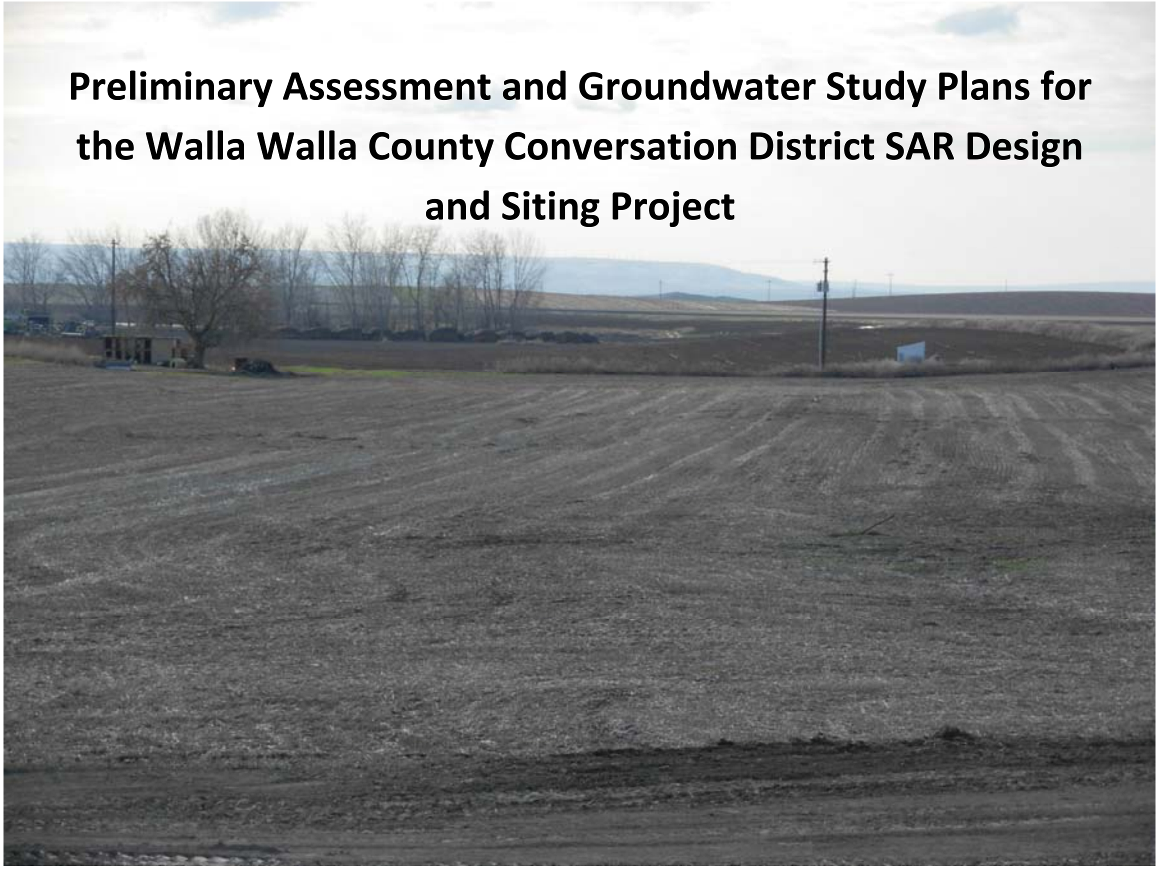
Preliminary Assessment and Groundwater Study Plans for the Walla Walla County Conversation District SAR Design and Siting Project



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Executive Summary

Three project areas were evaluated in the area between Touchet, Washington and Walla Walla, Washington for their SAR potential. These evaluations were based on existing data and information and limited reconnaissance. The three project areas are the: (1) Westside and Eastside areas adjacent to the Touchet River near Touchet, Washington, (2) Old Lowden and Bergivin-Williams Ditch areas near Lowden, Washington, and (3) Still Pond near the confluence of Mill Creek with the Walla Walla River. Project goals, potential work scope, and paths forward for each of these project areas differ between these project areas.

The basic goal of an SAR project in the Westside and Eastside project area is to offset the possible loss of alluvial aquifer recharge resulting from the recent conversion of the Westside and Eastside Ditches to piped systems. Given the general lack of background groundwater level, flow direction, and geochemistry in the project area the impact of this piping project are difficult to characterize, including impacts on Touchet and Walla Walla River baseflows and alluvial aquifer water level.

To move a Westside and Eastside project forward some baseline data collection would be useful in defining the impacts of the piping projects, identifying specific areas when an SAR project, or projects, would be effective in meeting possible goals, and scoping an SAR project. Also, meeting with well owners/operators and land owners in the project area would be important to defining past and present hydrologic conditions, the need for potential SAR project, and identifying sites where projects could be implemented. With site selection, specific project plans for water delivery, monitoring, operations, and permitting could be developed and implemented.

The basic goal of an SAR project in the Old Lowden and Bergivin-Williams project area would be to offset the possible loss of alluvial aquifer recharge resulting from planned conversion of these ditch systems to piped systems. Given the general lack of background groundwater level, flow direction, and geochemistry in the project area there currently is no baseline with which to measure if the conversion to piping is built. This will make it difficult to characterize impacts to wells and the Walla Walla River resulting from the proposed piping projects.

The first step in moving a potential Old Lowden and Bergivin-Williams SAR project forward is to collect baseline data so that the impact of piping on the alluvial aquifer can be assessed and SAR actions (or project) designed to address those impacts. At the same time meetings with well owners and landowners would be important to defining past and present hydrologic conditions and identifying potential project locations. At such time as a specific SAR project(s) are identified in the project area specific plans for water delivery, monitoring, operations, and permitted could be developed and implemented.

