SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102

May 25, 2017

Mr. Eugene Freeman
Washington State Department of Ecology
3190 160th Avenue Southeast
Bellevue, Washington 98008-5452

SUBJECT: SKS SHELL PROPERTY—REQUEST FOR DEWATERING SYSTEM DATA AND DESIGN
SKS Shell Property/Alaska Street Texaco
Facility/Site ID No. 39196282
3901 Southwest Alaska Street, Seattle, Washington
Project Number: 0914-001

Dear Mr. Freeman:

SoundEarth Strategies, Inc. (SoundEarth) has prepared this letter to address the Washington State Department of Ecology's (Ecology) questions regarding the methods used to calculate the capture zone for the temporary construction dewatering system. This response letter was prepared on behalf of Lennar Multifamily Investors LLC, the owner of the property located at 3901 Southwest Alaska Street in Seattle, Washington (the SKS Shell Property).

Below are Ecology's questions and comments submitted by email dated May 4, 2017, in bold, and SoundEarth's response to the questions are in italics.

(1) I need to acquire the electronic data, design, lithologic information, hydrogeologic information, method used to generate the capture analysis figure (Figure 15) presented in the DCAP (6/6/2013). I am attaching the figure with this email.

Attachment A provides a description of the model used for the capture zone analysis, WinFlow Model 8. The model description provides information regarding the model assumptions, input parameters, and analysis of remedial action. Attachment B provides the site specific WinFlow Model input parameters, a summary of the well construction details, and WinFlow Model output that was presented on the above referenced Figure 15, presented in the DCAP (6/6/2013). An excerpt from Section 2.9, Geologic and Hydrogeologic Setting, geologic cross section figures, and table summarizing water level measurements from the RIFS (SoundEarth 2014) are provided in Attachment C.

Attachment D provides a summary of the aquifer test results with an excerpt and summary table from the RIFS (SoundEarth 2014). The electronic data generated from the pump test is also provided on a CD for reference (Attachment D).

Information must include: Pumping rate at each well, Pumping duration and timing (when on and off), Water level measurements

Attachment E provides the field notes from the March 19, 2013, aquifer pump test which includes: pumping rate at test well, depth to water at test well and observation wells, and timing of observations.

Well construction information: Well diameter, Well coordinates (easting, northing), Screen interval, Screen slot size and filter pack placement, Diameter of borehole

Table 1 in Attachment B provides the well construction information requested.

Identify the type of pump used

Aquifer Pump Test—March 19, 2013—the pump used during the aquifer pump test was a Grundfos Redi-Flo2 electrical submersible pump controlled with a variable frequency drive (Attachment F).

Identify placement of the intake in the well (depth/elevation)

The pump intake was at approximately 35 feet below ground surface (bgs). Reference field notes in Attachment E, depth to the bottom of the pump at 35.9 feet bgs and distance from the bottom of the pump to the bottom of the pump inlet is 8.19 inches.

Was a backflow valve installed.

No, for the pump test, a backflow or check valve was not in line. When the pump was turn off the water discharge line was pinched with a clamp to prevent the backflow of water in the discharge line back into the casing of the pumping well.

Provide specification of the pump performance curves.

See Attachment F for the pump specifications and performance curve for the Grundfos Redi-Flo2 electrical submersible pump.

(2) I also need the same data for the wells that were actually used to do the dewatering.

Information must include: Pumping rate at each well, Pumping duration and timing (when on and off), Water level measurements

Field notes from the operation of the temporary construction dewatering system from March through June 2015 have been previously submitted. A flow totalizer tracked the total volume of groundwater recovered and petroleum hydrocarbon mass removed over time and is summarized in Table 2 (Attachment G). SoundEarth is in the process of tabulating all of the field observations and will provide that information as a follow up email submittal.

Well construction information: Well diameter, Well coordinates (easting, northing), Screen interval, Screen slot size and filter pack placement, Diameter of borehole

Table 1 in Attachment B provides the well construction information requested.

Identify the type of pump used

An electrical submersible pump was placed in each of the nine remediation wells and the pump specification is provided in Attachment H.

Identify placement of the intake in the well (depth/elevation)

Table 3 provides a summary of the well placement and depth to pump inlet for each remediation well (Attachment G).

Was a backflow valve installed.

Yes, each remediation well was equipped with a check valve between the water discharge line from each individual pump and the water discharge header.

Provide specification of the pump performance curves.

The pump performance curve is provided in the pump manual provided in Attachment F.

Provide the capture analysis information and the data from the actual operation of the dewatering system.

A capture analysis of the temporary construction dewatering system was not completed. Please see water level and pumping rate observations from remediation wells over the course of the system operation. SoundEarth is in the process of tabulating the field observations and will provide that information as a follow up email submittal.

I still do not have information for the two substitute wells that were used at the Site.

SoundEarth assumes from other conversations that Ecology is referring to wells DW-1 and DW-2. These wells were not used for dewatering and were decommissioned prior to remediation.

Provide Ecology specific well identification tag numbers for all wells that were submitted to the Ecology well logs database.

Please reference Table 1 in Attachment B.

(3) Was a revised capture analysis performed to confirm performance of the revised dewatering system.

Yes, on March 23 and 24, 2015, SoundEarth performed additional short-term aquifer draw down tests on remediation wells, RW03 and RW08. SoundEarth evaluated the raw data, but the WinFlow Model was

not finalized. SoundEarth is in the process of finalizing the capture zone analysis and will provide this information to Ecology under a follow up email submittal.

Was this information provided to Ecology. If so, in which report is this documented.

No, this information was used by SoundEarth to evaluate the pumping rate from remediation wells on the north and east portion of the SKS Shell Property to provide additional information and support the results of the aquifer pump test completed on RW01 in March 2013.

(4) I received data for the 2013 aquifer test in a pdf file. I need that as an electronic data file (EXCEL). Has this data been entered into EIM. (Time-series data input)

Attachment D has a CD with the electronic excel files related to the 2013 aquifer test. SoundEarth is in the process of uploading this data into EIM and will confirm with Ecology once the data is uploaded and validated.

We appreciate the opportunity to provide additional clarification regarding the costs being submitted for reimbursement. Please review the attachments and let us know if you have any questions.

Respectfully,

SoundEarth Strategies, Inc.

Suzy Stumpf, PE
Senior Engineer

Rob Roberts
Senior Scientist

Attachments: A, WinFlow Model Information
B, WinFlow Model Site Specific Input Parameters
C, Geologic and Hydrogeoloic Information
D, Aquifer Pump Test Results, March 2013
E, Pump Test Field Notes, March 2013
F, Pump Specification, March 2013 Pump Test
G, Dewatering System Operational Information
H, Pump Specification, Dewatering System

cc: Mr. Dale Myers, Washington State Department of Ecology
Mr. Kelley Kohout, Lennar Multifamily Investors LLC
Mr. Dave Cook, Aspect Consulting
Mr. Ken Lederman, Foster Pepper PLLC

SES:dnm/rt

ATTACHMENT A
WINFLOW MODEL INFORMATION

What is WinFlow?

The WinFlow Solver is a powerful yet easy-to-use groundwater flow model. The WinFlow Solver is now contained within Aquifer^{Win32} whose user-interface represents the most sophisticated and Windows^{TM} compliant available today. Aquifer^{Win32} provides an extensible common user-interface for analytical analyses and models capable of hosting other calculation engines in the future.

The WinFlow Solver is an interactive, analytical modeling tool that simulates two-dimensional steady-state and transient ground-water flow. The steady-state module simulates ground-water flow in a horizontal plane using analytical functions developed by Strack (1989). The transient module uses equations developed by Theis (1935) for confined aquifers, Hantush and Jacob (1955) and Hantush (1960) for leaky aquifers, and Neuman (1972) for unconfined aquifers. Each module uses the principle of superposition to evaluate the effects from multiple analytical functions (wells, etc.) in a uniform regional flow field.

The steady-state module simulates the effects of the following analytic elements in two-dimensional flow: wells, uniform recharge, circular recharge/discharge areas, and line sources or sinks. Any number of these elements may be added to the model, including a uniform regional hydraulic gradient. The model depicts the flow field using streamlines, particle traces, and contours of hydraulic head. The streamlines are computed semi-analytically to illustrate ground-water flow directions. Particle-tracking techniques are implemented numerically to compute travel times and flow directions. Both confined and unconfined aquifers are simulated with the steady-state module.

The transient module simulates the effects of wells, circular ponds, linear sources/sinks, and a uniform regional gradient for confined and leaky aquifers. Numerical particle-tracking is also available in the transient module. The transient module computes hydraulic heads using the Theis (1935) equation for confined aquifers and the Hantush and Jacob (1955) or Hantush (1960) equation for leaky aquifers. Neuman's method (1972) can also be used for unconfined aquifers with delayed yield from storage.

In addition to the WinFlow Solver described above, Aquifer^{Win32} extends other analytical solutions from pumping test analysis into its modeling environment. These additional solutions support any number of pumping wells with variable pumping rates. Auto-calibration to any number of transient targets is also supported for these additional solutions.

The WinFlow Solver is simple to use and highly interactive, allowing you to create an analytical model in minutes. The software features standard Windows pulldown menus and tab dialogs to facilitate the model design. The model is recomputed and recontoured either by selecting a menu item or by pressing a toolbar button. Streamlines and particle-traces are added interactively and recomputed each time new wells or other elements are added.

Aquifer^{Win32} can import a Drawing Interchange Format (DXF) file (from AutoCAD for example) to use as a digitized base map. QuickFlow and ModelCad-format map files may also be imported into Aquifer^{Win32}. The digitized map gives the modeler a frame of reference for designing the analytical model.

Aquifer^{Win32} produces report-quality graphics using any Windows device driver. Output may also be exported to a wide variety of file types, including SURFER, Geosoft, Spyglass, Windows Metafiles, and AutoCAD-compatible DXF files.

WinFlow Assumptions

It is important to understand the many simplifying assumptions inherent in an analytical model before the model can be applied to a real-world problem. Chapter 5 described the equations that are solved in WinFlow. Chapter 6 verified that these equations are properly implemented in the WinFlow software. This chapter presents potential applications of WinFlow to the solution of ground-water problems. First, however, some important assumptions are discussed as they apply to the practical application of WinFlow. For easy identification, the primary assumptions are underlined.

WinFlow is designed to solve two-dimensional ground-water flow problems in a horizontal plane. It is not designed for two-dimensional cross-sections (2D vertical plane). The two primary assumptions are that ground-water flow is horizontal and occurs in an infinite aquifer. WinFlow should not be applied to aquifers exhibiting strong vertical gradients unless the scale of the problem is such that horizontal flow can still be considered dominant. WinFlow can be used even in cases where there are significant vertical gradients if the horizontal scale of the model is much larger than the vertical scale, such as in regional studies.

Another assumption is that the aquifer hydraulic conductivity is assumed to be isotropic and homogeneous. The base of the aquifer is horizontal and fixed at a given elevation. In the steady-state and transient models, the top of the aquifer is also horizontal and fixed at a given elevation. In the steady-state model, however, unconfined conditions are simulated when the hydraulic head is below the top of the aquifer. In the transient model, the aquifer is always confined, even when the head falls below the top of the aquifer.

The reference head in the steady-state model is constant throughout all calculations. The reference head is analogous to a constant head boundary condition in a numerical model. It is therefore very important to keep the reference head far from the area of interest so that model predictions are not impacted.

The reference head in the transient model is only used in combination with the uniform gradient to compute an initial planar potentiometric surface. Drawdowns computed by either the Theis (1935) or the Hantush and Jacob (1955) methods are then subtracted from the planar potentiometric surface to obtain the resulting flow field. Drawdowns are also subtracted from the reference head in the transient model; however, there is an option that allows the user to keep the reference head constant in the transient model. This option should only be used when trying to compare the transient model to the steady-state model.

All pumping rates, linesink fluxes, pond recharge, and elliptical recharge rates are constant through time. In the transient model, all wells start pumping or injecting water at time zero.

All wells are assumed to fully penetrate the aquifer. Wells are assumed to be perfectly efficient and linesinks are in perfect hydraulic communication with the aquifer. Both assumptions are rarely encountered in practice. There is often head loss around the well screen or stream bottom caused by clogging of the pore-space by fine-grained material (clay). There are two important consequences of imperfect hydraulic communication.

> (1) Pumping rates predicted by WinFlow to achieve a desired response may not be attainable because more drawdown will be encountered in the actual well. The increased drawdown encountered in the field is caused by inefficiency around the well screen. The same effect will happen using linesinks to simulate trenches or drains.
>
> (2) The amount of water produced or injected by a linesink to maintain a specified head in the linesink will be overestimated if the actual drain has less than 100 percent efficiency.

Particle traces and streamlines are two-dimensional. In cases where the aquifer receives recharge, the capture zone of a pumping well will be large enough to capture the amount of recharge equaling the pumping rate of the well (Larson et al., 1987). In two-dimensional analyses, such as in WinFlow, the capture zone extends upgradient until encountering a ground-water divide or infinity. This is an important consideration in designing a containment system.

Analysis of Remedial Actions

WinFlow can provide valuable guidance in designing a ground-water remediation system. The most obvious remedial action that WinFlow can simulate is "pump & treat" where the goal is to contain a volume of contaminated aquifer. WinFlow can simulate the effects of both pumping and injection wells. To illustrate the capture zone of a well, use reverse particle-tracking and start the particles in a circle around the well.

WinFlow can simulate trenches and drains using linesinks. There are two options in simulating drains: (1) specify a head to be maintained in the drain and WinFlow will compute the discharge rate necessary to achieve the given head; or (2) specify the discharge rate and compute the resulting head in the drain. To illustrate the capture zone of the drain, use reverse particle-tracking and start the particles along two lines on either side of the linesink.

WinFlow can simulate a lagoon closure by using ponds. To do this, set up the initial analytical model with ponds that simulate the lagoon. Adjust the pond recharge rate to match field-measured heads. Finally, remove the pond (or set the pond recharge equal to zero) to simulate the effects of closure.

The effects of capping can be simulated with a combination of elliptical recharge and circular ponds. Set up the initial analytical model using recharge to match field-measured heads. A circular cap can then be simulated with a pond that has a recharge rate equivalent to the regional recharge rate but opposite in sign (e.g. negative).

ATTACHMENT B
WINFLOW MODEL SITE SPECIFIC INPUT PARAMETERS

MODEL INFORMATION

Solution Information

Neuman, 1972 (Unconfined Aquifer)
Theory of flow in unconfined aquifers considering delayed response of the water table.

Reference Head

Head: 23 feet
Gradient: 0
Angle: 290
Spatial Parameters – X:10202.6 and Y: -3640.67

Recharge

Rate: 0
Angle: 0
Spatial Parameters - X: 2000; Y: 2000; a: 2000; b: 2000

Parameters

Hydraulic Parameters
Transmissivity: 13.26 square feet/day
Storage Coefficient: 0.0006
Specific Yield: 0.15
Beta/(r*r): 0.0001 (1/square feet)
Particle Tracking Parameters
Porosity: 0.15
Aquifer Thickness: 20 feet

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Table 1
Summary of Well Construction Information
For Aquifer Test and Construction Dewatering Wells
SKS Shell Property
3901 Southwest Alaska Street
Seattle, Washington

Well Identification	Well Tag Number	Construction Date	Well Type	Well Casing Material	Well Screen Slot Size (inches)	Well Diameter (inches)	Borehole Diameter (inches)	Approximate Well Screen Interval (feet bgs)	Approximate Filter Pack Interval (feet bgs)	Approximate Pump Intake (feet bgs)	Well Coordinates [a]	
											Easting (feet)	Northing (feet)
MW-1	Unknown	07/06/95	Observation	PVC - Schedule 40	0.10 [b]	2.00	8.25 [b]	26.0 to 44.0 [c]	26.0 to 44.0 [d]	N/A	1258167.414620	208452.709109
MW104	BHK 623	11/02/12	Observation	PVC - Schedule 40	0.10	2.00	8.25 [b]	20.0 to 30.0	18.0 to 30.0	N/A	1258172.244490	208447.946389
RW01 (formerly PW01)	BHS 937	02/20/13	Pumping / Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.25	25.0 to 40.0	22.0 to 40.0	35.22 [e] 36.18 [f]	1258172.481520	208452.531323
RW02	BIP 867	07/09/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	24.4 to 39.4	21.0 to 39.4	37.10	1258172.100330	208390.125657
RW03	BIP 868	07/10/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	24.6 to 39.6	21.0 to 40.0	35.77	1258172.617130	208407.529915
RW04	BIP 869	07/11/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.0 to 40.0	22.0 to 40.5	35.88	1258173.095020	208423.437532
RW05	BIP 874	07/16/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.5 to 40.5	20.5 to 40.5	33.66	1258173.517490	208437.850837
RW06	BIP 873	07/15/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.0 to 40.0	21.0 to 40.5	35.97	1258163.919510	208466.499850
RW07	BIP 872	07/15/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.0 to 40.0	21.0 to 40.5	36.12	1258150.940280	208465.895848
RW08	BIP 871	07/14/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.5 to 40.5	20.5 to 40.5	36.14	1258138.038560	208466.229837
RW09	BIP 870	07/11/14	Construction Dewatering	PVC - Schedule 40	0.10	4.00	10.00	25.5 to 40.5	20.5 to 40.5	36.11	1258120.640710	208466.789868

NOTES:

[a] Coordinates from GIS-based computer map and field measurements.

[b] Assumed based on industry standards for 2 inch diameter monitoring well.

[c] Measured by G-Logics in 2011 using a vactor and camera (not based on the EAI boring logs).

[d] Assumed minimum interval based on industry standards.

[e] Pump test, depth to below of pump - pump intake above bottom of pump = 35.9 feet - 0.6825 feet = 35.22 feet.

[f] Construction dewatering, depth to intake.

bgs = below ground surface

N/A = not applicable

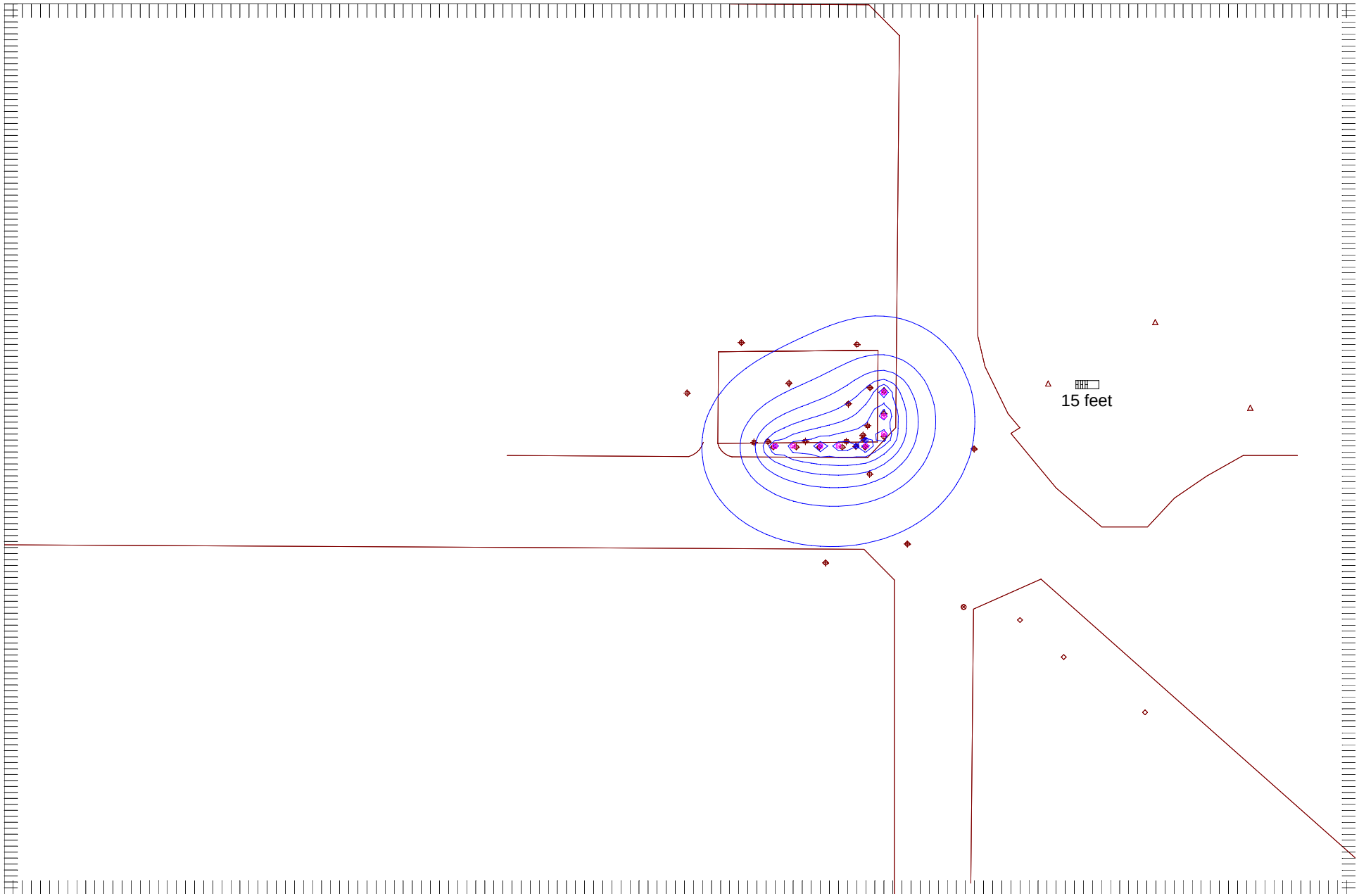
PVC = polyvinyl chloride

PW = pumping well

RW = remediation well

Unknown = not reported in historical reports by others or in Ecology's well logs database repository.

WinFlow Model_Neuman



ATTACHMENT C
GEOLOGIC AND HYDROGEOLOGIC INFORMATION

Seattle Public Utilities (SPU) provides the potable water supply to the City of Seattle. SPU's main source of water is derived from surface water reservoirs located within the Cedar and South Fork Tolt River watersheds. According to King County's Interactive Map for the County's Groundwater Program, there are no designated aquifer recharge or wellhead protection areas within several miles of the Site.

2.9 GEOLOGIC AND HYDROGEOLOGIC SETTING

This section summarizes the regional geology and hydrogeology in the Site vicinity, and the geologic and hydrogeologic conditions encountered beneath the Site.

2.9.1 Regional Geology and Hydrogeology

According to the Geologic Map of Seattle (Troost et al. 2005), the surficial geology in the vicinity of the Site consists of deposits corresponding to the Vashon Stade of the Fraser Glaciation and pre-Fraser glacial and interglacial periods. In the immediate Site vicinity, surficial deposits have been mapped as Vashon-age recessional outwash and lacustrine deposits (Troost et al. 2005).

The youngest pre-Fraser deposits in the Seattle area, known as the Olympia beds, were deposited during the last interglacial period, approximately 18,000 to 70,000 years ago. The Olympia beds consist of very dense, fine to medium, clean to silty sands and intermittent gravel channel deposits, interbedded with hard silts and peats (Troost and Booth 2008; Galster and Laprade 1991). Organic matter and localized iron-oxide horizons are common. The Olympia beds have known thicknesses of up to 80 feet. Beneath the Olympia beds are various older deposits of glacial and nonglacial origin. In general, deposits from older interglacial and glacial periods are similar to deposits from the most recent glacial cycle, due to similar topographic and climactic conditions (Troost and Booth 2008).

The Vashon ice-contact deposits in the vicinity of the Site are generally discontinuous, highly variable in thickness and lateral extent, and consist of loose to very dense, intermixed glacial till and glacial outwash deposits. The till typically consists of sandy silts with gravel. The outwash consists of sands and gravels, with variable amounts of silt (Troost et al. 2005).

The Vashon recessional outwash deposits are generally discontinuous in the Site vicinity, and consist of loose to very dense, layered sands and gravels, which are generally well-sorted (poorly graded). Layers of silty sands and silts are less common. The Vashon recessional lacustrine deposits consist of layered silts and clays, which range in plasticity from low to high, and that may contain localized intervals of sand or peat. The recessional lacustrine deposits may grade into recessional outwash deposits (Troost et al. 2005).

