Attachment A

Proposed Monitoring Plan for the Stiller Pond Aquifer Recharge Pilot Project Site

Table of Contents

List of Figures

Section 1: Introduction

This section outlines a proposed monitoring plan for the Stiller Pond project (the project). This proposed monitoring plan is prepared as an addendum to the proposed Stiller Pond Local Water Plan. Site descriptions and related information are provided in the proposed Local Water Plan.

Monitoring for the project is designed to meet five basic goals. These are to evaluate:

(1) Pre-recharge surface and shallow aquifer groundwater conditions.

(2) Changes in shallow groundwater caused by factors other than those related to recharge.

(3) Changes in shallow groundwater caused by recharge (track recharge performance).

(4) Potential problems caused by recharge that may require modification of recharge operations and/or mitigation actions.

(5) Events that affect recharge operations, such as freezing or flooding.

To meet these objectives, monitoring will track:

- Source-water quality and volume coming onto the Site.
- Downgradient groundwater quality and levels, both near and distal to the Site.

The following sections present proposed monitoring locations, constituents to be sampled, sampling procedures (including QA/QC), and reporting.

Section 2: Sampling Parameters

Sampling will focus on three basic types of data: source water and groundwater quality, water volume delivered to the Site, and water level in the alluvial aquifer system at the Site. Water volumes (gallons or acre-ft) will be measured to determine how much aquifer recharge water is delivered to the Site and when. Alluvial aquifer levels will be measured in one or more wells to observe how the aquifer system is responding to recharge. Water quality data will be collected in order to evaluate potential changes in groundwater geochemistry (if any) that might be caused by the proposed project. Water quality constituents proposed for sampling in this Plan are as follows:

- Standard field parameters, including pH, electrical conductivity, and temperature
- Total nitrogen as nitrate
- Total dissolved solids (TDS)
- Hardness
- Chloride
- Orthophosphate
- Chemical oxygen demand (COD)
- Total and fecal coliform bacteria (absent/present)

This constituent list was selected to optimize routine sampling to address constituents commonly of concern (nutrients and salt) and provide indication of potential impacts by analyzing for selected constituents (nitrate and chloride) that are typically good indicators of general water quality. Additional constituents may be proposed for future sampling if the results of the initial proposed sampling indicate this is necessary. In addition, if initial sampling suggests it, the project team may propose removal of some constituents from the list proposed here. All constituents will be reported to the method detection limit for each as per normal laboratory reporting procedures.

Section 3: Monitoring Locations and Frequency

Based on the work completed to-date, two basic types of monitoring points will be used. These include:

- Source-water monitoring.
- Groundwater monitoring at the Site.

Surface water monitoring is not proposed in this monitoring plan. Based on earlier discussions in the Walla Walla Watershed Partnership Water Resources Panel, Washington Department of Fish and Wildlife staff suggested surface water monitoring down gradient of the project site would be handled by them if the project proceeds.

3.1 Source-Water Monitoring

Source-water monitoring will occur at three points; one for water quality and two for flow volumes onto the site. Water quality samples will be collected at the point of diversion (Mill Creek). This location is shown on Figure 1.

Flow volumes will be measured using flow meters installed on the pipelines that will be used to deliver water to Stiller Pond and the east field. These locations are shown on Figure 1.

Proposed monitoring frequency is as follows:

- At a minimum, flow data will be collected using a totalizing flow meter installed on the delivery pipe. Manual readings will be made whenever project personnel are on-site.
- Water quality sampling will be based on predicted annual recharge activity. We can not list these dates in this plan because actual sampling conditions will be controlled by water availability for recharge operations. A total of two sampling events are proposed for source water quality and are as follows:
    - Two weeks prior to the projected beginning of the recharge period (assuming water is available in the appropriate time frame). If the water is not available then a sample will be collected as soon as it is reasonably practicable, prior to the start of recharge.
    - Two weeks following the start of recharge.

The results of source-water quality monitoring will be used by project and Ecology staff to determine if modifications to recharge operations are warranted.