The goal of an SAR project at the Stiller Pond site is to use SAR to enhance alluvial aquifer water levels to support groundwater pumping under an existing water right and leave water in the aquifer for potential baseflow augmentation on the nearby Walla Walla River. Unlike in the other two project areas specific

site location, layout, and operations are generally well understood. Work at the Stiller Pond project area should focus on characterization, monitoring, and planning need to start an SAR project in late 2010. With development and complementation of a monitoring, operations, and permitting plan a Stiller Pond Project could be up and running as early as the winter of 2010/2011.

Contents

Introduction

The purpose of this report is to present an initial assessment of groundwater conditions and preliminary goals, project scope, data needs, and recommended paths forward for several potential alluvial (or shallow) aquifer recharge sites located near the Walla Walla River west of Walla Walla, Washington. The locations of the sites, or project areas, discussed in this report are shown on Figure 1 and include:

1. Westside Ditch area and Eastside Ditch Area near Touchet, Washington.
2. The area adjacent to Old Lowden Ditch and Bergivin-Williams Ditch, near Lowden, Washington.
3. Stiller Pond, located east of Lowden, Washington.

This report is subdivided into several main sections that describe: (1) the basic physical, physiographic, geologic, and hydrogeologic settings of these project areas, (2) preliminary conceptual SAR study plans for each project area, which include goals, scope, data needs, and a path forward for each, and (3) recommendations for future work. This report is based on a review of existing information and data, and limited on-site reconnaissance.

The work discussed in this report was done by GSI Water Solutions, Inc. (GSI) for the Walla Walla County Conservation District (WWCCD) under a task order from the Walla Walla Basin Watershed Council (WWBWC). The funding source for the work is the Washington Department of Ecology (Ecology) and the funding was provided to WWBWC as the result of a grant request to Ecology from WWCCD. GSI's project manager and lead hydrogeologist for this project is Dr. Kevin Lindsey, LHg. This report is designed to meet the deliverable requirements for Task 1 of GSI's Task Order #8 with the WWBWC, and WWCCD's grant agreement with Ecology.

Site Settings

The purpose of this section is to describe the basic physical, physiographic, geologic, and hydrogeologic settings of the different potential project areas. These descriptions are based on surface reconnaissance of each area, existing geologic and hydrogeologic information describing these areas, and other relevant information we found in the course of doing this assessment.

Westside and Eastside Area

The Westside and Eastside project area is shown on Figure 2 and generally lies in close proximity to the route of two former irrigation canals generally referred to as the Westside Ditch and Eastside Ditch. The Westside area is more properly referred to as Touchet West Irrigation District #5, the Eastside area as Touchet East Irrigation District #5. Both of these routes are now occupied by piped water distribution systems which replaced the former open ditches. The basic goal of one or more SAR projects in this area would be to replace potential infiltration to the shallow groundwater system lost as a result of piping the ditches. Such SAR projects would mitigate for the potential loss of groundwater recharge and base flow to nearby streams resulting from piping of the formally unlined ditches.

Physiographic Setting

Both irrigation systems are supplied by water diverted from the Touchet River (Figure 2). In both cases water is pumped from the river into the pipe system in which it is then delivered to users. This piped system replaced an unlined, gravity driven ditch/canal distribution system. Basic information about these two systems is as follows:

- The diversions for both systems are north (up-stream) of the Town of Touchet, with the Westside Diversion (Figure 3) approximately 3 miles and the Eastside Diversion approximately 2.7 miles north of town.
- Combined, the total area served is 1,973 acres, with a historical maximum water right of 28.5 cfs.
- The two systems are not operated between mid-December and mid-March.
- The Eastside system tails out into fields along Highway 12, east of Touchet. The Westside system tails out into fields near Byrnes Road, west of Touchet and south of highway 12 (Figure 12).
- Multiple landowners use water delivered by these two systems.

Both systems generally follow the contours of the valley floor (Figure 2) and the low hills bordering the Touchet River valley, flowing from north to south. The Westside Ditch lies to the west of the Touchet River and the distance between it and the Touchet River increases as the flood plain widens from north to south. The Eastside Ditch also becomes further away from the Touchet River with the north to south widening of the flood plain and lies to the east of the Touchet River. The Walla Walla River serves as the southern boundary for this project area.

Hydrogeologic Setting

The project areas on both sides of the Touchet River are underlain by variable thicknesses of several suprabasalt sedimentary units which in turn rest unconformably upon continental flood basalt of the Columbia River Basalt Group (CRBG). Given the focus of the potential SAR projects in this project area, this section focuses solely on suprabasalt sediment geology and hydrogeology. This section is meant as a review of this hydrogeologic setting and is derived from recent work described in GSI (2007) and earlier work found predominantly in Newcomb (1965). The reader is referred to these reports if more detailed information is desired.

Using the terminology developed in GSI (2007), the suprabasalt sediment geologic units in the Westside/Eastside project areas consist of two Quaternary units, the fine unit and the coarse unit; the Mio-Pliocene upper coarse unit; and the Mio-Pliocene fine unit. Basic observations about these units in the project area are summarized below.

Quaternary coarse unit – This unit is found predominantly underlying the Touchet River flood plain and extends downstream from the areas of the diversion structures to the area underlying the Town of Touchet. Along the modern channel of the Touchet River, and within the modern flood plain, this unit is found several feet to several tens of feet below ground surface (bgs). The unit consists predominantly of un-cemented silt, sand, and gravel deposited by the Touchet River and possibly the Walla Walla River in the recent geologic past (last 10,000 years). It commonly hosts groundwater beneath the flood plain and generally is not present beneath the hills bordering the flood plain.

Quaternary fine unit – Laterally equivalent to and older than the Quaternary coarse unit, the Quaternary fine unit comprises fine grained (clay, silt, and sand) deposits on the modern Touchet River flood plain and the hills bordering the Touchet River valley. On the fringe of the flood plain, adjacent to the hills bordering the Touchet River valley, these deposits can be several tens of feet thick as shown in a recently drilled geologic log for WWBWC monitoring well # GW 126 (Figure 4). On the hills bordering the Touchet River flood plain the Quarternary fine unit consists of interbedded silt and sand of the Touchet beds. Quarternary fine deposits along the Touchet and Walla Walla Rivers are essentially reworked Touchet bed deposits. Although the unit may be saturated, where it is, its hydrologic properties generally are such that groundwater moves through it very slowly.

