

## Brookville Gardens Well

### Location

The Brookville Gardens Well is located within the City on City-owned property west of the FedEx distribution center on Valley Avenue East (**Figure 4 – Brookville Gardens Well Site Map**). The legal description of the well location is NE ¼ NE ¼, Section 18, Township 20N, Range 4E, W.M. and its Latitude/Longitude is N 47.226353 degrees; W 122.341436 degrees

### Well Construction

No driller's well log could be identified for this well. RH2 measured physical characteristics of the well (**Table 3 – Brookville Gardens Well Characteristics**) and prepared a schematic well log (**Appendix A – Created Well Logs**).

**Table 3 - Brookville Gardens Well Characteristics**

| Casing Diam.<br>(in)  | Casing<br>Type | Top of Casing<br>Elevation <sup>1</sup><br>(ft) | Ground<br>Surface<br>Elevation <sup>1</sup><br>(ft) | Depth of<br>Well <sup>2</sup><br>(ft) | Depth to<br>Water <sup>2</sup><br>(ft) | Groundwater<br>Elevation<br>(ft) |
|---|----------------|---|---|---------------------------------------|--|----------------------------------|
| 8 at surface  | Steel          | 25.92   | 24  | 278.75                                | +7.19                                  | 33.11                            |
| <sup>1</sup> Approximate Ground Surface Elevation obtained from Google Earth™.<br><sup>2</sup> Above Top of Casing – June 8, 2010 |                |   |   |                                       |  |                                  |

A weighted probe was inserted into the well casing to measure the depth of the well. At 259.17 feet below the TOC, a solid metallic surface was encountered. This surface likely represents the connection of the casing to a well screen. After working the probe, it was able to continue on to a total depth of 278.75 feet below the TOC. Based on typical well construction practices, it is assumed that the surface at 259.17 feet is a packer at the bottom of the 8-inch casing and that a 10- to 15-foot length of screen with a riser and possibly a tailpiece exists in the bottom 20 feet of the well (**Appendix A – Created Well Logs**).

### Characteristics of the Wellhead

The top of the well has a flange with 8 bolt holes that are not currently attached to a well cap. A 4-inch diameter PVC drop tube rises from the center of the well and is connected to a 90 degree elbow before being sealed by a threaded cap. At the top of the 8-inch casing, a sanitary seal secures the drop tube in place and contains the artesian pressure to shut-in the well.

There is a 2-inch diameter port on the wellhead at a height of 0.79 feet above ground surface. This pipe contains a gate valve, a reducer and a hose bib. There is a 4-inch diameter port on the wellhead at a height of approximately 1.3 feet above ground surface. The 4-inch port is sealed with a threaded cap (**Appendix B – Photos – Photo 5 – Brookville Gardens Wellhead**).

### Currently Installed Pumping System

The drop tube consists of 30 feet of 4-inch diameter Schedule 40 PVC pipe with a foot valve at the bottom of the pipe (**Appendix B – Photos – Photo 6 – Brookville Gardens Drop Pipe Foot Valve**). The drop tube has a 90 degree fitting after emerging from the well head with a short straight run leading to a threaded cap. The drop tube was likely designed to be connected to a centrifugal pump and motor that would supply the water for irrigation of the property.

### Artesian Conditions

This well is a flowing artesian well. Before the wellhead was opened, the static pressure measured on the hose bib was 3.6 psi, which is equivalent to 7.19 feet above the top of the casing. In order to open the well, a hose was attached to the hose bib and the gate valve and faucet were opened fully. The flow rate through the hose was measured as 2 gpm and did not decrease over time. The cap from the 4-inch drop tube was removed and flow was measured as 67 gpm. The total artesian flow from the well was 69 gpm.

### Test Pumping System Setup

Testing equipment consisted of an 8 hp Wacker PT3 centrifugal pump which has an 8 hp motor, 3-inch diameter intake and discharge, maximum pumping rate of 400-gpm, maximum suction lift of 25 feet, and maximum pumping head of 96 feet.

