

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PROTESTED REPORT OF EXAMINATION
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

- Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)
- Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE August 1, 2007	APPLICATION NUMBER G1-28511	PERMIT NUMBER	CERTIFICATE NUMBER
NAME The Highlands, Inc.			
ADDRESS (STREET) 1000 2 nd Avenue, Suite 1200	(CITY) Seattle	(STATE) WA	(ZIP CODE) 98104

PUBLIC WATERS TO BE APPROPRIATED

SOURCE Well (Highlands Park well)		
TRIBUTARY OF (IF SURFACE WATERS)		
MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE 80 (Qi)	MAXIMUM ACRE FEET PER YEAR 10 (Qa)

QUANTITY, TYPE OF USE, PERIOD OF USE

The application request is for a continuous (year-round) instantaneous pumping withdrawal of 10 gallons per minute (gpm), and a peak pumping withdrawal (Qi) of 80 gpm for no more than 30 days per year. The annual withdrawal (Qa) requested is 10 acre-feet per year (ac-ft/yr). These values are based on an application amendment request dated June 22, 2008. The period of use is year-round, as needed, and withdrawal will be from a single well that is already installed, although the permit application is for up to two wells. Water use is for filling (30 days per year) and for replenishing an aquatic habitat pond to be utilized for fish and wildlife maintenance and enhancement, and for recreational purposes. The project will involve the construction of aquatic and terrestrial habitat near the headwaters of a small tributary of Boeing Creek.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

The Highlands Park well was drilled in 2008 as part of this water right application in the SE ¼ of NE ¼ of Section 13 in the city of Shoreline (Figure 1). The well is 297 feet deep and is located at an elevation of approximately 515 feet above mean sea level (msl). The well yields enough water to serve the purposes of the project, and an additional well is not needed or planned at this time.

The extracted ground water will be pumped through piping to a reservoir/pond located in the SW ¼ of NE ¼ of Section 13 (Figure 2). The pond inlet is located approximately 500 feet southwest of the well location. The pond is being designed to have an overflow outlet of some type, which will divert some water back into a tributary of Boeing Creek or via an infiltration gallery back into the subsurface. This reservoir is being addressed under a separate reservoir application (R1-28527).

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) SE 1/4, NE 1/4 (Parcel No. 132603-9003)	SECTION 13	TOWNSHIP N. 26N	RANGE, (E. OR W.) W.M. 3E	W.R.I.A. 8	COUNTY King
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RECORDED PLATTED PROPERTY

LOT H2	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
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LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Real Property situated in the County of King, State of Washington: Lot "H2" of city of Shoreline Boundary Line Adjustment (BLA) No. SHLA 2007-05, recorded under recording number 20070423900002 SD BLA, records of King County, Washington, located in the south half of the northeast quarter, Section 13, Township 26 North, Range 3 East, Willamette Meridian. The well is located in the northern portion of Lot "H2" and the proposed pond is located in the south-central portion of adjacent Lot "E" (Parcel 132603-9090), both owned by The Highlands, Inc.

DESCRIPTION OF PROPOSED WORKS

The extracted ground water from the Highlands Park well will be used for filling and replenishing a fish-bearing pond located in the vicinity of the well. Some pond water will be regularly spilled to the tributary of Boeing Creek, and with other natural losses of water from the pond, the well will be used to maintain a certain water level within the pond. The water well and piping system will be used throughout the year to supply the pond.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE: Final design begun in April 2010	COMPLETE PROJECT BY THIS DATE: December 31, 2013	WATER PUT TO FULL USE BY THIS DATE: December 31, 2015
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PROVISIONS

- An approved measuring device shall be installed and maintained for each well identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use," WAC 173-173.
- Water use data shall be recorded monthly. Data shall be maintained by the property owner and promptly submitted to Ecology upon request. Recording and retention of data by the water right holder are required to inform the water users about how much water is used, when the water is used and to assist users in efficient water management.
- WAC 173-173 describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."
- Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.
- All water wells constructed within the State shall meet the minimum standards for well construction and maintenance as provided under WAC 18.104, Washington Water Well Construction Act of 1971, and WAC 173-160, Minimum Standards for Construction and Maintenance of Wells.
- In accordance with WAC 173-160-205, wells shall not be located within certain minimum distances of potential sources of contamination. These minimum distances shall comply with local health regulations, as appropriate. In general, wells shall be located at least 100 feet from a sewer, septic tank, privy, or other source of contamination. Wells shall not be located within 1,000 feet of a solid waste landfill.
- Installation and maintenance of an access port as described in WAC 173-160-291 is required. An air line and gauge may be installed in addition to the access port.
- In order to protect the resource, static water level (SWL) shall be measured at least twice a year, in April and September. Measurements shall be taken after the pump has been shut off a reasonable time to allow water level to return to normal. Ecology's Water Resources section at the Northwest Regional Office (NWRO) shall be notified if a below normal seasonal drop is measured in SWL; otherwise this data shall be maintained and be made available to Ecology upon request. (See enclosed form.)
- A certificate of water right will issue for only that quantity of water that has been withdrawn and applied to actual beneficial use. Such quantity applied to actual beneficial use shall not exceed the quantity specified in this report of exam and will be calculated based on the best information available to Ecology, including metering data and/or water duty analysis.
- A certificate of water right will not be issued until a final investigation is made.