Mio-Pliocene upper coarse unit – This unit consists predominantly of variably indurated, slightly muddy to muddy, basaltic sand and gravel (conglomerate) with interbedded clay. It is the primary host unit for the suprabasalt (or alluvial) aquifer system. Hydrologic properties inherent in this unit are variable because of the wide range of lithologies and induration found within it. Hydraulic conductivities of 10's to 100's of feet/day should be expected. In the vicinity of the Westside-Eastside project areas the unit ranges from 0 to approximately 270 feet thick.

Mio-Pliocene fine unit – The Mio-Pliocene upper coarse unit is underlain by a sequence consisting predominantly of weakly indurated claystone and siltstone assigned to the Mio-Pliocene fine unit (also referred to as the old clay, or blue clay). Although not impermeable, these strata likely have significantly lower permeability than overlying strata, and functionally form the base of the alluvial aquifer system. In this project area, these strata lie at depths of approximately 25 to 300 feet bgs, generally deepening from north to south.

Depth to groundwater, groundwater flow direction, and gradient in the alluvial aquifer system in this project area is very difficult to deduce because of a lack of up-to-date data. However, based on the small amount of modern data currently available and a limited amount of historical data, the following basic inferences are made.

- Depth to water in the alluvial aquifer system may be as deep as 40 to 50 feet, and as little as 5 to 10 feet (or even less). Depth to groundwater is inferred to increase with distance from the river, being deeper beneath the hills bordering the Touchet and Walla Walla River valleys, and decrease as one get closer to these streams. In addition, water has been periodically observed on the surface in the lower end of the Westside system near Highway 12. It is not known if this water is an expression of a shallow, continuous water table or localized perched water.

- With respect to groundwater flow direction, two basic flow regimes are expected in the project area, although little direct evidence for them is currently available.
  - One portion of this groundwater flow system would be associated with the Touchet River valley where the valley is incised into basalt bedrock, generally in the area north of the Pheasant Ridge Golf Course. In this area, groundwater flow in the alluvial aquifer system generally would be north to south, down the stream valley and into the area north of Touchet where it would merge with the much larger Walla Walla River alluvial aquifer system.
  - The portion of the alluvial aquifer system associated with the Walla Walla River valley generally would be flowing east to west in the project area. This system is inferred to be larger than that associated with the Touchet River and the transitions between the two generally lies in the vicinity of Touchet.
- Groundwater gradient – Without reliable, contemporaneous water table measurements it is difficult to estimate water table gradient. At this time we are not able to produce a reliable gradient estimate, although it seems likely it ranges from 5 to 20 feet/mile.

Old Lowden and Bergivin-Williams Area

The Old Lowden and Bergivin-Williams project area, shown on Figure 5, generally lies in close proximity to the two irrigation canal systems of the same names. Plans currently are being developed to convert these ditch systems to piped systems. The basic goal of one or more SAR projects in this area would be to replace infiltration to the shallow groundwater system potentially lost as a result of this conversion.

Physiographic Setting

Both irrigation systems are supplied by water diverted from the Walla Walla River (Figure 5). In both cases water is pumped from the river into the main delivery canals in which it is then delivered to users. Basic information for these two systems is as follows:

- As currently configured the Bergivin-Williams systems starts approximately 3.25 miles east of the unincorporated Town of Lowden and serves 1098 acres. This system tails out into the Old Lowden Ditch system approximately 1 mile east of Lowden (Figure 5).
- The Old Lowden Ditch system, which starts approximately 1.25 miles east of Lowden, serves approximately 1037 acres, primarily located west of Lowden. This system tails out into fields north of Highway 12 and west of Woodward Canyon Road (Figure 5).
- Historic diversions for the Bergivin-Williams and the Old Lowden systems are 10.24 cfs and 9 cfs, respectively.
- Multiple landowners use water supplied by these two irrigation systems.

Both of these systems are north of the Walla Walla River, which forms the southern boundary of this project area. The main Bergivin-Williams Ditch follows the contours of the Walla Walla River flood plain along the base of the low hills defining the northern boundary of the flood plain. The Old Lowden Ditch also follows the contours of the valley floor and the low hills bordering the Walla Walla River valley north of the Walla Walla River (Figure 6 and 7). Dry Creek flows through this project area from the northeast and empties into the Walla Walla River southwest of Lowden (Figure 5).

Hydrogeologic Setting

The Old Lowden and Bergivin-Williams project area is underlain by variable thicknesses of several suprabasalt stratigraphic sedimentary units which in turn rest unconformably of the CRBG. Given the focus of potential SAR projects in this area, this section focuses solely on suprabasalt sediment geology and hydrogeology. This section is meant as a review of this hydrogeologic setting and is derived from recent work described in GSI (2007) and earlier work found predominantly in Kennedy/Jenks (2004) and Newcomb (1965). The reader is referred to these reports if more detailed information is desired.

Using the terminology developed in GSI (2007), the suprabasalt sediment geologic units in this project area consists of two Quaternary units, the fine unit and the coarse unit; the Mio-Pliocene upper coarse unit; and the Mio-Pliocene fine unit. Basic observations about these units in the project area are summarized below.

Quaternary coarse unit – This unit is found predominantly underlying the Walla Walla River flood plain and extends the full length of the project area. Along the modern channel of the Walla Walla River, and beneath the modern flood plain, this unit is found several feet to several tens of feet bgs. The unit consists predominantly of uncemented silt, sand, and gravel deposited by the Walla Walla River in the recent geologic past (last 10,000 years). It commonly hosts groundwater beneath the flood plain.