3.2 Groundwater Monitoring

Groundwater monitoring will be done to track water level changes and groundwater quality changes (if any) as a result of recharge. Water quality samples will be collected from one purpose-built well located in the southwestern portion of the Site (Figure 1). Water level data will be collected from this purpose-built well and the three existing on-site water supply wells. The

purpose-built monitoring well will be built to *WAC 173-160* monitoring well standards, and will be generally open to the upper 10 to 20 feet of the alluvial aquifer.

Proposed monitoring frequency is as follows:

- The purpose-built well will be furnished with a digital transducer and water levels in it will be measured at a minimum on a daily basis.
- Water levels in the on-site wells will be measured at least monthly via the existing airlines. Immediately before, during, and following recharge events airline water level measurements will be collected at least weekly.
- Two water quality monitoring events, in the purpose-built well, for the basic constituents defined in Section 2 are proposed as follows:
    - Two weeks prior to the projected beginning of the recharge period (assuming water is available in the well at that time). If the water is not available then a sample will be collected as soon as it is reasonably practicable, prior to the start of the recharge season.
    - Two weeks, following the start of recharge.

The results of groundwater quality and groundwater level monitoring will be used by project and Ecology staff to determine if modifications to recharge operations are warranted.

3.3 Sampling Procedures

Equipment and sampling procedures proposed for monitoring are provided in the following sections.

This section lists the equipment for groundwater monitoring:

- Submersible pump (Grundfos or similar) or dedicated bailers/sampling line.
- Temperature measuring instrument.
- pH and conductivity meter(s) with calibration reagents.
- Water level meter (0.01 foot resolution required).
- Shipping cooler with ice packs or ice.
- Five gallon pail marked at the five gallon level, stopwatch.
- Laboratory supplied sample containers with appropriate preservatives.
- Tap water, deionized water, phosphate-free soap, cleaning brushes, field note book, and log sheets.

3.3.1 Water Level

An electronic water level meter will be used to measure the depth to groundwater in the observation well to the nearest 0.01 foot. Static water levels will be measured at an indicated reference point prior to purging any water from the well. The reference points will be on the top of the well casings. Static water levels in all wells should be measured on the same day. Accumulation of sediment in the well should also be checked by lowering a weighted tape to the bottom of the well, reading the depth at the well casing's reference point, and comparing this value to the as-built well depth.

3.3.2 Decontamination

All non-disposable field equipment that may potentially come in contact with any soil or water sample shall be decontaminated in order to minimize the potential for cross-contamination between sampling intervals. Thorough decontamination of all sampling equipment shall be conducted prior to each sampling event. In addition, the sampling technician shall decontaminate all equipment in the field as required to prevent cross-contamination of samples collected in the field.

3.3.3 Purging and Field Parameters

Sufficient water will be purged to ensure that the sample collected represents water from the geological formation. Borehole volumes are calculated as the volume of water in the casing and the volume of water in the filter pack.

During purging, measure pH, temperature, and electrical conductivity of the water removed. At a minimum, these parameters are measured at the start of purging and after each successive borehole volume is removed. Temperature should be measured first because it changes most rapidly. Purging continues until at least three borehole volumes have been purged and the field parameters are established to within $\pm$ 10 percent over three consecutive measurements. At this point, the observation well is considered adequately purged and can be sampled.

All field instruments should be calibrated per manufacturer instructions prior to sample collection. Instrument calibration and maintenance should precisely follow the manufacturers recommended procedures. Electrical conductivity and pH standards used to calibrate the instruments should be within the range encountered at the monitoring sites. Calibration records should be recorded on the sample collection forms.

3.3.4 Sampling

Samples will be collected after sufficient water has been purged according to the procedure described above. If a pump is used, samples will be collected from the discharge end of the pump hose after the flow rate has been reduced to less than approximately 0.2 gallons per minute. If a bailer is used it will be controlled to minimize agitation and aeration. Sample containers should be sealed with tape, labeled, and immediately placed in a cooler with ice. Sample containers should be filled completely to eliminate head space. Sample containers should be provided by the analytical laboratory and should be requested at least one week in advance of the sampling. The containers should be appropriate for the parameters analyzed and all shipping coolers should have chain-of-custody seals placed on them prior to shipping.

