼ SW¼ of Section 15, Township 40N, Range 3 East, for the rural community served by the Meadowdale (now Meadowbrook) Water Association. The priority date is April 23, 1954. This certificate is applicable to what is now known as the Kamm Road Wellfield (wells 1 & 2). Both wells have been decommissioned.
- G1-00123C - This certificate issued for 150 gpm, 100 ac-ft\yr, from a well in the SE¼ NE¼ of Section 7, Township 40N, Range 4 East, for the area served by the Meadowdale (now Meadowbrook) Water Association. The priority date is November 24, 1970. The annual quantity was issued as totally supplemental (non-additive) to Ground Water Certificate 2519. This certificate is applicable to what is now known as the Van Buren Road Wellfield (wells 1, 2, & 3). *The subject request is to add wells 2 and 3 as additional points of withdrawal to G1-26398C. Wells 2 and 3 will also continue to be authorized points of withdrawal for G1-00123C. Well 1 has been decommissioned.*

The Northwood Water Association currently holds and utilizes the following right:

- Ground Water Certificate 2114 – This certificate issued for 70 gpm, 112 ac-ft\yr, from a well in the NW¼ NW¼ of Section 14, Township 40N, Range 3 East, for domestic supply and stockwater for the members of the Northwood Water Association. The priority date is December 4, 1952.

The Northwood Park Water Association currently utilizes the following right:

- Ground Water Certificate G1-00144C – This certificate issued to Charles T. Bailey for 100 gpm, 12.5 ac-ft\yr, from a well in the NE¼ SE¼ SW¼ of Section 10, Township 40N, Range 3 East, for domestic supply. The priority date is August 5, 1971.

If the subject request is approved, the water supplied by the City of Sumas (through MWA) will replace the water supplied under the above two certificates. The wells authorized by both of these certificates have high nitrates and will therefore no longer be used. The ultimate disposition of these certificates has yet to be determined.

Hydrologic/Hydrogeologic Evaluation

In order for Ecology to approve additional points of withdrawal, the existing (authorized) wells and the proposed additional wells must tap the same body of public groundwater. The following Hydrologic-Hydrogeologic Evaluation (in italics and condensed by this report writer) was produced by Mr. Charles S. Lindsay, Senior Principal Geologist/Hydrogeologist, Associated Earth Sciences, Inc. (AESI), as part of the supporting documentation for the subject application for change. This evaluation is in a technical memorandum dated September 8, 2014, under AESI project number EH140061A, and is available in the subject water right record.

MWA Wellfield and Project Area Description

The project area is the general vicinity of the MWA Van Buren Road wellfield, which is located at 9163 Van Buren Road in the southeast ¼, northeast ¼, Section 7, Township 40 North, Range 4 East, in the Johnson Creek drainage of Whatcom County. The MWA wellfield is an approximately one acre parcel of property that includes two 10-inch-diameter steel cased production wells 7H02 and 7H03 (wells 2 & 3), one 36-inch-diameter concrete cased production well 7H01 (well 1), a small well house, and an above ground 132,000 gallon concrete reservoir. A summary of pertinent details for the MWA production wells is presented in Table 2. It is our understanding that production well 7H01 is not currently used by the MWA.

Table 2
Summary of MWA Van Buren Road Production Wells

Well	Location		Depth (feet)	Static Water Elevation (feet)	Potential Yield (gpm)	Completion Aquifer
	Latitude	Longitude				
7H01	48.973670	-122.331560	30.0	68.0	--	Sumas
7H02	48.973667	-122.331554	89.0	70.1	200.0	Sumas
7H03	48.973650	-122.331517	90.3	69.9	585.0	Sumas

Notes
"--" indicates unknown or data unavailable.

The area to the west of the MWA wellfield is generally comprised of gently rolling agricultural land and gravel mining property that generally slopes to the south, towards the Nooksack River. The area to the east of the MWA wellfield is also primarily agricultural land that slopes gently to the east and north, towards the northward flowing Sumas River. Johnson Creek is a small south to north flowing perennial tributary stream to the Sumas River that is located roughly 1,000 feet east of the MWA wellfield.

The ground surface elevation at the MWA wellfield is approximately 80 feet above mean sea level and the ground surface elevations in the project area range from over 200 feet, just northwest of the City's May Road wellfield, to less than 50 feet in the eastern portion of the project area where Johnson Creek enters the City of Sumas. All elevations referenced are relative to mean sea level, unless otherwise indicated. All depths referenced are relative to ground surface, unless otherwise indicated.

Geologic and hydrogeologic setting

Subsurface geologic and hydrogeologic conditions in the project area were evaluated based on the field explorations accomplished for this study, a visual reconnaissance of the project vicinity, and a review of applicable geologic/hydrogeologic materials.