A 3-inch diameter suction hose connected the 4-inch diameter by 30-foot-long drop tube to the pump. The pump discharge was controlled by throttling the motor and the water was discharged into a 3-inch diameter lay-flat hose connected to an orifice weir for flow rate measurements. After leaving the orifice weir the test water discharged into a storm drain in the FedEx parking lot (**Figure 4 and Appendix B – Photos – Photo 7 – Brookville Gardens Well Test Pump Setup and 8 – Brookville Gardens Well Test Orifice Weir Setup**).

In order to open the sanitary seal and prepare the well for the step test, the centrifugal pump was connected via a suction hose to the 4-inch port and water was pumped and discharged into the FedEx storm drain. Even when the pump was idling, it discharged more than the 69 gpm that the artesian conditions produced. The pump would break suction and then the water would spill over the TOC before being pumped down again and repeating the pattern. This carried on until the orifice weir was operational and the pump could be attached to the drop tube. At this time the pump was able to operate continuously without losing suction or allowing the water to overtop the TOC. The initial pumping rate when the pump was idling was 100 gpm and represents the first step of the test.

Flow rate was measured using a level orifice weir and manometer with a 4-inch pipe and a 3-inch orifice plate. Water levels were measured with a pressure gage when the well was shut-in and through a 1-inch sounding tube with an electronic tape when the well was being pumped (**Appendix C – Field Notes**).

Water was discharged into a storm drain on the adjacent FedEx property which drains to the stormwater pond to the south of the facility (**Figure 4 – Brookville Gardens Well Site Map**).

### Step-Rate Testing

A step-rate test was performed on June 8, 2010 to evaluate the well efficiency and estimate the maximum pumping rate of the well. During the step-rate test, the well flowed under artesian conditions for 130 minutes, was pumped for 150 minutes and then water level recovery was monitored for 85 minutes. The test consisted of 4 pumping steps plus recovery (**Figure 5 – Brookville Gardens Wellhead**). The rates, drawdown, duration, and specific

capacity of each step are contained in **Table 4 – Brookville Gardens Step Test Measurements**. At the end of the fourth and final pumping step, the total drawdown measured was 20.32 feet. Since the well is artesian under static conditions, this represents a depth to water of 13.13 feet below the TOC, which is roughly half of the depth of the drop tube.

**Table 4 - Brookville Gardens Step Test Measurements (Also see Figures 5 and 6)**

| Step | Pumping Rate (gpm) | Drawdown (ft) | Pumping Duration (min) | Specific Capacity at end of step (gpm/ft) |
|------|--------------------|---------------|------------------------|---|
| 1    | 100                | 9.79          | 6                      | 10.21                                     |
| 2    | 149                | 13.25         | 34                     | 11.25                                     |
| 3    | 202                | 17.30         | 57                     | 11.68                                     |
| 4    | 243                | 20.32         | 53                     | 11.96                                     |

The water produced from the well was clear and color-free throughout the testing. Occasionally, a hydrogen sulfide-like odor was noted during testing, but it could not be confirmed that the well water was the source of the odor.