Quaternary fine unit –This unit consists of fine grained (clay, silt, and fine sand) deposits on the modern Walla Walla River flood plain and the adjacent hills. In the hills these fines consist predominantly of interbedded silt and sand of the Touchet Beds, and typically are over 40 feet thick. On the flood plain the Quaternary fine unit consists of reworked Touchet Bed silt and sand deposited by Walla Walla River flood waters. These flood deposits are thin (<1 to 5 feet thick) near the Walla Walla River, and thickening towards the edge of the valley floor. Alkali hardpans have been described in these flood plain deposits, especially under low terraces north of the warm river channel (SCS, 1964). These hardpans have been shown to have very low permeability and water commonly accumulates on the ground surface atop them. Although the Quaternary find unit may be saturated, hydrologic properties generally are such that groundwater moves through it very slowly.

Mio-Pliocene upper coarse unit – This unit, which consists of variably indurated, slightly muddy to muddy, basaltic sand and gravel (conglomerate) with interbedded mud, is the primary host unit for the suprabasalt (or alluvial) aquifer system in the project area. Hydrologic properties inherent in this unit are variable because of the wide range of lithologies and induration found within the unit. Hydraulic conductivities of 10's to 100's of feet/day should be expected. In the vicinity of this project area the unit ranges from 0 to 147 feet thick, thickening from the north to the south.

Mio-Pliocene fine unit – The Mio-Pliocene upper coarse unit is underlain by a sequence consisting predominantly of weakly indurated claystone and siltstone assigned to the Mio-Pliocene fine unit (also referred to as the old clay, or blue clay). Although not impermeable, these strata likely have significantly lower permeability than overlying strata, and functionally form the base of the alluvial aquifer system. In this project area, these strata lie at depths of 48 to 187 feet bgs, generally deepening to the south.

Depth to groundwater, groundwater flow direction, and water table gradient in the alluvial aquifer system in this project area is difficult to deduce because of a lack of up-to-date data. However, based on the small amount of modern data currently available and a limited amount of historical data, the following basic inferences are made.

- Depth to water – Depth to water in the Old Lowden and Bergivin-Williams project area averages 25 feet bgs, with groundwater commonly being shallower near the Walla Walla River and in area where shallow hardpans are well developed. Beneath the hills bordering the Walla Walla River depth to water typically exceeds 50 feet.
- Groundwater flow direction – The general direction of groundwater flow beneath the study area east of Lowden likely is from east to west. West of Lowden, where Dry Creek enters the project area, it seems likely that flow direction will change from largely east to west, to northeast to southwest, following the change in valley orientation and the possible influence of groundwater moving down the Dry Creek valley. These projections are largely speculative and one should expect variations in local groundwater flow that reflect the proximity of surface water, changes in substrate, and impacts from water well pumping and seepage from irrigated fields and irrigation canals such as Old Lowden and Bergivin-Williams.
- Groundwater gradient – With the data currently in-hand, estimating a gradient for the alluvial aquifer system is problematic at best. From what has been compiled, it appears the gradient in the general project area ranges from 5 to 25 feet/mile, possibly averaging in the range of 10 to 15 feet/mile.

Stiller Pond Area

The Stiller Pond project area (Figure 8) generally lies in and immediately east of an intermittent pond locally referred to as Stiller Pond. Historically, water reached Stiller Pond via a ditch that carried water from Mill Creek to the Pond. This ditch was recently converted to a piped system. Anecdotal evidence indicates Stiller Pond would go dry when water delivery was shut off. The basic goal of an SAR project in this area would be to replace infiltration to the groundwater system lost as a result of piping the ditch, and to use Stiller Pond as a recharge location.

Physiographic Setting

Stiller Pond lies in a shallow swale on the edge of the hills bordering the north side of the Walla Walla River flood plain approximately 5.5 miles east of Lowden (Figure 9). This swale is located between the right-of-ways of old Highway 12 and new Highway 12. The western end of the swale is crossed by a dike that serves to hold water in the Pond when it is filled. Stiller Pond lies north of Mill Creek and the Walla Walla River. Mill Creek flows past the project area from the northeast and empties into the Walla Walla River southwest of the Pond (Figure 8).

Water is pumped from Mill Creek to the project area via a buried pipe that supplies water to an irrigation system on either side of the new Highway 12 right-of-way. This piped system also supplies water to the Pond. Water also is supplied to the project area from three water supply wells open to the alluvial aquifer underlying the project area. These wells (from west to east) are 165, 155 and 147 feet deep. Historically, well log information indicates that these wells have yields of 180, 423 and 250 gallons per minute (gpm) respectively. Currently they are reported to supply no more that a combined total of 350 gpm.

Basic information about the system as it is currently configured is as follows:

- The diversion point off Mill Creek is located on the north bank of the creek, approximately 0.4 miles east of Last Chance Road. The pipeline extends approximately 0.9 miles west to the project area (Figure 8).
- The eastern half of the project area consists of several tens of acres of cropland that is currently undergoing the transition to organic operations (Figure 8).
- The Pond, which covers much of the western portion of the project area, has an area of approximately 8 acres, and appears to have an average maximum depth of 4 to 5 feet when full.
- The pipe that delivers water to the project area is permitted to deliver a maximum of 996 gpm between October 1 and April 1, and a minimum of 100 gpm between June 15 and October 1.
- It is understood that at one time there were irrigation water rights assigned to Stiller Pond for use as both a storage location and a point of diversion.

Hydrogeologic Setting

The hydrogeologic setting of the Stiller Pond area is similar to that seen just to the west in the Old Lowden and Bergivin-Williams project areas, with the exception that the Quaternary coarse unit is not present. The Stiller Pond project area is underlain by the Quaternary fine unit, the Mio-Pliocene upper coarse unit, and the Mio-Pliocene fine unit. Basic observations about these units in the project area are summarized below.

Quaternary fine unit – The uppermost unit in the Stiller Pond area, this unit consists of fine grained (clay, silt, and sand) deposits. They are inferred to primarily be water lain and wind deposited materials derived from the Touchet Beds that comprise hills immediately to the North of the project area. Based on driller's logs for the three wells noted above, this unit ranges between approximately 10 and 20 feet in thickness in the project area.