Geologic Setting

The surficial geology of northwestern Whatcom County, including the study area, consists predominantly of unconsolidated glacial sediments deposited during the Fraser Glaciation. The Fraser Glaciation began approximately 20,000 years ago and had a duration of about 10,000 years (Porter and Swanson, 1998). Three phases of this glaciation, the Vashon Stade, the Everson Interstade, and the Sumas Stade, are represented in western Whatcom County by glacial deposits.

During the Vashon Stade, the Cordilleran Ice Sheet grew in size and a lobe of ice (Puget Lobe) extended into the Puget Sound. The Puget Lobe crossed the Canadian border about 19,000 years ago, and reached its terminus at Olympia, Washington, about 14,500 years ago (Porter and Swanson, 1998). Glacial till, a very dense, unsorted mix of silt to gravel-sized particles, was deposited at the base of the ice and blanketed the existing landscape. Vashon Stade deposits were not encountered in our study area but may be present at greater depths. Surface geology in the project consists of deposits, from oldest to youngest, of gray clay Everson glaciomarine drift (Qgdme), sand and gravel Sumas outwash (Qgso), Sumas ice-contact/terminal moraine deposits (Qgts), and Sumas valley silt lacustrine (lake) sediments (Qal).

The Everson Interstade lasted from about 13,500 to 11,000 years ago and represents a brief interglaciation event during which ice was retreating from the area. As the Vashon glacier retreated, it allowed seawater to reenter the Puget basin which caused the glacial ice to float. Everson interglacial deposits represent debris that fell from the floating and melting glacial ice and was deposited in marine water (Cox and Kahle, 1999). In the study area, deposits of the Everson Interstade are represented by glaciomarine drift (Qgdme), a gray silt/clay with occasional dropstones and sandy interbeds. Thickness of the glaciomarine drift can be greater than 250 feet in the project area (Lapen, 2000).

The final phase of the Fraser Glaciation, the Sumas Stade, lasted from roughly 11,000 to 10,000 years ago and represents the last pulse of glaciation before the current non-glacial period. At that time, the main glacial terminus was just north of the Canadian border with a lobe extending southward into Whatcom County at Sumas. Sumas outwash (Qgso) was deposited by meltwater streams carrying sand and gravel southward and southwestward from the terminus. The resulting outwash plain extends from the Canadian border southward to Lynden and southwest from Sumas to Everson and includes the project area (Easterbrook, 1976). The glacial outwash grades from gravel and cobble near the border to sand with occasional clay lenses near Lynden (Cox and Kahle, 1999).

Isolated ice-contact/ice-marginal deposits (terminal moraine - Qgts), distinguished by their grain-size distribution and unsorted appearance, denote an extent of the Sumas lobe and overly the Sumas outwash in north-central portion of the project area near the community of Clearbrook. Following the retreat of the Sumas ice sheet, this moraine feature served as a constraining feature for the meltwater emanating from the ice sheet resulting in the development of a lake in what is now the Sumas River valley. This lake acted as a sediment trap (Kovanen et.al., 2011), covering the Sumas valley in silts and clays (Qal) to an average depth of approximately 16 feet (Kahle, 1990), until the moraine was breached and the lake drained. The resulting outburst flood scoured away portions of the Sumas outwash in the project area exposing the glaciomarine drift at the ground surface.

Hydrogeologic Setting

A regionally extensive, highly productive and widely used near surface aquifer is located in the permeable sand and gravel Sumas glacial outwash deposits beneath most of the project area. This regional extensive aquifer has been commonly referred to as the Sumas-Blaine, Sumas-Abbotsford, Abbotsford-Sumas and Sumas aquifer by various authors. The regionally extensive aquifer located in the project area will be referred to as the Sumas aquifer for the purposes of this report in accordance with Cox and Kahle (1999). Pertinent characteristics of the Sumas aquifer in the project area are presented in the following sections of this report.

Aquifer Extent and Thickness

The Sumas aquifer is located near the ground surface in most of the northwestern portion of the project area but it appears to be generally absent in the southern portion of the area where the underlying glaciomarine drift is exposed at the ground surface. The aquifer is overlain by ice-contact/morainal sediments in the north-central portion of the project area and by lacustrine sediments (Qal) in most of the eastern portion of the project area. The aquifer, where present, is underlain by glaciomarine drift throughout the project area.

The Sumas aquifer can be over 150 feet thick in Whatcom County but in the project area the undulating upper surface of the underlying glaciomarine drift results in a highly variable aquifer thickness that is generally less than 120 feet. For example, the Sumas aquifer appears to thin and pinch out completely just north of East Badger Road where the underlying glaciomarine drift is exposed at the ground surface. Also, a northward trending subsurface ridge of glaciomarine drift appears to be located just east of Van Buren Road, extending a short distance north towards Clearbrook Road.