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, there will be no impairment of existing rights, the purpose of use is beneficial, and there will be no detriment to the public interest.

Therefore, I ORDER approval of Application No. G1-28511, subject to existing rights and the provisions listed above.

You have a right to appeal this action to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this document. 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 this document:

File your appeal and a copy of this document 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 document on Ecology in paper form - by mail or in person. (See addresses below.) Email is not accepted.

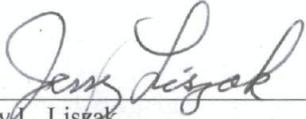
You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

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 P.O. Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board Environmental Hearings Office 1111 Israel Road SW, Suite 301 Tumwater, WA 98501	Pollution Control Hearings Board P.O. Box 40903 Olympia, WA 98504-0903

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 19th day of October, 2011.



 Jerry L. Liszak
 Acting Section Manager
 Water Resources Program
 Northwest Regional Office

BACKGROUND**Description and Purpose of the Project**

The subject application was submitted to Ecology by Nick Hanauer on behalf of The Highlands, and assigned a priority date of August 1, 2007. The application is for appropriation of ground water to provide water supply to a community pond to be used as aquatic habitat for fish and wildlife maintenance and enhancement, and for recreational purposes. The well has been installed and tested, but the pond and surrounding aquatic habitat have not yet been constructed. The pond will be initially filled during the winter time, when ground water and surface water levels are high. Periodic maintenance filling will subsequently take place. Figure 2 shows the location of the existing well and the proposed pond, which constitute the intended place of use. The land near the well is currently undeveloped and forested, adjacent to a gravel road. The property near the proposed pond is a former local household dumping area that has been cleared and leveled, with some grassy vegetation.

Legal Requirements for Application Processing

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 90.44.060.

The following legal requirements must be met, and have been met, prior to processing a water right application:

- **Public Notice**—Public notice of the applications for both G1-28511 and R1-28527 was published in the Seattle Daily Journal of Commerce, a weekly newspaper, for a period of two weeks on July 2 and July 9, 2008. There was one written protest received during the statutory 30-day protest period, by the Seattle Golf Club.
- **State Environmental Policy Act (SEPA)**—The subject water right application (G1-28511) for ground-water extraction is categorically exempt under SEPA WAC 197-11-305 and WAC 197-11-800(4) because the instantaneous quantity is less than the 2,250 gpm threshold. However, construction of the pond reservoir (R1-28527) will require a SEPA grading permit to be submitted to the city of Shoreline. This Report of Examination for application G1-28511 is being completed independent of the need for a SEPA permit for the reservoir.

INVESTIGATION

This investigation included, but was not limited to, research and/or review of:

- Dunn, L. 2010. *Highlands Park Groundwater Right Application G1-28511*; memo for the Highlands Park Project to Jay Cook of Department of Ecology, January 8, 2010.
- Golder Associates. 2008. *Technical Memorandum: Highlands Park Well Completion and Testing*; November 3, 2008, submitted to Washington Department of Ecology on November 12, 2008.
- Haase, P.C. 1987. *Glacial Stratigraphy and Landscape Evolution of the North-Central Puget Lowland, Washington*; Master's thesis, Department of Geological Sciences, University of Washington.
- Liesch, B.A., C.E. Price, and K.L. Walters. 1963. *Geology and Ground-Water Resources of Northwestern King County, Washington*; U.S. Geological Survey, Water Supply Bulletin No. 20, 1963.
- Richardson, D., J.W. Bingham, and R.J. Madison. 1968. *Water Resources of King County, Washington*; U.S. Geological Survey, Water-Supply Paper 1852.
- SAIC. 2009. *Phase I Review for The Highlands Water Right Application G1-28511*; Technical Memorandum from Thomas Dubé of SAIC to Jay Cook of Washington State Department of Ecology, Water Resources Program, March 30, 2009.
- Troost, K.G., and D.B. Booth. 2008. *Geology of Seattle and the Seattle Area, Washington*; in "Landslides and Engineering Geology of the Seattle, Washington, Area"; The Geological Society of America, Reviews in Engineering Geology XX, pp. 1-35.
- *Water Well Reports*, from the Department of Ecology well log database (various dates).
- Records of water rights (and related information) for the vicinity of the subject property.
- Project design and other documents provided by the applicant.
- Personal communication with Letha Dunn (Highlands Park Project), Jamie Morin (Mentor Law Group), and Michael Klisch (Golder Associates) during a site visit and meeting on April 27, 2010, as well as subsequent communication.