One additional sample should be collected from one of the sample points for quality control purposes. This sample should be evaluated as a “blind duplicate.”

Samples should be stored immediately after collection in an ice chest containing sufficient ice to cool the samples to 4 degrees Celsius (°C). Use *“blue ice”* if possible. If water ice must be used, the ice should be sealed in plastic bags, as should the sample bottles. Samples should remain cooled at 4°C and delivered to the laboratory within 24 hours of collection. Sample receipt at the laboratory must be sooner if analysis includes parameters with a shorter holding time. Care should be taken to prevent excessive agitation of samples or breakage/leakage of containers. Samples should be analyzed within the specified holding time for each constituent.

3.3.5 Chain of Custody and Sample Handling

A chain-of-custody form should be completed and signed by the sampler on the day samples are collected. The chain-of-custody form must be signed by laboratory personnel upon receipt and any other individuals that maintain custody of the samples in the interim. Coolers should be sealed and shipped or driven to the lab as soon as possible. The method of shipping, (bus, next day air, etc.) is usually determined by the parameter having the shortest holding time. In any case, shipping times of more than 24-hours should not be used, as the cooler(s) may warm and compromise sample quality.

3.3.6 Field Records and Data Validation

All field notes, analytical results, and other pertinent data associated with the project should be maintained in a secure location and be archived for at least a five year period. Data validation for both field and lab Quality Assurance and Quality Control (QA/QC) will be performed using a checklist. All pertinent information with respect to QA/QC will be checked.

The following items are included on the QA/QC review checklist:

- Field data sheets (or notebooks) and observations (observations are used to check for potentially erroneous data) will be reviewed to make sure they are completely filled out.
- Chain-of-custody forms will be completed, being signed by all sample handlers.
- Holding times for all constituents will be met.
- Field-blind-duplicate results will be evaluated to make sure they are compatible.

Laboratory method blanks, matrix spike, matrix spike duplicates, and surrogate percent recovery data supplied by the analytical laboratory will be evaluated to make sure they are compatible.

3.4 Data Reporting and Analysis

The following procedures for reporting analyses are proposed for this project.

3.4.1 Record Keeping

All field notes, laboratory results, critical calculations, and published reports will be maintained by the project team during the project. Following the project, copies of this material will be maintained by Walla Walla County. If possible, both paper and electronic copies will be maintained.

3.4.2 Evaluation

Monitoring data and observations should be evaluated when they are received from the sampler and laboratory. Materials to be received include:

- Field monitoring and sample collection records.
- Original laboratory reporting sheets.

Data evaluation will include:

- Verification of analytical methods and detection limits, along with the date the analysis was performed.
- Review of document handling, sampling and analytical problems, and actions taken to correct any problems.
- Summarizing water level data in tabular and/or graphical form.
- Summarizing water quality analytical results in tabular form and/or graphical form.
- Performing data validation checks, as appropriate to the data set.
- Identifying any significant increases in parameter concentrations.

Section 4: Reporting

All monitoring activities performed during the recharge season will be included in a report approximately two months following the end of the recharge season. This report will present the following monitoring information:

- Water quality data, including duplicate sample results in tabular form and time-series plots for specific parameters.
- Water level data, including hydrographs, showing water level changes over time.
- Basic statistical parameters for each parameter of interest: Mean, median, maximum, minimum, standard deviation, number of data points, and number of non-detects.
- Evaluation of field and laboratory data, including observed changes and groundwater flow direction and gradient.
- Discussion and conclusions, including recommended changes to recharge operations.

The methods needed to evaluate water quality and water level data will depend on the objectives of the evaluation. In general, the principal objective is, to evaluate whether or not recharge has affected groundwater levels and quality. Evaluation methods include:

- A comparison of water quality data with a concentration limit or with background water quality.
- Comparison of water quality, over time.
- Comparison of water quality between source-water and the downgradient well.

For the Site, it is anticipated that insufficient data will be available for statistical analysis until late in the project. Until that time, evaluation of data set trends will be solely qualitative, with the data being reevaluated after each sampling event.