The Sumas aquifer exists in both a confined and unconfined state in the project area. The aquifer transitions from an unconfined setting in the northwestern portion of the project area to a confined setting within the Sumas Valley and in north-central portion of the project area. The aquifer is confined in Sumas Valley by the overlying relatively low permeability lacustrine silt (Qal). The average thickness of the Qal in Sumas Valley is roughly 16 feet; however, thicknesses can range from 10 to 35 feet (Kahle, 1990). Ice-contact/morainal sediments (Qgts) appear to act as a confining unit over the Sumas aquifer in the north-central portion of the project area, including the area in the vicinity of the City's May and Kneuman Road wellfields. The City's production wells in these two wellfields are generally flowing artesian wells due to the confining pressure from the ice-contact sediments.

Aquifer Parameters

General

Estimates of pertinent parameters (hydraulic conductivity, transmissivity and storativity) for the Sumas aquifer within the general project area boundaries were derived from data presented in published reports, values presented in the literature, aquifer testing information presented on water well reports for selected wells located within the project area, and aquifer testing information for the MWA Van Buren Road production wells.

Aquifer Transmissivity

Aquifer transmissivity is a measure of the amount of water that can be transmitted horizontally by the full-saturated thickness of the aquifer under a hydraulic gradient (slope) of 1. Transmissivity can be estimated from the aquifer specific capacity data (discharge rate divided by total water level drawdown) using the modified Jacob nonequilibrium equation (Fetter, 1994). Data regarding aquifer testing rates, duration and resulting water level drawdown are typically recorded on water well reports by the well driller when aquifer tests are conducted. Six of the water well reports for wells located in the project area had sufficient aquifer testing information to reliably estimate well specific capacity and; consequently, aquifer transmissivity. The six wells and their corresponding aquifer parameters are presented in Table 3.

Table 3
Summary of Aquifer Parameter Data

Well	Specific Capacity (gpm/ft)	Data Analyses Method	Transmissivity (ft^2/d)	Hydraulic[1] Conductivity (ft/d)
5M01	5.9	Jacob	1,180	15
7B03	80.0	Jacob	16,040	200
7H02	25.0	Jacob	5,015	63
8A01	93.8	Jacob	25,070	314
8Q01	40.0	Jacob	10,700	134
8R01	60.0	Jacob	12,030	150
7H03	12.7	Moench	15,125	189
Average			12,165	152
Reported Range – Cox and Kahle (1999)			6,000 – 49,000[1]	74 – 610[2]
Reported Range - Culhane (1993)			1,350 – 17,400	17 - 220[1]

Notes:

[1] Based on estimated average aquifer thickness of 80 feet in project area.

[2] 25th to 75th percentile range for values obtained from 170 wells completed within the Sumas aquifer.

Using the Jacob method and the well specific capacity data, the aquifer transmissivity was estimated to range between roughly 1,200 square feet per day (ft^2/d) to just over 25,000 ft^2/d in the six wells identified for this project that had the required aquifer testing data for analyses (Table 3).

Water level drawdown and recovery data from a 24-hour constant-rate aquifer pumping test in MWA well 7H03 was also analyzed using the computer program AQTESOLV and the Moench method for unconfined

aquifers to estimate a value of transmissivity for the Sumas aquifer in the vicinity of the well. The aquifer transmissivity value estimated for 7H03 from the long-term aquifer testing data was 15,125 ft^2/d (Table 3). The average transmissivity for the Sumas aquifer in the project area, including the results from the 24-hour test in 7H03, is approximately 12,165 ft^2/d (Table 3). This estimated average transmissivity value compares well to the range of transmissivity values reported by Cox and Kahle (1999) for the Sumas aquifer and the range estimated by Culhane (1993) for the Sumas aquifer in the immediate vicinity of the project area (Table 3).

Aquifer Hydraulic Conductivity

Hydraulic conductivity is a measure of the rate at which water can move through an aquifer and is equal to the transmissivity divided by the saturated thickness of the unit. Information presented on water well reports for wells located in the project area and aquifer thickness information presented in Cox & Kahle (1999) indicate that the Sumas aquifer is an average of roughly 80 feet thick in the project area. Based on an assumed aquifer thickness of 80 feet, the transmissivity values estimated for the Sumas aquifer in the project area correspond to hydraulic conductivity values ranging between 15 feet per day (ft/d) and 340 ft/d, with an average value of 152 ft/d (Table 3). The estimated range of hydraulic conductivity values compares well with the ranges presented in Cox and Kahle (1999) and Culhane (1994) for the Sumas aquifer in the vicinity of the project area.