Geographic Setting of the Place of Use and Point of Withdrawal

The Highlands/Hanauer Park property (combined Lots "E" and "H2") is located in the city of Shoreline, Washington. The site (measured from the well location) is located about 4,500 feet east of the shoreline of Puget Sound, north of the city of Seattle, and receives approximately 38 inches of annual precipitation. As shown in Figure 1, the property is located on the western slope of a north-trending ridge. The site is situated within Water Resource Inventory Area (WRIA) 8, Cedar-Sammamish watershed. The Highlands/Hanauer Park property is located within the Boeing Creek sub-basin of this watershed. The property is currently largely undeveloped, with forested and open grassy areas, and some gravel roads. A number of residential lots border the property on its northern side, as part of the Shorewood Hills Division 1. Undeveloped land exists on the southern side of the property. To the west of Lot "H2" is Lot "E," also owned by The Highlands, Inc. The Highlands Park pond is located on Lot "E." The Highlands Park well is located close to the boundary between these two lots. East of Lot "H2" are a number of residences, part of the Highland Terrace development. On the west end of Lot "E" is a 150-foot wide landscape buffer, and beyond that to the west is the Hanauer residence and the Hanauer well.

The nearest named surface water body to The Highlands property is Boeing Creek, with Hidden Lake filling a portion of its main channel. The creek and lake are located approximately 3,400 feet northwest of the Highlands Park well. The upper portion of an unnamed southern tributary of this creek (nearest to the property) is usually dry and is located approximately 1,600 feet northwest of the well. In the downstream direction, this tributary begins showing surface water flow at an elevation of about 280 feet msl. Boeing Creek is closed to further consumptive appropriation throughout the year.

The Highlands Park well was drilled from July 23 to 29, 2008, as part of this water right application (Figure 1). The water right application requested a permit for two wells, but the first well provided sufficient quantities of water for the purposes of the project.

Purpose of Application

Ground water is requested for filling and replenishment of a pond, listed in the application for the purposes of “fish and wildlife maintenance, and recreational purposes.”

Hydrogeology

The discussion of geology and hydrogeology in this section is primarily based on information presented by Golder (2008), and SAIC (2009), as well as examination of maps and water-well logs, with regional background information from a number of documents referenced above.

The Highlands Park property is situated on a west-sloping hillside along a north-south trending glacial hill on the east side of Puget Sound. The site is primarily underlain by Pleistocene deposits associated with the Fraser Glaciation that occur throughout the greater Seattle area. These deposits are up to hundreds of feet thick and comprise most of the ridges and uplands in the region. Some of the coarser-grained members within this glacial drift host the uppermost aquifer in this region. Older glacial and interglacial units underlie the Fraser deposits. The geologic units are described below, along with their hydrostratigraphic characteristics, from youngest to oldest unit:

- *Vashon Recessional Outwash.* The recessional outwash consists of thin, discontinuous layers of sand and gravel, with less common silt; it but may hold some perched ground water.
- *Vashon Till.* This glacial till consists of unsorted sediments that vary from clay to boulder and are generally highly compacted. Till thickness is typically from 3 to 30 feet. This unit is generally classified as a nonaquifer, and it may perch water on or within it.
- *Vashon Advance Outwash.* This member consists of well-sorted sand and gravel, with local silt lenses. This unit is typically up to 200 feet thick and forms a widespread aquifer in the area.
- *Vashon Lawton Clay.* The Lawton Clay consists of massive silt, clayey silt, and silty clay. The Lawton Clay is laterally extensive, may fill former channels, can be greater than 100 feet thick in some areas, and functions as an aquitard.
- *Pre-Vashon Fine-Grained Deposits.* These pre-Fraser deposits are predominantly silt and clay up to 25 feet thick, with local sand, gravel, and till-like material. This unit has relatively low permeability and would typically form an aquitard.
- *Pre-Vashon Coarse-Grained Deposits.* This material includes sand and gravel near or above sea level, and thickness varies up to more than 100 feet. This unit forms a regional aquifer.

Based on the geologic map of this area (shown in Golder, 2008) and on well logs, Vashon till is present at the surface in the vicinity of the Highlands Park well. Vashon Advance Outwash is present below the till and is found at the surface along the slopes of the unnamed tributary and other valley sides. The pre-Vashon fine-grained deposits are present below the outwash and are found along Boeing Creek to the northwest of the property.

Two general aquifers have been identified in this region; one is shallow and occurs within the Vashon advance outwash, and the other is within the pre-Vashon coarse-grained deposits located near sea level. Both aquifers are relatively productive in terms of water yield and water quality.