The glacial and non-glacial deposits beneath the Seattle area comprise the unconsolidated Puget Sound aquifer system, which can extend from ground surface to depths of more than 3,000 feet. Coarse-grained units within this sequence generally function as aquifers, and alternate at various scales with fine-grained units which function as aquitards (Vaccaro et al. 1998). Above local or regional water table aquifers, discontinuous perched groundwater may be present in coarse-grained intervals seated above fine-grained intervals. Below the regional water table, the alternating pattern of coarse and fine-grained units results in a series of confined aquifers. Regional groundwater flow is generally from topographic highs toward major surface water bodies such as Puget Sound and Lake Union. Vertical hydraulic gradients are typically upward

near the major surface water bodies, and downward inland (Floyd Snider McCarthy Team 2003; Vaccaro et al. 1998).

2.9.2 Site Geology

Based on the results of the investigations summarized in later sections of this report, subsurface soil beneath the Site consists primarily of near surface anthropogenic fill overlying Vashon-age recessional outwash and lacustrine deposits.

The locations of the borings and wells advanced during explorations at the Site are shown in Figure 4. Cross sections depicting subsurface soil characteristics and geologic units encountered in the explorations are presented in Figures 5 through 7. Detailed boring logs with well construction details are included as Appendix B.

Anthropogenic Fill

Utility corridors and the USTs associated with the SKS Shell service station may include select gravel backfill bedding materials not encountered in the soil borings.

Vashon Recessional Outwash and Lacustrine Deposits

Vashon-age recessional outwash and/or lacustrine type deposits were encountered in all of the borings throughout the Site. In general, these deposits consisted of medium-dense to dense silty sand to sandy silt with variable gravel and sand-rich and silt-rich horizons. These deposits extended to the full depth explored in all of the Site borings (up to 55 feet below ground surface [bgs]).

2.9.3 Site Hydrology

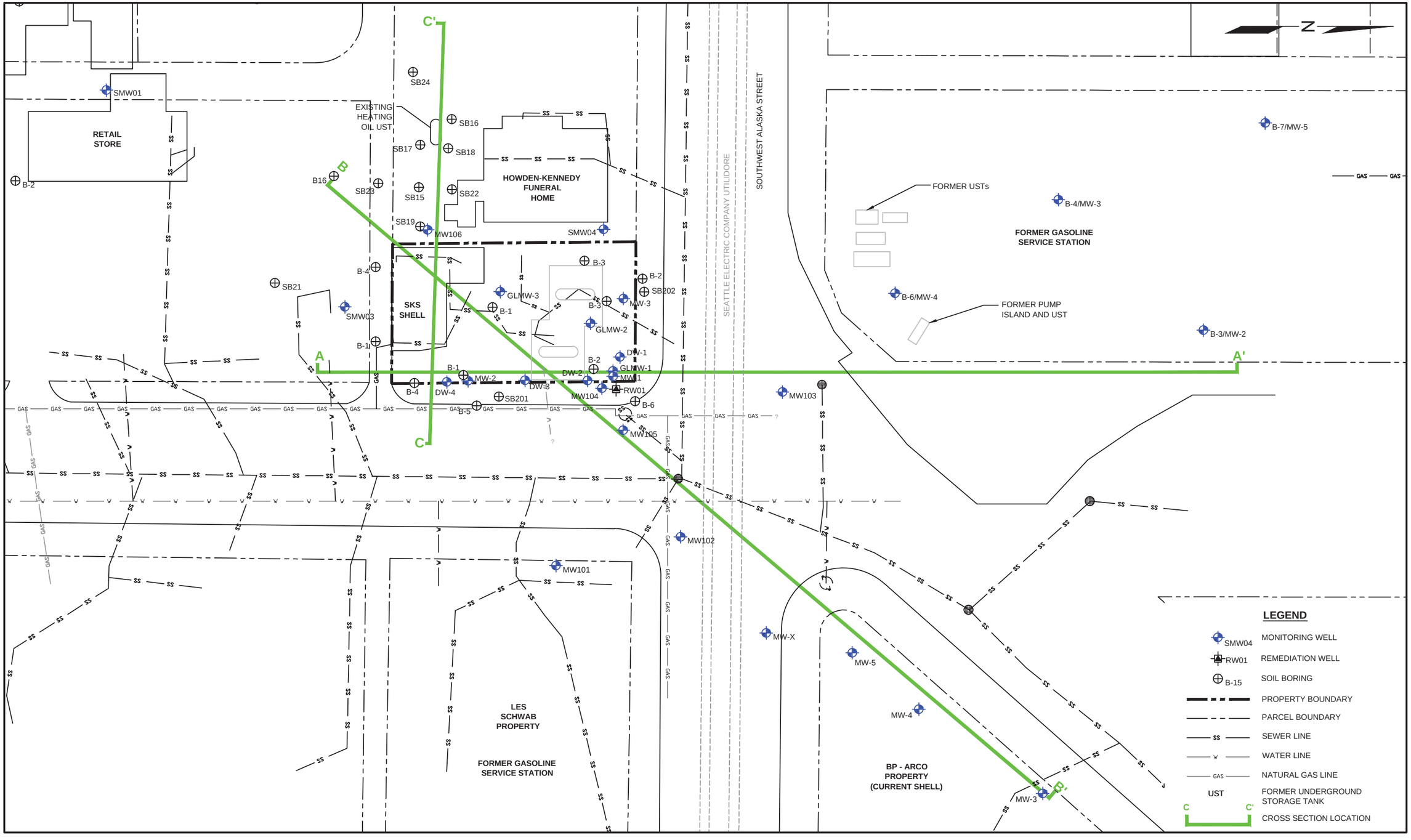
A consistent water-bearing zone was encountered within the recessional outwash deposits during Site explorations. This shallow water-bearing zone was encountered at depths ranging from approximately 23 to 25 feet bgs, extending to depth of at least 55 feet bgs, and corresponding to elevations of 247 to 245 feet North American Vertical Datum 1988 (NAVD88).

Figure 8 presents the groundwater contour map for the shallow water-bearing zone based on groundwater levels measured on November 7, 2012. Groundwater in the shallow water-bearing zone beneath the Site flows toward the northeast, with a shift toward the north at the intersection of Southwest Alaska Street and Fauntleroy Way Southwest. The hydraulic gradient for the water-bearing zone is approximately 0.03 feet/foot near the intersection of Fauntleroy Way Southwest and Southwest Alaska Street. The large dewatered excavation located across Southwest Alaska Street and immediately to the north of the SKS Shell property is approximately 30 to 35 feet below grade, and this excavation may influence groundwater flow directions and hydraulic gradients downgradient of the Site.

Aquifer testing was conducted by SoundEarth on the SKS Shell Property as discussed in Section 4.6.

3.0 PREVIOUS INVESTIGATIONS

This section summarizes the results of the previous investigations conducted at the SKS Shell Property, as well as the adjoining, upgradient properties to the south (Huling property) and west (Kennedy property). The locations of soil borings, groundwater monitoring wells, and other Property features are shown on Figure 4. The soil and groundwater analytical results are shown on Figures 9 and 10 and in



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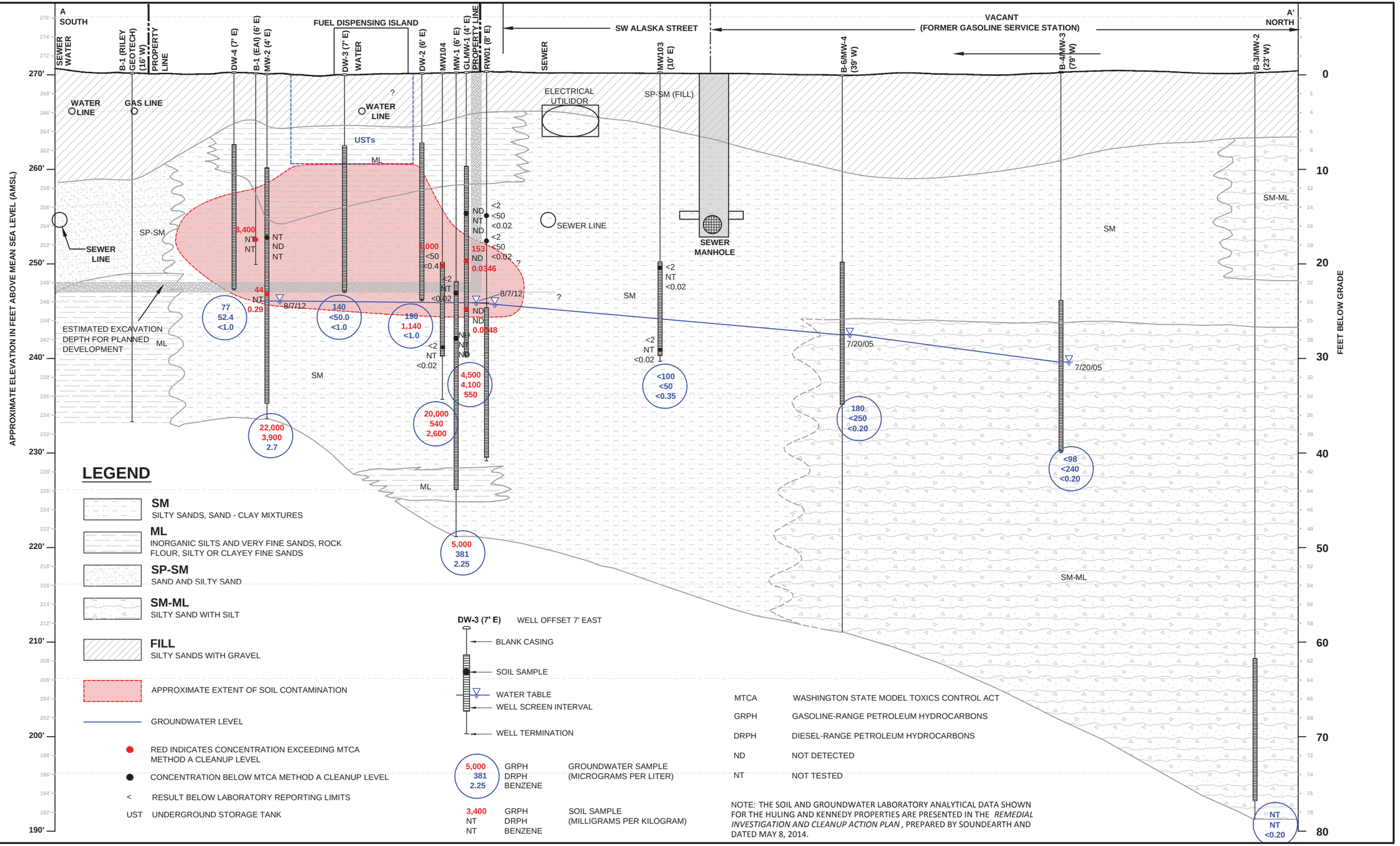
DATE: 12/27/12
DRAWN BY: BLR/JQC/NAC
CHECKED BY: CER
CAD FILE: 0914-004_FIG4_EL

PROJECT NAME: SKS SHELL PROPERTY
PROJECT NUMBER: 0914-004
STREET ADDRESS: 3901 SOUTHWEST ALASKA STREET
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 20 40 80
APPROXIMATE SCALE IN FEET

FIGURE 4
EXPLORATION LOCATION PLAN



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DATE: 12/27/12
DRAWN BY: BLR/JQC
CHECKED BY: CER
CAD FILE: 0914-004_FIG5_A-A

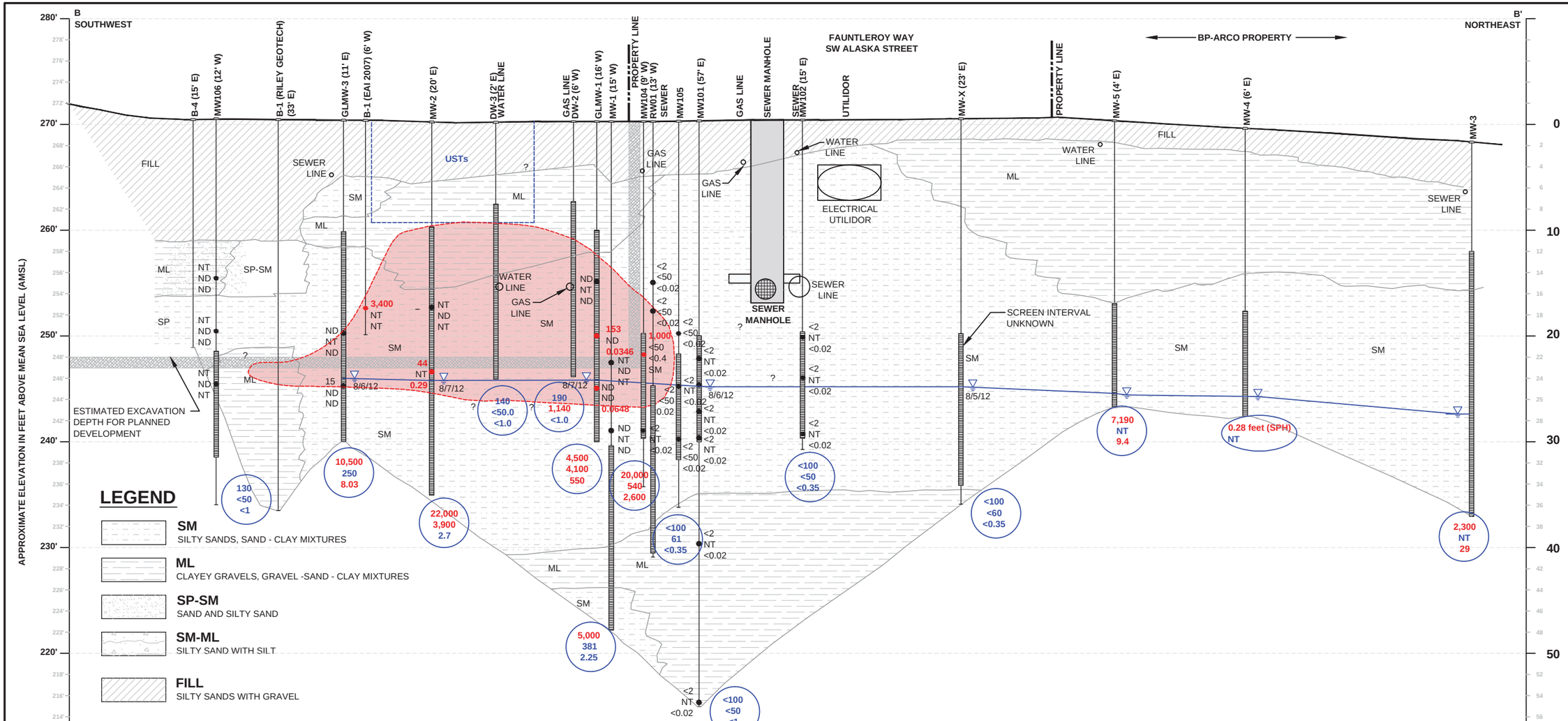
PROJECT NAME: SKS SHELL PROPERTY
PROJECT NUMBER: 0914-004
STREET ADDRESS: 3901 SOUTHWEST ALASKA STREET
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 15 30 60
APPROXIMATE SCALE IN FEET

FIGURE 5
SKS SHELL GEOLOGIC CROSS SECTION
A-A'

6/18/2014
P:\0914 LENNAR SHELL\0914-004 RIFS\CAP\TECHNICAL\CAD\2014 SKS SHELL RIFS FINAL\0914-004 FIG5 AA F.DWG
WWW.SOUNDEARTHINC.COM



SoundEarth Strategies
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DATE: 12/27/12
DRAWN BY: BLR/JQC
CHECKED BY: CER
CAD FILE: 0914-004_FIG6_B-B

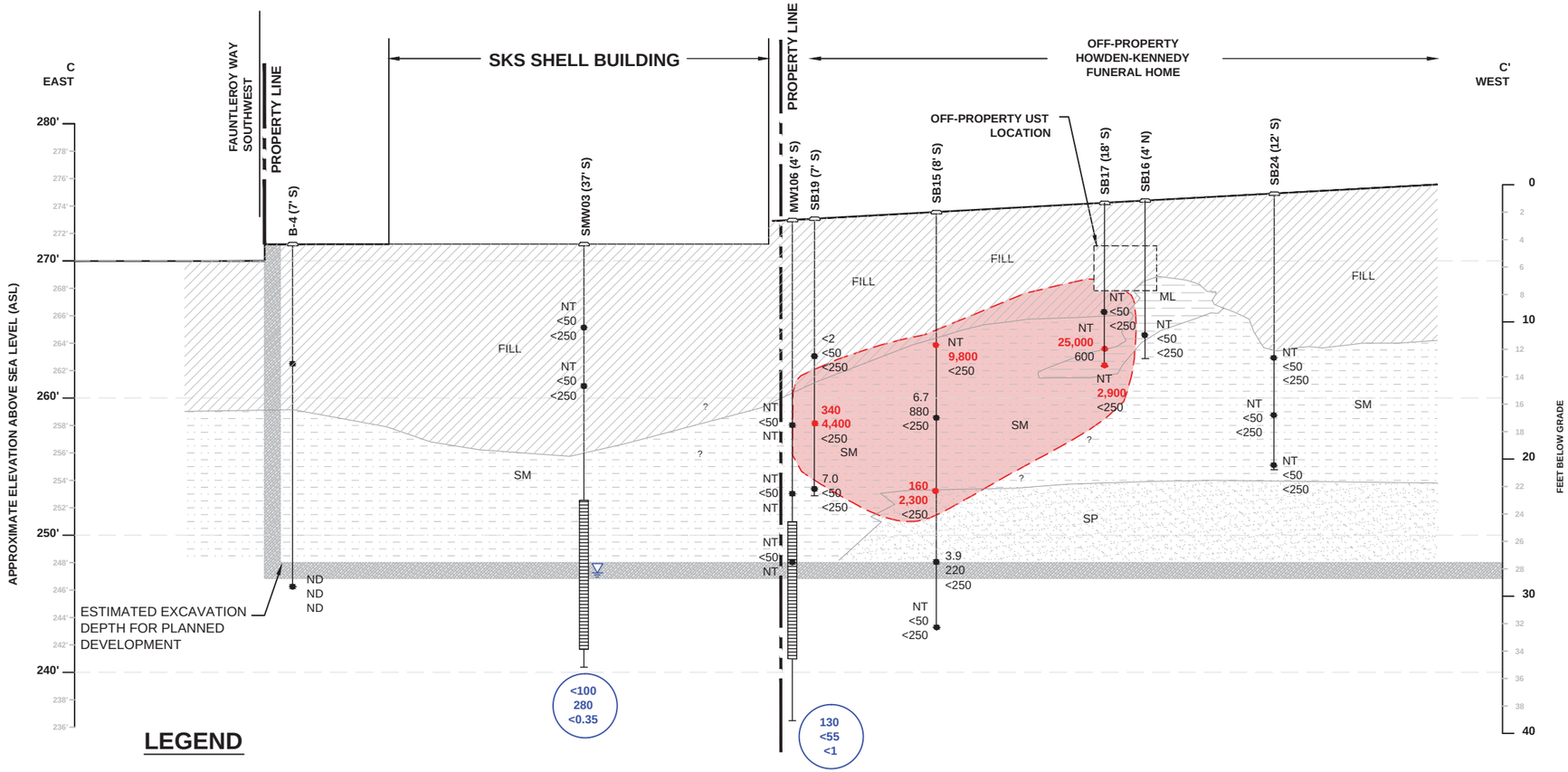
PROJECT NAME: SKS SHELL PROPERTY
PROJECT NUMBER: 0914-004
STREET ADDRESS: 3901 SOUTHWEST ALASKA STREET
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 15 30 60
APPROXIMATE SCALE IN FEET

FIGURE 6
SKS SHELL GEOLOGIC CROSS SECTION
B-B'

6/18/2014
P:\0914 LENNAR SHELL\0914-004 RIFS\CAP\TECHNICAL\CAD\2014 SKS SHELL RIFS FINAL\0914-004 FIG6 B-B F.DWG
WWW.SOUNDEARTHINC.COM



LEGEND

- **SM** — SILTY SANDS, SAND - CLAY MIXTURES
- **ML** — INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
- **SP** — SAND AND SILTY SAND
- **FILL** — SILTY SANDS WITH GRAVEL
- APPROXIMATE EXTENT OF SOIL CONTAMINATION

SMW03 (37' S) WELL OFFSET 37' SOUTH

- BLANK CASING
- SOIL SAMPLE
- WATER TABLE
- WELL SCREEN INTERVAL
- WELL TERMINATION

<100 280 <0.35	GRPH DRPH BENZENE	GROUNDWATER SAMPLE (MICROGRAMS PER LITER)
7.0 <50 <250	GRPH DRPH ORPH	SOIL SAMPLE (MILLIGRAMS PER KILOGRAM)

- RED INDICATES CONCENTRATION EXCEEDING MTCA METHOD A CLEANUP LEVEL
- CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL
- < RESULT BELOW LABORATORY REPORTING LIMITS

UST	UNDERGROUND STORAGE TANK
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
GRPH	GASOLINE-RANGE PETROLEUM HYDROCARBONS
DRPH	DIESEL-RANGE PETROLEUM HYDROCARBONS
ORPH	OIL-RANGE PETROLEUM HYDROCARBONS
NT	NOT TESTED
ND	NOT DETECTED

NOTE: THE SOIL AND GROUNDWATER LABORATORY ANALYTICAL DATA SHOWN FOR THE HULING AND KENNEDY PROPERTIES ARE PRESENTED IN THE *REMEDIAL INVESTIGATION AND CLEANUP ACTION PLAN*, PREPARED BY SOUNDEARTH AND DATED MAY 8, 2014.