Aquifer Storativity

Storativity is a dimensionless quantity that is equal to the volume of water that an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in hydraulic head. As previously discussed, the Sumas aquifer in the project area is under both confined and unconfined conditions. Storativity for confined aquifers generally ranges from highly confined conditions (0.00005) to semi-confined conditions (0.005). Storativity in unconfined aquifers is typically equal to the aquifer specific yield. The specific yield of unconfined aquifer typically ranges between 0.005 and 0.35 (Fetter, 1994).

The aquifer testing data available for MWA well 7H03 was used to estimate an aquifer specific yield value of 0.007, which indicates that the Sumas aquifer in the immediate vicinity of the MWA wellfield in likely in the transition zone between unconfined in the west and confined conditions in the east.

Aquifer Recharge and Discharge

Recharge to the aquifer where it is under unconfined conditions is from the downward percolation of precipitation into the aquifer. Discharge from the aquifer occurs from pumping wells and seeps up to ground surface where the water table intersects ground surface elevation. Recharge to the confined aquifer results primarily from the lateral inflow of ground water from the unconfined portion of the aquifer and, to a much more limited extent, from the vertical infiltration of precipitation through the low permeability confining units.

Where unconfined, the Sumas aquifer discharges to springs, seeps, and other surface water bodies, and through the use of ground water extraction wells. In the Sumas River valley, where the aquifer is under confined conditions, the aquifer likely primarily discharges via lateral outflow to unconfined portions of the Sumas aquifer and from the use of ground water extraction wells.

Ground Water Flow Direction

Ground water and surface water in the upland area northwest of the MWA wellfield generally flows towards the south and southeast. In the vicinity of the City's wellfields, the ground water flow direction is generally toward the east and southeast, into the Sumas River valley.

Just to the east of the MWA wellfield, ground water flow is blocked by a north-trending subsurface ridge of glaciomarine drift (Qgdme) that appears to be located just to the east of the railroad tracks. The clay-rich glaciomarine drift acts as a hydrogeologic barrier, allowing little to no ground water flow across the subsurface ridge. Instead, ground water is locally diverted north to northeasterly around the north trending ridge of Qgdme then turns to the east and flows into the confined portion of the Sumas aquifer located in the Sumas River valley. Ground water flow in the Sumas River valley generally flows to the north and/or northeast, eventually flowing into Canada.

Ground Water Flow Velocity

The average linear velocity of ground water flow in the Sumas aquifer can be estimated using the following equation:

$$Vel_{avg} = 1/n_e \times K \times i$$

Where:

n_e =	*Effective porosity (dimensionless)*
K =	*Hydraulic conductivity (ft/d)*
i =	*Aquifer hydraulic gradient (dimensionless)*

The effective porosity of the Sumas aquifer likely ranges between 0.15 and 0.25 based on information presented in Cox and Kahle (1999) and our understanding of the local geology/hydrogeology. For the average linear velocity calculation we assumed an average effective porosity of 0.20. As previously discussed, the average hydraulic conductivity in the project area is approximately 152 ft/d (Table 3). The hydraulic gradient of the upper surface of the Sumas aquifer in the vicinity of the MWA wellfield is approximately 0.02 (106 feet per mile).

Using the above described values for the variables in the average linear velocity equation indicates a ground water velocity in the immediate vicinity of the MWA wellfield of approximately 15.2 ft/d.

Potential impacts analyses

General

As previously discussed, Ecology is required to answer the three questions listed below during their investigation to determine if the two MWA production wells can be added as additional points of withdrawal to the City's water rights associated with the May Road and Kneuman Road wellfields.

1. ***The additional wells tap the same body of public ground water as the original wells per RCW 90.44.100(2)(a).***
2. ***Where an additional well(s) is constructed, the user may continue to use the original well(s), but the combined total withdrawal from all wells shall not enlarge the right conveyed by the original certificate per RCW 90.44.100(2)(c).***
3. ***Other existing rights shall not be impaired per RCW 90.44.100(2)(d).***

During a previous water right evaluation Ecology concluded that the City's production wells are completed within the "Sumas aquifer". As described in detail in this report, the two MWA wells that are proposed as additional POWs are also completed within the Sumas aquifer. Therefore, the same body of public groundwater criterion has been satisfied.

Adding the two MWA wells to the City's water right will not result in an enlargement of the "right conveyed by the original certificate" because no increases to the water right Qi (860 gpm) or Qa (1,376 afy) are proposed under the change. The following sections of this report discusses the potential for the proposed use of the MWA wells to "impair" other nearby existing water rights and/or streamflow in Johnson Creek.

Potential Impairment of Nearby Water Rights

A review of Ecology's water right database indicates that there are at least 13 ground water right claims, one surface water right claim, four surface water right certificates and one groundwater right certificate located within roughly 1,000 feet of the MWA wellfield. Furthermore, it is also likely that there are several exempt wells located within 1,000 feet of the wellfield. However, our review of the available information and site observations indicate that no wells are located within approximately 300 feet of the MWA wells.