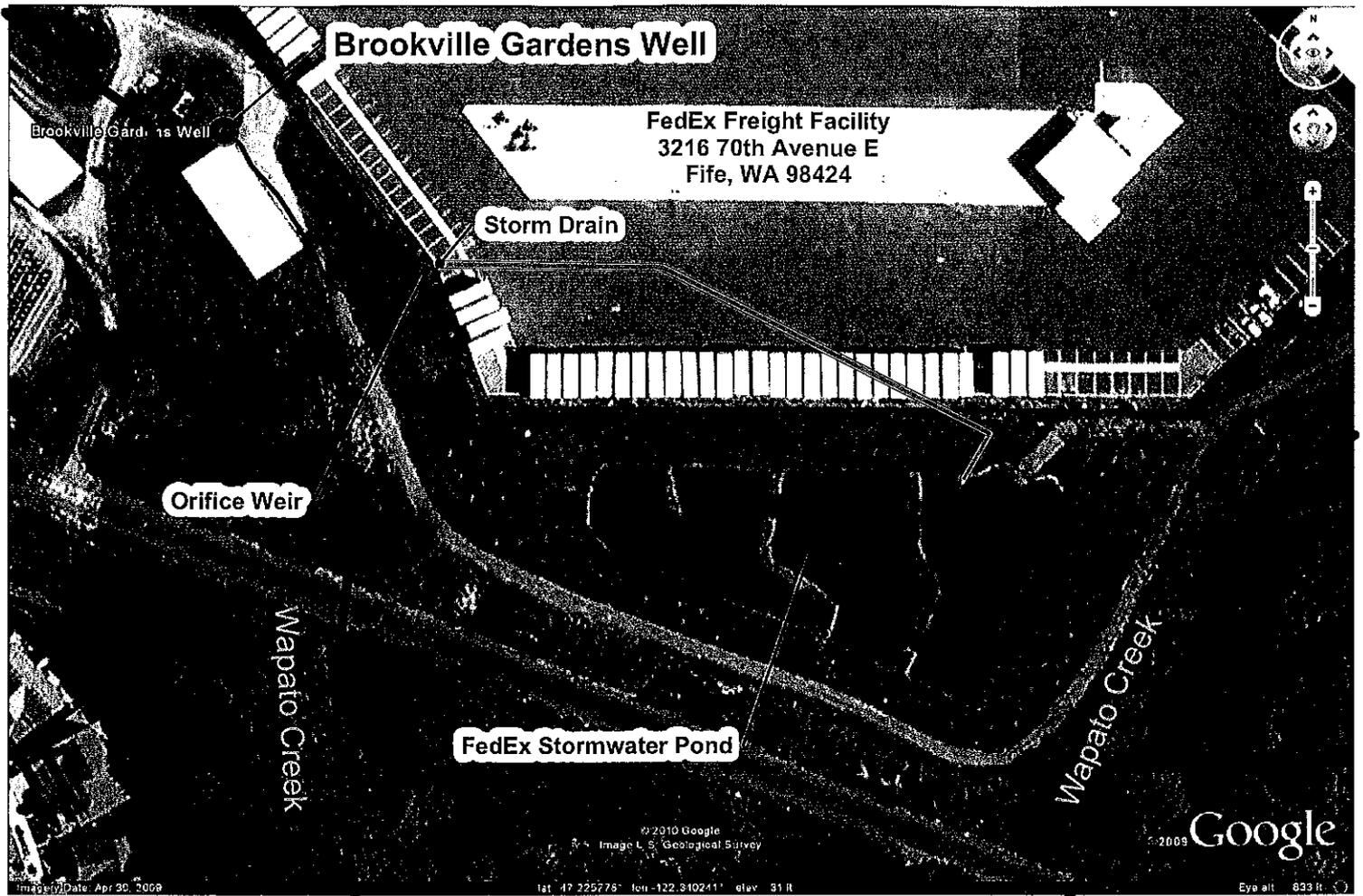
#### Step-Testing Results

The step test-based specific capacity values increased with each step, which is uncharacteristic; specific capacity values typically decrease during step-testing due to decreasing well efficiency at higher pumping rates. Rising specific capacity during a step-test could indicate that the well efficiency improves as the well-aquifer connection is developed by removal of fine-grained material at the well screen. However, the well discharge was clear, and did not indicate that well development occurred during the step-test. RH2 evaluated other natural effects on groundwater levels including Commencement Bay Tide, Puyallup River Stage and Barometric Pressure, which were plotted to examine their natural trends during the testing (**Figure 7**). The tide in Commencement Bay was rising over the course of the step-test. Tidal influence on the groundwater level could be the cause of the uncharacteristic specific capacity calculations.

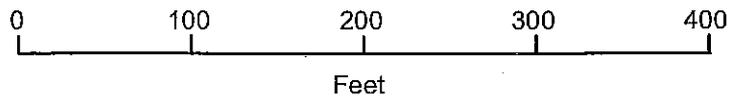
#### **Conclusions**

Based on the depth of completion and the static water level of the well, it appears that the well is completed in the confined intermediate aquifer, which is typically found at depths of 200 to 700 feet in the Lower Puyallup River Valley (RH2, 2010).