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

DATE: 12/27/12
DRAWN BY: JQC
CHECKED BY: CER
CAD FILE: 0914-004_FIG7_C-C

PROJECT NAME: SKS SHELL PROPERTY
PROJECT NUMBER: 0914-004
STREET ADDRESS: 3901 SOUTHWEST ALASKA STREET
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 20 40 80
APPROXIMATE SCALE IN FEET

FIGURE 7
SKS SHELL GEOLOGIC CROSS SECTION
C-C'

FUNERAL HOME

SKS SHELL

FORMER GASOLINE SERVICE STATION

LES SCHWAB PROPERTY

FORMER GASOLINE SERVICE STATION

BP-ARCO PROPERTY

FAUNTLEROY WAY SOUTHWEST

SOUTHWEST ALASKA STREET

39TH AVENUE SOUTHWEST

SEATTLE ELECTRIC COMPANY UTILIDORE

SIDEWALK

PLANTER

FORMER USTs

FORMER PUMP ISLAND USTs

MW106

SMW04

SMW03 (246.00')

GLMW-3 (245.74')

GLMW-2

MW-3 (245.47')

DW-1

GLMW-1 (244.92')

MW-1r (244.54')

DW-4

MW-2 (245.44')

DW-2

DW-3

MW104 (244.94')

RW01

MW105

MW103 (241.75')

MW102 (243.65)

MW101 (244.12')

MW-X (243.29')

MW-5

MW-4

MW-3

B-4/MW-3

B-6/MW-4

B-3/MW-2

246.00

245.00

244.00

243.00

242.00

LEGEND

MW104	MONITORING WELL (SOUNDEARTH, 2012)
GLMW-3	MONITORING WELL (G-LOGICS, 2011)
B-6/MW-4	FORMER MONITORING WELL (LSI ADAPT INC, 2005)
DW-4	EXTRACTION WELL (ALISTO, 1997)
MW-3	MONITORING WELL (EAI, 1995)
MW-5	MONITORING WELL (RZA AGRA INC, 1993)
MW-X	MONITORING WELL (ARCADIS, 2012)
RW01	REMEDIATION WELL (SOUNDEARTH, 2013)
MW-2	DECOMMISSIONED WELL
	PROPERTY BOUNDARY
	PARCEL BOUNDARY
SS	SEWER LINE
W	WATER LINE
GAS	NATURAL GAS LINE
	HISTORICAL UTILITY LINES
EAI	ENVIRONMENTAL ASSOCIATES, INC.
UST	UNDERGROUND STORAGE TANK
	GROUNDWATER FLOW DIRECTION
	FORMER UNDERGROUND STORAGE TANK
	1.00-FOOT-INTERVAL GROUNDWATER CONTOUR
(241.75')	GROUNDWATER SURFACE ELEVATION (NOVEMBER 7, 2012)

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

DATE: 12/27/12
DRAWN BY: BLR/JQC/NAC
CHECKED BY: CER
CAD FILE: 0914-004_FIG8_SKS_CM

PROJECT NAME: SKS SHELL PROPERTY
PROJECT NUMBER: 0914-004
STREET ADDRESS: 3901 SOUTHWEST ALASKA STREET
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 15 30 60
APPROXIMATE SCALE IN FEET

FIGURE 8
SKS SHELL GROUNDWATER ELEVATIONS (NOVEMBER 7, 2012)

SoundEarth Strategies

Table 3
Summary of Monitoring Well Data
SKS Shell Property and Adjoining Parcels
Seattle, Washington

Well ID	Property	Installation Date	Installed By	Approximate Screen Depth (feet bgs)	Monument Rim Elevation (feet)[a]	Top of Casing (TOC) Elevation[a]	TOC Depth to Groundwater (11/7/12)	Groundwater Elevation[a,b] (11/7/12)
MW-1	Huling	5/15/1997	EPI	8 to 25	274.12	273.76	19.51	254.25
MW-2	Huling	5/15/1997	EPI	15 to 30	273.83	273.26	27.19	246.07
MW-3	Huling	5/15/1997	EPI	10 to 30	274.14	273.88	23.64	250.24
SMW01	Huling	8/30/2012	SoundEarth	22 to 32	273.87	273.53	26.35	247.18
SMW02	Huling	10/1/2012	SoundEarth	20 to 30	273.29	272.92	27.94	244.98
SMW03	Huling	8/29/2012	SoundEarth	20 to 30	271.60	271.26	25.26	246.00
SMW04	Kennedy	8/29/2012	SoundEarth	23 to 33	272.51	272.30	26.83	245.47
MW-1	SKS Shell	7/6/1995	EAI	26 to 44[c]	269.81	269.45	24.91	244.54
MW-2	SKS Shell	7/7/1995	EAI	10 to 30[c]	270.20	269.79	24.35	245.44
MW-3	SKS Shell	7/7/1995	EAI	10 to 30[c]	270.75	270.25	25.37	244.88
GLMW-1	SKS Shell	2011	G-Logics	10 to 30	269.91	269.44	24.52	244.92
GLMW-2	SKS Shell	2011	G-Logics	10 to 30	270.16	269.52	24.64	244.88
GLMW-3	SKS Shell	2011	G-Logics	10 to 30	270.76	270.37	24.63	245.74
MW101	SKS ROW	8/5/2012	SoundEarth	20 to 30	269.79	269.54	25.42	244.12
MW102	SKS ROW	11/2/2012	SoundEarth	20 to 30	269.35	269.06	25.41	243.65
MW103	SKS ROW	11/2/2012	SoundEarth	20 to 30	269.83	269.55	27.80	241.75
MW104	SKS ROW	11/3/2012	SoundEarth	20 to 30	269.64	269.35	24.41	244.94
MW105	SKS ROW	12/12/2012	SoundEarth	22 to 32	--	269.30	24.25	245.05
MW106	Kennedy	12/12/2012	SoundEarth	22 to 32	--	273.33	26.97	246.36
MW-X	BP Arco ROW	2012	Arcadis	20 to 35[d]	268.71	268.45	25.16	243.29

NOTES:

Monitoring wells MW101, MW102, MW103, MW104, MW105, MW106, and MW-X surveyed by SoundEarth. All Other well monuments survey by Dowl HKM.

[a]Elevation reference datum NAVD88 (Surveyed by Dowl HKM November 2012, except for MW105 and MW106 surveyed by SoundEarth Dec. 2012).

[b]Wells MW105 and MW106 groundwater levels were measured on March 6, 2013.

[c]Measured by G-Logics in 2011 using a vactor and camera (not based on the EAI boring logs).

[d]Estimated by SoundEarth with tape measure.

-- = not measured

bgs = below ground surface

EPI = Environmental Partners Inc.

EAI = Environmental Associates Inc.

G-Logics = G-Logics Inc.

ROW = right-of-way

SoundEarth = SoundEarth Strategies Inc.

TOC = top of casing elevation

ATTACHMENT D
AQUIFER PUMP TEST RESULTS, MARCH 2013

4.6.5 Groundwater Monitoring and Sampling

SoundEarth collected groundwater samples over time from on- and off-property wells. The groundwater monitoring events and sampling results are summarized below. The laboratory analytical results are presented on Table 2.

4.6.5.1 March 2013

SoundEarth collected groundwater samples from off-property downgradient wells MW104 and MW105 on March 6, 2013. Concentrations of GRPH, DRPH, and benzene exceeded the CULs in MW104. The analytical results for MW105 were similar to samples collected from the well in December 2012. No GRPH or benzene was detected in well MW105. A DRPH concentration of 61µg/L was detected in MW105, well below the CUL of 500 µg/L.

4.6.5.2 April 2013

SoundEarth collected groundwater samples from MW101, MW104, MW106, and SMW04 on April 1, 2013. Concentrations of GRPH and benzene exceeded the CULs in MW104 and SMW04. Concentrations of DRPH exceed the CUL in MW104. No COCs exceeded the CULs in MW101 and MW106.

4.6.5.3 November 2013

SoundEarth collected a groundwater sample from MW-2 on November 5, 2013, prior to abandonment of the well associated with the UST decommissioning. Concentrations of GRPH, DRPH, ORPH, ethylbenzene and total xylenes exceeded the CULs in MW-2.

4.6.5.4 June 2014

SoundEarth collected groundwater samples from MW104, GLMW-1, and MW-3 on June 12, 2014. During this monitoring event approximately 0.2 feet of SPH (product), that was blue-green in coloration, was detected in MW-3. A sample of the product and a groundwater sample from beneath the product and groundwater interface were collected from MW-3. Concentrations of GRPH, DRPH, and benzene exceeded the CULs in all three wells. The concentration of total xylenes exceeded the CUL in MW104.

4.6.6 Aquifer Testing and Analysis

A short-term aquifer pumping test was completed for the shallow water-bearing zone located beneath the northeast corner of the SKS Shell Property and the adjacent ROWs for Fauntleroy Way Southwest and Southwest Alaska Street. The purpose of the pumping test was to obtain aquifer hydraulic data needed for evaluating potential remedial options for this part of the Site.

A 4-inch-diameter Schedule 40 PVC pumping well, identified as recovery well RW01, was installed between monitoring wells MW-1 and MW104 on February 20, 2013 (Figure 4). Well RW01 was constructed using PVC well screen (0.010-inch slot widths) extending from 25 to 40 feet below ground surface. A detailed boring log with well construction details is included in Appendix B. Well RW01 and monitoring well MW-1 were developed on February 20, 2013.

The well screens for pumping well RW01 and monitoring wells MW-1 and MW104 were installed in the shallow water-bearing zone that comprises the upper portion of the local water table aquifer beneath this area of the Site. Well MW104 was completed with a shorter well screen than wells RW01 and MW-1, and does not extend as deep into the shallow-water zone (Figures 5 and 6). A well step test was completed on March 14, 2013, to evaluate the range of

pumping rates which could be maintained for the constant rate test. The results of the step test indicated that a rate of 1 gallon per minute (gpm) could be sustained for several hours in RW01 given the available drawdown in the well.

The short-term constant-rate pumping test was conducted on March 19, 2013. A Grundfos Redi-Flow submersible pump was used to pump water from well RW01. Groundwater was pumped at a relatively constant rate of about 1 gpm for about 5 hours (304 minutes), and discharged into 55-gallon drums for temporary storage on the Site. Vented (gauged) 30 pound per square inch pressure transducers with integrated data loggers were placed in RW01, MW-1 and MW104. The pressure transducers were programmed to obtain pressure readings at 10-second intervals and synchronized to a field laptop computer. Water level recovery measurements were obtained after the pump was shut off. Manual water level measurements were obtained from all three wells during the pumping and recovery tests for comparison with the electronic data collected by the pressure transducers.

Static water level depths of about 23.3 feet below the top of the well casing were measured in the wells immediately before starting the constant-rate pumping test. A water level drawdown of 9.92 feet was measured in pumping well RW01 at the conclusion of the constant-rate test. Water level drawdowns of 2.61 feet and 1.54 feet were measured in wells MW-1 and MW104, respectively, at the conclusion of the constant-rate pumping test. Water levels in the three wells recovered to approximately 98 to 99 percent of the initial static water level within about 100 minutes after the well pump was shut off.

The resulting water level data were compiled and processed, and then imported for analysis into the AquiferWin 32 software program (Version 4.05) developed by Environmental Solutions, Inc. Based on the known hydraulic characteristics of the shallow water-bearing zone and the limitations of the short-term pumping test, several analytical solutions were used to estimate aquifer properties:

- Theis Method (1935) for unconfined aquifers
- Neuman Method (1972) for unconfined aquifers
- Cooper and Jacob Straight Line Method (1946) for confined aquifers

These analytical methods have multiple assumptions for applying the solutions to specific aquifer or test conditions, including the following:

- The aquifer is homogeneous, has an infinite areal extent and has a uniform thickness.
- Well discharge (pumping) is at a constant rate.
- The well screens for the pumping well and observation wells fully penetrate the full thickness of the aquifer.
- Well storage is relatively small, and discharge is derived exclusively from the aquifer storage.

Although some of these assumptions were not completely met given the known subsurface conditions and the design of the wells, these three methods were deemed to be generally applicable for estimating the aquifer properties at the SKS Shell Property. Partial penetration

effects were more evident for the data obtained from well MW104 because of the shallower well screen. Therefore, the data obtained from well MW104 was considered to be less reliable than the data obtained from well MW-1, and were not used for estimating aquifer hydraulic parameters.

The results of the aquifer test analysis for well MW-1 are listed in Table 4. Aquifer transmissivity estimates ranged from about 9.3 to 17.5 square feet per day (ft^2/day), with an average value of 14.5 ft^2/day. Using an aquifer thickness of 25 feet, an average hydraulic conductivity of 5.82 x 10^{-1} feet per day, or 2.05 x 10^{-4} centimeters per second (cm/s), was estimated from the aquifer test analysis for the shallow water-bearing zone in the vicinity of the three wells. The range of hydraulic conductivity values estimated from the aquifer test analysis corresponds to the physical characteristics of the silty sand and sandy silt comprising the shallow water-bearing zone at this location.

4.6.7 Summary of SKS Shell Remedial Investigation Field Program

The results of the remedial investigation conducted by SoundEarth indicate that PCS beneath the Shell SKS Property extends vertically to a maximum depth of 25 feet bgs mostly beneath the northern two-thirds of the property as illustrated on Figure 9. The lateral extent of contaminated soil was bound by soil boring SB201 to the north and monitoring well MW105 to the northeast. The southern extent of contamination is likely beneath the SKS Shell building. Soil borings conducted further south on the Huling and alley properties (SMW03, B-1, and B-4) did not encounter petroleum-impacted soils (Section 4.7).

Laboratory analytical results for groundwater samples collected from downgradient monitoring wells MW101 through MW103, MW105, and MW-X indicate that the plume extends less than 25 feet northeast of the SKS Shell Property boundary beneath the Fauntleroy Way Southwest ROW, and the plume does not extend beyond the Southwest Alaska Street ROW (Figure 10).

As reported in Section 3.1.2, ECC Horizon's review of available records revealed a shortage of 17,000 gallons of fuel from January 2003 to December 2008. Based on the concentrations identified in soil and groundwater during previous investigations and the current RI/FS, SoundEarth estimated the residual mass of petroleum contamination in soil and groundwater for the Site. Table 5 provides a summary of the mass calculations and assumptions for both soil and groundwater. The estimated amount of GRPH in soil is 14, 897 gallons and approximately 1 gallon of dissolved GRPH in groundwater for a total of 14,898 gallons of gasoline released to the subsurface.

Data Gaps. The soil and groundwater samples collected from monitoring well SMW04 indicate that the groundwater plume extends to the west beneath the Kennedy property; however, as discussed in Sections 5.0 and 7.0 below, the planned redevelopment of the SKS Shell Property includes excavation of soil to approximately 28 feet bgs in this area of the Site, as well as dewatering and treatment of contaminated groundwater beneath the SKS Shell Property and Kennedy property. After demolition of the funeral home building occurs in July or August 2014, a soil boring and well (MW107) will be installed in the area approximately 20 feet to the west of SMW04 to further bound the extent of the SKS Shell plume. The results of soil and groundwater sampling will used to modify the cleanup plan (if necessary).

Table 4
Aquifer Test Results
SKS Shell Property
3901 Southwest Alaska Street
Seattle, Washington

Well ID	Well Type	Well Diameter (inches)	Well Screen Interval (feet bgs)	Aquifer Thickness (ft)	Radial Distance to Pumping Well (ft)	Maximum Drawdown (ft)	Analytical Method	Aquifer Model	Transmissivity (ft^2/d)	Hydraulic Conductivity (ft/d)	Hydraulic Conductivity (cm/s)
MW-1	Observation	2	29 - 44	25.0	4.1	2.61	Cooper-Jacob (1946)	Confined	1.68E+01	6.72E-01	2.37E-04
							Neuman (1972)	Unconfined	9.29E+00	3.72E-01	1.31E-04
							Theis (1935)	Unconfined Approximation	1.75E+01	7.02E-01	2.48E-04
								Average	1.45E+01	5.82E-01	2.05E-04

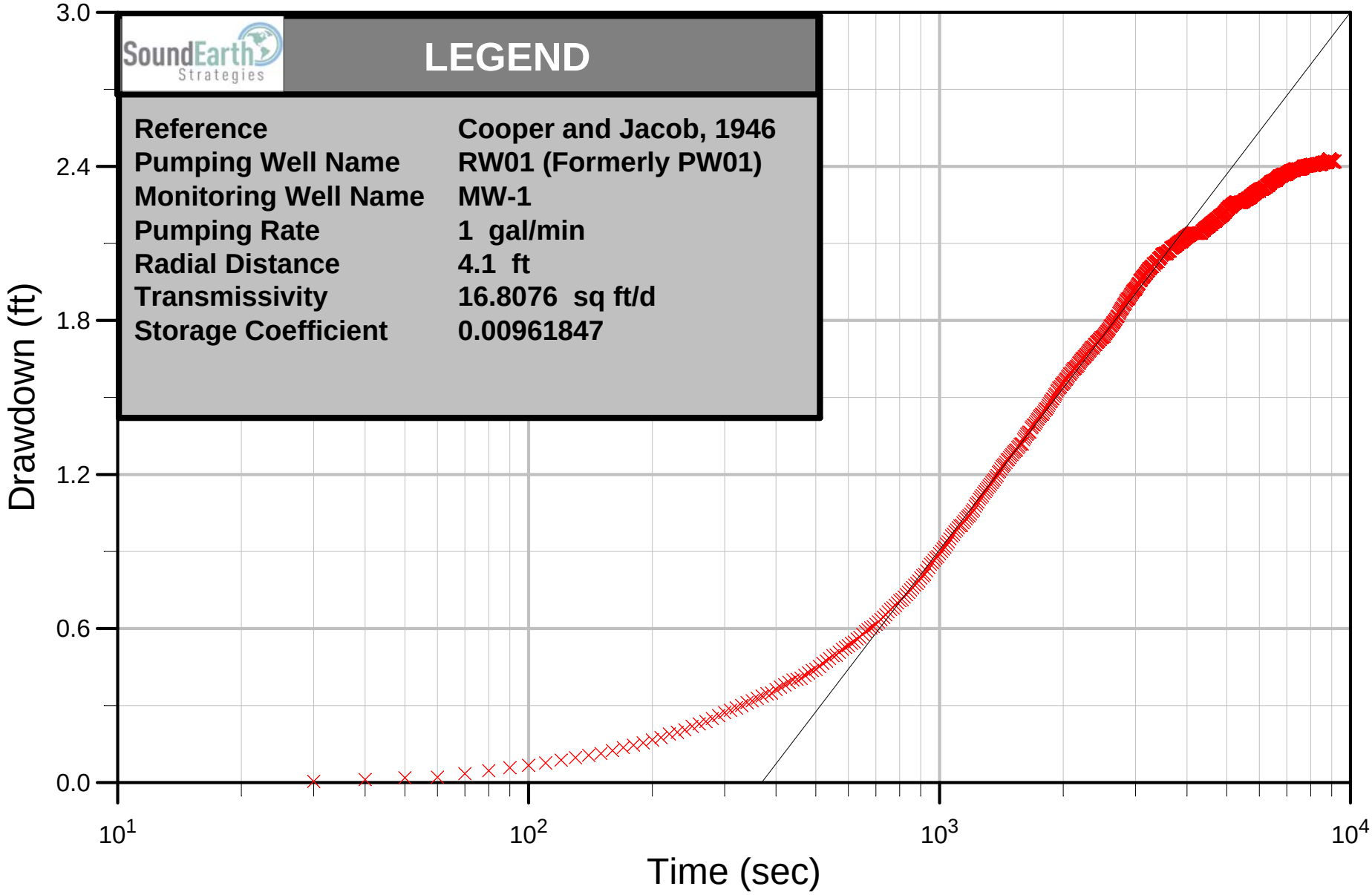
Pumping Well Information

Well ID	Well Type	Well Diameter (inches)	Well Screen Interval (feet bgs)	Pumping Rate (gpm)	Pumping Rate (ft^3/s)	Pumping Duration (minutes)	Maximum Drawdown (ft)
RW01	Pumping	4	25-40	1.0	0.0022	304	9.93

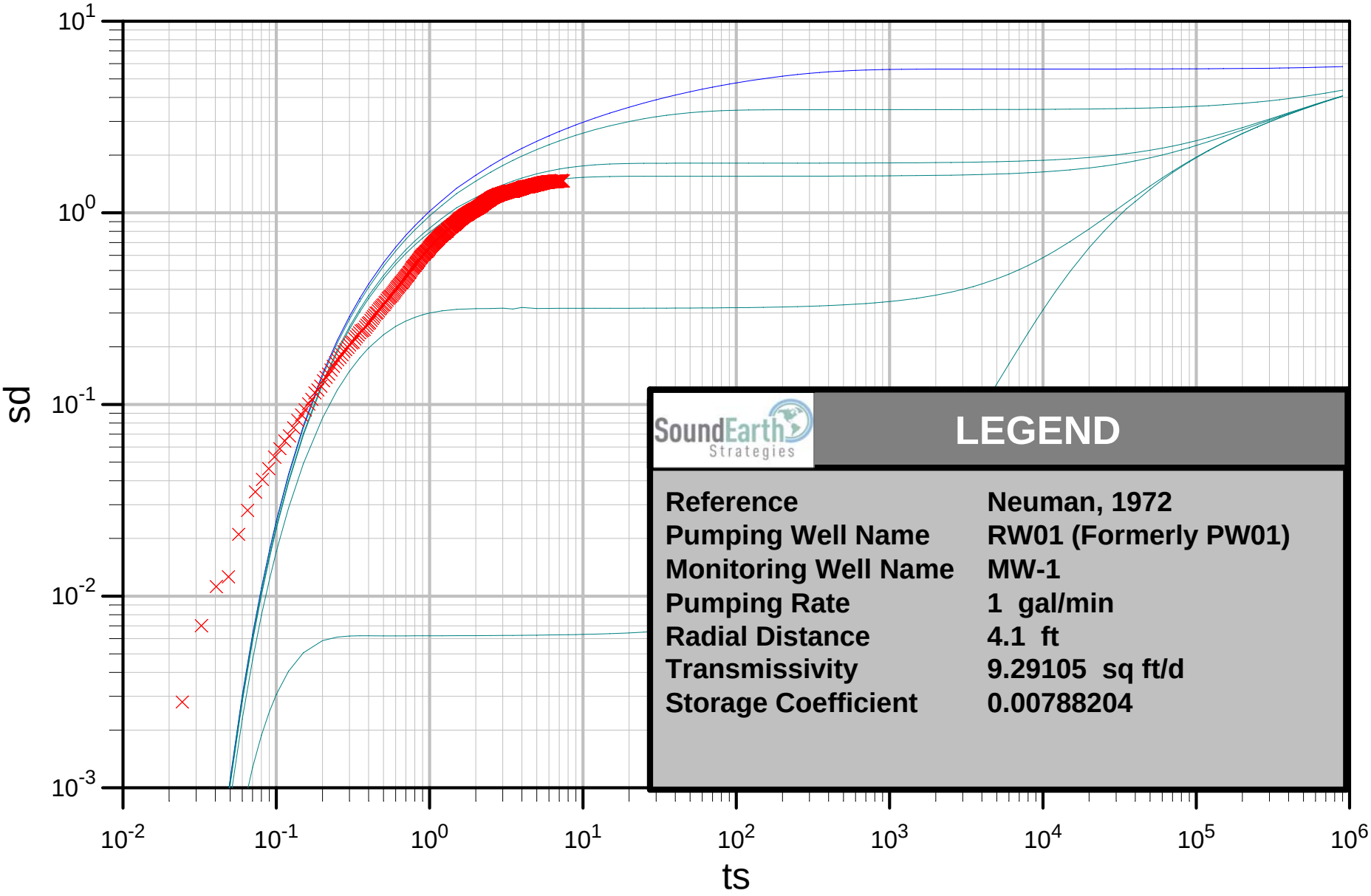
NOTES:

bgs = below ground surface
cm/s = centimeter per second
cm^2 = centimeter squared
ft = feet
ft/s = feet per second
ft/d = foot per day
ft^2/d = square feet per day
ft^3/s = cubic feet per second
gpm = gallons per minute
s = seconds
t = time