The shallow aquifer in the vicinity of the property appears to be unconfined. The Vashon advance aquifer above and below the water table is described (in the Highlands Park well log) as consisting of fine to medium sand with minor silt and coarse sand. The ground-water flow direction in this vicinity is interpreted to be generally toward the west, with a component of flow to the northwest toward Boeing Creek (Golder, 2008). The unnamed southern tributary to Boeing Creek begins to show surface flow at the contact between the Vashon advance outwash and the underlying pre-Vashon fine-grained deposits (at 280 feet msl), suggesting discharge of the advance outwash aquifer to the creek.

Site Visit

On April 27, 2010, Tom Dubé of SAIC met with Jamie Morin of Mentor Law Group, Letha Dunn of the Highland Park Project, Michael Klisch of Golder Associates, and two members of the landscape design team. The site visit included observation of the well site, which currently does not have a pump or well house, and the location of the proposed pond and outlet. The place of use (the pond) currently includes undeveloped land with a gravel/dirt access road.

Well Information and Pumping Test Results

A number of existing water wells are located in the Highlands Park area. The aspects of water usage, water rights and exemptions are discussed below. For purposes of this well information discussion, the characteristics of the Highlands Park well and other pertinent wells in the general vicinity (Figures 1 and 2) are listed as follows:

- *Highlands Park well:* Total depth 297 ft, screened 266.5 to 277 ft below ground surface (bgs)
- *Highlands Community Center well:* Total depth 220 ft, screened 206.5 to 216.5 ft bgs
- *N. Hanauer well:* Total depth 240 ft, screened 210 to 220 ft bgs
- *J. Dellafield well:* Total depth 220 ft, screened 209 to 219 ft bgs
- *M. Glenn well:* Total depth 216 ft, screened 195.5 to 210.5 ft bgs
- *Seattle Golf Club well 1:* Total depth 260 ft, screened 242 to 256 ft bgs
- *Seattle Golf Club well 2:* Total depth 494 ft, screened 479 to 494 ft bgs
- *Seattle Golf Club well 3:* Total depth 270 ft, screened 255 to 270 ft bgs
- *Seattle Golf Club well 4:* Total depth 498 ft, screened 485 to 498 ft bgs
- *Seattle Golf Club well 5:* Total depth 530 ft, screened 495 to 500 ft bgs

Several exempt domestic wells and five non-exempt irrigation wells (at the Seattle Golf Club) exist in the vicinity of the Highlands Park property. Information on these well logs shows that these wells extract water from two different depth zones: 195 to 277 feet bgs and 479 to 500 feet bgs. These depths correspond to the two regional aquifers. The Highlands Park well is screened in the lower portion of the Vashon advance outwash unit at a depth of 266.5 to 277 feet bgs (elevation of approximately 238 to 248 feet msl), with a static water level of 185 to 190 feet bgs (about 327 feet msl). Other wells that are screened in this aquifer include the Hanauer well, Dellafield well, Glenn well, Highlands Community Center well, and Seattle Golf Club wells 1 and 3. The Seattle Golf Club wells 2, 4, and 5 are screened a short distance above sea level in the Pre-Vashon coarse-grained deep aquifer.

Based on the likely ground-water flow direction from the Highlands Park well, the Hanauer well is located downgradient and the Seattle Golf Club wells are cross-gradient. The Highlands Community Center well, Dellafield well, and Glenn well are located between downgradient and cross-gradient.

Golder Associates (2008) performed aquifer testing on the Highlands Park well from August 5 to 9, 2008. Step pumping tests and a constant-rate test were conducted, and water levels were also monitored in the Hanauer well, located approximately 1,600 feet downgradient. Pumping rates during the step tests increased from 18 to 88 gpm, with a final drawdown of 35 feet. The 72-hour constant-rate pumping test averaged 82 gpm, with a final drawdown of 37 feet. During the recovery phase, residual drawdown was about 1.7 feet at three days following pump shutoff, and about 0.5 foot after one month.

During the pumping phase, no drawdown was observed in the Hanauer well from August 5 to 13, 2008. Monitoring of the Seattle Golf Club wells (located about 1,600 feet south-southeast) apparently did not take place during the aquifer testing or during initial testing upon well installation, and the Seattle Golf Club filed a protest (July 31, 2008) regarding the Highlands water right application. According to discussions during the site visit meeting, this dispute has been largely resolved. Limited data were collected after the pump test to compare water levels between the Highlands Park well and the Golf Club wells. Water level monitoring in both the Hanauer and Highlands Park wells shows that ground-water levels respond significantly to barometric pressure changes (Golder, 2008). This effect is likely a result of the widespread, tight till layers in the vadose zone, which act as a barometric confining layer producing a delayed response in transmitting changes in atmospheric pressure to the water table (SAIC, 2009).