With an appropriately sized centrifugal pump and the currently installed drop tube, this well should be able to pump up to 250 gpm under all tidal conditions while limiting the drawdown to 20 feet below the TOC to avoid the potential for loss of suction and pump cavitation. If a submersible pump was installed in the well, then the pump intake could be installed deeper in the casing to allow for much higher discharge rates and eliminate any concern about tide-induced water level fluctuations.



**Figure 4**  
**Brookville Gardens Well**  
**Pumping Test Setup and**  
**Site Map**



**Legend**

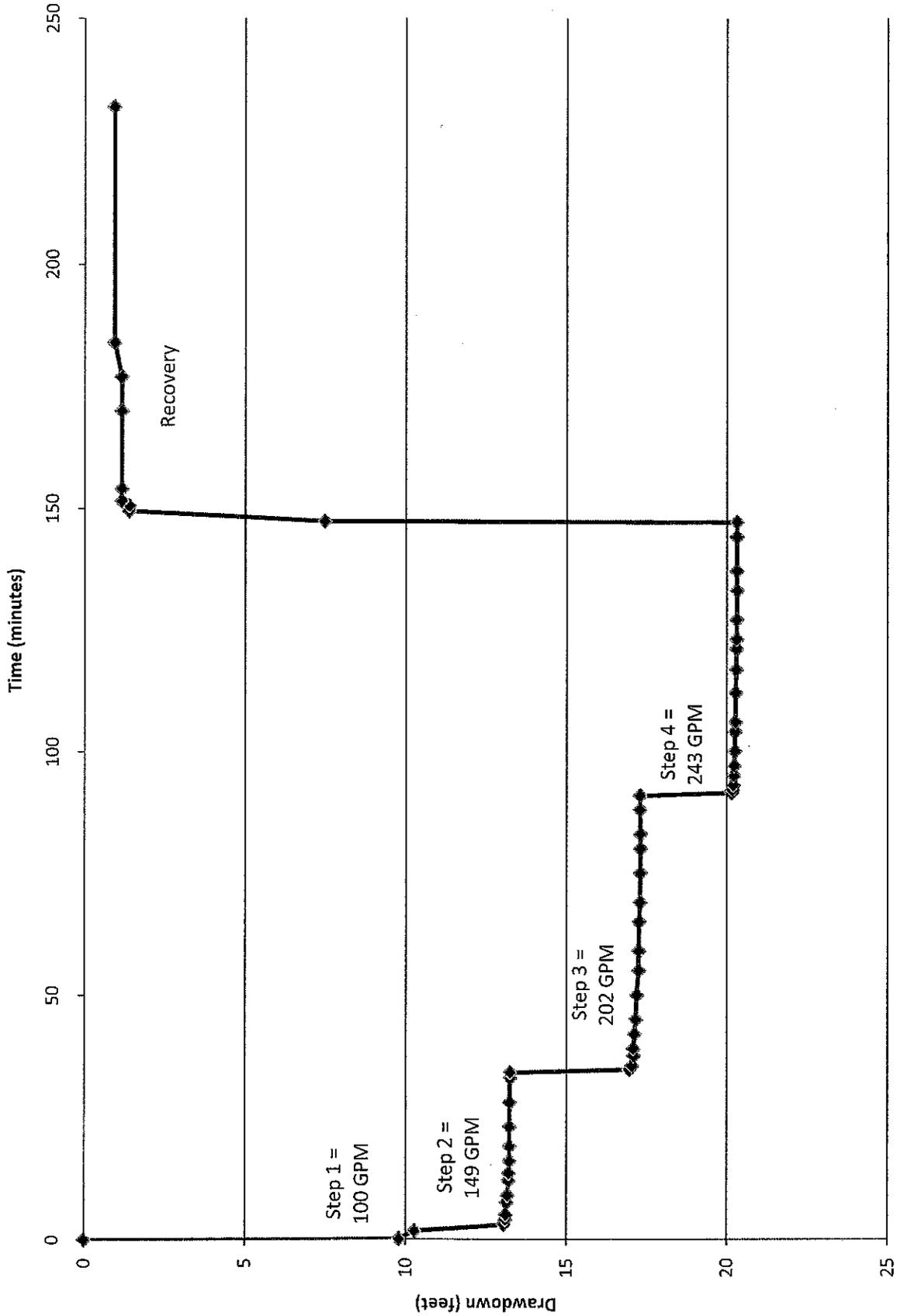
- FedEx Stormwater Pipe
- Wapato Creek
- Testing Discharge Line