Mio-Pliocene upper coarse unit – In the vicinity of Stiller Pond the Quaternary fine unit is underlain by gravel and conglomerate assigned to the Mio-Pliocene coarse unit. This unit consists predominantly of indurated, slightly muddy to muddy, basaltic sand and gravel (conglomerate) and interbedded mud and it is the primary host unit for the suprabasalt (or alluvial) aquifer system. Hydrologic properties inherent in this unit are variable because of the wide range of lithologies and variable induration found within it. Crude data from step draw down pumping tests yielded estimated specific capacities, transmissivities and hydraulic conductivities of 2.8 gpm/ft, 8771 ft^2/day and 68 ft/day for the middle well and 4.6 gpm/ft, 24,738 ft^2/day and 177 ft/day for the west well respectively. In the vicinity of this project area, the Mio-Pliocene coarse unit ranges from approximately 40 to 160 feet thick, and well logs suggest it contains several thick muddy interbeds.

Mio-Pliocene fine unit – Like the other projects, the Mio-Pliocene upper coarse unit on the Stiller Pond area is underlain by a sequence consisting predominantly of weakly indurated claystone and siltstone assigned to the Mio-Pliocene fine unit (also referred to as the old clay, or blue clay). Although not impermeable, these strata likely have significantly lower permeability than overlying strata, and functionally form the base of the alluvial aquifer system. In the Stiller Pond project area, these strata lie at depths of approximately 140 to 150 feet.

Depth to groundwater, groundwater flow direction, and groundwater gradient in the alluvial aquifer system in this project area is very difficult to deduce because of a lack of up-to-date data. However, based on the small amount of modern data currently available and a limited amount of historical data, the following basic inferences are reached.

Depth to water – Historically, depth to water in the Stiller Pond project area may have been as little as 10 to 15 feet. More recently anecdotal evidence from the well operator suggests a depth to water of 20 to 25 feet. However, static water levels taken at the times of the above mention step draw down pumping tests were both 25 feet bgs in January and April 2009. As indicated in Table 1, recent airline water levels taken on March 4, 2010 and April 1, 2010 were significantly different between all three wells. Pumping was not under way at the time at which these measurements were taken.

East Well			Middle Well			West Well		
Date	DTW (fee	WT	Date	DTW	WT	Date	DTW	WT
9/8/1970	13	620	4/18/1968	11	616	4/17/1974	15	612
3/4/2010	81	552	4/6/2009	25	602	1/13/2009	25	602
4/1/2010	41	592	3/4/2010	89	538	3/4/2010	71	556
6/11/10	44	589	4/1/2010	43	584	4/1/2010	43	584
			6/11/2010	82	545	6/11/2010	59	568

- Groundwater flow direction – The general direction of groundwater flow through the greater study area probably is from the east-northeast to the west-northwest, following the general orientation of the Walla Walla River valley. However, the water table information in Table 1 suggests localized groundwater flow beneath the Stiller Pond Area could be to the northwest.
- Groundwater gradient – With the data currently in-hand, estimating a gradient for the alluvial aquifer system is problematic at best. From what we have compiled, it appears the gradient in

the general project area ranges from 5 to 25 feet/mile, possibly averaging in the range of 10 to 15 feet/mile.

Conceptual SAR Study Plans for the Proposed Project Areas

The purpose of this section is to outline the basic goals, potential scope, probable data needs, and a general path forward for potential SAR projects in the project areas described herein. This discussion is meant to provide guidance for more detailed planning for these potential projects.

Westside and Eastside Project Area

Basic Goals

If declines in alluvial aquifer water levels are observed in this project area as a result of the recently completed piping projects, SAR is one way to mitigate for those. One or more SAR projects could be implemented in this project area to offset the possible loss of alluvial aquifer recharge resulting from the conversion of the Westside Ditch and Eastside Ditch to piped systems. The goals of such projects, if built, would be to elevate alluvial aquifer water levels to: (1) increase the supply of cool temperature baseflow to the Touchet River in the summer and early autumn and (2) improve static water levels in shallow alluvial water wells.

Potential Scope

A potential SAR project, or projects, in the Westside and Eastside project area might generally include the following components:

1. Water supply would be from the Touchet River via one or both of the piped systems. This water most likely would be supplied during the late winter and spring and availability likely would be contingent on Touchet River flows and use of the irrigation system by irrigators.

2. Given the physiographic setting of the Touchet River valley floor, SAR water delivered via the piped system would be discharged to an SAR site by using one or more turn-out points in the system. These turn-outs could be existing ones, or purpose built, depending on where a project is located relative to existing infrastructure. These sites should be on the valley floor, where the Quaternary fine unit is thinnest. SAR sites located on the hills bordering the valley floor will need to contend with greater thicknesses of the Quaternary fine unit.

3. The specific configuration of a recharge site would need to be determined on the basis of site specific conditions. Potential configurations include:

    a. One or more small (50 x 100 to 100 x 200 feet across) infiltration basins.

    b. Buried infiltration galleries.

    c. Discharge to an otherwise unmodified ground, including plowed fields or pastures.

4. A reconnaissance of the project area shows that the hills bordering the valley floor generally are further from the river on the west side of the river, therefore more potential candidate sites may be found west of the river. However, a specific set of sites has not yet been determined.

5. To reduce construction cost, a site near or directly serviced by existing infrastructure would be preferred.

6. Recharge locations also need to be sited so as to achieve intended results. For example, if baseflow augmentation in the late summer is the primary goal of a specific SAR site, it would need to be located so that the water discharged to it reaches the Touchet River in the desired time window. In another example, if the goal of recharge is to provide additional groundwater pumping potential so as to reduce demands on the Touchet River (or Walla Walla River) the project would need to be sited so that recharge water is within the zone of influence of a pumping well(s) when that well is pumping.

7. It is likely that once a site, or sites, is located a monitoring and operations plan will need to be prepared for acceptance by permitting entities. This plan will provide the basic project approach for a given site and likely become part of the permitting documentation under which the project operates. If multiple sites are selected a single plan encompassing all of them, not separate plans for each, should be prepared.