A log-log time-drawdown plot for the Highlands Park well shows a shape fairly typical of an unconfined aquifer, with a steep early-time segment for 1 to 2 minutes (and 28 feet of drawdown), followed by a delayed-yield curve that is nearly flat (SAIC, 2009). Drawdown and recovery data from the pumping test were used by Golder to determine the aquifer characteristics. The transmissivity values were estimated at 3,200 ft²/day based on recovery, and 1,120 ft²/day based on drawdown (the latter value can be corrected to approximately 1,610 ft²/day by applying the Jacob late-time drawdown correction using an unconfined aquifer thickness of 110 feet). These transmissivity values are utilized below for impairment consideration.

Water Rights in the Vicinity of the Highlands Property

The Department of Ecology Water Right Tracking System (WRTS) database was queried to identify senior water rights within and near the Boeing Creek subwatershed. (Note that this search encompasses a large area that, based on results of the interference analysis presented below, is outside the expected radius of influence for the Highlands Park well.) The search indicated that there are three senior water rights in this area (Figure 1). These three senior water rights, two extracting from wells and one from a surface water source, are listed in the following table.

Water Rights Within One-Half Mile of the Highlands Park Well							
File #	Owner	Document	Priority Date	Purpose	Qi (gpm)	Qa (ac-ft/yr)	T/R/S
G1- *05639CWRIS	Highlands Inc.	Certificate	6/16/1960	Domestic multiple	200	78.4	T26N, R3E, S12 (NW¼, SE¼)
S1- 00187CWRIS	Vernon E. Day	Certificate	6/29/1966	Recreation, Irrigation	0.05	1.0	T26N, R3E, S12
G1-27202	Seattle Golf Club	Permit	6/21/1993	Irrigation	500	241.6	T26N, R3E, S13 (NE¼, SE¼)

The Highlands Inc. certificate is for a well drilled in August 1960 to a depth of 67 feet. The well is located approximately 1.1 miles north of the Highlands Park well, on the opposite side of Boeing Creek. This well is apparently not currently used, and the water right is held by the same owner as the Highlands Park well, and thus is not of interest in terms of competing water rights.

The Vernon Day 1966 certificate is for a surface water source somewhere in Section 12 (shown in center of Section in Figure 1). It is uncertain where the exact location is or if this source is still used, but it may be surface waters of Boeing Creek (it could also be located outside the Boeing Creek subwatershed in Section 12). If the surface water right is for Boeing Creek, any mitigation measures for the Highlands Park project will assure that no impact will take place to this source.

The Seattle Golf Club wells are located about 1,600 feet south-southeast of the Highland Park well. The wells are used to irrigate 151 acres of land on the course golf. As stated above, two of the five wells are screened in the same aquifer as the Highlands Park well. Thus these wells will need to be evaluated as part of the impairment consideration below.

As mentioned above, a number of exempt domestic wells are known from the vicinity of the Highlands Park property. Those that are located within a one-half mile radius of the Highlands Park well are shown on Figure 1 (many locations are approximate). A radius of one-half mile is supported by the comparatively small radius of influence calculated above, and because a one-half mile distance extends beyond the subwatershed boundaries to the west and south. The only known locations of exempt domestic wells near the Highlands Park property are shown on Figure 2. The Highlands area is connected to the municipal water supply, and the city of Shoreline provides water to all residents in the area. However, some exempt wells continue to be used for irrigation purposes. According to The Highlands community employees and some residents, exempt wells being used near the Highlands Park well are limited to the Highlands Community Center well, Hanauer well, Dellafield well, and Glenn well. These owners use water from their wells for limited irrigation of gardens and other planting areas. These wells will also be considered below in the evaluation of potential impairment.

FINDINGS

Under state law the following four criteria must be met for an application to be approved:

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

Water Availability

The Highlands Park well is capable of pumping 80 gpm from the Vashon advance outwash aquifer. The two Seattle Golf Club wells that are also screened in this aquifer were initially pump-tested at 130 gpm for 24 hours and at 110 gpm for 2 hours. Thus, the upper aquifer in this area is capable of yielding appropriate quantities of ground water to meet the intended purpose of this project. However, as discussed below, Boeing Creek is closed by state regulations to further consumptive appropriation throughout the year. Therefore, although ground water may be physically available, it must be shown that extraction will not negatively impact the flow of Boeing Creek or mitigation measures must be taken.

Impairment Considerations

Ground-water extraction from the Highlands Park well may have potential impairment effects on existing ground water usage in the vicinity. Therefore, senior water rights were evaluated in the Boeing Creek subwatershed, both in terms of ground water and surface water sources. It is also in the public interest to evaluate all exempt well owners in the vicinity, to determine if pumping from the Highlands Park well is detrimental to use of those wells. Potential impact to Boeing Creek surface flows is addressed below under the Public Interest Considerations section.