Potential interference drawdowns at various distances were calculated using the aquifer average transmissivity value (12,165 ft^2/d) and storage value (0.007) obtained from the previously discussed MWA aquifer tests, and assuming a maximum pumping rate equal to the G1-26398C Qi of 860 gpm. The maximum calculated interference drawdowns at distances of 200, 500 and 1,000 feet were 10.5 feet, 8.6 feet, and 7.1 feet, respectively. This data indicates that the potential interference drawdown decreases rapidly with distance from the MWA wells.

It is unlikely that the use of the MWA wells at a pumping rate of 860 gpm would cause impairment to surrounding water right claims and certificates, and/or exempt wells because: (1) the Sumas aquifer is relatively thick in the immediate vicinity of the wellfield which results is a significant depth of available water level drawdown, (2) the hydraulic conductivity and transmissivity of the aquifer is moderately high, and (3) the calculated potential interference drawdowns are relatively low at distances of 200 feet and greater from the MWA wells.

Potential Impairment to Johnson Creek

General

Pumping ground water from the MWA wells could result in a potential decrease in ground water recharge to Johnson Creek, which is located to the east of the wellfield. AESI used the Hunt spreadsheet to estimate the potential impact to Johnson Creek from the continuous use of the MWA wells at the maximum potential pumping rate of the well under water right G1-26398C.

Bruce Hunt (Civil Engineering Department, University of Canterbury) developed a series of Excel spreadsheets and a collection of user-defined functions for analyzing some problems in ground water resource analysis, including estimating stream depletion from ground water pumping in a setting where the aquifer is separated from surface water by low-permeability sediments or bedrock, which is similar to the conditions in the Sumas Valley (Hunt spreadsheet). The Hunt spreadsheet utilizes well known and

proven analytical solutions such as Theis (1935), Hantush (1967), Hantush-Jacob (1955), Boulton (1963), and Neuman (1969). The analytical basis for the spreadsheets is described in detail in Hunt (1983, 1998, 2003a, 2004, 2005, and 2008), Hunt and Scott (2005, 2007), and Hunt and Smith (2008).

The Hunt spreadsheet was used to quantify the potential reduction in ground water recharge to surface water (Johnson Creek), assumed to be located 1,100 feet east of the MWA wells, under the maximum water right pumping conditions for the well (860 gpm). The values of the spreadsheet input parameters were chosen based on the available information presented in the previously referenced USGS reports, other cited sources or from specific field collected data. To be conservative, many of the parameter values were intentionally skewed in a manner that would result in a greater calculated potential impact on surface water in the immediate vicinity of the Meadowbrook wells. The input parameters chosen for the analysis are discussed below.

Pumped Aquifer

An aquifer is a water-bearing or saturated formation that is capable of serving as a ground water reservoir supplying enough water to satisfy a particular demand. As discussed previously, the MWA wells are completed in the Sumas outwash (Qgso). Aquifer testing data indicates that the transmissivity of the Sumas aquifer in the vicinity of the MWA wellfield is an average of approximately 12,165 ft^2/d (Table 3). The MWA well testing program also indicated a storage value for the Sumas aquifer of 0.007. Therefore, a transmissivity value of 12,165 ft^2/d and an aquifer storage value of 0.007 were used in the Hunt model.

Aquitard

As previously discussed, area well logs and information compiled by Khale (1990) indicate that the Sumas aquifer just to the east of the MWA wellfield is separated from the ground surface by an average of roughly 16 feet of very fine-grained, low-permeability alluvial sediments that are predominately lacustrine silt and clay deposits. The lacustrine sediments act as an aquitard/confining unit that retards but does not completely prevent the flow of water to or from the Sumas aquifer and surface water such as Johnson Creek.

For the purposes of this analysis, we assumed that the laboratory measured permeability value for the alluvial sediments was representative of the hydraulic conductivity of the alluvial sediments. However, to be conservative, the aquitard hydraulic conductivity value input into the Hunt model was set at 0.0159 ft/d which is 10 times greater than the measured laboratory value. A greater aquitard hydraulic conductivity value will result in the Hunt model predicting a higher percentage of impact to surface water from the use of the MWA wells.

The thickness of the aquitard was assumed to be 16 feet based on the well drilling records and Khale's (1990) data collection and analysis. The specific yield of the silt/clay aquitard unit was assumed to be 0.03, which is the typical average value for these types of sediments (Fetter, 1994).