MW-1_Cooper-Jacob



MW-1_Neuman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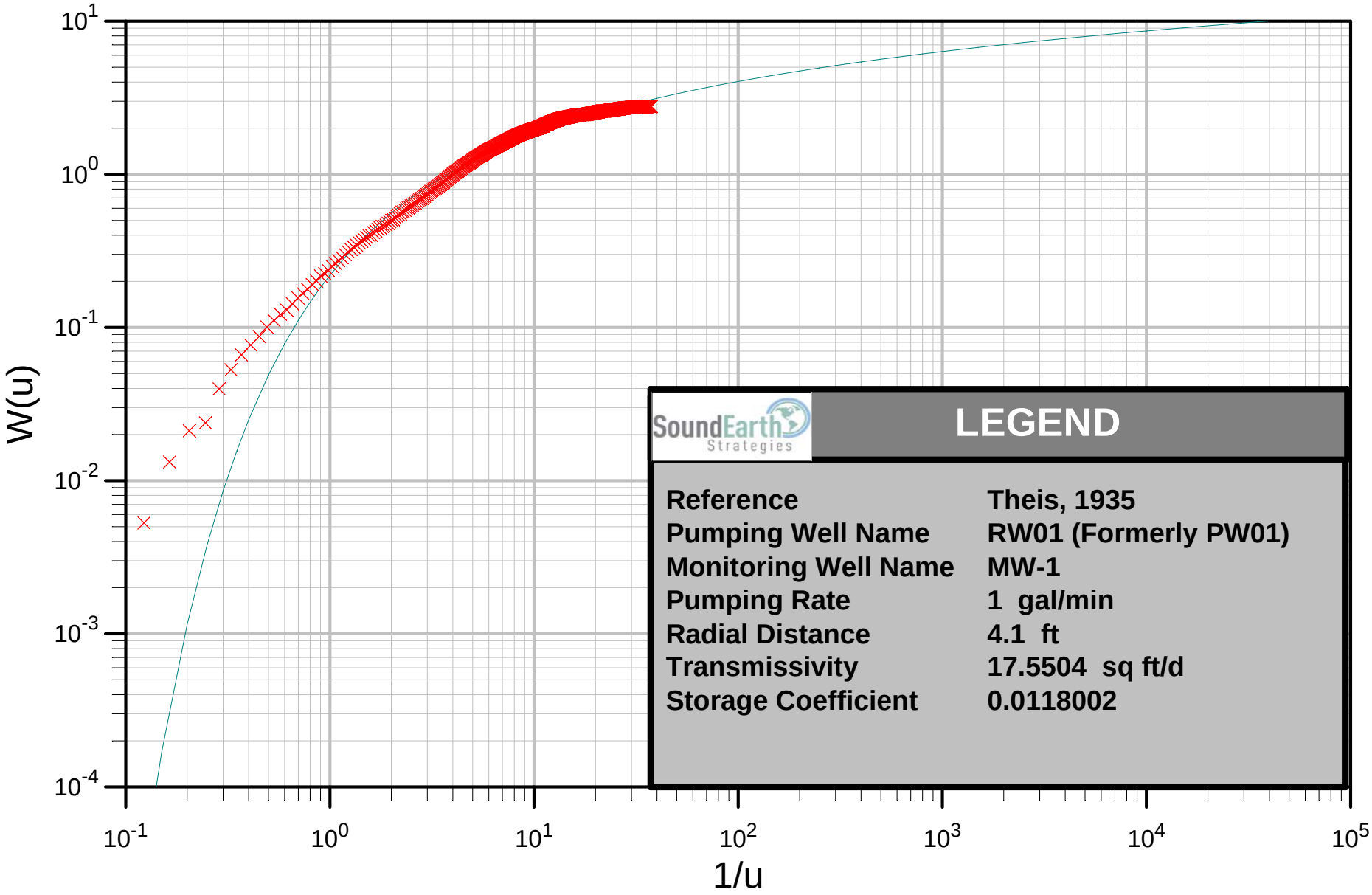
10^{4}
10^{5}
10^{6}
SoundEarth Strategies
LEGEND
Reference Neuman, 1972
Pumping Well Name RW01 (Formerly PW01)
Monitoring Well Name MW-1
Pumping Rate 1 gal/min
Radial Distance 4.1 ft
Transmissivity 9.29105 sq ft/d
Storage Coefficient 0.00788204

MW-1_Theis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SoundEarth Strategies
LEGEND
Reference Theis, 1935
Pumping Well Name RW01 (Formerly PW01)
Monitoring Well Name MW-1
Pumping Rate 1 gal/min
Radial Distance 4.1 ft
Transmissivity 17.5504 sq ft/d
Storage Coefficient 0.0118002

	Time (sec)	Drawdown (ft)
1	30	0.00462
2	40	0.01155
3	50	0.01848
4	60	0.02079
5	70	0.03465
6	80	0.0462
7	90	0.05775
8	100	0.06699
9	110	0.07623
10	120	0.08778
11	130	0.09702
12	140	0.10626
13	150	0.11319
14	160	0.12474
15	170	0.13629
16	180	0.14553
17	190	0.15477
18	200	0.16632
19	210	0.17556
20	220	0.18942
21	230	0.19635
22	240	0.20559
23	250	0.21945
24	260	0.22869
25	270	0.23793
26	280	0.24948
27	290	0.26103
28	300	0.27258
29	310	0.28182
30	320	0.29106
31	330	0.3003
32	340	0.31185
33	350	0.31878
34	360	0.32802
35	370	0.33726
36	380	0.3465
37	390	0.34881
38	400	0.36267
39	410	0.37191
40	420	0.38115
41	430	0.39039
42	440	0.39963
43	450	0.40194
44	460	0.40656
45	470	0.41811
46	480	0.42735
47	490	0.43659

	Time (sec)	Drawdown (ft)
48	500	0.44121
49	510	0.45276
50	520	0.46431
51	530	0.47355
52	540	0.48279
53	550	0.49434
54	560	0.49665
55	570	0.5082
56	580	0.51975
57	590	0.52668
58	600	0.53361
59	610	0.54285
60	620	0.54747
61	630	0.55902
62	640	0.56595
63	650	0.5775
64	660	0.58905
65	670	0.59598
66	680	0.60291
67	690	0.60753
68	700	0.61677
69	710	0.62601
70	720	0.63525
71	730	0.64449
72	740	0.65373
73	750	0.66528
74	760	0.67452
75	770	0.68145
76	780	0.69069
77	790	0.69993
78	800	0.70917
79	810	0.71379
80	820	0.72303
81	830	0.73227
82	840	0.74151
83	850	0.75075
84	860	0.75999
85	870	0.76923
86	880	0.77616
87	890	0.7854
88	900	0.79695
89	910	0.80619
90	920	0.81081
91	930	0.82467
92	940	0.83853
93	950	0.85008
94	960	0.85701

	Time (sec)	Drawdown (ft)
95	970	0.86625
96	980	0.87549
97	990	0.88011
98	1000	0.89166
99	1010	0.9009
100	1020	0.91014
101	1030	0.91707
102	1040	0.92862
103	1050	0.93786
104	1060	0.94941
105	1070	0.96096
106	1080	0.96789
107	1090	0.97713
108	1100	0.98406
109	1110	0.9933
110	1120	1.00023
111	1130	1.00254
112	1140	1.01178
113	1150	1.01871
114	1160	1.02795
115	1170	1.03488
116	1180	1.0395
117	1190	1.04643
118	1200	1.05567
119	1210	1.0626
120	1220	1.07646
121	1230	1.0857
122	1240	1.09263
123	1250	1.10418
124	1260	1.11111
125	1270	1.11804
126	1280	1.12728
127	1290	1.13421
128	1300	1.14114
129	1310	1.14807
130	1320	1.155
131	1330	1.16193
132	1340	1.16886
133	1350	1.17579
134	1360	1.18041
135	1370	1.18965
136	1380	1.19658
137	1390	1.20813
138	1400	1.21275
139	1410	1.22199
140	1420	1.23123
141	1430	1.23585

	Time (sec)	Drawdown (ft)
142	1440	1.24047
143	1450	1.2474
144	1460	1.25664
145	1470	1.25895
146	1480	1.26588
147	1490	1.27281
148	1500	1.27743
149	1510	1.28436
150	1520	1.28898
151	1530	1.2936
152	1540	1.29591
153	1550	1.30515
154	1560	1.30977
155	1570	1.3167
156	1580	1.31901
157	1590	1.31901
158	1600	1.33518
159	1610	1.34211
160	1620	1.34904
161	1630	1.35597
162	1640	1.36059
163	1650	1.36521
164	1660	1.36521
165	1670	1.38138
166	1680	1.386
167	1690	1.39293
168	1700	1.39293
169	1710	1.39986
170	1720	1.40679
171	1730	1.41372
172	1740	1.41834
173	1750	1.42527
174	1760	1.42989
175	1770	1.43451
176	1780	1.43451
177	1790	1.44144
178	1800	1.44837
179	1810	1.4553
180	1820	1.4553
181	1830	1.46223
182	1840	1.46916
183	1850	1.47609
184	1860	1.48302
185	1870	1.48764
186	1880	1.49457
187	1890	1.49457
188	1900	1.50381

	Time (sec)	Drawdown (ft)
189	1910	1.51074
190	1920	1.51536
191	1930	1.5246
192	1940	1.52922
193	1950	1.53615
194	1960	1.53846
195	1970	1.54308
196	1980	1.55001
197	1990	1.55232
198	2000	1.55694
199	2010	1.55925
200	2020	1.56618
201	2030	1.5708
202	2040	1.57311
203	2050	1.58004
204	2060	1.58466
205	2070	1.59159
206	2080	1.59159
207	2090	1.59621
208	2100	1.60314
209	2110	1.60776
210	2120	1.61238
211	2130	1.61238
212	2140	1.61469
213	2150	1.61931
214	2160	1.62162
215	2170	1.62624
216	2180	1.63317
217	2190	1.63548
218	2200	1.6401
219	2210	1.64472
220	2220	1.64934
221	2230	1.65165
222	2240	1.65396
223	2250	1.65858
224	2260	1.66089
225	2270	1.66551
226	2280	1.66782
227	2290	1.67244
228	2300	1.67706
229	2310	1.68168
230	2320	1.68399
231	2330	1.68861
232	2340	1.69323
233	2350	1.69554
234	2360	1.69323
235	2370	1.69785

	Time (sec)	Drawdown (ft)
236	2380	1.70478
237	2390	1.70709
238	2400	1.70709
239	2410	1.71402
240	2420	1.71633
241	2430	1.71864
242	2440	1.72095
243	2450	1.72557
244	2460	1.72788
245	2470	1.7325
246	2480	1.7325
247	2490	1.73481
248	2500	1.73712
249	2510	1.73943
250	2520	1.74405
251	2530	1.74867
252	2540	1.75098
253	2550	1.7556
254	2560	1.75791
255	2570	1.76253
256	2580	1.76484
257	2590	1.76946
258	2600	1.77639
259	2610	1.7787
260	2620	1.78101
261	2630	1.78563
262	2640	1.79025
263	2650	1.79256
264	2660	1.79718
265	2670	1.79949
266	2680	1.80411
267	2690	1.80642
268	2700	1.81335
269	2710	1.81566
270	2720	1.81797
271	2730	1.82721
272	2740	1.83183
273	2750	1.83645
274	2760	1.84107
275	2770	1.84569
276	2780	1.84569
277	2790	1.85031
278	2800	1.85724
279	2810	1.86186
280	2820	1.86417
281	2830	1.86879
282	2840	1.87572

	Time (sec)	Drawdown (ft)
283	2850	1.87803
284	2860	1.88265
285	2870	1.88265
286	2880	1.88496
287	2890	1.88727
288	2900	1.89189
289	2910	1.89651
290	2920	1.90113
291	2930	1.90344
292	2940	1.90806
293	2950	1.91268
294	2960	1.91499
295	2970	1.9173
296	2980	1.91961
297	2990	1.92192
298	3000	1.92423
299	3010	1.92654
300	3020	1.93116
301	3030	1.93578
302	3040	1.9404
303	3050	1.94271
304	3060	1.94502
305	3070	1.95426
306	3080	1.95657
307	3090	1.95888
308	3100	1.96119
309	3110	1.96581
310	3120	1.96812
311	3130	1.97043
312	3140	1.97274
313	3150	1.97505
314	3160	1.97736
315	3170	1.98198
316	3180	1.98429
317	3190	1.9866
318	3200	1.99122
319	3210	1.99353
320	3220	1.99584
321	3230	2.00046
322	3240	2.00277
323	3250	2.00277
324	3260	2.00508
325	3270	2.00739
326	3280	2.0097
327	3290	2.01201
328	3300	2.0097
329	3310	2.01894

	Time (sec)	Drawdown (ft)
330	3320	2.02125
331	3330	2.01663
332	3340	2.02356
333	3350	2.02356
334	3360	2.02587
335	3370	2.02818
336	3380	2.03049
337	3390	2.0328
338	3400	2.03049
339	3410	2.03973
340	3420	2.03973
341	3430	2.04204
342	3440	2.04435
343	3450	2.04666
344	3460	2.04666
345	3470	2.05359
346	3480	2.0559
347	3490	2.05821
348	3500	2.05821
349	3510	2.06052
350	3520	2.06052
351	3530	2.06052
352	3540	2.06052
353	3550	2.06283
354	3560	2.06283
355	3570	2.05821
356	3580	2.06283
357	3590	2.06745
358	3600	2.06745
359	3610	2.06976
360	3620	2.07207
361	3630	2.06976
362	3640	2.07207
363	3650	2.08131
364	3660	2.08131
365	3670	2.08362
366	3680	2.08362
367	3690	2.08593
368	3700	2.08593
369	3710	2.08593
370	3720	2.08824
371	3730	2.09055
372	3740	2.08824
373	3750	2.09055
374	3760	2.09286
375	3770	2.09517
376	3780	2.09748

	Time (sec)	Drawdown (ft)
377	3790	2.09748
378	3800	2.09979
379	3810	2.1021
380	3820	2.1021
381	3830	2.10441
382	3840	2.10441
383	3850	2.10672
384	3860	2.10903
385	3870	2.10672
386	3880	2.10903
387	3890	2.10903
388	3900	2.11134
389	3910	2.11365
390	3920	2.11365
391	3930	2.11596
392	3940	2.11827
393	3950	2.12058
394	3960	2.12289
395	3970	2.12289
396	3980	2.12289
397	3990	2.1252
398	4000	2.12751
399	4010	2.12751
400	4020	2.12751
401	4030	2.12982
402	4040	2.13213
403	4050	2.13213
404	4060	2.13444
405	4070	2.13444
406	4080	2.13444
407	4090	2.13675
408	4100	2.13906
409	4110	2.13906
410	4120	2.13906
411	4130	2.13906
412	4140	2.13906
413	4150	2.14137
414	4160	2.14137
415	4170	2.13906
416	4180	2.13906
417	4190	2.13906
418	4200	2.13906
419	4210	2.13906
420	4220	2.13906
421	4230	2.13906
422	4240	2.13906
423	4250	2.13906

	Time (sec)	Drawdown (ft)
424	4260	2.13906
425	4270	2.14137
426	4280	2.14137
427	4290	2.14137
428	4300	2.14137
429	4310	2.13906
430	4320	2.13906
431	4330	2.14137
432	4340	2.14137
433	4350	2.14599
434	4360	2.1483
435	4370	2.1483
436	4380	2.15061
437	4390	2.15061
438	4400	2.15292
439	4410	2.15523
440	4420	2.15754
441	4430	2.15754
442	4440	2.15985
443	4450	2.15985
444	4460	2.16216
445	4470	2.16216
446	4480	2.16447
447	4490	2.16447
448	4500	2.16678
449	4510	2.16678
450	4520	2.16909
451	4530	2.16909
452	4540	2.1714
453	4550	2.17371
454	4560	2.17371
455	4570	2.17602
456	4580	2.17833
457	4590	2.17602
458	4600	2.18064
459	4610	2.18064
460	4620	2.18064
461	4630	2.18295
462	4640	2.18295
463	4650	2.18526
464	4660	2.18757
465	4670	2.18757
466	4680	2.18988
467	4690	2.18757
468	4700	2.19219
469	4710	2.18988
470	4720	2.1945

	Time (sec)	Drawdown (ft)
471	4730	2.1945
472	4740	2.1945
473	4750	2.19681
474	4760	2.19681
475	4770	2.20143
476	4780	2.20143
477	4790	2.20143
478	4800	2.20374
479	4810	2.20605
480	4820	2.20605
481	4830	2.20836
482	4840	2.20374
483	4850	2.20836
484	4860	2.21067
485	4870	2.21067
486	4880	2.21298
487	4890	2.21298
488	4900	2.21298
489	4910	2.21529
490	4920	2.2176
491	4930	2.21991
492	4940	2.22222
493	4950	2.22222
494	4960	2.22453
495	4970	2.22684
496	4980	2.22684
497	4990	2.22915
498	5000	2.23377
499	5010	2.23377
500	5020	2.23377
501	5030	2.23608
502	5040	2.23608
503	5050	2.23839
504	5060	2.2407
505	5070	2.24301
506	5080	2.24301
507	5090	2.24532
508	5100	2.24532
509	5110	2.2407
510	5120	2.24532
511	5130	2.24532
512	5140	2.24763
513	5150	2.24994
514	5160	2.24994
515	5170	2.25225
516	5180	2.25225
517	5190	2.25456

	Time (sec)	Drawdown (ft)
518	5200	2.25456
519	5210	2.25687
520	5220	2.25687
521	5230	2.25687
522	5240	2.25918
523	5250	2.25918
524	5260	2.26149
525	5270	2.26149
526	5280	2.26149
527	5290	2.26149
528	5300	2.26149
529	5310	2.25918
530	5320	2.25918
531	5330	2.25918
532	5340	2.25918
533	5350	2.25918
534	5360	2.25918
535	5370	2.25918
536	5380	2.25918
537	5390	2.25918
538	5400	2.26149
539	5410	2.26149
540	5420	2.25918
541	5430	2.25918
542	5440	2.26149
543	5450	2.26149
544	5460	2.26149
545	5470	2.26149
546	5480	2.26149
547	5490	2.2638
548	5500	2.2638
549	5510	2.26611
550	5520	2.26611
551	5530	2.26842
552	5540	2.27073
553	5550	2.27073
554	5560	2.27073
555	5570	2.27073
556	5580	2.27073
557	5590	2.27073
558	5600	2.27304
559	5610	2.27304
560	5620	2.27535
561	5630	2.27535
562	5640	2.27766
563	5650	2.27535
564	5660	2.27766

	Time (sec)	Drawdown (ft)
565	5670	2.27766
566	5680	2.27766
567	5690	2.27997
568	5700	2.28228
569	5710	2.27997
570	5720	2.28459
571	5730	2.28459
572	5740	2.28228
573	5750	2.2869
574	5760	2.2869
575	5770	2.28921
576	5780	2.28921
577	5790	2.28921
578	5800	2.29152
579	5810	2.29383
580	5820	2.29383
581	5830	2.29383
582	5840	2.29383
583	5850	2.29614
584	5860	2.29614
585	5870	2.29845
586	5880	2.30076
587	5890	2.30076
588	5900	2.30076
589	5910	2.30307
590	5920	2.30076
591	5930	2.30076
592	5940	2.30307
593	5950	2.30538
594	5960	2.30538
595	5970	2.30538
596	5980	2.30769
597	5990	2.30769
598	6000	2.30307
599	6010	2.31
600	6020	2.31
601	6030	2.31231
602	6040	2.31231
603	6050	2.31231
604	6060	2.31231
605	6070	2.31231
606	6080	2.31231
607	6090	2.31462
608	6100	2.31231
609	6110	2.31462
610	6120	2.31462
611	6130	2.31462

	Time (sec)	Drawdown (ft)
612	6140	2.31462
613	6150	2.31462
614	6160	2.31693
615	6170	2.31693
616	6180	2.31924
617	6190	2.31924
618	6200	2.31924
619	6210	2.31924
620	6220	2.31924
621	6230	2.31924
622	6240	2.32386
623	6250	2.32386
624	6260	2.32617
625	6270	2.32617
626	6280	2.32617
627	6290	2.32848
628	6300	2.32617
629	6310	2.32617
630	6320	2.32848
631	6330	2.33079
632	6340	2.33079
633	6350	2.3331
634	6360	2.3331
635	6370	2.33541
636	6380	2.33541
637	6390	2.33772
638	6400	2.34003
639	6410	2.34003
640	6420	2.34003
641	6430	2.34003
642	6440	2.34003
643	6450	2.34234
644	6460	2.34234
645	6470	2.34234
646	6480	2.34234
647	6490	2.34234
648	6500	2.34234
649	6510	2.34465
650	6520	2.34465
651	6530	2.34465
652	6540	2.34696
653	6550	2.34696
654	6560	2.34696
655	6570	2.34696
656	6580	2.34927
657	6590	2.34927
658	6600	2.34696

	Time (sec)	Drawdown (ft)
659	6610	2.34927
660	6620	2.35158
661	6630	2.35158
662	6640	2.35389
663	6650	2.35389
664	6660	2.3562
665	6670	2.3562
666	6680	2.35851
667	6690	2.35851
668	6700	2.36082
669	6710	2.36082
670	6720	2.36313
671	6730	2.36313
672	6740	2.36313
673	6750	2.36313
674	6760	2.36313
675	6770	2.36082
676	6780	2.36313
677	6790	2.36313
678	6800	2.36544
679	6810	2.36544
680	6820	2.36544
681	6830	2.36544
682	6840	2.36775
683	6850	2.36775
684	6860	2.37006
685	6870	2.37006
686	6880	2.37006
687	6890	2.37006
688	6900	2.36775
689	6910	2.36775
690	6920	2.36775
691	6930	2.37006
692	6940	2.37006
693	6950	2.37006
694	6960	2.37006
695	6970	2.37006
696	6980	2.37006
697	6990	2.37006
698	7000	2.37237
699	7010	2.37237
700	7020	2.37468
701	7030	2.37468
702	7040	2.37468
703	7050	2.37468
704	7060	2.37468
705	7070	2.37699

	Time (sec)	Drawdown (ft)
706	7080	2.37699
707	7090	2.37699
708	7100	2.3793
709	7110	2.3793
710	7120	2.3793
711	7130	2.38161
712	7140	2.38161
713	7150	2.38161
714	7160	2.38392
715	7170	2.38392
716	7180	2.38392
717	7190	2.38392
718	7200	2.38392
719	7210	2.38392
720	7220	2.38392
721	7230	2.38392
722	7240	2.38623
723	7250	2.38623
724	7260	2.38392
725	7270	2.38392
726	7280	2.38392
727	7290	2.38623
728	7300	2.38854
729	7310	2.38854
730	7320	2.38854
731	7330	2.39085
732	7340	2.38854
733	7350	2.39085
734	7360	2.39085
735	7370	2.39085
736	7380	2.38854
737	7390	2.38854
738	7400	2.38854
739	7410	2.38854
740	7420	2.38854
741	7430	2.38854
742	7440	2.38854
743	7450	2.38854
744	7460	2.38854
745	7470	2.39085
746	7480	2.39085
747	7490	2.38854
748	7500	2.38854
749	7510	2.38854
750	7520	2.38854
751	7530	2.38854
752	7540	2.38854

	Time (sec)	Drawdown (ft)
753	7550	2.38854
754	7560	2.39085
755	7570	2.39085
756	7580	2.39316
757	7590	2.39316
758	7600	2.39316
759	7610	2.39085
760	7620	2.39316
761	7630	2.39316
762	7640	2.39547
763	7650	2.39547
764	7660	2.39547
765	7670	2.39778
766	7680	2.40009
767	7690	2.40009
768	7700	2.40009
769	7710	2.4024
770	7720	2.40009
771	7730	2.40009
772	7740	2.40009
773	7750	2.40009
774	7760	2.40009
775	7770	2.40009
776	7780	2.4024
777	7790	2.40009
778	7800	2.40009
779	7810	2.4024
780	7820	2.40009
781	7830	2.40009
782	7840	2.4024
783	7850	2.4024
784	7860	2.4024
785	7870	2.4024
786	7880	2.40471
787	7890	2.4024
788	7900	2.4024
789	7910	2.4024
790	7920	2.4024
791	7930	2.4024
792	7940	2.40471
793	7950	2.40471
794	7960	2.40471
795	7970	2.40471
796	7980	2.40471
797	7990	2.40702
798	8000	2.40702
799	8010	2.40702

	Time (sec)	Drawdown (ft)
800	8020	2.40702
801	8030	2.40702
802	8040	2.40702
803	8050	2.40702
804	8060	2.40702
805	8070	2.40702
806	8080	2.40933
807	8090	2.40702
808	8100	2.40702
809	8110	2.40471
810	8120	2.40471
811	8130	2.40471
812	8140	2.40471
813	8150	2.40471
814	8160	2.40471
815	8170	2.40471
816	8180	2.40702
817	8190	2.40702
818	8200	2.40702
819	8210	2.40702
820	8220	2.40702
821	8230	2.40702
822	8240	2.40702
823	8250	2.40933
824	8260	2.40933
825	8270	2.40933
826	8280	2.40933
827	8290	2.40933
828	8300	2.40933
829	8310	2.40933
830	8320	2.40933
831	8330	2.40933
832	8340	2.41164
833	8350	2.40933
834	8360	2.40933
835	8370	2.40933
836	8380	2.40933
837	8390	2.40702
838	8400	2.40702
839	8410	2.40933
840	8420	2.41164
841	8430	2.40702
842	8440	2.40702
843	8450	2.40933
844	8460	2.40933
845	8470	2.40933
846	8480	2.40933

	Time (sec)	Drawdown (ft)
847	8490	2.41164
848	8500	2.41164
849	8510	2.41164
850	8520	2.40933
851	8530	2.41395
852	8540	2.41395
853	8550	2.41626
854	8560	2.41626
855	8570	2.41395
856	8580	2.41395
857	8590	2.41395
858	8600	2.41395
859	8610	2.41395
860	8620	2.41395
861	8630	2.41626
862	8640	2.41626
863	8650	2.41626
864	8660	2.41857
865	8670	2.41626
866	8680	2.41626
867	8690	2.41626
868	8700	2.41626
869	8710	2.41626
870	8720	2.41395
871	8730	2.41626
872	8740	2.41395
873	8750	2.41626
874	8760	2.41626
875	8770	2.41857
876	8780	2.41626
877	8790	2.41857
878	8800	2.41857
879	8810	2.42088
880	8820	2.42088
881	8830	2.42319
882	8840	2.4255
883	8850	2.4255
884	8860	2.4255
885	8870	2.42781
886	8880	2.42781
887	8890	2.42781
888	8900	2.43012
889	8910	2.43012
890	8920	2.4255
891	8930	2.4255
892	8940	2.4255
893	8950	2.42319

	Time (sec)	Drawdown (ft)
894	8960	2.42088
895	8970	2.42088
896	8980	2.42319
897	8990	2.42319
898	9000	2.42088
899	9010	2.41857
900	9020	2.41857
901	9030	2.41857
902	9040	2.42088
903	9050	2.42088
904	9060	2.41857
905	9070	2.41857
906	9080	2.41626
907	9090	2.41626
908	9100	2.41626
909	9110	2.41626
910	9120	2.41857
911	9130	2.41857
912	9140	2.41857
913	9150	2.42088
914	9160	2.41857
915	9170	2.42088

ATTACHMENT E
PUMP TEST FIELD NOTES, MARCH 2013

SoundEarth Strategies

2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102
P: (206) 306-1900 F: (206) 306-1907

FIELD REPORT

Client & Site Name/Number:		SoundEarth Project Number:	Date:
Lennar SKS Shell		0914-004	3/19/13
Site Address:		**Purpose of Visit/Task #:**	**Field Report Prepared by:**
4724 40th Ave SW, Seattle		Pump test	JAB, LWBC
Temp/Weather:	**Permit Required to Work:**	**Time of Arrival/Departure (2400):**	**Personnel Onsite:**
Overcast/Rain	—	0745 onsite to 1625 offsite	JAB, LWBC

0745: JAB onsite to perform pump test. Prepare field forms and PPE

0750: JAB inform Shell station tenant will be performing work.
Begin setting up delineators around work area.