8. Permitting and authorization for potential SAR projects in the project area would likely follow one of two basic approaches:

    a. One would be to use the temporary water use authorization approach such as has been done to date at the Locher Road Site. This authorization sets all the parameters under which the project could operate. One of the primary limitations of this authorization is that it is only good for 1 year, and if a project is to run over multiple years, each year of operation will require a new authorization.

    b. The second permitting approach focuses on use of a Local Water Plan (LWP) authorized under the Walla Walla Watershed Partnership with Ecology approval. This LWP sets all the parameters under which the project could operate. This permitting pathway is new, and specific to the Walla Walla Basin. A LWP could allow multi-year operation if it is accepted.

Data and Information Needs

There are several data and information needs to meet for moving forward with one or more Westside - Eastside SAR projects. The primary one identified from this assessment is background groundwater data (e.g., water level, flow direction and velocity, and groundwater geochemistry) and stream flow data. Just as importantly, the impacts of the recently completed piping projects on the alluvial aquifer are unknown. These potential impacts need to be assessed in order to have some basis for planning one or more SAR projects. These uncertainties influence the path forward presented in the following section.

Path Forward

Given our current understanding of groundwater and surface water conditions in the project area we recommend the flowing actions for moving a Westside-Eastside project forward:

- Set a data collection goal, which in this case likely focuses on determining the impact of piping on the alluvial aquifer and Touchet River.
- Meet with landowners and water users in the project area to gain their insights and inputs on past and current groundwater and surface water conditions and the potential for SAR projects to help solve perceived problems.
- Once that is done, select surface water and groundwater monitoring locations and gain access to them. These locations could be new purpose built ones, or existing ones.
- At these monitoring locations collect background data that would be used to identify the impacts of the piping projects on alluvial aquifer water level, baseflow to the Touchet River, and alluvial aquifer pumping conditions. We recommend that this monitoring continue for a minimum of 1 year, thus getting some insight into seasonal fluctuations between times of water plenty and times of water scarcity.
- Once impacts are identified, set the goals for specific SAR projects (e.g., baseflow restoration, supporting well pumping, etc.) and identify locations where a project or projects can have the greatest impact.

With this final point a SAR project in the Westside-Eastside project area would move forward following whatever permitting pathway seems to be best suited for achieving specific project goals.

Old Lowden and Bergivin-Williams Project Area

Basic Goals

Unlike the Westside – Eastside project area, ditch piping has been proposed, but not yet been done in the Old Lowden and Bergivin-Williams systems. If one or more SAR projects were to be implemented in the Old Lowden Bergivin-Williams project area they likely would be done under two possible scenarios.

1. One would be to construct a project prior to piping in an effort to offset the future potential loss of alluvial aquifer recharge resulting from the future conversion of the ditches to piped systems.
2. The other would be done after conversion, and done to address specific observable impacts on the alluvial aquifer as a result of piping.

In either of these cases, as well as others, an SAR project, if built, would strive to elevate alluvial aquifer water levels to: (1) increase the supply of cool temperature baseflow to the Touchet River in the summer and early autumn and (2) improve static water levels in shallow alluvial water wells.

Potential Scope

Given that the conversion to piped systems has not yet been done, scoping for future potential SAR projects in this project area should focus on working with local land owners to collect baseline groundwater and surface water data. The decision to build one or more SAR sites would be based on the results of this baseline data collection. Part of this effort would be to work with local land owners to identify areas with more and less infiltration capacity. This is especially important as the alkali hardpans noted earlier in this report will influence SAR site selection and performance.

If, on the basis of the baseline data collection, an SAR project looks feasible, its potential scope generally would be as follows:

1. Water supply would be from the Walla Walla River via one or both of the systems. This water most likely would be supplied during the late winter and spring and availability likely would be contingent on Walla Walla River flows and use of the two systems by irrigators.

2. Given the physiographic setting of the Walla Walla River valley floor east and west of Lowden, SAR water delivered via these systems would be discharged to the ground for aquifer recharge using one or more turn-out points in the system. These turn-outs could be existing ones, or purpose built, depending on where a project is located relative to existing infrastructure.

3. The specific configuration of a recharge location would need to be determined on the basis of site specific conditions. Potential configurations include:

    a. One or more small (50 x 100 to 100 x 200 feet across) infiltration basins.

    b. Buried infiltration galleries.

    c. Discharge to the ground on otherwise unmodified ground, including plowed fields or pastures.

4. Recharge locations would need to be sited so as to achieve intended results. For example, if baseflow augmentation in the late summer is the goal of a specific SAR site, it would need to be located so that the water discharged to it reaches the Walla Walla River in the desired time window. In another example, if the goal of recharge is to provide additional groundwater pumping potential so as to reduce demands on the Walla Walla River, the project would need to be sited so that recharge water is within the zone of influence of a pumping well(s) when that well is pumping.

5. It is likely that once a site is identified a monitoring and operations plan will need to be prepared for acceptance by permitting entities. This plan will provide the basic project approach for a given site and likely become part of the permitting documentation under which the project operates. If multiple sites are selected a single plan, not multiple plans, should be prepared.

6. Potential SAR projects in the project area likely would be permitted following one of two basic approaches:

    a. One would be to use the temporary water use authorization approach such as has been done to date at the Locher Road Site. This authorization sets all the parameters under which the project could operate. One of the primary limitations of this authorization is that it is only good for 1 year, and if a project is to run over multiple years, each year of operation will require a new authorization.

    b. The second permitting approach focuses on use of a Local Water Plan (LWP) authorized under the Walla Walla Watershed Partnership with Ecology approval. This LWP sets all the parameters under which the project could operate. This permitting pathway is new, and specific to the Walla Walla Basin. A LWP could allow multi-year operation if it is accepted.