Streambed

The streambed hydraulic conductivity of Johnson Creek was assumed to be the same as the aquitard at 0.0159 ft/d. Setting the streambed conductivity to the same value as the valley aquitard material is conservative in that a fine sediment layer generally forms at the base of most streams which reduces the

streambed conductivity and restricts interaction with the underlying geologic units. For the purposes of the Hunt analysis, it was assumed that the streambed did not restrict the potential movement of water from the stream to the aquifer any more than the underlying alluvial aquitard sediments. For input into the spreadsheet, the streambed thickness is defined as the distance between the base of the stream and the top of the aquifer. To be conservative, the thickness of the streambed was assumed to be 1.6 feet (0.5 meters). It should be noted that a thicker streambed would result in less impact to the stream from the use of the wells. The average width of the Johnson Creek, in the immediate vicinity of the project site, was estimated at 20 feet based on our site observations and measurements taken using GoogleEarth.

Wells

As previously discussed, the maximum pumping rate of the MWA wells was assumed to be equal to the maximum water right Qi of 860 gpm. The separation distance is the ground water travel distance between the well and the stream. Ground water flowing past the MWA wells will have to flow to the north and then east, around a subsurface barrier of glaciomarine drift, a total distance of at least 2,000 feet before it can potentially impact flow in Johnson Creek. However, for the purposes of this analysis, the horizontal separation distance was set at 1,100 feet, which is the closest straight line distance between the MWA wells and Johnson Creek.

Hunt Model Results

The analytical analysis completed using the Hunt spreadsheet program and the conservative input values discussed above, indicate that the use of the MWA wells at a withdrawal rate of 860 gpm for one year of continuous pumping could potentially result in a decrease in ground water recharge to nearby Johnson Creek of approximately 8%. Therefore, the impact to Johnson Creek that will need to be mitigated will be equal to 8% of the long term average pumping rate from the MWA wells under the City's water right G1-26398C.

AESI CONCLUSIONS

- *The referenced geologic maps, Khale's (1990) study, the City of Sumas Wellhead Protection Plan, and additional site-specific data indicate that the project area in the immediate vicinity of the MWA wellfield is underlain by the Sumas aquifer.*

- *Ground water flows into the project area generally from the northwest and just to the east of the MWA wellfield makes an abrupt turn to the northeast and flows around a previously-unmapped lobe of very fine-grained glaciomarine drift deposits (Qgdme) which prevents ground water from flowing into the Sumas River valley directly to the east of the wellfield.*

- *Well logs and prior cited studies indicated that the Sumas aquifer in the Sumas Valley is confined by approximately 16 feet of low-permeability lacustrine silts and clays which create some degree of hydraulic separation between the aquifer and surface waters.*

- *The conservative analytical calculations presented in this report indicated a potential impact to Johnson Creek (a tributary of the Sumas River) equal to roughly 8% of the long-term average pumping rate of the wells under water right G1-26398C. It should also be noted that the Hunt analytical calculation did not take into account continued recharge to the aquifer system by seasonal rainfall, which would likely further reduce the potential impacts.*

MITIGATION PLAN

The above analyses indicate a potential ground water recharge impact to Johnson Creek that is equal to 8% of the long-term average pumping rate of the MWA wells. Due to the previously discussed subsurface geologic/hydrogeologic setting in the immediate vicinity of the MWA wellfield, the potential ground water recharge impact would likely occur in the reach of Johnson Creek that is located approximately 2,000 feet northeast of the wellfield. Therefore, it would take roughly 133 days (4.3 months) for the effects of the use of the MWA wells to begin impacting Johnson Creek, based on an average ground water flow velocity of 15 ft/d.

The Meadowbrook Water Association proposes to mitigate the potential ground water recharge impact to Johnson Creek by discharging water at a rate equal to 8% (now 18%, see page 24) into a small tributary stream located roughly 400 feet south of the MWA wellfield. The tributary stream flows generally to the east and discharges into Johnson Creek roughly 1,000 feet upstream of where ground water recharge to the stream may be affected by the proposed used of the MWA wells. Our field observations indicate that the tributary stream is incised into the underlying low permeability glaciomarine drift from just upstream of Van Buren Road to near where the tributary meets Johnson Creek.

The (mitigation) water will be discharged into the stream via an energy dissipation/aeration structure. The mitigation water will flow down the tributary stream channel approximately 1,000 feet and then into the mainstem of Johnson Creek.

MITIGATION PLAN UPDATE

The following mitigation plan update was submitted to Ecology in a letter dated October 7, 2014, from Rod Fadden.

