Appendices II-A

OWRD Limited Testing License for HBDIC Recharge Site (#2) LL-1189

Permit to operate recharge: 2009-2014

Oregon Water Resources Department

Final Order
Limited License Application LL-1189

Appeal Rights

This is a final order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date, the petition was filed, the petition shall be deemed denied.

Requested Water Use

On January 30, 2009, the Water Resources Department received completed application **LL-1189** from Hudson Bay District Improvement Company for the use of 50 cubic feet per second from the Walla Walla River, located in the SE ¼, NE ¼, Section 2, and the SW ¼, NE ¼, Section 12, Township 6 North, Range 35 East, W.M., for ground water recharge use, for the period of February 19, 2009, through February 18, 2014.

Authorities

The Department may approve a limited license pursuant to its authority under ORS 537.143, 537.144 and OAR 690-340-0030.

ORS 537.143(2) authorizes the Director to revoke the right to use water under a limited license if it causes injury to any water right or a minimum perennial streamflow.

A limited license will not be issued for more than five consecutive years for the same use, as directed by ORS 537.143(8).

Findings of Fact

1. The forms, fees, and map have been submitted, as required by OAR 690-340-0030(1).

2. The Department provided public notice of the application, on February 3, 2009, as required by OAR 690-340-0030(2).

3. This limited license request is limited to an area within a single drainage basin as required by OAR 690-340-0030(3).

4. The Department has determined that there is water available for the requested use.

5. The Department has determined that the proposed source has not been withdrawn from further appropriation.

6. Because this use is from surface water and has the potential to impact fish, the Department finds that fish screening is required to protect the public interest.

7. Because the use requested is longer than 120 days and because the use is in an area that has sensitive, threatened or endangered fish species, the use is subject to the Department's rules under OAR 690-33. These rules aid the Department in determining whether a proposed use will impair or be detrimental to the public interest with regard to sensitive, threatened, or endangered fish species.

8. The Department has received comments related to the possible issuance of the limited license from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) in support of the project and requesting measured and reported data and results from the previous 5 years and annual reporting of results to CTUIR and basin water managers. Oregon Department of Environmental Quality (ODEQ) notified the Department that it had no comments, since the water quality monitoring plan for the previous Limited License was acceptable, and did not change for this application. The comments did cause the Department to add additional conditions or limitations. The licensee shall work with CTUIR to provide data as requested. The authorization of limited license **LL-1189**, as conditioned below, will satisfactorily address the issues raised in those comments.

9. Pursuant to OAR 690-340-0030(4)(5), conditions have been added with regard to notice and water-use measurement.

Conclusions of Law

The proposed water use will not impair or be detrimental to the public interest pursuant to OAR 690-340-0030(2), as limited in the order below.

Order

Therefore, pursuant to ORS 537.143, ORS 537.144, and OAR 690-340-0030, application **LL-1189** is approved as conditioned below.

1. The period and rate of use for **LL-1189** shall be from February 23, 2009, through February 18, 2014, for the use of 50 cfs of water from the Walla Walla River, for the purpose of groundwater recharge testing during the period November 1 through May 15 each year.

2. The licensee shall give notice to the Watermaster in the district where use is to occur not less than 15 days or more than 60 days in advance of using the water under the limited license. The notice shall include the location of the diversion, the quantity of water to be diverted and the intended use and place of use. In the case of this application, this order serves as the notice described above.

3. When water is diverted under this Limited License, the use is limited to times when the following minimum streamflows are met in the Tum A Lum reach of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam: November – 64 cfs, December and January – 95 cfs, February to May 15 – 150 cfs. Nursery Bridge Dam is located just downstream of Nursery Bridge and is downstream of the Little Walla Walla diversion. The District 5 Watermaster, based on gage and/or streamflow measurements, shall make the determination that the above described streamflows are flowing past Nursery Bridge Dam. Diversion under this Limited License shall cease when said streamflows are unmet.

4. The Licensee shall follow the same operations, monitoring and reporting plan that was developed with ODEQ for the water quality plan followed in LL-758.

5. Based on a review of water quality information generated during the term of this Limited License, or from other sources, ODEQ may require the licensee to terminate the diversion of water into the recharge area. In addition, if monitoring data or other information result in identification of potential water quality concerns, ODEQ may require modifications to the existing Limited License and/or require a permit to address the water quality concerns prior to resumption of artificial groundwater recharge.