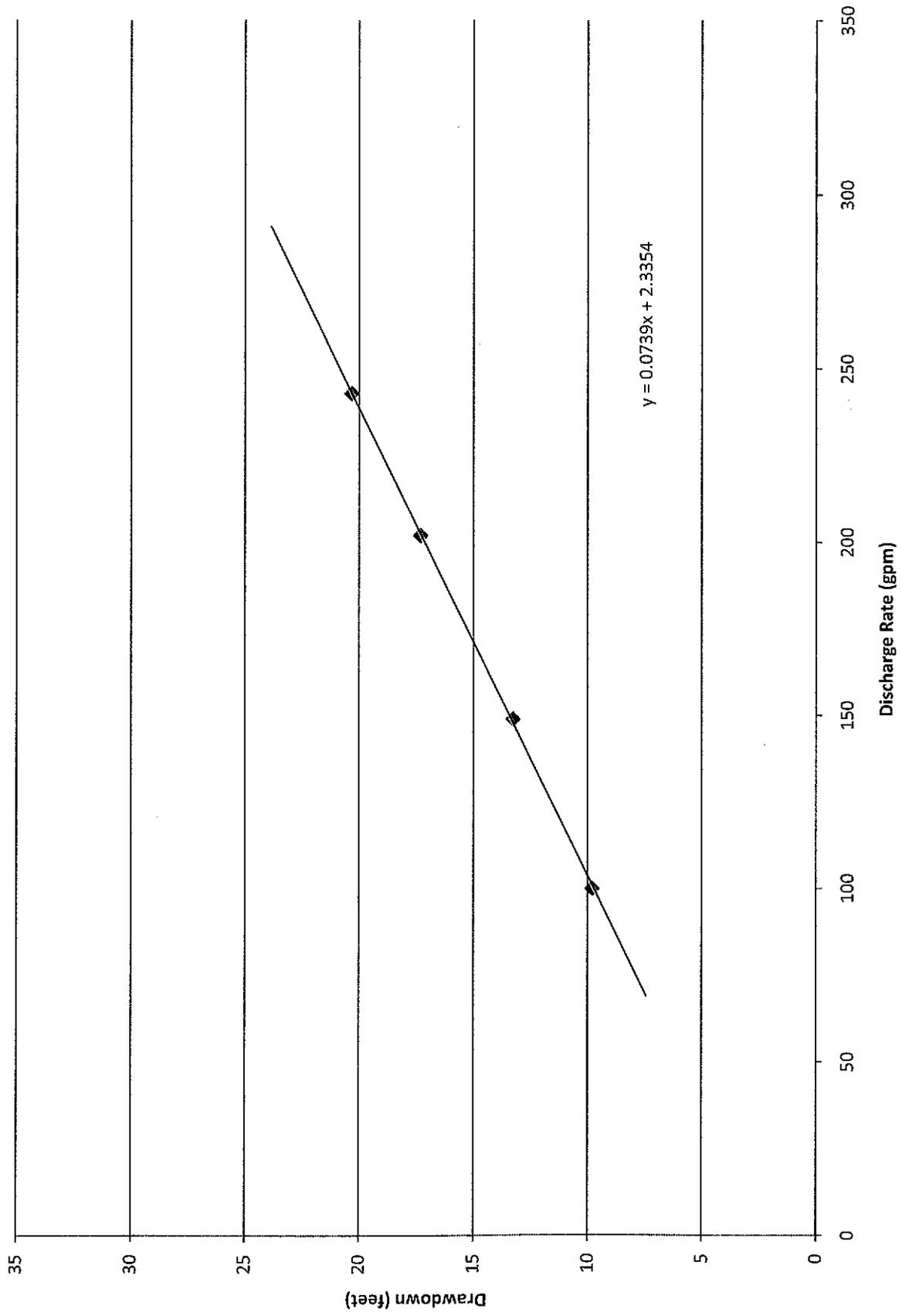
Revision Date: June 21, 2010