Data in the Golder (2008) report are used to evaluate the radius of influence for drawdown created by pumping the Highlands Park well. The Hanauer well, located 1,600 feet downgradient (west) of the Highlands Park well, showed no drawdown during four days of pumping and the following four days. The zone of potential interference drawdown (cone of depression) for this eight-day period appears to be less than 1,600 feet. To calculate the radius of influence, a typical storage coefficient of 0.1 is applied for a fine to medium-grained sand in an unconfined aquifer. Using the Cooper-Jacob equation and the range of transmissivity values listed above, this yields a radius of influence ranging from 330 to 465 feet. Based on these calculations, although approximate, it would appear that potential interference drawdown beyond about 500 feet would be negligible, although some minor impact in the downgradient direction might be expected through time.

The wells with senior water rights in this same aquifer are the Seattle Golf Club wells 1 and 3, which are located cross-gradient from the Highlands Park well at a distance of approximately 1,600 feet. As a result, these wells also would not be expected to show impairment by pumping at the Highlands Park well. The three deeper Golf Club wells are separated from the shallow aquifer by at least 200 vertical feet, in a distinct aquifer zone, and thus would not be impaired by pumping at the Highlands Park well.

The other two senior water right holders in the Boeing Creek subwatershed are for the old Highland Inc well and the Vernon Day surface water right. Neither of these water rights would be impaired.

The four exempt wells listed above (Hanauer, Highlands Community Center, Dellafield, Glenn) are located approximately 1,250 to 1,700 feet from the Highlands Park well, in a downgradient to cross-gradient location. These wells also would not be expected to show drawdown impairment, and they are used only for low-quantity extraction for intermittent irrigation purposes. In addition, because the Hanauer well owners are sponsors of the Highlands Park project, they have expressed a lack of concern about impairment effects related to the Highlands Park well.

Beneficial Use

Ground water used for purposes of fish and wildlife maintenance and enhancement, for recreational purposes, and for preservation of environmental and aesthetic values are considered to be a beneficial use for waters of the state under RCW 90.54.020(1).

Public Interest Considerations

The only other potential for detriment to the public interest identified during the investigation for operation of the Highlands Park well is a potential impact on Boeing Creek. Ecology has closed Boeing Creek to further appropriation under WAC 173-508-040, where it is listed as "unnamed stream (11-26-3E)." The State includes the relationship to ground water as a consideration: "In any future permitting actions relating to ground water withdrawals, the natural interrelationship of surface and ground waters shall be fully considered in water allocation decisions to assure compliance with the intent of this chapter." Considering that the proposed withdrawal is upgradient of a tributary to Boeing Creek and that the source aquifer is unconfined, it is possible that the proposed withdrawal will have an impact on Boeing Creek. As a result, mitigation measures will be required to fully offset any impacts to Boeing Creek.

The following mitigation measures, factors, and calculations have been proposed by the Highlands Park Project team (Dunn, 2010):

- The pond will be initially filled during the winter season, when levels of ground water and surface water are naturally high, thus minimizing any impacts of pumping at a fill rate of approximately 30 gpm. This will involve consuming about 1.25 acre-feet (407,000 gallons) of well water for initial filling, which can be accomplished in 9 or 10 days during a rainy period.
- Measures will be taken to minimize loss of water from the pond and surrounding wetland, resulting in losses stemming only from evaporation and evapotranspiration. These measures include installing an impermeable liner under the pond, and using enclosed conduit between the well and pond and between the pond outlet and its discharge point. The resultant estimated pumping rate for maintenance pond-filling is 30 gpm for 2 hours per day, year-round, totaling approximately 4.03 acre-feet (1.31 M gallons) per year. Note that the requested Q_a value of 10 ac-ft/yr is based on summing the 1.25 and 4.03 ac-ft/yr and allowing for extra capacity, and to annually match the requested reservoir capacity of 10 acre-feet.
- Water overflowing from the pond will be directed toward Boeing Creek to recharge this drainage, in order to account for any ground water that did not naturally discharge to the creek due to well extraction. This will take place in the form of either a pipe leading down the unnamed tributary to the channel, or through a shallow infiltration gallery to allow subsurface water to move downslope toward the channel. This decision will be made during the design phase.
- Various calculations of pumping, pond filling, discharge, and evaporation have shown that about 90 percent of the volume of water pumped into the pond will be released from the pond toward Boeing Creek. By making some assumptions about hydrology and ground-water recharge, calculations suggest that there would actually be a net gain of water reaching Boeing Creek.