6. Before water use may begin under this license, the licensee shall install a totalizing flow meter at each point of diversion. The totalizing flow meter must be installed and maintained in good working order. In addition the licensee shall maintain a record of all water use, including the total number of hours of pumping, the total quantity pumped, and the categories of beneficial use to which the water is applied. During the period of the limited license, the record of use shall be submitted to the Department annually, and shall be submitted to the Watermaster upon request.

7. The Director may revoke the right to use water for any reason described in ORS 537.143(2), and OAR 690-340-0030(6). Such revocation may be prompted by field regulatory activities or by any other information.

8. Use of water under a limited license shall not have priority over any water right exercised according to a permit or certificate, and shall be subordinate to all other authorized uses, including Limited Licenses issued prior to this one, that rely upon the same source.

9. The licensee shall install, maintain and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife to prevent fish from entering the proposed diversion. See copy of enclosed fish screening criteria for information.

10. The licensee shall provide the Confederated Tribes of the Umatilla Indian Reservation the data, results, and analysis that were sought by letter dated February 17, 2009.

11. A copy of this limited license shall be kept at the place of use, and be available for inspection by the Watermaster or other state authority.

NOTE: This water-use authorization is temporary. Applicants are advised that issuance of this final order does not guarantee that any permit for the authorized use will be issued in the future; any investments should be made with that in mind.

Issued March 5, 2009

E. Timothy Wall

E. Timothy Wallin, Water Rights Program Manager, *for*
Phillip C. Ward, Director
Water Resources Department

Enclosures - limited license, fish screen criteria

cc: Tony Justus, District 5 Watermaster
Bill Duke, ODFW
Phil Richerson, DEQ
Eric Quaempts, CTUIR
Hydrographics
File

If you need further assistance, please contact the Water Rights Section at the address, phone number, or fax number below. When contacting the Department, be sure to reference your limited license number for fastest service.

Remember, this limited license does not provide a secure source of water. Water use can be revoked at any time. Such revocation may be prompted by field regulatory activities or many other reasons.

Water Rights Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem OR 97301-1271
Phone: (503) 986-0817 Fax: (503) 986-0901

Appendices II-B

WWBWC-HBDIC Application to OWRD Limited Testing License for HBDIC Recharge Site (#2) LL-1189

1/21/2009

State of Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1271
(503) 986-0900

Application for Limited Water Use License

A summary of review criteria and procedures that are generally applicable to these applications is available at www.wrd.state.or.us/OWRD/PUBS/forms.shtml.

License No. LL-1089

Applicant(s): Hudson Bay District Improvement Co. (HBDIC)

Contact Person: John Zerba - HBDIC (Bob Bower - WWBWC)

Mailing Address: 144 Main str. Milton-Freewater, OR 97862

Telephone No: 541-938-6105 (Zerba) / 541-938-2170 (Bower)

I (We) make application for a Limited License to use or store the following described surface waters or groundwater-not otherwise exempt, or to use stored water of the State of Oregon for a use of a short-term or fixed duration :

1. SOURCE(S) OF WATER for the proposed use: Walla Walla River a tributary of Columbia River.

2. TOTAL AMOUNT OF WATER to be diverted: 50 cubic feet per second, or 22440 gallons per minute. If water is to be used from more than one source, give the quantity from each: -0-.

3. INTENDED USE(S) OF WATER: (check all that apply)
   - [ ] Road construction or maintenance;
   - [ ] General construction;
   - [ ] Forestland and rangeland management; or
   - [x] Other: Aquifer Recharge

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SALEM, OREGON

4. DESCRIPTION OF PROPOSED PROJECT: Include a description of the intended place of use as shown on the accompanying site map, the method of water diversion, the type of equipment to be used (including pump horsepower, if applicable), length and dimensions of supply ditches and pipelines:
   * See attached cover letter & support materials.