0800: Set transducers: Bottom of transducers @:
MW04 = 28.5 MW-01 = 41.9 PW01 = 36.90

0814: Bottom of Grunfos pump set in PW01 at 35.9 feet bgs.
Allow for Equilibration. Begin setting up drums:
Set transducers to START Recording at JB ~~0930~~ 0915 by computer time.

0850: Seattle Barrel onsite Dropping off 4x refurbished open Top 55 gal Drums.

0859: open MW-2 to Allow for Equilibration

0901: Seattle Barrel offsite

1005 OHO on-site

1455: MANIAC onsite. pump 16 drums w/ 250 gallons

1614: pull Transducers.

1625. offsite.

JB

Attachments: pump test DTW forms

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

Aquifer Test Data Collection Sheet
Site: Lennar SKS Shell **Field Personnel:** JAB, LOBC **Equipment:** PT2X Transducers, vented RENTALS

Date	Well ID	Initial DTW (ft below TOC)	Total Depth (ft below TOC)	Distance from Pumping Well (ft/direction)	Bottom of Transducer (ft below TOC)	Initial Transducer Reading (PSI)	Time Pump On	Time Pump Off	Time Observations Stop	Total Volume Extracted (gallons)	Comments
Test Well	PW01			NA	36.9	5.745	0926	1430	~~1651~~ 1640	300	Bottom of pump @ 35.9', 15.1 psi
Observation Well	MW104			2.7' S	28.5	~~8.032~~ 2.174	NA	NA		NA	Initial pressure 2.177 psi
Observation Well	MW-01			4.1' E	41.9	8.03	NA	NA		NA	Initial pressure 0.8029 psi
Observation Well	~~MW105~~						NA	NA		NA	
Observation Well	~~GLMW-1~~		JAB				NA	NA	JAB	NA	
Observation Well											

Depth to Water (ft below TOC)							Flow Rate Checks		Other Observations (i.e. pump frequency, water clarity, odor, pump performance, etc.)
Time	Test Well: PW01	Obs Well: MW104	Obs Well: MW-01	Obs Well: ~~MW105~~ MW02 → final	Obs Well: ~~GLMW-1~~		Time	Rate (gpm)	
0920	23.35	23.26	23.77	23.02	23.03				Initial
0925	23.36	23.27	23.77						Initial
0927	24.05	23.27	23.81						135.4 Hz
0930	24.99	23.30	23.90					0.80 gpm	121 Hz, clear H_2O
0931	25.39	23.33	24.02					—	
0932	25.63	23.34	24.08					0.60 gpm	122 Hz, clear H_2O
0933	25.84	23.36	24.13					0.70	123 Hz, clear H_2O
0934	26.01	23.38	24.19					0.75	123 Hz, clear H_2O
0935	26.29	23.40	24.24					0.75	125 Hz, clear H_2O
0936	26.56	23.42	24.29					0.80	125 Hz, clear H_2O

Δ2.61 0.35'

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

	FW01	MW101	MW104						
0937	26.72	23.44	24.34					0.80	126 Hz, clear H_2O
0938	26.99	23.46	24.41					0.75	128 Hz, clear H_2O
0939	27.20	23.47	24.45					0.80	128 Hz, clear/slightly silty
0940	27.44	23.49	24.50					0.80	130 Hz, clear/slightly silty
0941	27.74	23.52	24.56					0.90	130 Hz, clear/slightly silty
0942	27.96	23.53	24.61					0.90	130 Hz, clear/slightly silty
0943	28.20	23.55	24.68					0.90	130 Hz, clear/slightly silty
0944	28.36	23.56	24.72					0.90	130 Hz, clearish
0945	28.52	23.59	24.78					0.90	131 Hz, clearish
0946	28.68	23.60	24.83					0.90	131 Hz, clearish
0947	28.84	23.62	24.86					0.90	132 Hz, clearish
0948	29.05	23.64	24.92					0.90	133 Hz, clearish
0949	29.21	23.66	24.97					0.90	133 Hz, clearish
0950	29.41	23.68	wc 25.01					0.90	wc 133 Hz, clear
0951	29.48	23.70	25.08					0.90	133 Hz, clear
0952	29.57	23.72	25.08					0.90	134 Hz, clear
0953	29.68	23.75	25.10					0.90	134 Hz, clear

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

		MW-01	MW-04						
0954	29.74	23.76	25.16					0.80	135 Hz, clear
0955	29.87	23.78	25.19					0.90	137 Hz, clear
0956	29.98	23.79	25.23					0.90	137 Hz, clear
0957	30.11	23.81	25.26					0.90	137 Hz, clear
0958	30.23	23.83	25.30					1.0 gpm	137 Hz, clear
0959	30.32	23.85	25.33					0.90	137 Hz, clear
1000	30.38	23.87	25.35					0.90	137 Hz, clear
1001	30.45	23.88	25.38 WC					0.90	137 Hz, clear
1002	30.53	23.90	25.41					0.90	137 Hz, clear
1003	30.63	23.92	25.42					0.90	137 Hz, clear
1004	30.66	23.93	25.46					0.90	138 Hz, clear
1005	30.74	23.95	25.47					1.0	138 Hz, clear
1006	30.80	23.96	25.48					0.90	138 Hz, clear
1007	30.84	23.97	25.51					0.90	138 Hz, clear
1008	30.91	23.99	25.53					0.80	138 Hz, clear
1009	30.99	24.01	25.55					1.0	140 Hz, clear
1010	31.14	24.02	25.57					1.0	140 Hz, clear

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

Time	PW01	MW-01	MW104						
1011	31.24	24.04	25.59					1.0 gpm	140 Hz, clear
1012	31.35	24.05	25.62					1.0	140 Hz, clear
1013	31.44	24.06	25.64					0.9	140 Hz, clear
1014	31.51	24.07	25.67					0.9	140 Hz, clear
1015	31.58	24.08	25.69					1.0	140 Hz, clear
1016	31.64	24.10	25.71					0.9	140 Hz, clear
1017	31.69	24.11	25.73					0.9	140 Hz, clear, some silt
1018	31.74	24.12	25.76					0.9	140 Hz, clearish
1019	31.81	24.14	25.77					0.9	140 Hz, clearish
1020	31.85	24.16	25.79					0.9	140 Hz, clearish
1021	31.87	24.16	25.81					0.9	140 Hz, clearish
1022	31.91	24.17	25.81					0.9	140 Hz, clearish
1023	31.96	24.18	25.82					0.9	140 Hz, clearish
1024	31.97	24.19	25.84					0.9	140 Hz, clearish
1025	31.99	24.20	25.85					0.9	140 Hz, clearish
1026	32.01	24.21	25.85					0.9	140 Hz, clearish
1027	32.03	24.22	25.86					0.9	140 Hz, clearish

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

time	PW01	~~MW-01~~ MW104	~~MW104~~ MW-01						
1029	32.04	24.24	25.88					0.9 gpm	140 Hz, clearish
1031	32.08	24.26	25.91					0.9	141 Hz, clearish
1033	33.11	24.28	25.92					1.0	141 Hz, clearish
1035	33.11	24.29	25.94					1.0	141 Hz, clearish
1037	32.02	24.31	25.94					1.0	141 Hz, clear
1039	32.08	24.32	25.94					1.0	141 Hz, clear
1041	32.22	~~24.33~~ 24.33	25.95					1.0	141 Hz, clear
1043	32.30	24.35	25.92					0.9	141 Hz, clear
1045	32.33	24.36	25.98					0.9	141 Hz, clear
1047	32.41	24.37	26.01					1.0	141 Hz, clear
1052	32.56	24.41	26.04					1.0	141 Hz, clear
1057	32.42	24.43	26.05					1.0	141 Hz, clear
1102	32.59	24.45	26.07					1.0	141 Hz, clear
1107	32.66	24.47	26.10					0.9	141 Hz, clear
1112	32.72	24.49	26.12					1.0	141 Hz, clear
1117	32.76	24.51	26.15					1.0	141 Hz, clear
1122	32.79	24.53	26.16					1.0	141 Hz, clear

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

	PW01	MW04	MW01						
1127	32.84	24.55	26.17					1.0 gpm	141 Hz, clear
1132	32.77	24.56	26.18					1.0	141 Hz, clear
1137	32.79	24.57	26.19					1.0	141 Hz, clear
1142	32.76	24.58	26.20					1.0	141 Hz, clear
1147	32.77	24.61	26.20					1.1	141 Hz, clear
1157	32.91	24.62	26.21					1.0	141 Hz, clear
1207	32.31	24.63	26.16					1.0	141 Hz, clear
1217	31.98	24.63	26.10					1.0	141 Hz, clear
1227	32.07	24.62	26.08					0.9	141 Hz, clear
1237	32.19	24.62	26.10					1.0	141 Hz, clear
1247	32.18	24.63	26.10					0.80	142 Hz, clear
1257	32.58	24.64	26.14					1.0	142 Hz, clear
1307	32.76	24.64	26.17					1.0	142 Hz, clear
1317	32.63	24.66	26.16					0.7	142 Hz, clear
1327	33.00	24.67	26.21					1.0	143 Hz, clear
1337	33.03	24.68	26.25					1.0	143 Hz, clear
1347	32.89	24.70	26.28					1.0	143 Hz, clear

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/3
Site: Lennar SKS Shell

time	PW01	MW104	MW-01					gpm	
1357	33.01	24.71	26.21					1.0	143 Hz, clear
1407	33.01	24.73	26.33					1.0	143 Hz, clear
1417	32.97	24.76	26.33					0.9	143 Hz, clear
1427	33.28	24.76	26.37					1.0	143 Hz, clear
1431	32.95	24.77	26.38						Begin Recovery
1431.5	32.04	24.80	—						
1432	31.60	24.77	26.30						
1432.5	31.26	24.76	—						
1433	—	—	—						
1433.5	30.50	24.80	26.12						
1434	30.28	24.8	26.10						
1434.5	29.92	24.79	26.08						
1435	29.70	24.79	26.02						
1435.5	29.61	24.79	25.97						
1436	29.44	24.78	25.96						
1436.5	29.32	24.77	25.91						
1437	29.15	24.77	25.89						

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

time	PW01	MW104	MW-01						
1437.5	28.95	24.77	25.82						
1438	28.78	24.76	25.80						
1438.5	28.64	24.76	25.76						
1439	28.48	24.75	25.74						
1439.5	28.37	24.75	25.73						
1440	28.18	24.73	25.67						
1440.5	28.01	24.73	25.64						
1441	27.87	24.73	25.61						
1442	27.61	24.71	25.56						
1443	27.40	24.70	25.48						
1444	27.21	24.69	25.42						
1445	26.98	24.67	25.37						
1446	26.75	24.65	25.30						
1447	26.61	24.64	25.26						
1448	26.46	24.63	25.23						
1449	26.27	24.61	25.16						
1450	26.10	24.59	25.11						

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Dat

time	PW01	MW104	MW-01						
1451	25.93	24.57	25.04						Raining
1452	25.80	24.56	25.01						
1453	25.68	24.53	24.98						
1454	25.55	24.52	24.93						
1455	25.46	25.50	24.91						
1456	25.34	24.47	24.85						
1457	25.25	24.45	24.81						
1458	25.16	24.43	24.78						
1459	25.08	24.41	24.72						
1500	25.00	24.39	24.71						
1502	24.93	24.37	24.70						
1504	24.81	24.33	24.66						
1506	24.70	24.30	24.60						
1508	24.62	24.27	24.57						
1510	24.51	24.22	24.51						
1515	24.34	24.14	24.43						
1520	24.25	24.07	24.37						

SoundEarth Strategies

Aquifer Test Sheet- Pump Test
Lennar SKS Shell
4755 Fauntleroy Way SW
Seattle, Washington

Date 3/19/13
Site: Lennar SKS Shell

time	PW01	MW01	MW02						
1525	24.14	24.02	24.31						
1530	24.07	23.95	24.26						
1535	24.00	23.91	24.22						
1540	23.95	23.87	24.20						
1545	23.90	23.83	24.16						
1550	23.85	23.80	24.14						
1555	23.82	23.76	24.12						
1600	23.79	23.74	24.09						
1605	23.77	23.72	24.08						
1610	23.74	23.71	24.07						STOP measurements
					JB				

ATTACHMENT F
PUMP SPECIFICATION, MARCH 2013 PUMP TEST

GO TO GEOTECH

Electrical Submersible Sampling Pump

Grundfos Redi-Flo2® Environmental Pumps

The Grundfos Redi-Flo2® electrical submersible pump provides smooth, uninterrupted water flow during ground water sampling to depths down to 280 feet (85m). Both high flow rates needed for purging and low flows recommended for sampling are achieved with the same pump.

FEATURES

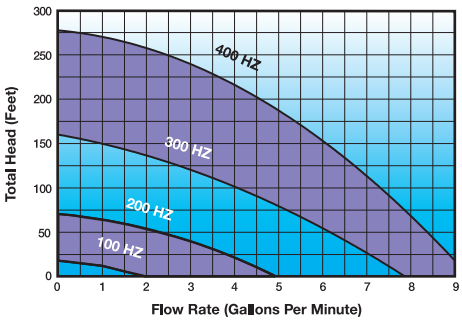
- **Chemically inert materials**
  Maximum sample integrity and easy decontamination
- **1.8 inch (4.6cm) diameter**
  Easy access into 2" (5cm) or larger wells
- **Flow rates range from 8 GPM (30 LPM) to as little as 100ml/min**
  Controlled with the simple push of a button
- **Low velocities and agitation**
  Ideal for sampling and purging
- **Portable solid state converter**
  Eliminates the need for control valves
- **Continuous flow**
  Ensures a cleaner, simpler sample catch
- **Dedicated or Portable configurations available**

OPERATION

Designed for long-term reliability in dedicated monitoring wells, the Redi-Flo2® provides optimal sample quality. Whether doing traditional purging prior to sampling or low draw-down passive sampling when operated with the Redi-Flo VFD (Variable Frequency Drive) flow control is easy!

Purging and sampling with the same pump is extremely efficient. The unique design and superior materials allow for easy operation, decontamination and maintenance as well as disassembly and reassembly.

PERFORMANCE



Redi-Flo2® pump as a portable system mounted on Geo Reel

Dedicated Redi-Flo2® pump setup with tubing, All-In-One motor lead and integrated safety cable, and well cap

Add confidence using the Geotech all-in-one motor lead with integrated safety cable

CALL GEOTECH TODAY (800) 833-7958

Geotech Environmental Equipment, Inc.
2650 East 40th Avenue • Denver, Colorado 80205
(303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242
email: sales@geotechenv.com website: www.geotechenv.com

Electrical Submersible Sampling Pump

Grundfos Redi-Flo2® Environmental Pumps

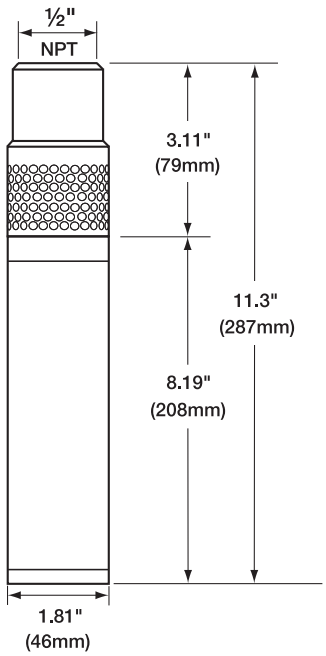
CUSTOM ACCESSORIES

Professional accessories make your job easier, your equipment last longer, and protect your investment!

Geotech has a shroud specifically designed for use with the Grundfos Redi-Flo2® in wells 4" (10cm) in diameter or larger. The Redi-Flo2® electrical submersible pump was designed to stay cool by the action of the water passing rapidly over the body of the stainless steel and PTFE pump. In 2" (5cm) diameter wells this is achieved automatically. In larger diameter wells the pump may overheat, causing permanent damage to the inner workings. The Geotech pump shroud can help you avoid damage to your Redi-Flo2® pump, and help you to protect your investment, project after project.

If your site plan requires all the water passing through your pump be disposed of and not allowed to return to the well, ask your sales representative about our custom stainless steel check valve.

DIMENSIONS



SPECIFICATIONS

Electric

Full Load Rating	.5 HP/220V/3 PH/400 Hz/5.5A
Maximum Current (SFA)	5.5 amps
Motor Protection	Thermal overload – Thermik Geratebau, Series SY6 (176°F/80°C)
Current Overload	Incorporated into Redi-Flo VFD (9.0A for 10 seconds)

Piping Connection

Discharge Port	1/2" Female NPT

Operating Conditions

Minimum Ambient Fluid Temp.	34°F (1°C)
Maximum Ambient Fluid Temp.	80°F (28°C)

Motor Fluid

Motor Lubricating Fluid	Deionized (DI) Water

Dimensions & Weight
(Pump & Motor)

Dimensions	11.3" L x 1.81" D (28.7cm L x 4.6cm D)
Net Weight	5.5 lbs. (2.5 kg), excluding motor lead

Lead Lengths

Standard Lengths in Feet	30, 50, 75, 100, 125, 150, 175, 200, 250, 300 (9, 15, 23, 30, 38, 46, 53, 61, 76, 91 meters)
Custom Lengths	Available in 1 ft. (0.3m) increments from 30 to 300 ft. (9-91m)

Redi-Flo2® Cooling Shroud

Redi-Flo2® Stainless Steel Check Valve

CALL GEOTECH TODAY (800) 833-7958

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Electrical Submersible Sampling Pump

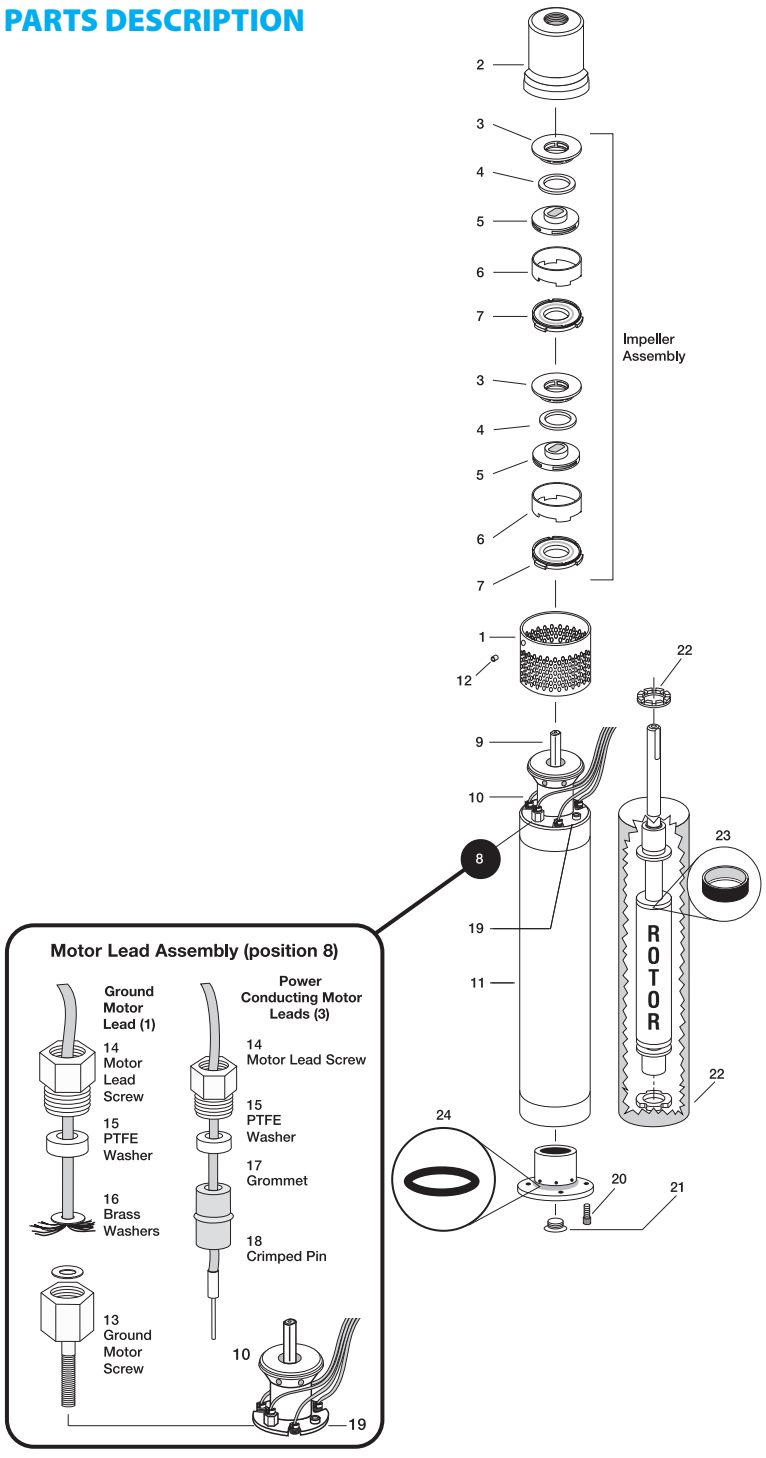
Grundfos Redi-Flo2® Environmental Pumps

PUMP COMPONENTS

Pos. No.	Part Description	No. Used Per Pump	Part Number
1	Inlet Screen	1	1A0004
2	Pump Housing ½" NPT	1	1A0044
3	Guide Vane	2	See Service Kits
4	Wear Ring	2	"
5	Impeller	2	"
6	Spacer Ring	2	"
7	Wear Plate	2	"
8	Motor Lead Assembly	4	See Pos. 13-18
9	Shaft, Rotor	1	Not Available*
10	Suction Interconnector	1	1A5004
11	Stator Housing	1	Not Available*
12	Set Screw	1	See Service Kits
13	Ground Motor Screw	1	"
14	Motor Lead Screw	4	"
15	PTFE Washer	4	"
16	Brass Washer	2	"
17	Grommet	3	"
18	Crimped Pin	3	"
19	Motor Screw (long)	2	"
20	Motor Screw (short)	6	"
21	Filling Screw w/O-Ring	1	"
22	Motor Thrust Washers	2	"
23	Lip Seal	1	ID5566
24	Bearing Housing O-Ring	2	See Service Kits

*Not economical to replace, must purchase complete pump / motor.