> *The AESI report conservatively estimates that the potential impact to Johnson Creek resulting from use of the two MWA wells under the City's water right would be less than 8% of the long-term combined pumping rate of the two wells. Consequently, the mitigation plan developed by AESI proposes to mitigate the potential impact to Johnson Creek by discharging 8% of the water pumped from the MWA wells under G1-26398C into a tributary stream that discharges to Johnson Creek.*
>
> *A provision of water right G1-26398C currently requires that 18% of the water withdrawn under this right from the City's May and/or Kneuman Road wellfields (current POWs) be discharged to a nearby surface water spring system as mitigation for potential impacts. Although the current 18% mitigation volume far exceeds the predicted 8% impact resulting from the use of the two MWA wells, the City is proposing to extend the 18% mitigation volume to the use of the MWA wells under water right G1-26398C for the following reasons:*

- *Increasing the mitigation volume from 8% to 18% will far exceed the predicted potential impact to Johnson Creek and will result in an increase in flow in the creek and ultimately the Sumas River.*
- *Groundwater pumped from the MWA wells under the City's water right will be utilized as municipal water in the MWA service area which is primarily located within the Nooksack River basin. The MWA service area does not have a regional wastewater collection/treatment system but utilizes individual septic drainfields for wastewater disposal. Therefore, a significant percentage of the groundwater imported into the Nooksack basin from the use of MWA wells will ultimately end up as shallow groundwater recharge, which should result in an increase in flow in the Nooksack River and various tributaries.*

Therefore, approving the City's water right change application with an 18% mitigation provision will result in an increase in surface water flows in both the Sumas and Nooksack River basins and, consequently, a potential enhancement of critical fisheries habitat.

CONCLUSIONS

Based on my review of the AESI report, the updated mitigation plan, personal knowledge of the area, and review of other pertinent reports and records, I conclude the following:

- The requested additional points of withdrawal tap the same body of public ground water as the original wells as required in RCW 90.44.100(2)(a).
- All the subject wells will be required to be metered, with use recorded and reported, therefore I believe the combined total withdrawal from all wells will not enlarge the right conveyed by the original certificate as required in RCW 90.44.100(2)(c).
- Other existing rights will not be impaired as required in RCW 90.44.100(2)(d).
- The AESI report stated that pumping the Meadowbrook wells would affect Johnson Creek at an expected impact equal to 8% of the long-term average pumping rate of the MWA wells. However, the City of Sumas has offered (and Ecology has accepted) to keep their mitigation rate at 18% of the pumping rate as required by the existing water right certificate.
- The subject water right has been fully perfected, is in good standing, and is eligible for change.
- And, there will be no detriment to the public interest. In fact, this approval will resolve a long-standing public health situation.

Consideration of Protests

The subject application was protested by the Lummi Indian Business Council. The protest is based on concerns over current and future potential impacts on instream flows. However, the subject of this report is an application for change, not an application for new (consumptive) water use. Because the quantities of water involved will remain unchanged and because each of the wells pumps from the same body of public water, no additional or new negative impacts are anticipated from the subject change. The pumping of water from any of the subject wells will not create a diminishment of stream flows any greater than current conditions.

RECOMMENDATIONS

Based on the above investigation and conclusions, I recommend this request for a change of water right be approved in the amounts and within the limitations listed below and subject to the provisions listed on pages 3 and 4.

Authorized Quantities, Points of Withdrawal, and Place of Use

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:

Authorized Quantities

860 gallons per minute, 1376 acre-feet per year for municipal supply and mitigation

- Quantities withdrawn under G1-23698 and G1-26398 shall not exceed 1660 gallons per minute and 1825.0 acre-feet per year. Due to hydraulic continuity, Johnson Creek shall be augmented at a rate of 18 gpm for every 100 gpm withdrawn under G1-23698 and G1-26398. Stream augmentation is to occur simultaneously as the water is withdrawn. Stream augmentation shall occur as near to the utilized point(s) of withdrawal as feasible.

Authorized Points of Withdrawal

SOURCE	STATUS	PARCEL	WELL TAG	TWP	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
KRW Well 2	M/E	4104334412930000	AGK373	41N	04E	33	SENE	49.000695	-122.289418
KRW Well 2R	A	4104334412930000	BCS869	41N	04E	33	SENE	49.000671	-122.289435
KRW Well 3	A	4104334412930000	ACK313	41N	04E	33	SENE	49.000880	-122.289520
KRW Well 4	M/E	4104334412930000	AGK337	41N	04E	33	SENE	49.000770	-122.288880
KRW Well 4R	A	4104334412930000	ACR785	41N	04E	33	SENE	49.000770	-122.288890
KRW Well 5	A	4104334412930000	AGK361	41N	04E	33	SENE	49.000605	-122.289033
MRW Well 1	A	4104331061080000	AGK351	41N	04E	33	SWSW	48.994530	-122.302120
MRW Well 2	A	4104331061080000	AGF270	41N	04E	33	SWSW	48.995950	-122.302180
MRW Well 3	A	4104331061080000	AGK357	41N	04E	33	SWSW	48.995760	-122.302208
MWA Well 2	A	4004074943620000	ABO392	40N	04E	07	SENE	48.973667	-122.331554
MWA Well 3	A	4004074943620000	AGO439	40N	04E	07	SENE	48.973650	-122.331517