LL-1189

5. PROJECT SCHEDULE: (List day, month, and year)
Date water use will begin Feb. 19th 2009
Date project will be completed Feb 18th 2014
Date water use will be completed Feb 18th 2014

PLEASE READ CAREFULLY

NOTE: A completed water availability statement from the local watermaster, Land Use Information Form completed by the local Planning Department, fees and site map meeting the requirements of OAR 690-340-030 must accompany this request. The fee for this request is $150 for the first point of diversion plus $15 for each additional point of diversion. *Failure to provide any of the required information will result in return of your application.* The license, if granted, will not be issued or replaced by a new license for a period of more than five consecutive years. The license, if granted, will be subordinate to all other authorized uses that rely upon the same source, or water affected by the source, and may be revoked at any time it is determined the use causes injury to any other water right or minimum perennial streamflow.

If water source is a well, well logs or adequate information for the Department to determine aquifer, well depth, well seal and open interval, etc. are required. The licensee shall indicate the intended aquifer. If for multiple wells, each map location shall be clearly tied to a well log.

If a limited license is approved, the licensee shall give notice to the Department (Watermaster) at least 15 days in advance of using the water under the Limited License and shall maintain a record of use. The record of use shall include, but need not be limited to, an estimate of the amount of water used, the period of use and the categories of beneficial use to which the water is applied. During the period of the Limited License, the record of use shall be available for review by the Department upon request.

REMARKS: OWRD Water Master (Tony Justus) sending his water availability report (separately) to Salem, for this application.

SIGNATURE of Applicant: [signature] DATE: 1-21-09
Title: HBDTC manager

Mapping Requirements (OAR 690-340-0030):

(1) A request for a limited license shall be submitted on a form provided by the Water Resources Department, and shall be accompanied by the following:
(c) A site map of reproducible quality, drawn to a standard, even scale of not less than 2 inches = 1 mile, showing:
(A) The locations of all proposed points of diversion referenced by coordinates or by bearing and distance to the nearest established or projected public land survey corner;
(B) The general course of the source for the proposed use, if applicable;
(C) Other topographical features such as roads, streams, railroads, etc., which may be helpful in locating the diversion points in the field.

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This page to be completed by the local Watermaster.

WATER AVAILABILITY STATEMENT

Name of Applicant: Hudson Bay Improvement Company Limited License Number: LL-1189

1. To your knowledge, has the stream or basin that is the source for this application ever been regulated for prior rights?

☒ Yes ☐ No

If yes, please explain:

The Walla Walla River is typically short of water to serve all water rights in July, August, September and October.

2. Based on your observations, would there be water available in the quantity and at the times needed to supply the use proposed by this application?

☒ Yes ☐ No

3. Do you observe this stream system during regular fieldwork?

☒ Yes No

If yes, what are your observations for the stream?

Typically, there can be water available November thru June. OAR Division 33 may also dictate restrictions on period of use dates.

4. If the source is a well and if WRD were to determine that there is the potential for substantial interference with nearby surface water sources, would there still be ground water and surface water available during the time requested and in the amount requested without injury to existing water rights?

☐ Yes ☐ No ☒ N/A

What would you recommend for conditions on a limited license that may be issued approving this application?

Allow diversion only when by-pass flows are met below Nursury Bridge Dam. Restrict with by-pass flows similar to the flows in Permit 53662. November- 64 cfs, December & January- 95 cfs, February thru May 15-132 cfs.

5. Any other recommendations you would like to make?

Subordinate to any other limited license from the same source issued prior to this one.

Signature ______________________ WM District #:________ Date:______________

This page to be completed by the local Watermaster.

WATER AVAILABILITY STATEMENT

Name of Applicant: Hudson Bay Improvement Company Limited License Number: LL-1189

1. To your knowledge, has the stream or basin that is the source for this application ever been regulated for prior rights?

☒ Yes ☐ No

If yes, please explain:

The Walla Walla River is typically short of water to serve all water rights in July, August, September and October.

2. Based on your observations, would there be water available in the quantity and at the times needed to supply the use proposed by this application?

☒ Yes ☐ No

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3. Do you observe this stream system during regular fieldwork?

☒ Yes No

If yes, what are your observations for the stream?

Typically, there can be water available November thru June. OAR Division 33 may also dictate restrictions on period of use dates.

4. If the source is a well and if WRD were to determine that there is the potential for substantial interference with nearby surface water sources, would there still be ground water and surface water available during the time requested and in the amount requested without injury to existing water rights?

☐ Yes ☐ No ☒ N/A

What would you recommend for conditions on a limited license that may be issued approving this application?