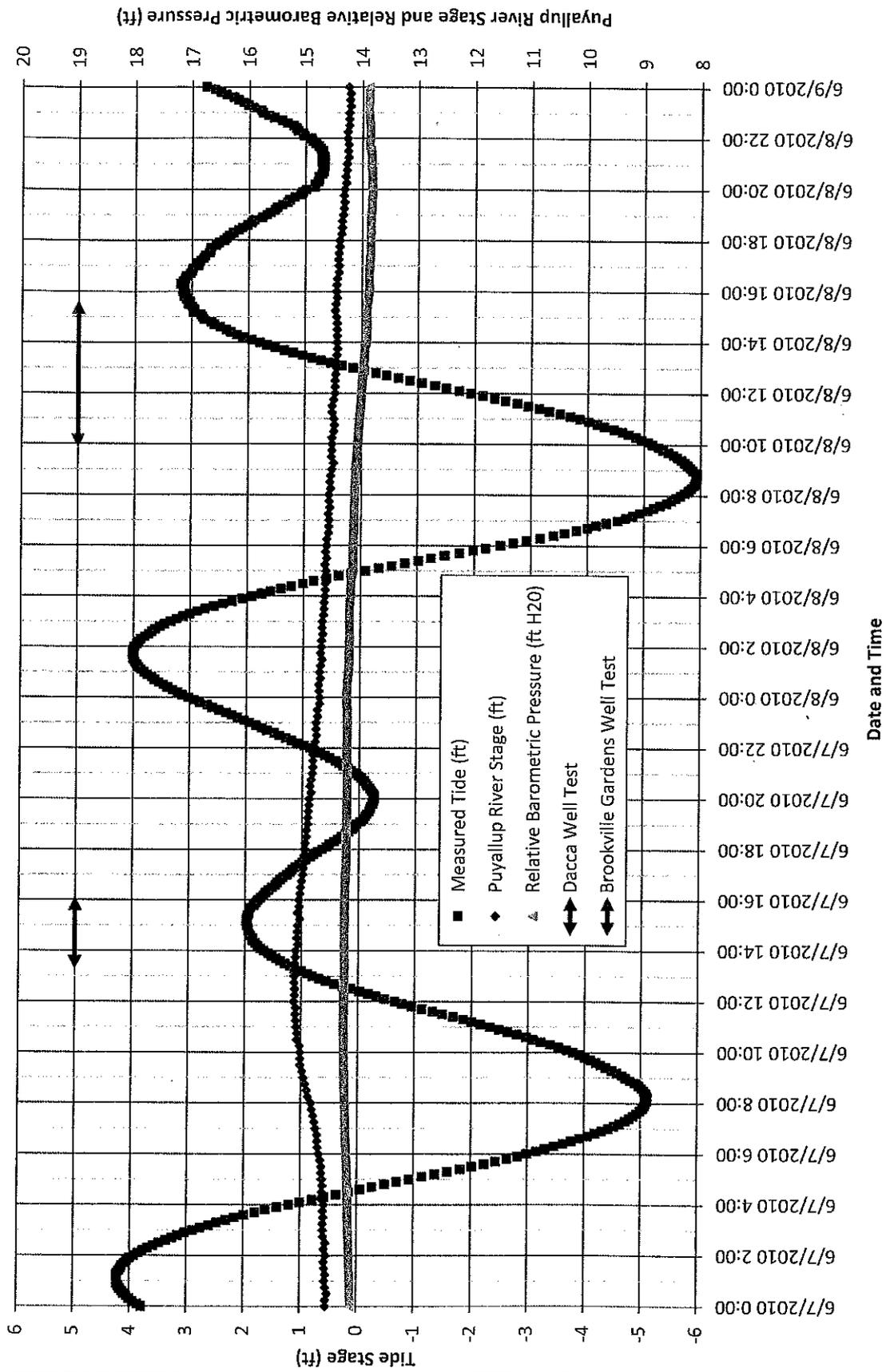
Figure 5. Brookville Gardens Step-Rate Test and Recovery