PARTS DESCRIPTION



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ATTACHMENT G
DEWATERING SYSTEM OPERATIONAL INFORMATION

SoundEarth Strategies

Table 2
Groundwater Mass Removal Estimate
SKS Shell Property
3901 Southwest Alaska Street
Seattle, Washington

Operation and Maintenace Visit Date	Sample Taken (Yes/No)	Pore Volume	Extracted Groundwater		Hydrocarbon Recovery - Aqueous-Phase					
					GRPH			Benzene		
			Discharge Flow Totalizer (gallons)	Treated Between Visits (gallons)	Influent GRPH Concentration[1, 2] (µg/L)	GRPH Removed[3,4] (lb)	Cumulative Removed[4,5] (lb)	Influent Benzene Concentration[1,2] (µg/L)	Benzene Removed[3,4] (lb)	Cumulative Removed[4,5] (lb)
03/16/15	No	1	-	-	--	--	--	--	--	--
03/17/15	No		-	-	--	--	--	--	--	--
03/22/15	No		71	71	--	--	--	--	--	--
03/23/15	No		189	118	--	--	--	--	--	--
03/24/15	No		336	147	--	--	--	--	--	--
03/25/17	No		1,112	776	--	--	--	--	--	--
04/01/15	No		22,048	20,936	--	--	--	--	--	--
04/02/15	No		24,237	2,189	--	--	--	--	--	--
04/03/15	No		27,940	3,703	--	--	--	--	--	--
04/06/15	Yes		33,536	5,596	3,100	1.2	1	78	0.03	0.03
04/07/15	No		38,163	4,627	--	--	--	--	--	--
04/08/15	No		43,473	5,310	--	--	--	--	--	--
04/09/15	No	2	45,826	2,353	--	--	--	--	--	--
04/10/15	No		51,183	5,357	--	--	--	--	--	--
04/13/15	Yes		51,183	-	5,300	2.0	3	*333*	*0.13*	*0.15*
04/15/15	No		51,183	-	--	--	--	--	--	--
05/21/15	No		51,183	-	--	--	--	--	--	--
05/26/15	No		56,722	5,539	--	--	--	--	--	--
05/27/15	No		60,766	4,044	--	--	--	--	--	--
05/28/15	No		66,054	5,288	--	--	--	--	--	--
05/29/15	Yes		70,485	4,431	1,300	0.5	4	60	0.02	*0.18*
06/02/15	No		79,200	8,715	--	--	--	--	--	--
06/04/15	No		86,600	7,400	--	--	--	--	--	--
06/05/15	No		90,455	3,855	--	--	--	--	--	--

SoundEarth Strategies

Table 2
Groundwater Mass Removal Estimate
SKS Shell Property
3901 Southwest Alaska Street
Seattle, Washington

Operation and Maintenace Visit Date	Sample Taken (Yes/No)	Pore Volume	Extracted Groundwater		Hydrocarbon Recovery - Aqueous-Phase					
					GRPH			Benzene		
			Discharge Flow Totalizer (gallons)	Treated Between Visits (gallons)	Influent GRPH Concentration[1, 2] (µg/L)	GRPH Removed[3,4] (lb)	Cumulative Removed[4,5] (lb)	Influent Benzene Concentration[1,2] (µg/L)	Benzene Removed[3,4] (lb)	Cumulative Removed[4,5] (lb)
06/08/15	No	3	91,532	1,077	--	--	--	--	--	--
06/12/15	No		101,783	10,251	--	--	--	--	--	--
06/15/15	No		105,891	4,108	--	--	--	--	--	--
06/17/15	No		111,508	5,617	--	--	--	--	--	--
06/19/15	No		117,380	5,872	--	--	--	--	--	--
06/22/15	No		127,641	10,261	--	--	--	--	--	--
06/24/15	No		131,095	3,454	--	--	--	--	--	--
06/26/15	No		135,780	4,685	--	--	--	--	--	--

NOTES:

[1]Effluent samples collected prior to removal by Marine Vacuum Services.

[2]Lab data from 4/13/15 is an average of analytical results from RW02, RW04, RW07, and RW09.

[3] Mass removal weight (lb) = gallons recovered x concentration (µg/L) x conversion factor (8.344E-9 lb-L/µg-gallon).

[4]Nondetectable influent concentrations assumed to be 50% of the laboratory's lower reporting limit. Removal rates based upon this assumption are shown in *italics.*

[5]Cumulative mass of GRPH removed (lb) = GRPH mass removal between sampling visits (lb) + previous cumulative total (lb).

-- = not analyzed, measured, or calculated

µg/L = micrograms per liter

GRPH = gasoline-range petroleum hydrocarbons

lb = pound(s)

Table 3
Dewatering System Pump Installation
SKS Shell Property
3901 Southwest Alaska Street
Seattle, Washington

Site Name/Facility ID: Whittaker / SKS Shell Property

Address: 3901 Southwest Alaska Street

City, State: Seattle, Washington

SoundEarth Project No.: 0914-001-13 Task 203

Field Personnel: Jonathan Loeffler **Date Opened:** 3/16/2015 **Date Measured:** 3/16/2015 **Water Level Instrument Used:** Gray Matter

Well ID	Well Details: Diameter (in.)	Well Details: Screened Interval (feet)	Time: Opened	Time: Measured	Measured Depth (feet below TOC): to Water	Measured Depth (feet below TOC): Total	Measured Depth (feet below TOC): to NAPL	Pump Information: Depth (feet below TOC): top of pump	Pump Information: Depth (feet below TOC): top of inlet	Design Flow Rate (gpm)	Sample Well?	Comments or Issues
RW01	4	-- --	--	11:10	22.13	37.93	--	35.35	36.18	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW02	4	-- --	--	10:25	21.28	38.85	--	36.27	37.10	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW03	4	-- --	--	10:35	21.68	37.52	--	34.94	35.77	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW04	4	-- --	--	10:42	21.59	37.63	--	35.05	35.88	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW05	4	-- --	--	11:00	21.69	35.41	--	32.83	33.66	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW06	4	-- --	--	11:45	22.33	37.72	--	35.14	35.97	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW07	4	-- --	--	11:36	22.56	37.87	--	35.29	36.12	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW08	4	-- --	--	11:18	22.82	37.89	--	35.31	36.14	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
RW09	4	-- --	--	11:25	23.49	37.86	--	35.28	36.11	--	No	Top of pump inlet is 15" above bottom of pump. Total pump length is 2.08'
MW104	2	-- --	--	12:30	22.05	29.67	--	--	--	--	No	No Pump
MW105	--	-- --	--	--	--	--	--	--	--	--	No	No pump. Not measured due to location in Fauntleroy Way ROW
MW107	2	-- --	--	12:45	25.08	29.66	--	--	--	--	No	No Pump

*Use an interface probe to measure LNAPL in this well.

Comments:

ATTACHMENT H
PUMP SPECIFICATION, DEWATERING SYSTEM

HALLMARK INDUSTRIES INC.

Deep Well Submersible Pumps
Operating & Installation Instructions

WARNING:

Read the user's manual thoroughly before installing the pump!

- The pump's voltage on its nameplate must match your power line voltage! Warranty voided if the pump damaged because of the wrong voltage! Believe us, many users burnt their pumps this quick and this easy! CHECK THE VOLTAGE!
- The ground wire maybe marked as 'PE', or ground symbol ⏚. For 3 wire pumps, in addition to the ground wire, a 110V pump has black and blue wires (hot + neutral, OK to reverse). A 220V pump has red and brown wires (hot + hot). Wires may have other colors.
- The external control box for 4 wire 220V pumps may come with a 3 prong plug. The plug is for 220V.
- The pump may have been water tested, and may contain water.
- The pump must be installed in a proper sized well casing.
- The pump has not been investigated for use in swimming pool or marine areas.
- Do not run pump dry. Pump must be fully submersed in water prior to starting. Or the pump and motor will be damaged.
- We strongly recommend testing the pump in a bucket of water first, before your final installation.

Hallmark Industries Inc
624 Estes Ave.
Schaumburg, IL 60193, USA
www.hallmarkind.com

HALLMARK INDUSTRIES, INC.
624 Estes Ave, Schaumburg, IL 60193, U.S.A.
Tel: 847-301-8050 Fax: 847-301-8839
Email: sales@hallmarkind.com Website: www.hallmarkind.com

PUMP SELECTION GUIDE (MUST READ!)

Never select a pump based on the horse power (HP)! Many brands mark down their HP to falsely claim that their pumps use less electricity. It is common in the pump industry. So your old 1/2HP pump may actually be a 1HP pump. We do not mark down our pumps' HP. But Amps won't lie. Compare the Amps, NOT HP!

If a pump has max 150' head & 25 gpm, its gpm is not always 25! Gpm reduces with the increase of pumping level, from max 25 gpm (@0' head) and reduces to 0 gpm (@150' head). Read the flow curve! 150' head is *to an open water tank with no back pressure! A pressure tank will reduce the pump's head significantly.* 1 psi setting in the pressure tank equals 2.307' of head. We use our 1/2HP (max head 150') for 2 cases below.

Case 1: To determine its flow at water level 20', 20/40 psi pressure switch setting:

The min total head (@20 psi) = 20' + 20x 2.307 = 66'

The max total head (@40 psi) = 20' + 40x 2.307 = 112.3'

Read the flow chart for MA0343X-4 (MA0343X-4A). The flow at 66' is about 15 gpm, at 115' is about 10 gpm. So the pump will start at 15 gpm (@ 20 psi on) and lower to 10 gpm (@40 psi off). In this case, the head used is not 20', and flow is not 19 gpm (@ 20').

Case 2: To decide the max pumping level (1/2HP) to a pressure tank, 30/50 psi setting (@50 psi):

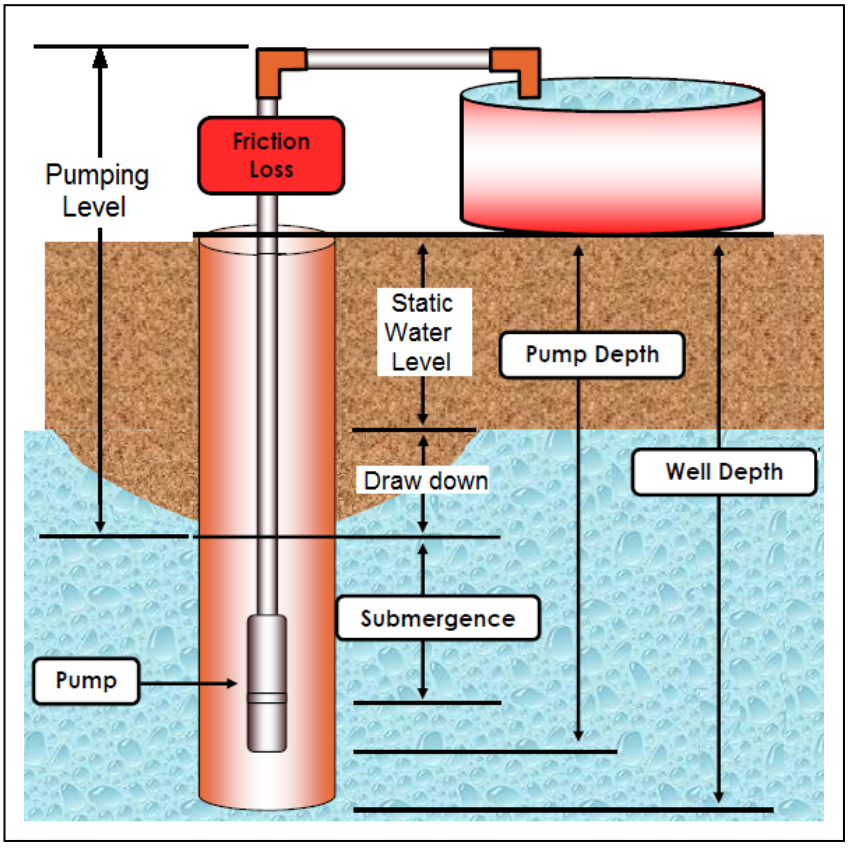
150 – 50 X 2.307 = 34.65 (feet)

So the water level should be less than 34 feet in order for this pump to get 50 psi in the pressure tank. If the water level is deeper than 34 feet (i.e. 38 feet), you will not get 50 psi. Fittings, and elbows etc will add resistance to the water head, and reduce the psi. Here is the chart for the pumping levels vs. psi settings.

Our Pump's true HP	1/2HP	1HP	2HP
Pump's Max rated Head	150 (feet)	207 (feet)	400 (feet)
Max pumping level for 20/40 psi setting	57 (feet)	114 (feet)	307 (feet)
Max pumping level for 30/50 psi setting	34 (feet)	91 (feet)	284 (feet)
Max pumping level for 40/60 psi setting	11 (feet)	68 (feet)	261 (feet)

For pressure tank application:

If your old pump was 1/2HP and not Hallmark Industries brand, you may need our 1HP pump!



HALLMARK INDUSTRIES INC.
Deep Well Submersible Pumps
Operating & Installation Instructions

CAUTION: Before operating or installing this pump, read this manual and follow all Safety Rules and Operating Instructions

INSPECT THE EQUIPMENT

Inspect your pump when you receive it to make sure there is no damage during shipping.
Pump's voltage must match your power line voltage! Or warranty is voided!
Two wire plus GROUND pump/motor assemblies DO NOT require a control box.
NOTE: Internal pipe threads in the discharge head are 1-¼" standard NPT.

WARNING - General Precautions

- Review all the instructions before operating. Failure to follow these instructions could cause bodily injury and/or property damage.
- The pump's voltage must match your power supply! Or warranty will void!
- Pump must be installed in the appropriately sized casing or it may overheat to cause the pump fail.
- This pump is for clean water, pumping sand will clog the pump. Installing a good filter may prevent the pumping of abrasives.
- This pump may have been water tested at factory, and may contain water.
- Do NOT run pump dry!
- Pump must installed in an appropriately sized well casing to prevent pump from over heating
- The pump, piping and system must be protected against freezing temperatures.
- Wear gloves and eye protection during assembly and installation as precautionary safety measures.
- Never use in swimming pools or pool areas.

WARNING - Electrical Precautions

All wiring, electrical connections and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician.

- A ground fault interrupter (GFI) protected circuit is recommended for use with any electrical device operating near water.
- Have a qualified electrician provide electrical power to the motor. For cable sizes, see Table 1.
- Make sure the line voltage, frequency of the electrical current supply match the specifications printed on the motor.
- Be sure leads and ground wires are properly waterproofed and securely connected.
- Ensure the motor is properly grounded.
- Always disconnect the power before servicing.
- Never test a pump or use outside a well without proper electrical grounding of the system.

Assembly

Tools Required for Assembly

- Pipe wrenches
- Pipe vises or clamps
- Teflon tape
- Gloves and safety glasses
- CSA or UL approved PVC electrical tape
- Tripod with chain hoist or some other device to support the unit while lowering it into the well
- Miscellaneous wrenches / tools as needed

Table 1 - Cable Selection SINGLE PHASE MOTOR (For reference only

Motor Rating		Copper Wire Size (1)								
Volts	HP	14	12	10	8	6	4	2	0	00
115	1/2	100	159	249	390	608	930	1410	1910	
230	1/2	404	641	1003	1575	2450	3750	5710		
	3/4	293	473	740	1161	1810	2760	4210	5680	
	1	248	392	617	968	1507	2300	3510	4730	5920
	1-1/2	205	326	510	801	1248	1920	2930	3950	4940
	2	180	286	449	703	1096	1675	2550	3440	4300
	3		229	359	563	877	1339	2041	2750	3440
	5			216	315	490	750	1142	1540	1925

CAUTION:
1. Use of wire size smaller may damage the pump and thus void warranty.
2. For 1HP 115V wire, use the wire size for 2HP 230V.

Installation

General Information

The most important things you should know about your well are:

1. **Well total depth** - the distance from the ground level to the bottom of the well.
2. **Head** – A vertical distance from the pump to the ground level where water is discharged or into a pressure tank.
3. **GPM** - the amount of water in GPM the pump produces.

Suitability of Well

IMPORTANT: The well should be fully developed and ***must*** be pumped until all fines and foreign matter are removed ***before this pump is installed***. Make sure the well is large enough to allow the pump to be set at the required depth. ***Do not*** set the pump below the casing perforations or well screen unless you are sure there is adequate flow of water around the motor for cooling. To determine the correct pump setting use the driller's records by taking into account the depth to water level and draw down at the proposed pumping rate. Always keep the pump a minimum of five feet from the bottom of the drilled well.

Grounding

All wiring, electrical connections and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician.

Permanently ground all electrical components in accordance with National Electrical Code and applicable local codes and ordinances.

DO NOT ground to a gas supply line.

DO NOT connect to electric power supply until unit is permanently grounded.

If a plastic well casing is used in your installation, ground the metal well cap or well seal, providing electrical leads to the pump motor go through the well cap or well seal. Ensure correct wire size is used. **Refer to local electrical code.**

Cable Splicing Methods

When the drop cable must be spliced or connected to the motor leads, it is necessary that the splice be water tight. The splice can be made with commercially available potting or heat shrink splicing kits. Follow the kit instructions carefully.

1. Heat Shrink Tubing Method - RECOMMENDED METHOD

i) Strip about 1/2" of installation from cable and lead ends.
ii) Slide about 3" long heat shrink tubing over the cables.
iii) Connect cable and lead ends with STA-KON or similar connectors (Figure 1).

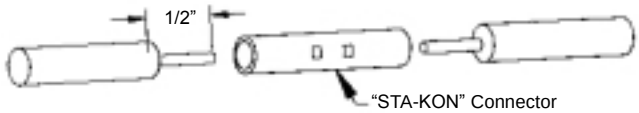


Figure 1 - Heat Shrink Splicing

iv) Position the tubing over the connection keeping the connector at its center.
v) Apply heat (about 135°C) evenly on the tubing and working from center outwards to avoid trapping air. While heated, the adhesive liner seals the interfaces between the tubing and the connector cable. Perfect sealing is achieved when adhesive liner flows outside the tubing and seals the ends.

While heating, care must be taken not to overheat the cable outside the tubing. This will damage the insulation of the cable.

2. Tape Method (Alternative)

SPLICING SUBMERSIBLE CABLES WITH TAPE

Tape splicing should use the following procedure. See Figure 2.

i) Strip individual conductor of insulation only as far as necessary to provide room for a stake type connector. Tubular connectors of the staked type are preferred. If connector O.D. is not as large as cable insulation, buildup with CSA/UL approved rubber electrical tape.

ii) Tape individual joints with CSA/UL approved rubber electrical tape, using two layers; the first extending tow inches beyond each end of the conductor insulation end, the second layer two inches beyond the ends of the first layer. Wrap tightly, eliminating air spaces as much as possible.

iii) Tape over the rubber electrical tape with #33 Scotch® or CSA/UL approved PVC electrical tape, (3M Canada Inc./Minnesota Mining and Manufacturing Co.) or equivalent, using tow layers as in step "2" and making each layer overlap the end of the preceding layer by at least two inches.

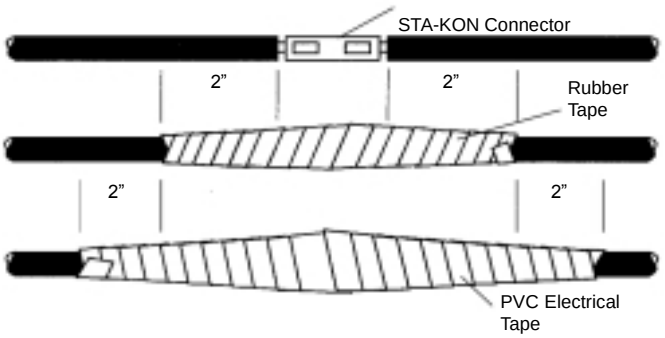


Figure 2 - Tape Splicing

In the case of a cable with **three** or **four** conductors encased in a single outer sheath, tape individual conductors as described, staggering joints.

Total thickness of the tape should be no less than the thickness of the conductor insulation.

The following test is recommended before installation. Cable and splice test for leaks to ground.

1. Immerse the cable and splice connections into a steel barrel of water with both ends out of the water and not touching the barrel (Figure 3).
2. Set ohmmeter on RX 100K and adjust needle to zero (0) with leads clipped together.
3. Clip one ohmmeter lead to the barrel and the other to each cable lead individually.
4. If the needle deflects to zero (0) on any of the cable leads, a faulty splice connection is indicated. To double check the faulty splice connection, pull the splice out of the water. If the needle now moves to ∝ (infinite resistance) the leak is in the splice.
5. Repairs should be made with CSA and or UL approved electrical Rubber & PVC tape.
6. If the leak is not in the splice, pull the cable out of the water slowly until the needle moves to ∝. When the needle moves to ∝ the leak is at that point.

Installing Your Pump

PUMP LOCATION

Your submersible pump should be installed no less than 5 feet (1.5 meters) from the bottom of your well.

CAUTION: To avoid accidental loss of the pump in the well, it is recommended that a 1/4" polypropylene rope be permanently attached to the eye provided on the discharge head of the pump. The other end of the polypropylene rope should be secured to an anchor at the well head.

Drilled Well Installation

1. Check your submersible pump and accessories for physical damage.
2. Check the electric supply for proper voltage, fusing, wire size, grounding and transformer size.
3. Check the well casing. The upper edge of the casing should be perfectly smooth. Jagged edges could cut or scrape the cable and cause a short circuit.
4. Select your pipe. Use only CSA approved polyethylene pipe, semi-rigid plastic pipe or schedule 40 steel pipe for setting high pressure pumps. The pipe must have sufficient strength to withstand the system's maximum pressure. The pump discharge is 1-1/4". 1" pipe may be used on the 5, 7 & 10 gpm units. On 10 gpm units when depth to water level exceeds 300 feet (91 m) deep use only 1-1/4" pipe sizes. On 15 and 20 GPM units use only 1-1/4" pipe sizes. Ensure that you have the correct length of pipe required. The pump should be installed no less than 5 feet (1.5 meters) from the bottom of the well.

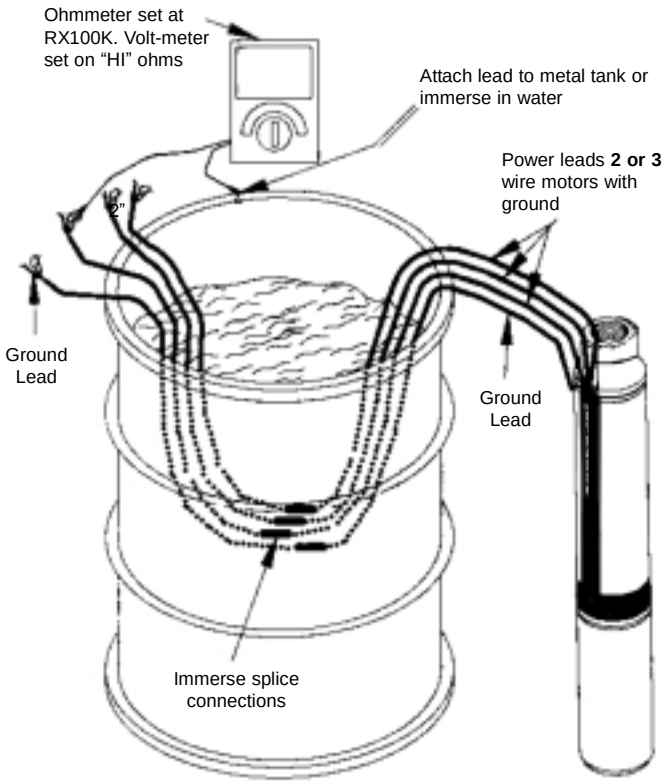


Figure 3 - Cable Test

Installation Cont'd

Installing The Pump With Polyethylene Pipe

- Wrap the thread of a 1-1/4" NPT x 1" male plastic pipe adapter with teflon tape if 1" pipe is being installed.
- Install the adapter into the pump discharge opening **while holding the discharge head with a pipe wrench to prevent the head from loosening from the pump housing.**
- Install two 1" **all stainless steel** hose clamps over one end of the pipe and tighten.
- Heat the polyethylene pipe to soften the pipe.
- Press the polyethylene pipe over the adapter.
- Tighten clamps securely around the pipe over the adapter end.
- As the pump and pipe are lowered into the well, the submersible wire cable must be secured to the discharge pipe 5 feet from the top of the pump using electrical tape or snap wire ties. Then repeat this procedure at 10 foot (3 m) intervals along the discharge piping.