Allow diversion only when by-pass flows are met below Nursury Bridge Dam. Restrict with by-pass flows similar to the flows in Permit 53662. November- 64 cfs, December & January- 95 cfs, February thru May 15-132 cfs.

5. Any other recommendations you would like to make?

Subordinate to any other limited license from the same source issued prior to this one.

Signature Tony Justus WM District #: 5 Date: January 30, 2009

LL-1189

Oregon Water Resources Department
Land Use Information Form

THIS FORM IS NOT REQUIRED IF: 1) water is to be diverted, conveyed, and/or used only on federal lands; or 2) the application is for a water-right transfer, allocation of conserved water, exchange, permit amendment, or ground water registration modification, and all of the following apply: a) only the place of use is proposed for change, b) there are no structural changes, c) the use of water is for irrigation, and d) the use is located in an irrigation district or exclusive farm-use zone.

Applicant Name: Hudson Bay District Improvement Company

Mailing Address: 144 Main Str. [redacted]

City: Milton-Freewater State: OR Zip: 97862 Day Phone: 541-938-6105

A. Land and Location

Please include the following information for all tax lots where water will be diverted (taken from its source), conveyed (transported), or used. Applicants for municipal use, or irrigation uses within irrigation districts may substitute existing and proposed service-area boundaries for the tax-lot information requested below.

Township	Range	Section	¼ ¼	Tax Lot #	Plan Designation (e.g. Rural Residential/RR-5)	Water to be: N/A	Proposed Land Use:
6N	35E	33	NE	900	N/A	Diverted Conveyed Used	N/A
						Diverted Conveyed Used	
						Diverted Conveyed Used	
						Diverted Conveyed Used	

List all counties and cities where water is proposed to be diverted, conveyed, or used. N/A

B. Description of Proposed Use

Type of application to be filed with the Water Resources Department:

- ☐ Permit to Use or Store Water
- ☐ Water-Right Transfer
- ☐ Exchange of Water
- ☐ Allocation of Conserved Water
- ☒ Limited Water Use License
- ☐ Permit Amendment or Ground Water Registration Modification

Source of water: Reservoir/Pond ☐ Ground Water ☒ Surface Water (name) Walla Walla River

Estimated quantity of water needed: 50 ☒ cubic feet per second ☐ gallons per minute ☐ acre-feet

Intended use of water: ☐ Irrigation ☐ Commercial ☐ Industrial ☐ Domestic for ______ household(s) ☐ Municipal ☐ Quasi-municipal ☐ Instream ☒ Other Recharge

Briefly describe: HBDIC Aquifer Recharge site will recharge water to shallow aquifer for community and ecological benefits.

Note to applicant: *If the Land Use Information Form cannot be completed while you wait, please have a local government representative sign the receipt below and include it with the application filed with the Water Resources Department.*

Receipt for Request for Land Use Information

State of Oregon Water
Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301-1266

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WATER RESOURCES DEPT
SALEM, OREGON

LL-1189

For Local Government Use Only

The following section must be completed by a planning official from each county and city listed unless the project will be located entirely within the city limits. In that case, only the city planning agency must complete this form.

This deals only with the local land-use plan. Do not include approval for activities such as building or grading permits.

Please check the appropriate box below and provide the requested information

Land uses to be served by proposed water uses (including proposed construction) are allowed outright or are not regulated by your comprehensive plan. Cite applicable ordinance section(s): 152.056.

Land uses to be served by proposed water uses (including proposed construction) involve discretionary land-use approvals as listed in the table below. (Please attach documentation of applicable land-use approvals which have already been obtained. Record of Action/land-use decision and accompanying findings are sufficient.) **If approvals have been obtained but all appeal periods have not ended, check "Being pursued".**

Type of Land-Use Approval Needed (e.g. plan amendments, rezones, conditional-use permits, etc.)	Cite Most Significant, Applicable Plan Policies & Ordinance Section References	Land-Use Approval:	
N/A	N/A	Obtained Denied	Being pursued Not being pursued
		Obtained Denied	Being pursued Not being pursued
		Obtained Denied	Being pursued Not being pursued
		Obtained Denied	Being pursued Not being pursued
		Obtained Denied	Being pursued Not being pursued

Local governments are invited to express special land-use concerns or make recommendations to the Water Resources Department regarding this proposed use of water below, or on a separate sheet.