**Figure 6. Brookville Gardens Well Specific Capacity**



**Figure 7. Puyallup River Stage, Barometric Pressure, and Commencement Bay Tide During Testing**



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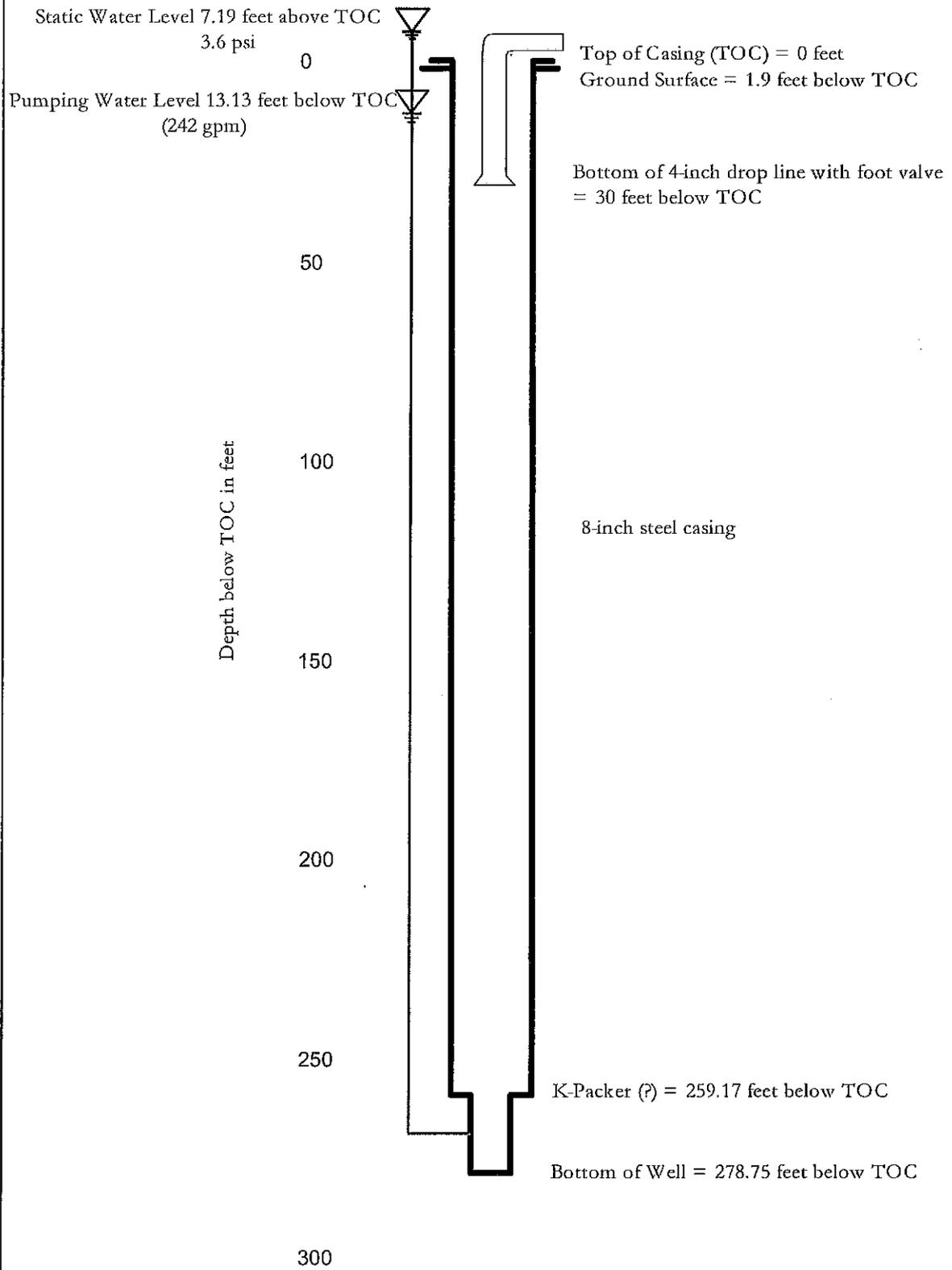