Sources: KRW – Kneuman Road Wellfield (City of Sumas), MRW- May Road Wellfield (City of Sumas), MWA – Meadowbrook Water Association

Status: M- monitoring, E- emergency, A- active

Authorized Place of Use

The place of use (POU) of this water right is the service area described in the most recent City of Sumas Water System Plan approved by the Washington State Department of Health, so long as the water system is and remains in compliance with the criteria in RCW 90.03.386(2). RCW 90.03.386 may have the effect of revising the place of use of this water right.

Buck Smith, LG, LHG, License #1479 *Date*

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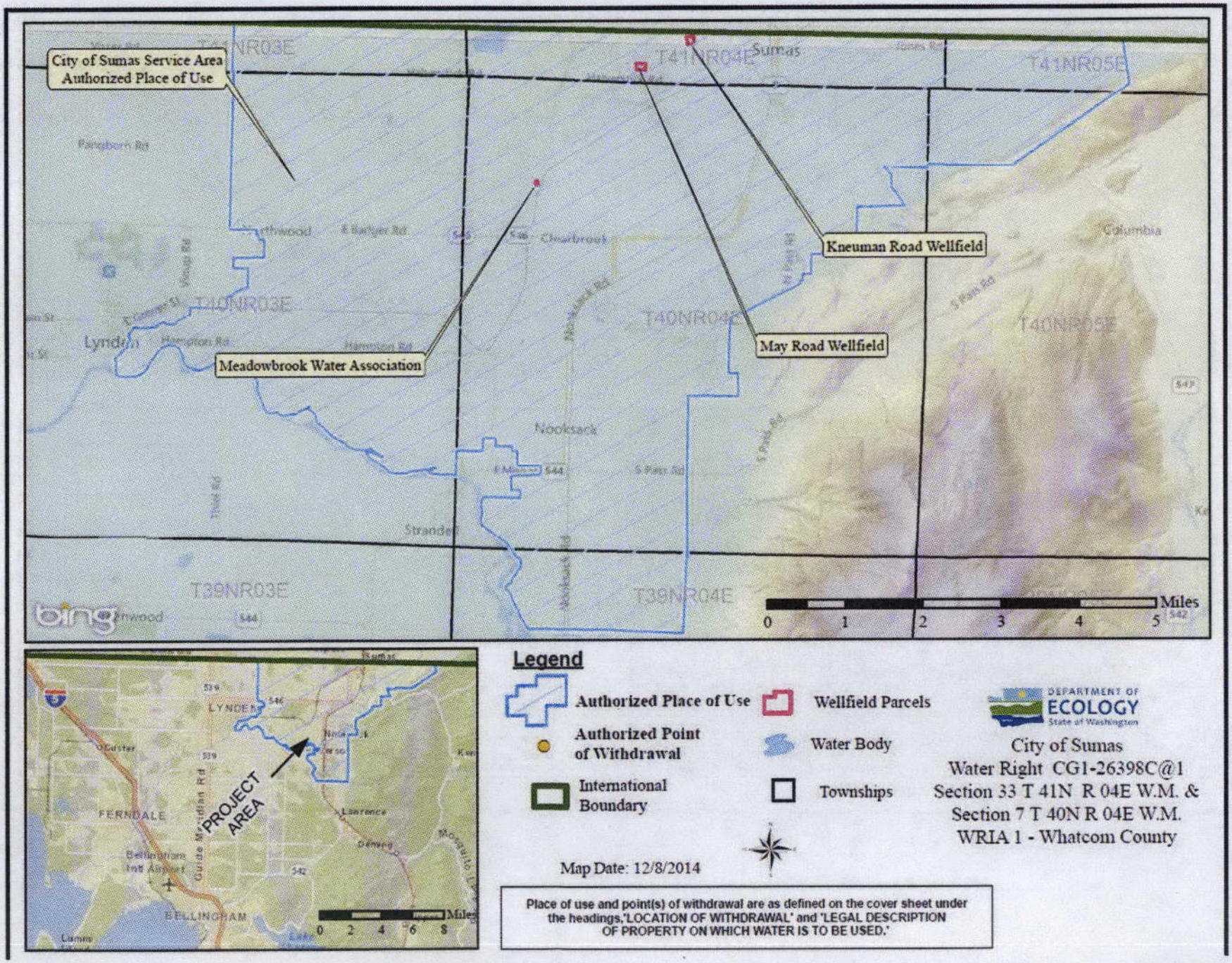

ATTACHMENT 1

ATTACHMENT 2