This project previously approved by Planning. Umatilla County Planning is supportive of developing innovative, multi-beneficial water storage projects. We believe we can be the "Showcase" county for innovative water management solutions.

Name: J. R. Cook Title: Asst. Planning Dir.

Signature: [signature] Phone: 541.278.6251 Date: 1-26-09

Government Entity: Umatilla County

Note to local government representative: *Please complete this form or sign the receipt below and return it to the applicant. If you sign the receipt, you will have 30 days from the Water Resources Department's notice date to return the completed Land Use Information Form or WRD may presume the land use associated with the proposed use of water is compatible with local comprehensive plans.*

Receipt for Request for Land Use Information

Applicant name: ______________________

City or County: ______________ Staff contact: ______________

Signature: ______________ Phone: ______________ Date: ______________

Last updated 12/22/06 WR

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To: Water Rights Section
Oregon Water Resources Department
158 12th St NE
Salem, OR 97310

From: Walla Walla Basin Watershed Council (WWBWC)/Hudson Bay District Improvement Company (HBDIC)
810 South Main Street
Milton-Freewater, Oregon 97862

RE: ***New*** Limited Testing License Application for HBDIC Recharge Site (Final Order 758).

To Whom It May Concern:

This letter and attached documents are being submitted in support of our application for a new limited testing license for aquifer recharge at the HBDIC Recharge project, in Umatilla County Oregon. The actual recharge site is located in the NE ¼, of Section 33, Township 6 North, and Range 35 East. The project has been in operation for nearly 5 years and has shown to effectively recharge water to the aquifer, help restore baseflows to downgradient streams and recharge good quality surface water in to the shallow aquifer system. Through a series of Rules Advisory Committee (RAC) meetings last spring and early summer the OWRD worked to add aquifer recharge to the basin rules[1] along with surface storage. The RAC was decided that the decision to add aquifer recharge and surface storage for the Walla Walla basin would be delayed pending the US Army Corp of Engineers (CTUIR) Feasibility study project being completed in 2010. Therefore to continue to test aquifer recharge at the HBDIC recharge site we are submitting a new limited testing license for the site (see attached).

We are also submitting the support materials (study plan, etc) from the original application titled *Hudson Bay Aquifer Recharge Project: An application for AR Testing Limited License to Oregon Water Resource Department (OWRD)* (October, 20th 2003, **Attachment A**). In this new limited testing license application we request to follow the **same** operations, monitoring and reporting plan that was outlined in this original application. ODEQ (Phil Richerson, Pendleton-ODEQ) was contacted this week regarding this new application and gave a verbal permission to submit the same water quality plan that was developed with ODEQ (2003) and submitted with our original application.

We are also requesting that the new limited license has **the same** water-use conditions of Final Order #758 including:

- Water Use time period: **November 1st through May 15th**
- Maximum Water Use Allocation of **50 cfs.**
- **Seasonal Minimum Instream flow requirements** (Walla Walla River) as were determined by ODFW and CTUIR in original application which were:
    - November 1st through November 31st = 64 cfs

[1] Mike Ladd, Tony Justus at OWRD Pendleton office can be contacted regarding this process.

- December 1st through January 31st = 95 cfs
- February 1st through May 15th = 150 cfs

Final Order #758 Final Requirements stated that "*The licensee shall meter all water use and maintain a record of use, including the total number of hours of diversion and an estimate of the total quantity diverted. During the period of the limited license, the record of use shall be available for review by the Department upon request and shall be submitted to the Watermaster upon request. Upon project completion, the license shall submit the record of use to the Water Resources Department.*"

At the time of this letter, the project was still in operations (2008-9 recharge season), but a summary for the *record of use* (as outlined above) can be found in **Attachment B**. The attachment outlines both the water use from the Walla Walla River (POD) to the HBDIC Recharge Project (as estimated conveyance loss of 10 cfs) and the actual water use at the HBDIC recharge site. Following the completion of final order #758, a summary of all water use 2004-2009 will be provided to the department. All water use meter records are available to OWRD staff at any time, upon request. As the HBDIC site has gone through several expansions during this 2004-2008 period, **Attachment C** outlines some additional information that will help assess the changes in water use at the site over the period of record. The HBDIC recharge project managers intend to further develop this site for recharge testing upon approval of a new limited testing license.