Photo 5 – Brookville Gardens Wellhead

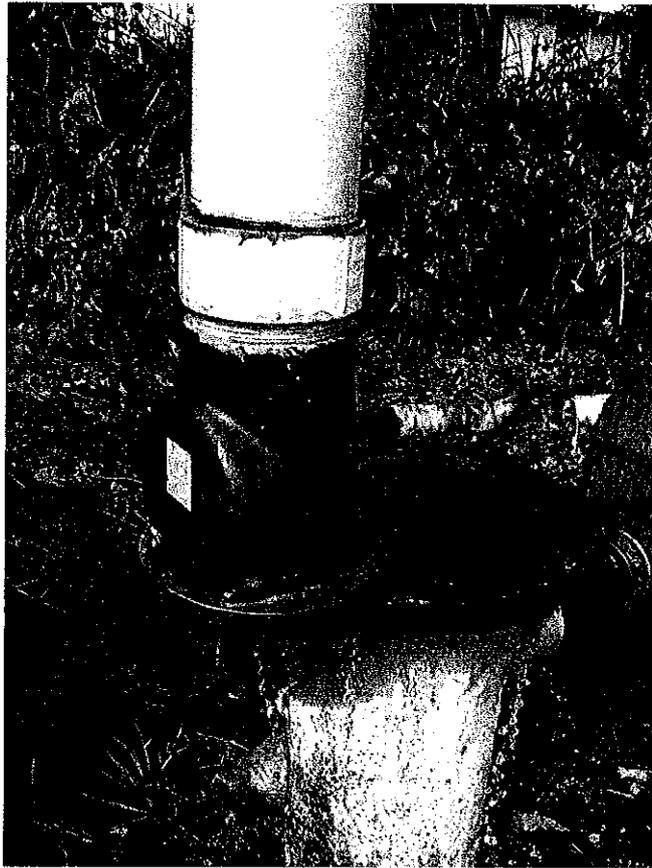


Photo 6 – Brookville Gardens Well Drop Pipe Foot Valve

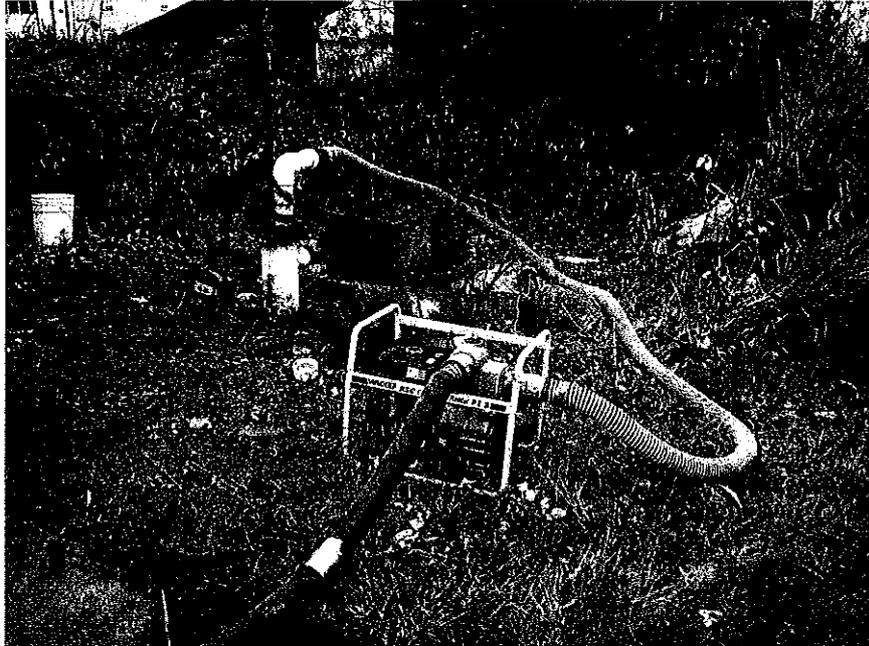


Photo 7 – Brookville Gardens Well Test Pump Setup