The calculations and assumptions described in Dunn (2010) are necessarily somewhat simplified and optimistic. The question of impact to Boeing Creek centers on how much of the extracted ground water would have naturally discharged to feed the surface waters of this

drainage, compared to the amount of water released to the drainage via pond discharge. The first half of this water balance is not known, and the second half assumes that all water released from the pond will eventually reach the creek. According to the calculations presented by Dunn (2010), a net gain to Boeing Creek would occur under conditions where approximately 90 percent or less of the extracted ground water would have naturally reached this drainage. In other words, an adverse impact would take place if more than 90 percent of pumped ground water would have otherwise reached Boeing Creek.

A qualitative, probabilistic evaluation of ground-water flow and discharge will help to determine if more than about 90 percent of extracted ground water would possibly have fed Boeing Creek, and thus would create a negative impact by pumping. Although the specific ground-water flow direction in this area (during non-pumping conditions) is not known, the ground-water gradient likely mimics the overall topographic gradient. This is the usual condition for an unconfined aquifer in relatively steep terrain leading down to water bodies, such as Boeing Creek and Puget Sound. A relatively deep water table, such as at this site, will follow the general topographic trends, likely ignoring the smaller-scale features. Thus, it can be inferred that the ground-water flow from the area near the Highlands Park well (within a 500-foot radius) is most likely oriented toward the west, but varying between west-southwest and west-northwest. The point of surface discharge will be near the base of the Vashon advance outwash unit (i.e., ground-water discharge will not take place in the upper portion of this unit, above about 280 feet msl). As a result, ground water flowing toward the west-northwest (or more northerly) will discharge to Boeing Creek; ground water flowing more southerly, between west-southwest and nearly west-northwest, will not discharge to the Boeing Creek drainage. By making these hydrogeologic assumptions and tracking the potential ground-water movement from the Highlands Park area, it appears that there is a likelihood of about one-third or less that this ground water would discharge to the watershed of Boeing Creek. Because this probability of one-third or lower is far less than the 90 percent required in calculations mentioned above (Dunn, 2010), the proposed mitigation measures appear to be more than sufficient to prevent loss of flow in Boeing Creek. Even if the project assumptions and calculations are overly optimistic, there is a large margin of error for protection of the creek flow. Therefore, the mitigation measures proposed for this project to protect flows in Boeing Creek appear to be satisfactory and protective.

DISCUSSION

The use of pumped ground water from the Highlands Park well to fill and replenish a pond for fish and wildlife maintenance appears to be a viable project with little or no impairment concerns. The well has suitable yield to meet the project objectives, and there does not appear to be a negative impact on neighboring wells, water rights, or creek flow. The major uncertainty at this time involves the design of the pond and its discharge, including the specific means of releasing excess water from the pond. This will need to be designed to optimize release of water to reach the channel of Boeing Creek without producing erosion or other hazards. Also see information included in the associated Reservoir Report of Examination, R1-28527.

RECOMMENDATIONS

Although the well pump, piping, pond, and discharge structures have not been installed and tested, based on the above investigation and findings there does not appear to be any impairment or detriment from use of the well as proposed. Careful evaluation and design should be incorporated into the pond discharge structure and determination of the discharge rate, and thus the ground-water extraction rate for pond-water replenishment. Pilot testing of discharge or infiltration structures may be worthwhile prior to actual filling of the pond. Water discharge from the pond should be managed to assure that water is safely being released and is effectively recharging the Boeing Creek watershed. Long-term monitoring should include inspection of the pond discharge point and locations downslope of it for impact to stability and potential erosion. Occasional flow measurements on Boeing Creek should be made before and after the project begins active operation, to confirm that these activities are not having long-term adverse affects on the creek flow.

Therefore, at this time it is recommend that the request for a ground-water permit be approved in the quantities and within the limitations listed below and the provisions listed elsewhere.

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:

- 80 gallons per minute (Qi)
- 10 ac-ft/yr (Qa)
- For filling and maintaining a pond, year-round

Point of Withdrawal

Up to two wells, with a current well located within SE ¼ of NE ¼ of Section 13, Township 26 North, Range 3 East, W.M.

Place of Use

A pond located within SW ¼ of NE ¼ of Section 13, Township 26 North, Range 3 East, W.M.

CONCLUSIONS

In accordance with chapters 90.03 and 90.44 RCW, it is concluded that ground water is potentially 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.