You will find the following Attachments in support of this new application:

- ❑ **Attachment A-C**: Original Application Supporting document that includes:
  - Maps of site as required by OWRD application
  - ODEQ Water Quality Monitoring Plan (and supplementary changes)
- ❑ **Attachment D**: Copy of Current OWRD Limited Testing License (Final Order#758)
- ❑ **Attachment E**: Original Water availability report from OWRD water master (New one being sent to Salem from Pendleton Office)

Also attached you will find the application fee for $165 dollars to cover new limited license application. As there are now two separate diversions at the recharge site, we added the additional $15 for this application to ensure the proper fee was submitted.

Thank you for your continued support.

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Robert J. Bower
Senior Hydrologist/HBDIC Project Co-manager
Walla Walla Basin Watershed Council

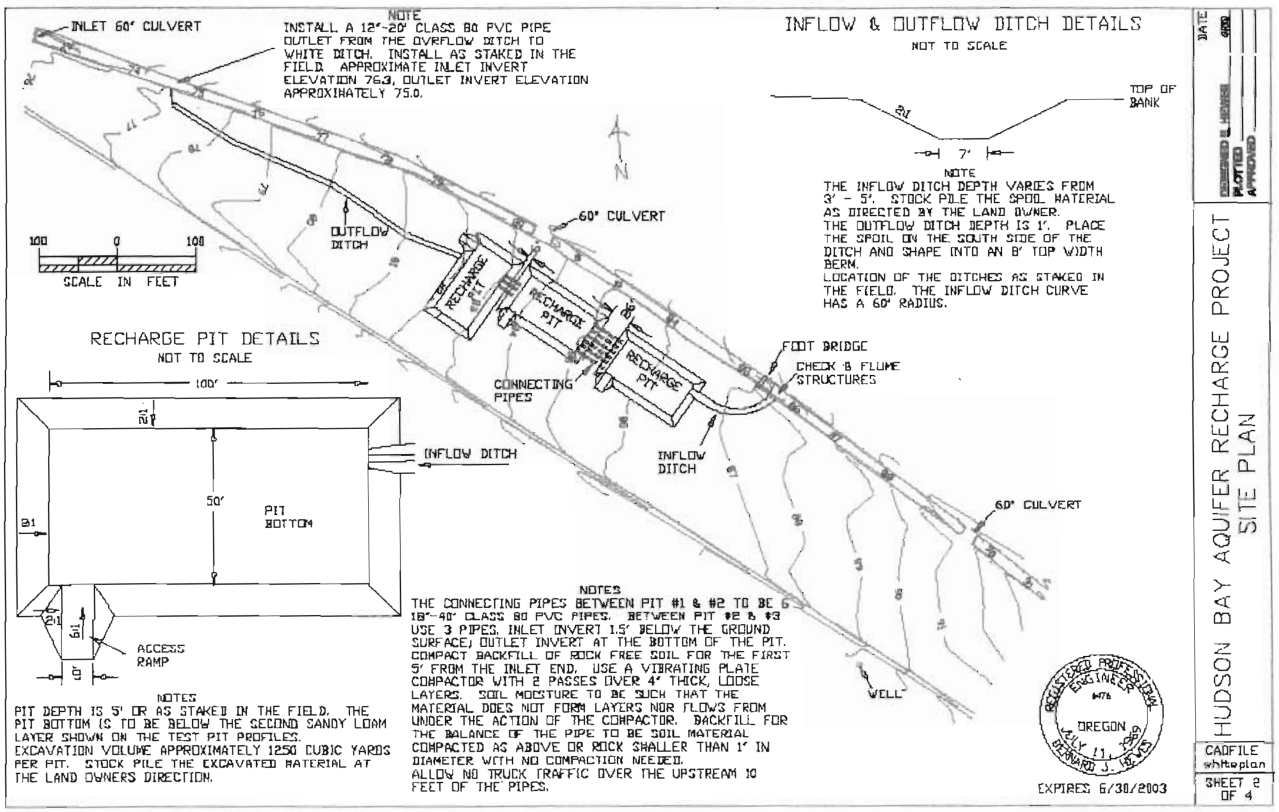
Cc: Tony Justus, OWRD Pendleton
Rick George, CTUIR, Mission
Phil Richerson, ODEQ, Pendleton
Bill Duke, ODFW, Pendleton

Attachment A

Limited License Supplemental Application Materials
10/16/03

Hudson Bay Aquifer Recharge Project

An application for ASR Testing Limited License to Oregon Water Resources Department (OWRD) (OAR 690-350-0020)



Prepared for the HBDIC by:

Walla Walla Basin Watershed Council
Kennedy and Jenks Consultants, Inc.