NOTE: A pipe vise or collar clamp should always be firmly affixed to the upper end of the pipe as it is being lowered.

- When the pump has reached the desired depth, pass the pipe and cable through the openings in the well seal. **The well seal must be vented.**
- Continue pipe connection to the tank location in the house. Continue securing the submersible pump cable to the pipe. Additional clamps and fittings will be required to make the necessary connections at the elbow and at the control center.

Installing The Pump With Semi-Rigid Plastic Pipe

- Wrap the thread of the pipe with teflon tape.
- Thread the first section of the pipe into the pump discharge opening.
- Sections are available in 10 and 20 foot lengths. Use a pipe coupling and solvent to join pipe sections together.

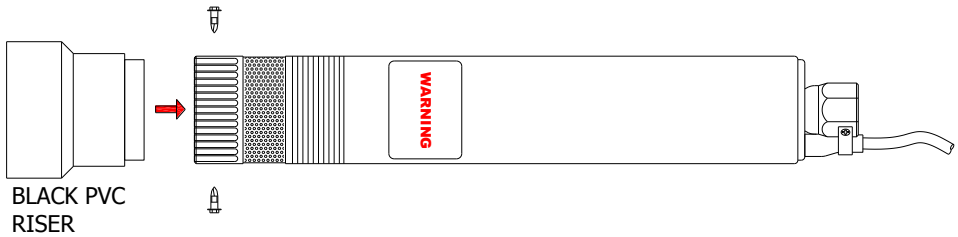
NOTE: A pipe vise or collar clamp should always be firmly affixed to the upper end of the pipe as it is being lowered.

- As the pipe is lowered, the submersible wire cable must be secured to the discharge pipe 5 feet from the top of the pump using electrical tape. Then repeat this procedure at 10 foot (3 m) intervals along the discharge piping.
- When the pump has reached the desired depth, pass the pipe and cable through the openings in the well seal. The discharge pipe goes through the centre hole and the cable through the conduit opening. The well seal must be vented.
- Cut the last section to the length required.
- Install a 1" or 1-1/4" male connector over the end of the pipe using solvent to weld the pieces together.
- Wrap the threads of a 90 degree plastic elbow with teflon tape.
- Thread the elbow into the male connector.

NOTE: If the pipe was not cut, and the last section of pipe has a female connector, use a 2" long nipple and then thread the elbow into the nipple.

- Install the well seal into the well casing by tightening down cap screws on the well seal. The well seal must be vented.
- Continue pipe connection to the tank location in the house. Continue securing the submersible pump cable to the pump. Additional clamps and fittings will be required to make the necessary connections at the elbow and at the control center.

NOTE: Some bottom intake pumps may come with an optional black PVC riser, which is used to prevent sand or mud being sucked into the pump. The riser is optional and its diameter is bigger than 4 inch. If your well casing is suitable for the riser, and you plan to use the riser, please insert the riser into the bottom of the pump, and then tighten it with 2 self drilling screws.



Riser is optional, and for bottom suction pumps only.

Installing The Control Center (Figure 5)

NOTE: Teflon tape must be used on all thread joints.

- Wrap the outside thread of the tank control center with teflon tape at position (A) and thread into tank opening (see Figure 4). Control center will thread directly into 1" opening in the side of the pre-charged tank.
- Install the pressure gauge with a 3/4" x 1/4" busing at the opening marked position (B) on the control center.
- Install a pressure switch or "loss of pressure" switch using 1/4" x 3" nipple at the opening position (C) in the control center.
- Connect pipe coming from well and pump to position (E) in the control center using the appropriate male plastic adapter and clamp, if polyethylene is used or thread directly into control center if ABS or steel pipe is used.
- Proceed from position (D) on the control center to house service lines.

NOTE: The use of teflon tape is recommended on all threaded joints.

NOTE: It is recommended that the 1 HP and 1-1/2 HP models should not be installed where the pumping level is less than 30 m (100 ft).

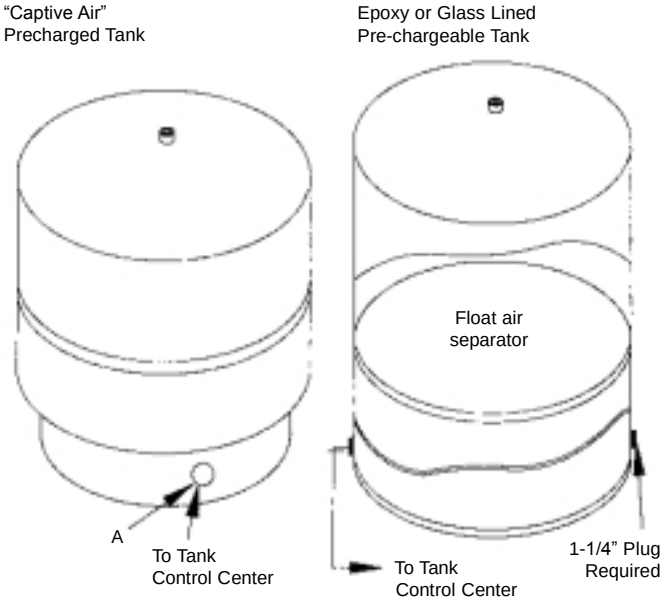


Figure 4 - Tank Openings

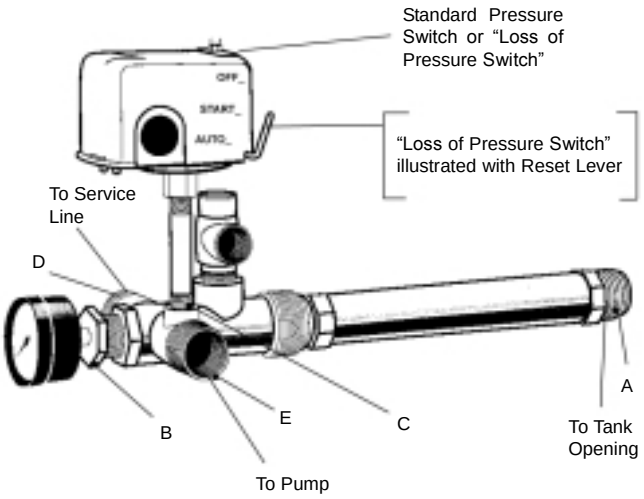


Figure 5 - The Control Center

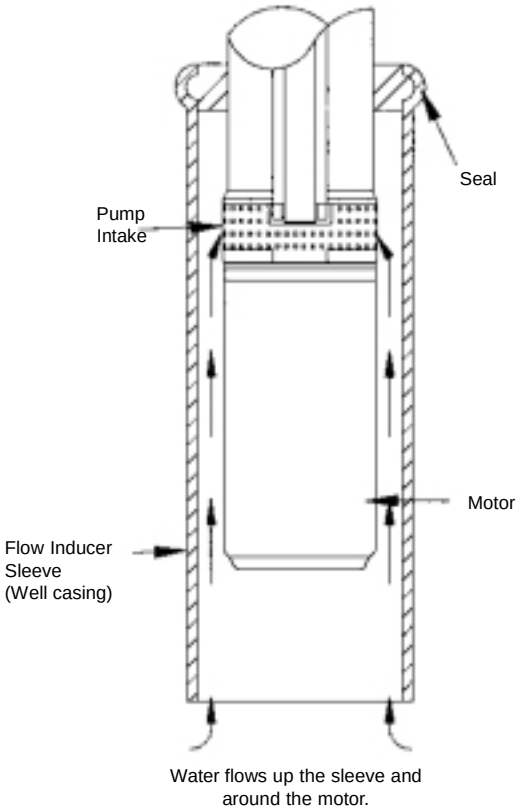


Figure 6 - Flow Inducer Sleeve

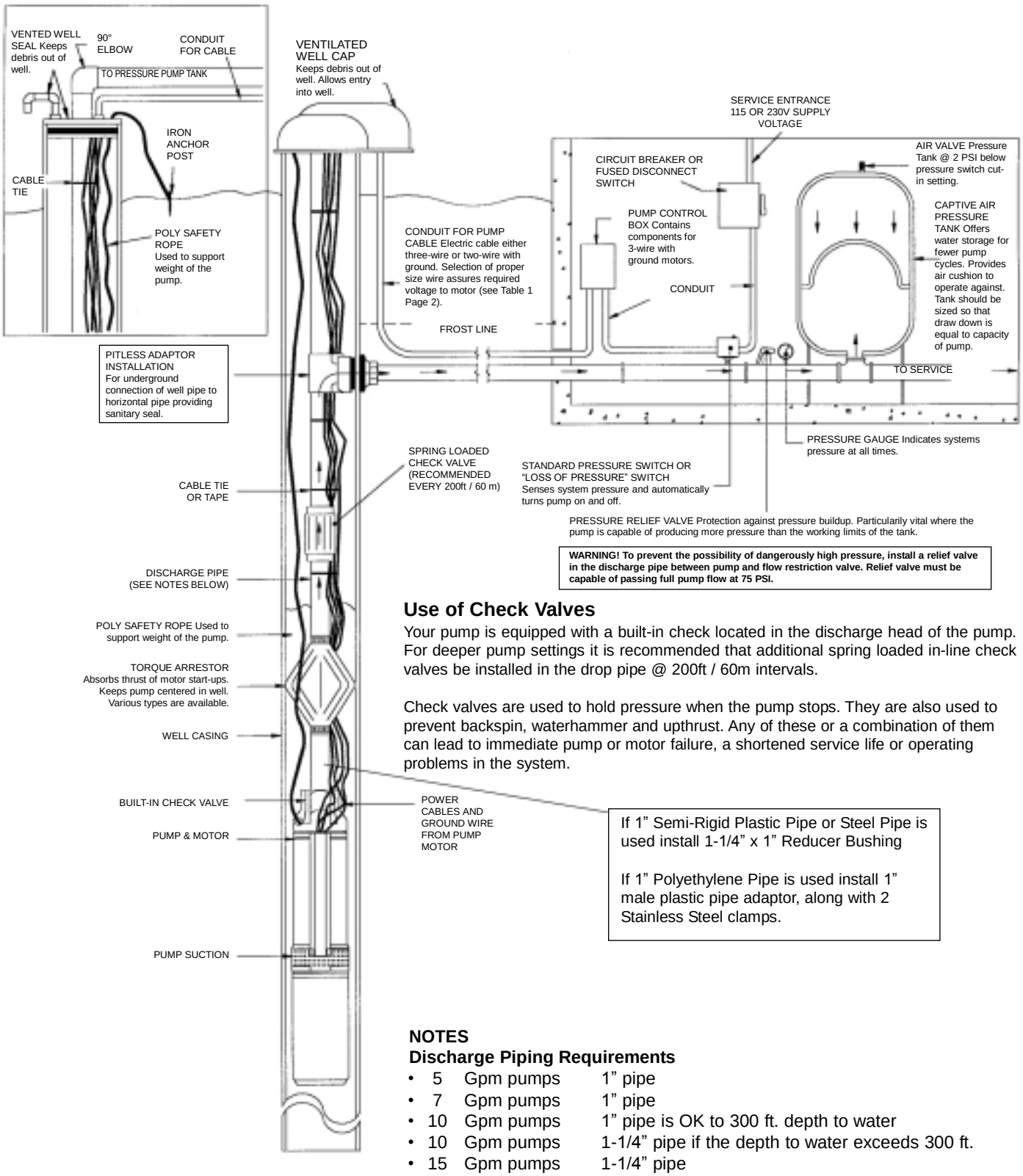
Lake or Large Diameter Well Installation

All wiring, electrical connections and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician.

If a pump is installed in a lake or large diameter well, a flow inducer sleeve must be placed around the motor. The sleeve should have an inside diameter of 4" to 6", and be composed of corrosion resistant metal or heavy plastic. The sleeve will ensure proper flow of water around the motor for cooling purposes. The flow inducer sleeve is closed off above the pump intake and extends to the bottom of the motor or lower as shown in Figure 6.

Pictorial of 3 Wire System With and Without a Pitless adapter

(see page 9, Figure 9 in this manual for Wiring Diagrams)



Use of Check Valves

Your pump is equipped with a built-in check located in the discharge head of the pump. For deeper pump settings it is recommended that additional spring loaded in-line check valves be installed in the drop pipe @ 200ft / 60m intervals.

Check valves are used to hold pressure when the pump stops. They are also used to prevent backspin, waterhammer and upthrust. Any of these or a combination of them can lead to immediate pump or motor failure, a shortened service life or operating problems in the system.

If 1" Semi-Rigid Plastic Pipe or Steel Pipe is used install 1-1/4" x 1" Reducer Bushing

If 1" Polyethylene Pipe is used install 1" male plastic pipe adaptor, along with 2 Stainless Steel clamps.

NOTES

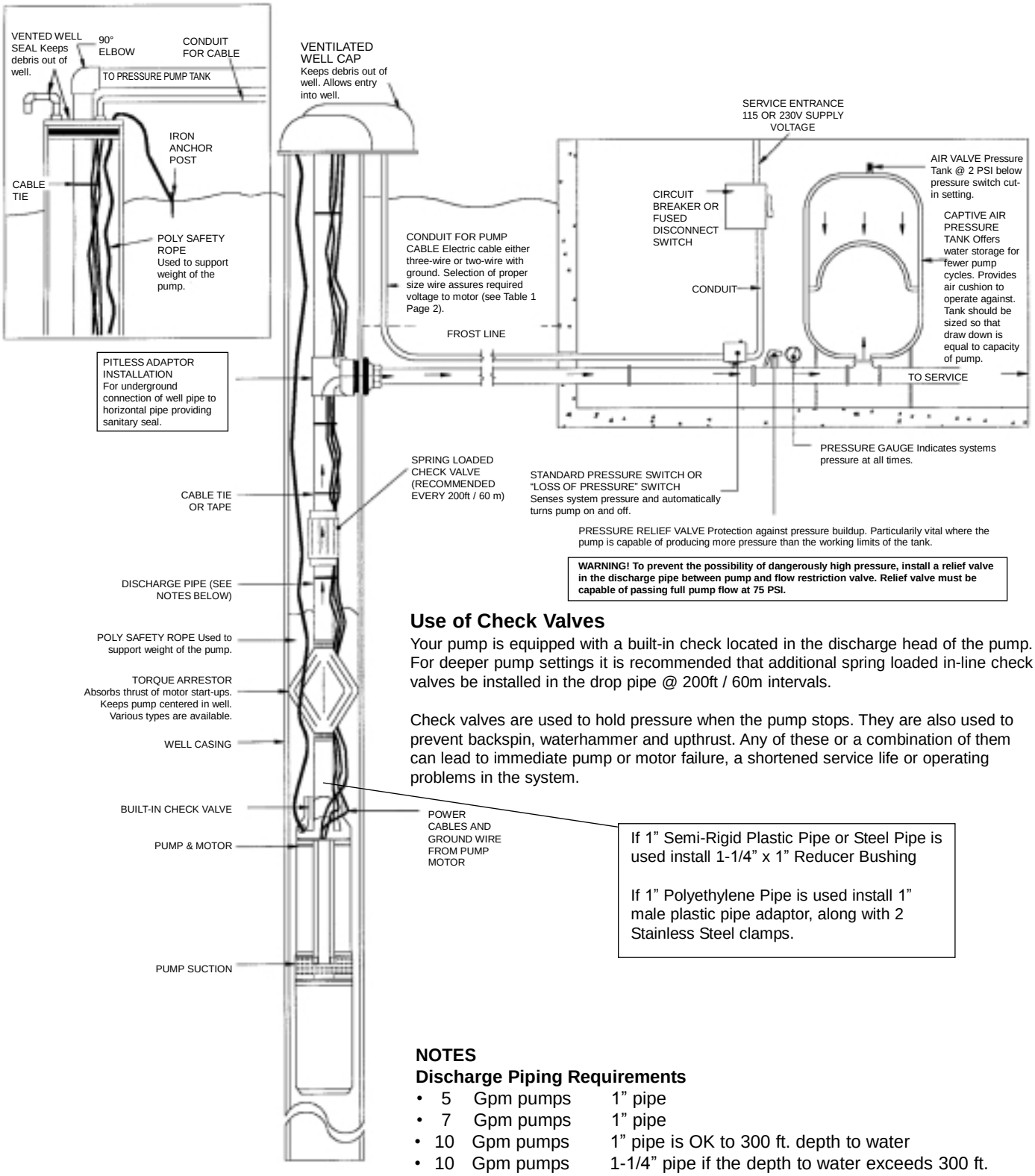
Discharge Piping Requirements

- 5 Gpm pumps 1" pipe
- 7 Gpm pumps 1" pipe
- 10 Gpm pumps 1" pipe is OK to 300 ft. depth to water
- 10 Gpm pumps 1-1/4" pipe if the depth to water exceeds 300 ft.
- 15 Gpm pumps 1-1/4" pipe
- 20 Gpm pumps 1-1/4" pipe
- 30 Gpm pumps 2" pipe
- 50 Gpm pumps 2" pipe
- 85 Gpm pumps 2" pipe

Figure 7 - Pump Installation

Pictorial of 2 Wire System With and Without a Pitless Adapter

(see page 9, Figure 9 in this manual for Wiring Diagrams)



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If 1" Polyethylene Pipe is used install 1" male plastic pipe adaptor, along with 2 Stainless Steel clamps.

NOTES

Discharge Piping Requirements

- 5 Gpm pumps 1" pipe
- 7 Gpm pumps 1" pipe
- 10 Gpm pumps 1" pipe is OK to 300 ft. depth to water
- 10 Gpm pumps 1-1/4" pipe if the depth to water exceeds 300 ft.
- 15 Gpm pumps 1-1/4" pipe
- 20 Gpm pumps 1-1/4" pipe
- 30 Gpm pumps 2" pipe
- 50 Gpm pumps 2" pipe
- 85 Gpm pumps 2" pipe

Figure 8 - Pump Installation

Installation Cont'd

Electrical Connections (Figure 9)

WARNING - Electrical Precautions - All wiring, electrical connections and system grounding must comply with the national electrical code (NEC) and with any local codes and ordinances. A licensed electrician should be employed.

WARNING - Risk of Electrical Shock

Employ a licensed electrician to do the electrical wiring. A separate circuit breaker in your home's electrical panel is required. A ground fault interrupter (GFI) protected circuit should be used for all electrical devices operating near water. Install a properly fused disconnect switch in the line and make certain the wiring is adequately sized and well insulated. ***Undersized wire between the motor and the power source will adversely limit the starting and load carrying abilities of the motor and void the warranty.*** Minimum wire sizes for motor branch circuits are recommended in Table 1, Page 2. **For safety, the pump motor must be properly grounded.** For fusing requirements, see Table 2.

- Turn off main power supply to pump before attempting in wiring.
- Turn the pressure switch control lever to the ***"OFF"*** position (if your switch is equipped with a control lever), disconnecting the switch.
- Remove the cover from the pressure switch by loosening the cover nut. Connect the wires coming from the power source to the ***"LINE"*** terminals on the pressure switch. Use no less than 14 gauge wire to the terminals on the pressure switch.
- Cut the submersible wire cable to length from the well and connect the wires to the ***"LOAD"*** terminals on the pressure switch.
- Replace the cover on the pressure switch and reset lever to ***AUTO*** if your switch is so equipped.

Starting the Pump

Turn the circuit breaker switch to the "ON" position to start pump. Pump should start building pressure immediately. Allow pump to run until water runs clear.

NOTE: If your pressure switch is equipped with a loss of pressure cut-off switch (with a lever) it will be necessary for you to hold the lever in the start position until the pump build sufficient pressure to remain on without holding lever in the start position. The pump will run until system pressure builds up to the cutoff setting of the switch. The system will operate automatically between the cut-in & cut-out pressure settings on the switch.

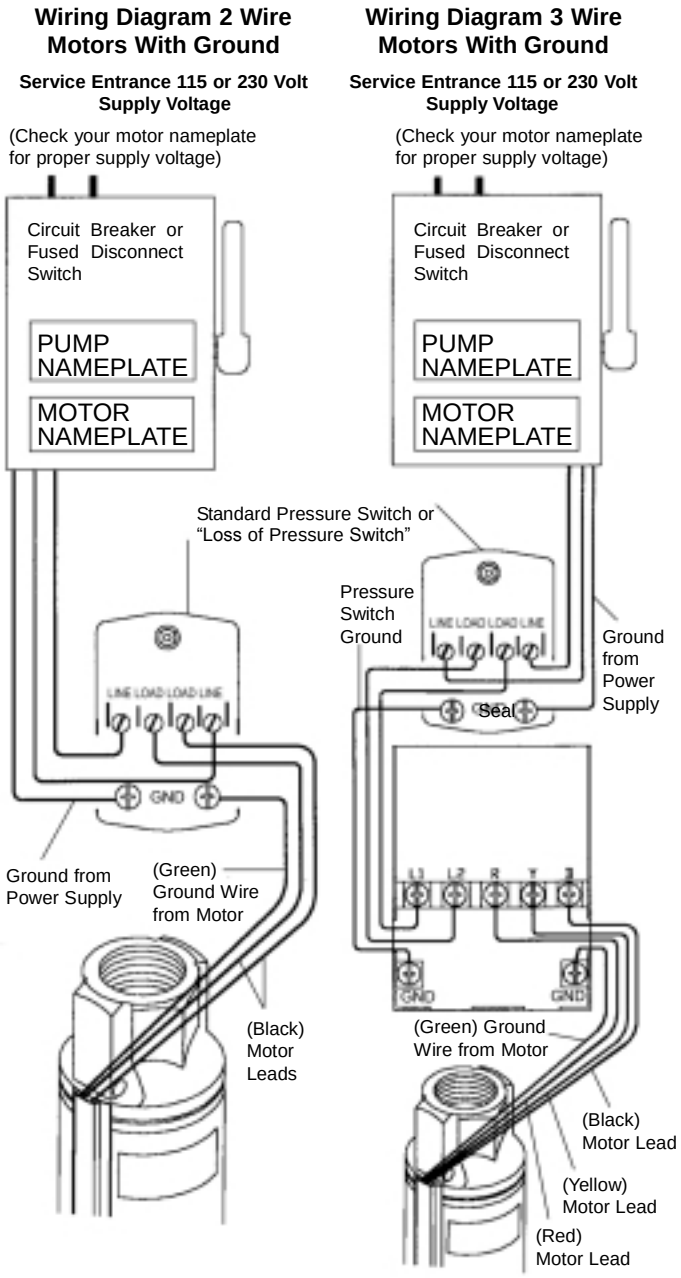

Figure 9 - Wiring Diagram

Table 2 - Motor Circuit Breaker or Fuse Requirement

Rating			Wire	Phase	Circuit Breakers of Fuse Amps					
					(Maximum Per NEC)			(Typical Submersible)		
HP	KW	Volts			Standard Fuse	Dual Element Time Delay Fuse	Circuit Breaker	Standard Fuse	Dual Element Time	Circuit Breaker
1/2	0.37	115	2	1	35	20	30	30	1	30
1/2	0.37	230	2	1	20	10	15	15	8	15
3/4	0.55	230	2	1	25	15	20	20	1	20
1	0.75	230	2	1	30	20	25	25	1	25
1.5	1.1	230	2	1	35	20	30	35	1	30
1/2	0.37	115	3	1	35	20	30	30	1	30
1/2	0.37	230	3	1	20	10	15	15	8	15
3/4	0.55	230	3	1	25	15	20	20	1	20
1	0.75	230	3	1	30	20	25	25	1	25
1.5	1.1	230	3	1	35	20	30	30	1	30
2	1.5	230	2 or 3	1	30	20	25	30	1	25
3	2.2	230	2 or 3	1	45	30	40	45	2	40
5	3.7	230	3	1	80	45	60	70	3	60
7.5	5.5	230	3	3	80	45	60	70	3	60
7.5	5.5	575	3	3	30	20	25	30	1	25
7.5	5.5	460	3	3	40	25	30	35	1	30
10	7.5	575	3	3	45	25	35	40	2	35
10	7.5	460	3	3	60	30	45	50	2	45

Maintenance

No regular maintenance is required on a submersible pump.
However, it is advisable to check the wiring and piping annually.