Data and Information Needs

There are several data and information needs to be met before moving forward on an Old Lowden and Bergivin-Williams SAR projects. One is simply to identify the potential impact of piping on alluvial aquifer recharge. Prior to conversion, seepage runs in the ditch systems would be one way to evaluate where a conversion to piping could have the most impact on alluvial aquifer conditions. Based on such data, the purpose and scope of a potential SAR project could be determined. Following conversion, the scope and need for an SAR project would be based on observed changes in the area's hydrologic conditions, such as diminished well pumping performance and/or reduction in springs. In either case, the collection of data describing basic background conditions would be important. Given these, the primary data needed for this project area is background water level, groundwater geochemistry, and stream flow data in the project area.

Path Forward

Given our current understanding of groundwater and surface water conditions in the project area and the fact that piping has not yet been done, we recommend the following actions for moving an Old Lowden and Bergivin-Williams project forward:

- Set a data collection goal, which in this case likely focuses on determining baseline alluvial aquifer water level and flow direction, groundwater and surface water geochemistry, and stream flow conditions.

- Meet with landowners and water users in the project areas to gain their insights and inputs on past and current groundwater and surface water conditions and the potential for SAR projects to help solve potential future problems.

- Once that is done, select surface water and groundwater monitoring locations and gain access to them. These locations could be new purpose built ones, or existing ones.

- At these monitoring locations collect background data that would be used to identify the impacts of the piping projects on alluvial aquifer water level, baseflow to the Touchet River, and alluvial aquifer pumping conditions. We recommend that this monitoring continue for at least 2 years, thus getting insight into 2 full seasonal fluctuations between times of water plenty and times of water scarcity.
- Use this baseline to assess piping impacts and design SAR projects accordingly.

With this final point an SAR project in the Old Lowden and Bergivin-Williams project area would move forward following whatever permitting pathway seems to be best suited for achieving specific project goals. One of the major challenges in this project area will be to determine the hydrologic impacts of the hardpans common to the area, especially their influence on infiltration and water movement to the water table. These alone argue for a characterization and baseline investigation prior to SAR project design and implementation.

Stiller Pond Project Area

Basic Goals

The Stiller Pond project area has goals that will differ significantly from those of the other two areas. This is because it is smaller, anecdotal evidence suggest alluvial aquifer water levels are declining, and a potential Stiller Pond project will focus on the efforts of one land owner, one land leaser, and site-specific performance objectives. In additional, the available anecdotal evidence provided by the land owner and the land leaser suggests that when the Pond is filled with water it will drain into the ground. Given such observations it seems likely that the Pond can be used as a recharge point for the underlying alluvial aquifer. The basic goals of a Stiller Pond SAR project would be to artificially store water in the alluvial aquifer for two basic uses. One use is to have water banked, or stored, in the alluvial aquifer so the on-site wells could be pumped at higher rates without net negative effect on Walla Walla River baseflow in critical summer months. The other use is to simply increase groundwater storage to support high base flow to the river.

Potential Scope

The potential scope of a Stiller Pond SAR project generally includes the following components:

1. Water supply would be from Mill Creek, delivered to the Site via the existing diversion and pipe system.
    a. If the project uses the existing Mill Creek water right it would simply involve the expansion of the beneficial use definition within that water right (# __) to include aquifer recharge with no change in actual instantaneous or total use.
    b. If an additional diversion amount and volume is desired, these would need to be permitted under a new authorization (water right) which likely would be contingent on Mill Creek flows and use of the system by the single irrigator using it.

2. Water delivered via the piped system to the Site for SAR use would be used on-site in two primary ways:

    a. One would be to discharge it to the ground on the field comprising the eastern end of the site. This water would be allowed to infiltrate into the ground at such rates as the substrate under the field would support. This field is situated immediately east of Stiller Pond and at this time is not envisioned the construction of basins or other features designed to enhance infiltration. It is our understanding that existing valves on the pipeline could be used to do deliver water to this field.

    b. The second SAR approach involves the Pond itself. In this case we recommend that the bottom of some, or all, of the pond be scrapped clean of fine sediment and debris. This would be done to enhance infiltration capacity. If only a portion of the Pond is used, we suggest that the eastern ¼ to ½ of the Pond be cleaned, leaving the remaining (western) portion of the Pond available for surface storage if desired. The depth of excavation would be based on on-site investigations that are described below. It is our understanding that existing piping might be adequate, with only minor modification, to deliver water to the Pond.

3. Assuming a Stiller Pond SAR project is implemented, monitoring (used to check against the antidegradation standards and evaluate success in meeting project performance goals) might be established as follows:

    a. At the Mill Creek diversion the intake would be monitored to ensure that diversion volumes are within the parameters set by the existing water right (if used), or a new water use authorization (if that is used).

    b. Source water geochemistry would be monitored where the delivery pipe enters the Site. This monitoring would focus on periodic sampling. Based on experience with other SAR projects in the Walla Walla valley the basic use of source water monitoring will be to show that source water geochemistry is very similar to groundwater geochemistry and will likely have little or no negative impact on groundwater. A list of parameters and sampling frequency would need to be developed, but at this time we recommend a list similar to that being used at the Locher Road Site.

    c. Groundwater level and geochemical sampling, used to monitor the impact of the project on the alluvial aquifer, would be done in the existing water wells and/or one or more purpose built wells. Until more can be learned about the existing wells there is not a specific recommendation concerning their use for monitoring.

4. Aquifer testing of the existing on-site wells is important for this project. This would be used to establish site aquifer properties and predict the timing of when SAR water delivered to the Site will reach the Walla Walla River.

5. Unlike the other two projects described previously, one of the goals of the Stiller Pond project is to recharge the underlying alluvial groundwater system so that it can be used for water supply in the summer, being pumped via the existing site wells. Given this project goal, one of the outcomes needed to move this project forward will be for the project proponent to come to an agreement with appropriate entities about the amount of water that can be withdrawn via the wells versus the amount of water left in the aquifer for down-gradient instream baseflow to the Walla Walla River. This would be part of any permit issued authorizing the project.