October 20, 2003

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Introduction

The Walla Walla Basin Watershed Council (WWBWC), in cooperation with the Hudson Bay District Improvement Company (HBDIC), has proposed to test shallow aquifer recharge at a site located adjacent to the HBDIC's *White Ditch* in section 33, T6N, R35E. At the test site a series of three infiltration pits will be built. Water will be supplied to these pits via a diversion from the canal. Recharge activities are proposed during the winter and spring months, when the Walla Walla River (the source of water for the canal) is running at higher flows. The proposed shallow aquifer recharge testing would be done under an ASR Testing Limited License granted by Oregon Water Resources Department (OWRD) (OAR 690-350-0020). By recharging shallow groundwater it is hoped that a portion of the recharge water will return to restore diminished spring-creek and Walla Walla River baseflows. Testing <u>will not include</u> removal of stored water by pumping or other artificial means.

The Limited License Application requires several supporting documents be attached (690-350-0020 (3)(b)), including (but not limited to) those describing proposed testing, groundwater conditions (including hydrogeologic conditions and groundwater quality), and source water quality. Information not included in this assessment report, but still needed for the application, will be collected during proposed site-specific hydrogeologic characterization, monitoring, and testing process. This limited license application is to gain approval of the proposed shallow aquifer recharge testing. The complete list of Attachments as called for in include:

Attachment 1. Project Layout and Size, 690-350-0020(3)(a)(E) and (I) and 690-350-0020(3)(b)(B)
Attachment 2. Water Rights Statement, 690-350-0020(3)(a)(F) and (G)
Attachment 3. Land Use Approval, 690-350-0020(3)(a)(H)
Attachment 4. Proposed Test Program, 690-350-0020(3)(b)(A)
Attachment 5. Proposed Monitoring Program, 690-350-0020(3)(b)(A)
Attachment 6. Site Hydrogeology, 690-350-0020(3)(b)(C), (E), and (G)
Attachment 7. Source Water Quality, 690-350-0020(3)(b)(D)

Overview of Watershed Conditions

The quantity, storage, timing, and availability of water are several major challenges facing watershed managers in the Walla Walla River Basin. The relationship between the Walla Walla River and its distributaries with that of the shallow alluvium aquifer has been shown to be highly interdependent (Piper, 1933, Newcomb, 1965, Barker & McNish, 1975, Bower et. al., 2001). The Walla Walla Basin Watershed Council, Walla Walla Watershed Alliance, and Hudson Bay District Improvement Company (HBDIC), working with their partners in OWRD, ODEQ and ODFW, propose to explore the utility of artificially recharging the shallow alluvial aquifer as a way to help offset the loss of natural recharge opportunities throughout the basin.

Surface water and shallow groundwater in the Walla Walla Basin (the Basin) form an interconnected system. In some areas, especially upstream areas where streams leave the mountains and highlands surrounding the Basin to flow out onto the Basin floor, streams historically probably branched out onto the Basin floor and some of the water they carried seeped into the ground, recharging the shallow groundwater system. This shallow groundwater, recharged near the edge of the Basin, formed the main source of clean, cool groundwater found further down basin where it returned to the surface via springs and base flow to the Walla Walla River. Through the years, the issuance of hundreds of surface and groundwater rights has resulted in the allocation of nearly all of the naturally available water in the basin. These allocations have pressured water resources, compelling the

Washington State Department of Ecology to close ground waters to further appropriations due to concerns about dropping water table levels. Other indicators of overstressed water resources include: (1) dry or dropping well levels, some wells in OWRD's inventory of state-observation-wells, (2) dry or dropping flow volumes in the spring branches, and (3) loss of natural and artificial groundwater recharge opportunities through irrigation efficiency and improved surface water management.