Trouble Shooting

PROBLEM	CAUSE	CORRECTIVE ACTION
1. Your pump delivers little or no water	A. Water level in a low producing well drops too low while pump is operating, causing it to air lock. (Resulting in loss of prime and possibly serious damage to the pump)	A. Lower the pump further into the well, but make sure it is at least five feet from the bottom of the well. Install a control valve in the discharge pipe between the pump and pressure tank. Use the control valve to restrict the flow until the discharge rate does not exceed well recovery rate. **WARNING! To prevent the possibility of dangerously high pressure, install a relief valve in the discharge pipe between pump and flow restriction valve. Relief valve must be capable of passing full pump flow at 75 PSI.**
	B. Intake screen is partially plugged.	B. Lime or other matter in the water may build up on screen. Pull pump and clean screen.
	C. Check valve(s) may be stuck.	C. Make sure that the built-in check valve in the pump and any check valves in the discharge line are free to open properly.
	D. Voltage is too low; the motor runs slowly, causing low discharge pressure (head) and high operating current draw.	D. Have a certified electrician verify voltage at the electrical disconnect box (2 wire) or control center (3 wire) while the pump is operating. If the voltage is low, the power company may need to raise it or installation may require larger wire. Discuss this with the power company or a licensed electrician.
2. Air or milky water discharges from your faucets	A. Well water may be gaseous.	A. If your well is naturally gaseous and your system has a standard tank, remove the bleeder orifices and plug the tees. If the condition is serious, check with certified well professionals.
3. Pump starts too frequently	A. Leak in the pressure tank or plumbing.	A. Check all connections with soapsuds for air leaks. Fix any leaks you find. Check the plumbing for water leaks. Fix any leaks you find.
	B. Pressure switch is defective or out of adjustment.	B. If necessary, replace switch.
	C. Check valve is leaking.	C. Inspect valves and replace if necessary.
	D. Tank is waterlogged.	D. Captive Air® Tanks: Check the tank for leaks; correct if possible. Precharge tanks to 18 PSI with a 20-40 PSI switch, 28 PSI for a 30-50 PSI switch, 38 PSI for a 40-60 PSI switch, etc. Standard tanks: Check the tank for leaks; correct if possible. Check bleeder orifices and clean bleeders; replace if necessary.
	E. Drop pipe leaking.	E. Raise one length of pipe at a time until the leak is found. When water stands in the pipe there is no leak below this point.
	F. Pressure switch is too far from the tank.	F. Move the pressure switch to within one foot of the tank.
4. Fuses blow or overload protector trips when the motor starts	A. Fuses or wires are too small.	A. Replace with correct wire sizes (see Table 1 on Page 2).
	B. Low or high voltage.	B. While motor is running, voltage should not exceed plus 5% or minus 5% or rated voltage shown on motor nameplate. Call the electric power company to adjust line voltage if not within these limits.
	C. Cable splices or motor windings grounded, shortened, or open.	C. Consult certified electrician or service technician.
	D. 3-wire only; Cable leads may be improperly connected in pump control box, pressure switch or fused disconnect switch.	D. Check wiring diagram on pump control box (also see Figure 9 on Page 9) and color coding of drop cable.
	E. 3-wire only; There may be a broken wire in the pump control box.	E. Employ certified electrician examine all connections and wiring in control panel. If necessary, repair them.
	F. 3-wire only; Starting or running capacitor in control box may be defective or vented (blown out).	F. Inspect capacitors. Employ a certified electrician to check capacitors and replace them if necessary. **WARNING! Hazardous voltage, can shock, burn or cause death. Capacitors may still carry voltage charges even after being disconnected from wiring. Have them checked by a certified electrician.**

Trouble Shooting Cont'd

PROBLEM	CAUS	CORRECTIVE ACTION
5. Motor will not start but does not blow fuses. **WARNING! Hazardous voltage. Can shock, burn or cause death. Employ a qualified electricians should work on electrical service.**	A. No voltage to motor. B. Cable splices or motor windings may be grounded, shorted or open-circuited. C. Open circuit in pump control box (3-wire only); faulty connections; faulty wires. D. Faulty pressure switch. E. 3-wire only; Cable leads improperly connected in the control center.	A. With a voltmeter check; 1) fuse box to make sure full voltage is available; 2) pressure switch terminals, to make pressure switch is passing voltage correctly; and 3) terminal strips in pump control box or disconnect switch box to make sure voltage is available there. On 1-1/2 through 3 HP: Push red overload reset button(s) on the bottom of control center. B. Consult certified electrician or service electrician. ***Do not attempt to disassemble pump or motor.*** C. Examine all connections and wires; examine terminal strips in the control center (3-wire only); repair if necessary. D. Check pressure switch; replace if necessary. E. Check wiring diagram on control center panel (or see Figure 9 on Page 9 of this manual) and color coding of drop cable.
6. Pressure switch fails to shut off pump.	A. You may have selected an undersized pump. Please refer to Pump Selection Guide (p2). B. Voltage is too low; motor will run slowly, causing low discharge pressure (head) and high operating current draw. C. Faulty pressure witch. D. Drop pipe is leaking. E. Water pumping level in the well may become too low when pump is running.	A. Lower the pressure setting. B. Verify voltage while the pump is operating. If the voltage is low, your power company may require larger wire. Discuss with the power company or a certified electrician. Check voltage with a recording meter if trouble recurs. C. Replace switch. D. Raise one length at a time until the leak is found. When water stands in the pipe, there is no leak below this point. E. Lower pump further into well, make sure it is between five and ten feet from the bottom of the well. Install a valve into the discharge pipe between the pump and the pressure tank. Use the valve to restrict flow until discharge rate does not exceed the well recovery rate. **WARNING! To prevent the possibility of dangerous high pressure, install a relief valve in the discharge pipe between the pump and flow restriction valve. The relief valve must be**
7. Fuses blow or overload protector trips when motor is running.	A. Low or high voltage. B. 3-Wire only: High ambient (atmospheric) temperature. C. 3-Wire only: Pump control box is wrong horsepower or voltage for installation. D. Wire size is too small. Improperly connected in the pump control box. E. Cable splices or motor windings may be grounded, shorted or open-circuited.	A. While the motor is running, voltage should not exceed plus 5% or minus 5% of rated voltage shown on motor nameplate. Call your power company to adjust line voltage if it is not within these limits. B. Make sure the pump control box is installed out of direct sunlight. C. Compare horsepower and voltage rating of motor (from motor nameplate) with those of the pump control box (from pump control box nameplate). These numbers must match. D. See Table 1 on Page 2 of this manual and make sure the wire sizes match specifications in the Table. E. Consult certified electrician or a service technician to determine if this is the cause of the problem or not. **Do not attempt to disassemble pump or motor.**

Before you decide to return this pump, please test it in a bucket of water with a short electric cable. Make sure that the pump is completely submerged in water while its discharge outlet above water level. If the pump works in the testing condition, **IT IS A GOOD PUMP**. We have received many good pumps returned to us. Possible causes:

1. Loose electric cable connections.
2. Your electric cable is too long which causes the volt drop. Please change to a bigger wire gauge cable according to the wire gauge calculation sheet.
3. Air in the pipe system. Prime the system before running the pump.

Congratulations!

You are now the owner of a quality Hallmark Industries' Submersible Well Pump. The product that you have purchased has been manufactured using the latest techniques, best materials and quality workmanship.

Roll over image to zoom in

Hallmark Industries

Hallmark Industries MA0343X-4A Deep Well Submersible Pump, 1/2 hp, 220V, 60 Hz, 25 GPM, 150' Head, Stainless Steel, 4"

53 customer reviews | 12 answered questions

Price: $125.51 & **FREE Shipping**. Details

In Stock.

Want it Saturday, May 6? Order within **7 hrs 2 mins** and choose **Two-Day Shipping** at checkout. Details

Ships from and sold by Amazon.com. Gift-wrap available.

Installation options: **Get expert installation** Details

Without expert installation | Expert installation + $391.09

See more

- Pump, Deep Well Submersible Pump, 1/2HP, 220V 60HZ, 25 Gpm, Stainless Steel, for 4" or bigger well, long life
- 2 wire pump with built in control box- DOES NOT require external control box; Industrial grade heavy duty, good for home usage; Built in thermal protection
- American company

Specifications for this item

Part Number	MA0343X-4A	Item Weight	24.35 pounds
Number of Items	1	Length	26 inches
Maximum Pressure	61 pounds_per_square_inch	Maximum Feet of Head	150
Measurement System	Inch	Maximum Flow Rate	25 gallons_per_
Body Material	Stainless Steel	Minimum Flow Rate	0 gallons_per_
Brand Name	Hallmark Industries	Model Number	MA0343X-4A
Connector Type	NPT Female	Motor Horsepower	0.5 horsepov
Exterior Finish	Stainless Steel	Motor Power Type	Electric
For Pipe Size	1.25 inches	Outlet Connection Size	1.25 inches
For Use With	Water Well	Outlet Connection Type	NPT thread
Height	26 inches	UNSPSC Code	40151513
Horsepower	0.5 horsepower		
Item Shape	Round		
Item Thickness	4 inches		

Voltage	220 volts
Wattage	375 watts

See more product details

Used & new (4) from $99.77 & FREE shipping. Details

Frequently bought together

Total price: $145.15

Add all three to Cart

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These items are shipped from and sold by different sellers. Show details

- ☑ **This item:** Hallmark Industries MA0343X-4A Deep Well Submersible Pump, 1/2 hp, 220V, 60 Hz, 25 GPM, 150' Head… $125.51
- ☑ Well Pump Wire Splice Kit, Submersible 3M Dual Wall Heat Shrink Tubing and Copper Connector for 4… $7.89
- ☑ Rubber Torque Arrestor $11.75

Customers who bought this item also bought

Page 1 of 4

Well Pump Wire Splice Kit, Submersible 3M Dual Wall Heat Shrink Tubing and Copper Connector for 4…
110
$7.89

Rubber Torque Arrestor
49
#1 Best Seller in Gas Tube Arrestors
$11.75

Brands2O TC2104-P2 Well Pump Pressure Gauge
299
$9.41

Square D by Schneider Electric FSG2J24CP 40-60 PSI Pumptrol Water Pressure Switch
240
$14.62

Hallmark Industries MA0414X-7A Deep Well Submersible Pump, 1 hp, 230V, 60 Hz, 33 GPM,…
168
$135.18

Ha M Su 23
$1

Sponsored products related to this item (What's this?)

Page 1 of 14

Franklin Electric FPS 1/2 hp 20 gpm Effluent Septic Pump
$260.00

Sta-rite 20DOM05121+1 20gpm Septic Pump/Cistern pump
$230.00

Sivan Health and Fitness Balance Ball Fit Chair with Pump, Black, Large
86
$62.99

Express Water 5 Stage Home Drinking Reverse Osmosis Water Filtration System 100 GPD RO…
39
$179.99

Franklin Electric C1 Septic Water High Head Submersible Effluent Pump, 20 GPM, 1/2…
$236.00

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$4

Ad feedback

From the manufacturer

Hallmark Industries Deep Well Submersible Pump

Hallmark Industries MA0343X-4A Deep Well Submersible Pump, 1/2 hp, 220V, 60 Hz,

4-inch Stainless Steel and heavy duty cast iron

This is 220V (230V) pump. Does not work for 110V (115V).

- 4" deep well submersible pump, fits in the 4" or bigger well casing.
- Built in starter box- Does not require external control (starter) box.
- 2 wire pump with 3-wires (2 wires + ground wire).
- High quality UL approved motor, UL file No.: E233961.
- Built in 1/2 HP capacitor start, and thermal protection switch.
- This pump has a built in check valve.
- 1-1/4" NPT discharge.
- High efficiency, hermetically sealed motor is thermally protected to prevent overheating, and uses less energy.

This is a complete pump

Installation and user's manual, and tape kit are included.

- Max head 150 feet for no pressure holding tank
- Pressure tank @ 20/40 psi, max water level 43'
- Pressure tank @ 30/50 psi, max water level 24'
- Pressure tank @ 40/60 psi, max water level 5'





	1/2HP, 115V (MA0343X-4)	1/2HP 230V, (MA0343X-4A)	1HP, 115V, (MA0414X-7)	1HP 230V, (MA0414X-7A)	2HP, 230V, (MA0419X-12A)
Pressure tank, 20/40psi setting	Max water level 43'	Max water level 43'	Max water level 112'	Max water level 112'	Max water level 300'
Pressure tank 30/30 psi setting	Max water level 24'	Max water level 24'	Max water level 89'	Max water level 89'	Max water level 280'
Pressure tank 40/60 psi setting	Max water level 5'	Max water level 5'	Max water level 66'	Max water level 66'	Max water level 260'
Max Head, No pressure tank	150 feet	150 feet	207 feet	207 feet	400 feet
Built-in starter (control) box?	Yes. It does not need starter box.	Yes. It does not need starter box.	Yes. It does not need starter box.	Yes. It does not need starter box.	Yes. It does not need starter box.
Built-in check valve?	Yes	Yes	Yes	Yes	Yes

Product description

Deep Well Submersible Pump, 1/2HP, 220V/60HZ/1PH, 25 GPM Max, 150 Feet MAX, S.S. SHELL C.I Intake, 1¼" NPT discharge.
Brand new product in the box! NOT 'Manufacturer Refurbished'.
We are based in the U.S., customer services, tech support & warranty are handled in the U.S.

FEATURES:
* 4" deep well S.S submersible pump, 1/2HP, 220V, 3.3 Amps, 150 Feet MAX Head, 25 GPM Max
* Patented impeller provides heavy duty higher performance and longer life than most other well pumps.
* Solid stainless steel body with heavy duty cast iron discharge
* Industrial grade heavy duty, also good for home usage.
* Built in 1/2 HP capacitor start, and thermal protection switch. For longer life and powerful start.

* Built in control box. This pump DOES NOT require an external control box!
* This pump uses high quality UL approved motor, UL file No.: E233961
* This is a 2 wire pump with 3-Wire (2 wires + ground wire)
* 10' long electric cord comes with this submersible deep well pump
* 1¼" NPT discharge
* Heavy-duty thermoplastic impellers, diffusers, and intake screen.
* Check valve is removed for easy winterizing operation.
* This is a 2 wire pump with 3-Wire (2 wires + ground wire).
* Submersible design eliminates the need for priming and creates quiet operation.
* High efficiency and hermetically sealed motor has thermal protection prevents overheating, uses less energy.
* 150 Max head is for open water tank. The max head will be reduced in pressure tanks. Read the Selection Guide for details!
* Installation manual, and tape kit are included.
* Free technical support available during installation.

Condition: New
Use business address for fast shipping.

Product details

Product Dimensions: 29 x 8.4 x 5.4 inches ; 24.4 pounds

Shipping Weight: 24.4 pounds (View shipping rates and policies)

Domestic Shipping: Item can be shipped within U.S.

International Shipping: This item can be shipped to select countries outside of the U.S. Learn More

ASIN: B00NTT2JW6

Item model number: MA0343X-4A

Average Customer Review: 53 customer reviews

Amazon Best Sellers Rank:
#3 in Industrial & Scientific > Hydraulics, Pneumatics & Plumbing > Pumps > **Submersible Pumps**

Manufacturer's warranty can be requested from customer service. Click here to make a request to customer service.

Would you like to **tell us about a lower price**?
If you are a seller for this product, would you like to **suggest updates through seller support**?

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$22.99

1.5 HP 4" Submersible Well Pump Complete Set Incl Motor, Pump-end and Control Box. 480 Foot…
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$409.00

BACOENG 2hp 4" Deep Well Pump Submersible 220v Stainless Steel 528ft Max 33ft Cord
14
$248.99

LOVSHARE Deep Well Pump 1.5HP 4 Inch Submersible Pump 200FT 40GPM…
1
$189.99

WACKER NEUSON PST2-400 2 In. Elect
9
$284.99

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Customer Questions & Answers

See questions and answers

Customer Reviews

53

3.8 out of 5 stars

5 star	56%
4 star	19%
3 star	2%
2 star	0%
1 star	23%

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Top Customer Reviews

Quality product

By Michael Griffith Jr on September 13, 2016

Verified Purchase

The reason for the four star review instead of 5 star is due to the first well pump coming in broken the packaging was inadequate and not any kind of problem with the product itself. Amazon was very prompt and sending me a replacement and once I got the new replacement Pump I began to install. watch me a few YouTube videos the process was actually quite easy. my well is roughly a hundred and ten foot deep and the pump itself had no problem delivering water to my house. the pump seem nice quality and very sturdily built. if the first part didn't come in broken I would have no reason not to review this as being a 5 Star item. buying this pump on Amazon saved me roughly $300 compared to the local store which was one of a large reasons why I bought this. I would tell anybody that's looking for a replacement Well pump that this is a good quality item at a very good price. [...]

Comment 2 people found this helpful. Was this review helpful to you? Yes No Report abuse

NOT BUILT "WELL"

By With good intent on July 4, 2015

Verified Purchase

POOR CONSTRUCTION. If you take a moment to pour water into it before plunging it into your well, you will see why people report that it short-cycles... There are screws drilled into the unit above the check valve which hold the wiring next to the pump. This drains water out of the pressurized section of the installation which will cost you lots of wasted electricity. Maybe some units are doped or do not leak so badly but I had a highly experienced plumber show me that it would be unwise to utilize this pump. I returned it as defective and got a refund -- I suggest everyone do the same... A decent unit with a Franklin-manufactured motor will cost slightly more but will likely have 6 stages and not leak. A better bargain that will pay for itself in short time.

Comment 4 people found this helpful. Was this review helpful to you? Yes No Report abuse

Quality Appears Good for the Low Price

By retiredandlovingit on November 1, 2016

Verified Purchase

Painted cast iron parts rust quickly but are not a performance issue. I dropped it in a plastic 55 gallon drum of water to test it and found rust stains from the cast iron parts bleeding onto the stainless steel casing the next day. Used it to replace a dead pump in a shallow bored (3' wide x 50' deep) back-up well we switch to when we have a power outage. Water level is at 20' and I have the pump at 45'. I can run this pump on a small 3,500 watt generator providing 220 volts, I can't run our main 3HP deep well pump off the generator. Pumps a good head with more than adequate flow. I just hope it will last as long as the one I pulled out which was dated 1982.

Customer Images

See all customer images

Most Recent Customer Reviews

No warranty, stopped working.

Stopped working after a few months, left grease and oil in my well. I don't think it has any warranty! Amazon should remove these. Read more

Published 13 days ago by Mollie Mazza

One Star

Pump failed after 2 months Read more

Published 1 month ago by Amazon Customer

Five Stars

Very satisfied Read more

Published 2 months ago by Amazon Customer

Plan to buy others in the future.

As of this date it performs as well as other pumps I have purchased for over twice the price. Read more

Published 4 months ago by charles noll

Terrible. It stopped workng a month after i bought ...

Terrible . It stopped workng a month after i bought it.. Read more

Published 4 months ago by Amazon Customer

Comment Was this review helpful to you? Yes No Report abuse

2 pumps in 2 weeks

By Doug G. on September 22, 2015

Verified Purchase

package was timely received, but I was busy so I did not install it for about a month,after installed it failed in about a week,I contacted AMAZON and they said it was past the 30 day policy and i could not return it, i called hallmark they also would not help me , after much thought i gave in to the idea that i got a bad pump and that it was my fault i waited so long before installation , so because of the low price i re order the same pump, i install it right away , i feel pretty good , great psi., a week goes by and it fails also, i am able to send it back, so i get refund on this pump,go to local plumbing supply and buy a mcdonald pump has been installed for months no problems, and has a 5 year warranty!!! you get what you pay for , this pump is NO GOOD!!

Comment Was this review helpful to you? Yes No Report abuse

Nice not having to prime it.

By Steven R on October 5, 2016

Verified Purchase

replaced a surface suction pump with this. it is working very well and I don't miss priming that other thing. easy to install if you are handy with tools and have plumbed before. be sure to get water proof electrical splices from your local store or order with the pump (as I did.)

Comment One person found this helpful. Was this review helpful to you? Yes No Report abuse

Don't Waste Your Money

By Kevin Wood on March 23, 2015

Verified Purchase

Do not waste your time on this product, if you are trying to use it with any pressure switch concept. I placed this pump in a 60 foot well and pump placed at 50 feet. One pipe to the top with the bladder and pressure switch. This pump will only build pressure to 32 LBS. PSI. When i called the company the person could not understand the operation and tried to say i purchased too small of a pump. But it plainly states 150 max head, and only pumping 50 feet. after replacing pressure switches to smaller ones and adjusting pressure switch down so they would cut off, i filled my tanks for my animals and the next day pulled out this excuse for a pump and replaced with a new one from Lowe's. Should have spent the extra $200.00 at the beginning and would have not had to pull out 2 times.If you use this pump only for a stock tank with a float valve operation it may work but will not correctly with a pressure tank operation switch.

1 comment 6 people found this helpful. Was this review helpful to you? Yes No Report abuse

So far so good. The pump we pulled out was over 35 ...

By Marsha Crawford on April 13, 2017

Verified Purchase

So far so good. The pump we pulled out was over 35 years old. We will see how this one does.

Comment Was this review helpful to you? Yes No Report abuse

highly recommend

By Amazon Customer on March 31, 2016

Verified Purchase

It was fairly easy to install. Just pay attention to how the old one was hooked up and you should be able to reconnect it. The pump took a few days to notice the "new" taste out of the water. The price was half of what local places were offering it to us. I would highly recommend this pump.

Comment One person found this helpful. Was this review helpful to you? Yes No Report abuse

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... no problems and the second one has been working fine.

The first one I received didn't work but it was replaced promptly with no problems and the second one has been working fine. Read more

Published 6 months ago by beverly craig

Five Stars

Great product. Great price! Read more

Published 6 months ago by Shawn S

Five Stars

so far so good working well Read more

Published 8 months ago by Troy H.

A great bet!

THis pump was a lot cheaper than other comparables and works like a charm! Highly recommend. Read more

Published 9 months ago by Grant Peterson

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Amazon Giveaway allows you to run promotional giveaways in order to create buzz, reward your audience, and attract new followers and customers. Learn more about Amazon Giveaway

This item: Hallmark Industries MA0343X-4A Deep Well Submersible Pump, 1/2 hp, 220V, 60 Hz, 25 GPM, 150' Head, Stainless Steel, 4"

Set up a giveaway

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Hallmark Industries MA0414X-7A Deep Well Submersible Pump, 1 hp, 230V, 60 Hz, 33 GPM,…
168
$135.18

Well Pump Wire Splice Kit, Submersible 3M Dual Wall Heat Shrink Tubing and Copper Connector for 4…
110
$7.89

Hallmark Industries MA0343X-4 Deep Well Submersible Pump, 1/2 hp, 110V, 60 Hz, 25 GPM,…
97
$136.67

Hallmark Industries MA0419X-12A Deep Well Submersible Pump, 2 hp, 230V, 60 Hz, 35 GPM,…
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