6. Like the other SAR projects described herein, the Stiller Pond project would likely be permitted following one of two basic approaches:

    a. One would be to use the temporary water use authorization approach such as is been done to date at the Locher Road Site. This authorization sets all the parameters under which the project could operate. One of the primary limitations of this authorization is that it is only good for 1 year, and if a project is to run over multiple years, each year of operation will require a new authorization.

    b. The second permitting approach focuses on use of a Local Water Plan (LWP) authorized under the Walla Walla Watershed Partnership with Ecology approval. This Plan sets all the parameters under which the project could operate. This permitting pathway is new, and specific to the Walla Walla Basin. A LWP could allow multi-year operation if it is accepted.

Data and Information Needs

Based on the information reviewed for this assessment report, it is difficult to predict the actual impact of an SAR project at the Pond on the underlying alluvial aquifer and the nearby Walla Walla River. Clearly these two bodies of water will be impacted, but it is not currently known if they will be impacted in such a manner as to positively influence the desired project goals. Namely, will the aquifer support significantly improved well pumping and what is the timing and volume of baseflow enhancement for the nearby Walla Walla River as the result of this project.

To better assess the potential impacts of an SAR project at this site, and to develop a clear path forward for such a project, some background water level, groundwater geochemistry, and stream flow data in the project area will be needed for the project area. In addition, aquifer testing on one or more of the existing wells will provide aquifer pump data and allow a better prediction of aquifer response to recharge, pumping, storage, and ultimately how to enhance well ops using storage while at the same time enhance flow to the river.

Path Forward

Given the current understanding of groundwater and surface water conditions in the project area, and the goals of the land owner and land leaser, the following actions for moving a Stiller Pond project forward are recommended:

- Set the project goal, which in this case likely focuses on building an SAR project that increases baseflow to the River and improves well pumping performance in the summer season.

- Identify the permitting pathway and begin the process to gain the required permit(s), either a temporary water use authorization or a LWP. A part of this process will be to use site specific data collected in the spring and summer of 2010 to build an operation and monitoring plan needed to support the necessary permit. Site specific work could include hydrogeologic characterization of one or more purpose built or existing wells, shallow back-how or soil borings and infiltration testing.

- Establish surface water and groundwater monitoring locations that would be useful in assessing the project's success in meeting the stated goal. These locations could be new purpose built ones, or existing ones.

- At these monitoring locations collect background data that would be used to evaluate the impacts of SAR on the alluvial aquifer and the River. It is recommended that monitoring data requirements be similar to those used at the Locher Road Site, focusing on a simple list of basic water quality parameters and periodic data collection before, during, and after a recharge season. Concurrent with the establishment of a monitoring system, modify the Pond as desired (e.g., cleaning out some or all of it).

Throughout this effort it is strongly recommended that all project participants have an operational start-up goal of 01 December 2010. If this date can be met, a Stiller Pond project will be in place early enough to capture late winter and spring high flow in Mill Creek, get water into the alluvial aquifer at the Site, and have that water available for summer base-flow enhancement, well pumping, and assessment of project performance.

Conclusions

Three project areas were evaluated in the area between Touchet, Washington and Walla Walla, Washington for their SAR potential. These evaluations were based on existing data and information, and limited reconnaissance. The three project areas are the: (1) Westside and Eastside areas adjacent to the Touchet River near Touchet, Washington, (2) Old Lowden and Bergivin-Williams Ditch areas near Lowden, Washington, and (3) Stiller Pond near the confluence of Mill Creak with the Walla Walla River. Project goals, potential work scope, and paths forward for each of these project areas differ between these project areas.

Westside and Eastside Project Area: The basic goal of an SAR project in the Westside and Eastside project area is to offset the possible loss of alluvial aquifer recharge resulting from the recent conversion of the Westside and Eastside Ditches to piped systems. Given the general lack of background groundwater level, flow direction, and geochemistry in the project area the specific impacts of these piping projects, including impacts on Touchet and Walla Walla River baseflows and alluvial aquifer water level, are difficult to describe.

To move a Westside and Eastside project forward some baseline data collection would be useful in defining the impacts of the piping projects, identifying specific areas when SAR projects would be effective in meeting possible goals, and scoping an SAR project. Also, meeting with well owners/operators and land owners in the project area would be important to defining past and present hydrologic conditions, the need for potential SAR project, and identifying sites where a project could be implemented. With site selection, specific project plans for water delivery, monitoring, operations, and permitting could be developed and implemented.

Old Lowden and Bergivin-Williams Project Area: The basic goal of an SAR project in the Old Lowden and Bergivin-Williams project area would be to offset the possible loss of alluvial aquifer recharge resulting from planned conversion of these ditch systems to piped systems. Given the general lack of background groundwater level, flow direction, and geochemistry in the project area there currently is no baseline with which to measure impacts of lost recharge if, or when, the piping is built. This will make it difficult to characterize impacts to wells and the Walla Walla River resulting from the proposed piping projects.

The first step in moving a potential Old Lowden and Bergivin-Williams SAR project forward is to collect baseline data so that the impact of piping on the alluvial aquifer can be assessed and SAR actions (or project) designed to address those impacts. At the same time meetings with well owners/operators and landowners would be important to defining past and present hydrologic conditions and identifying potential project locations. At such time as a specific SAR project(s) are identified in the project area specific plans for water delivery, monitoring, operations, and permitted could be developed and implemented.

Stiller Pond Project Area: The goal of an SAR project at the Stiller Pond site is to use SAR to enhance alluvial aquifer water levels to support groundwater pumping under an existing water right and leave water in the aquifer for potential baseflow augmentation on the nearby Walla Walla River. Unlike in the other two project areas specific site location, layout, and operations are generally well understood. With development and complementation of a monitoring, operations, and permitting plan a Stiller Pond Project could be up and running as early as the winter of 2010/2011. As early as possible the project proponent should meet with regulatory entities to set up possible guidelines for how much SAR water can be used in the summer (via pumping the wells) versus left in the alluvial aquifer for potential baseflow to the Walla Walla River.

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