Prepared by:

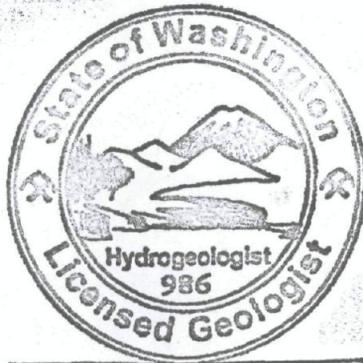
Thomas Dubé

10-17-11

Thomas Dubé, LHG
Science Applications International Corporation

Date

Licensed Geologist/Hydrogeologist No. 986, expires 11-17-11



Thomas E. Dubé

Reviewed by:

Jay Cook

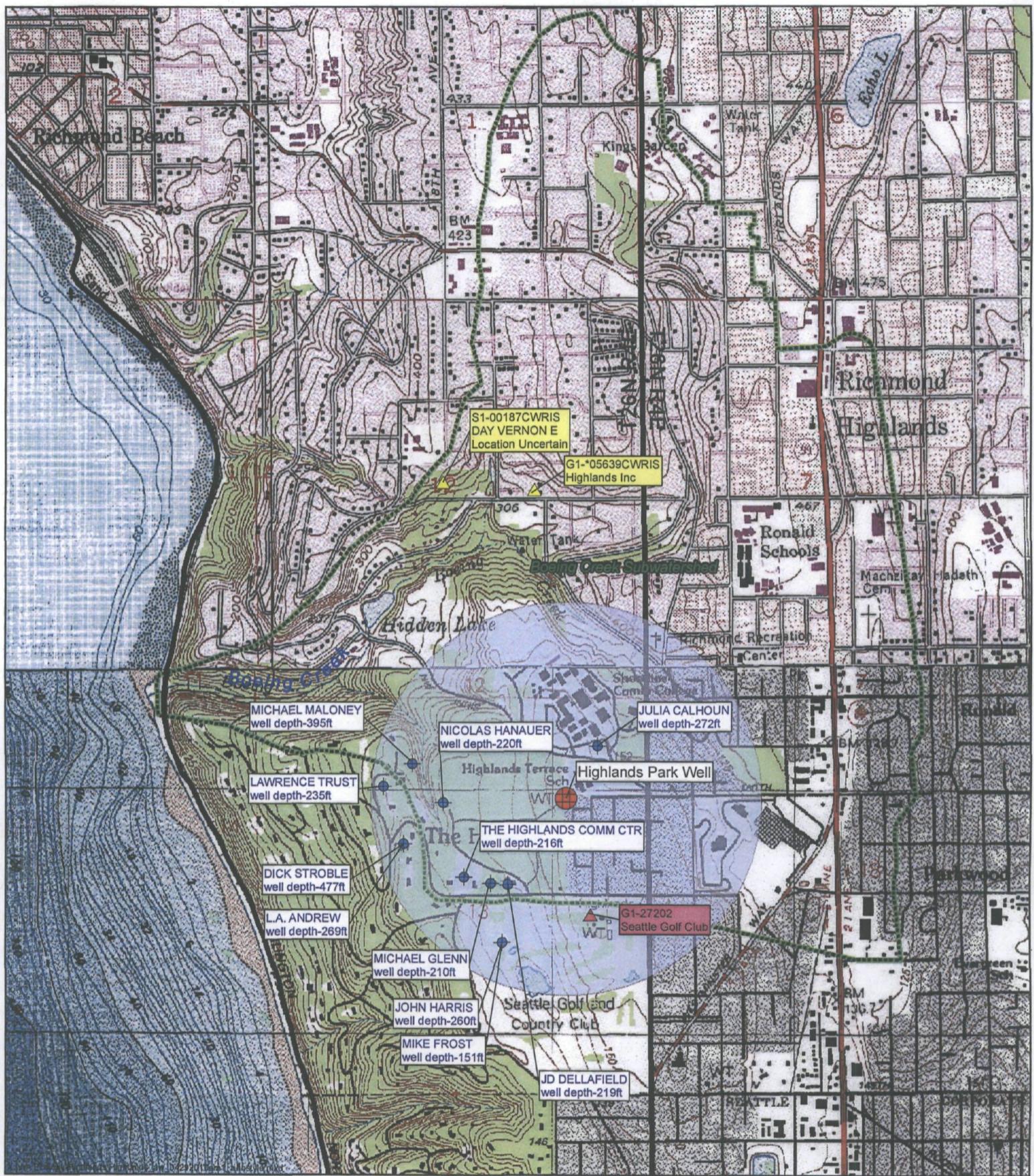
10-12-11

Jay Cook
Washington State Department of Ecology

Date



John C. Cook



-  Certificate
-  Permit
-  Highlands Park Well
-  Exempt Wells
-  1/2 mile buffer from Highlands well

-  Township and Range
-  Boeing Creek Subwatershed

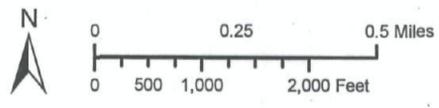


Figure 1
Locations of Senior Water Rights and
Approximate Locations of Exempt Wells



Figure 2
Features in Vicinity of
Highlands Park Well

- ◆ Selected Exempt Wells
- Highlands Park Proposed Infrastructure
- ▲ Permit
- waterline
- Pond Reservoir
- Property Parcel Boundary
- ▭ Boeing Creek Subwatershed



0 250 500 Feet

0 50 100 Meters

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