The state of Oregon has recognized use of artificial recharge as a tool "that can be an effective and efficient method for storing water for futures uses."(OWRD, Umatilla Basin Report, 1988). Artificial recharge has been shown to work in other areas of Umatilla County such as the County Line Water Improvement District Project, in operation since 1977. An OWRD review of this project states "It has been instrumental in arresting and reversing ground water level declines in a portion of the Ordnance Critical Ground Water Area." (OWRD, 1988). The USGS also noted the need for artificial recharge in the Walla Walla valley to offset increased water demands and loss of natural and artificial recharge mechanisms: "(Irrigation efficiency measures) can diminish the infiltration to recharge the ground water," wrote Newcomb in his important 1965 report. "Consequently, any such plans for changes in river regimen could well be required to provide for compensatory recharge or to sustain counter charges for their diminution of natural recharge and storage.

This project will comprise of three major components: Construction-Operation, Monitoring-Evaluation and Outreach-Education.

Construction-Operation: After receiving the appropriate permits and/or approval from OWRD, OWDF, ODEQ, USFWS, NOAA Fisheries and the Umatilla County Planning Department, a series of three pits specifically designed for passive artificial recharge will be constructed on land provided by the Hudson District Improvement Company (HBDIC). The land is being leased from one of the district's patrons by the HBDIC and a written agreement for the lease has been secured. The pits will be constructed in such a way to maximize recharge rates while minimizing the ground water quality impacts during the winter/spring recharge period. Project features include a concrete check structure in adjacent White Ditch, a concrete flow-measuring flume, an open connection ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit. These pits are designed to handle 50 cubic feet per second (cfs) of water anticipated to be available during the winter/spring Walla Walla River runoff. The actual volume of winter-spring water delivered will depend on the above-mentioned permitting and review process and the actual field verified constraints once in operation. Operation of this structure will be based on the instructions provided by OWRD in the operation permit and agreed to by the various project partners and agencies.

Monitoring-Evaluation: Monitoring of project will be conducted at several levels including: (1) on-site subsurface hydrologic and hydrogeologic monitoring, (2) off-site subsurface hydrologic and hydrogeologic monitoring, (3) off-site surface monitoring of springs through flow and photo-point measurements, (4) on/off-site water quality monitoring of key physical and chemical properties. The results of this intensive monitoring will be evaluated to identify impacts of the proposed project on groundwater levels and flow beneath and around the site, on surface water and spring discharges down gradient of the site, and on base flow to the Walla Walla River. Monitoring will also identify potential problems associated with the project

Outreach-Education: This project will also serve as an important outreach and education tool for the general public and water users of the Walla Walla valley. Particular focus and time will be spent on utilizing the site and the results for the recharge analysis to educate people on the role that ground water plays in the rivers and streams of the Walla Walla Watershed.

This project meets all of the habitat restoration actions from the *Oregon Aquatic Habitat Restoration and Enhancement Guide* including:

1. Change the trend of aquatic habitat function from one of a diminishing ability to support salmonids and other organisms to one that supports a complex, self-sustaining system. Such systems provide high quality habitat and ecological capacity for salmonids and other species; or
2. Correct or improve conditions caused by past management and/or disturbance events; or
3. Maximize beneficial habitat in the short term where watershed degradation has been extensive and natural processes will need substantial time to restore habitat; or
4. Create beneficial habitat and restore stream function to the fullest extent possible within developed areas where no reasonable expectation of returning to natural conditions exists.

HUDSON BAY AQUIFER RECHARGE PROJECT
LOCATED IN THE NE$\frac{1}{4}$ OF SEC33, T6 N, R35E W.M.

Figure 1 Scaled Map of Project and Surrounding Area

0 400 800

SCALE IN FEET

ONE INCH EQUALS 400FT

NOTE
THE PURPOSE OF THIS MAP IS TO IDENTIFY THE APPROXIMATE LOCATION OF THE PROJECT. IT IS NOT INTENDED TO PROVIDE INFORMATION RELATIVE TO THE EXACT LOCATION OF PROPERTY OWNERSHIP BOUNDERY LINES OR ANY OTHER SIGNIFICANT MAP SUBJECTS

LEGEND

POWELL PV CANAL

TAX LOT BOUNDERY LINES

QUARTER QUARTER LINES

28 27 33 34 SECTION CORNER

HUDSON BAY AQUIFER RECHARGE PROJECT
LOCATED IN THE NE1/4 OF SEC33, T6 N, R35E W.M.
FIGURE 1A

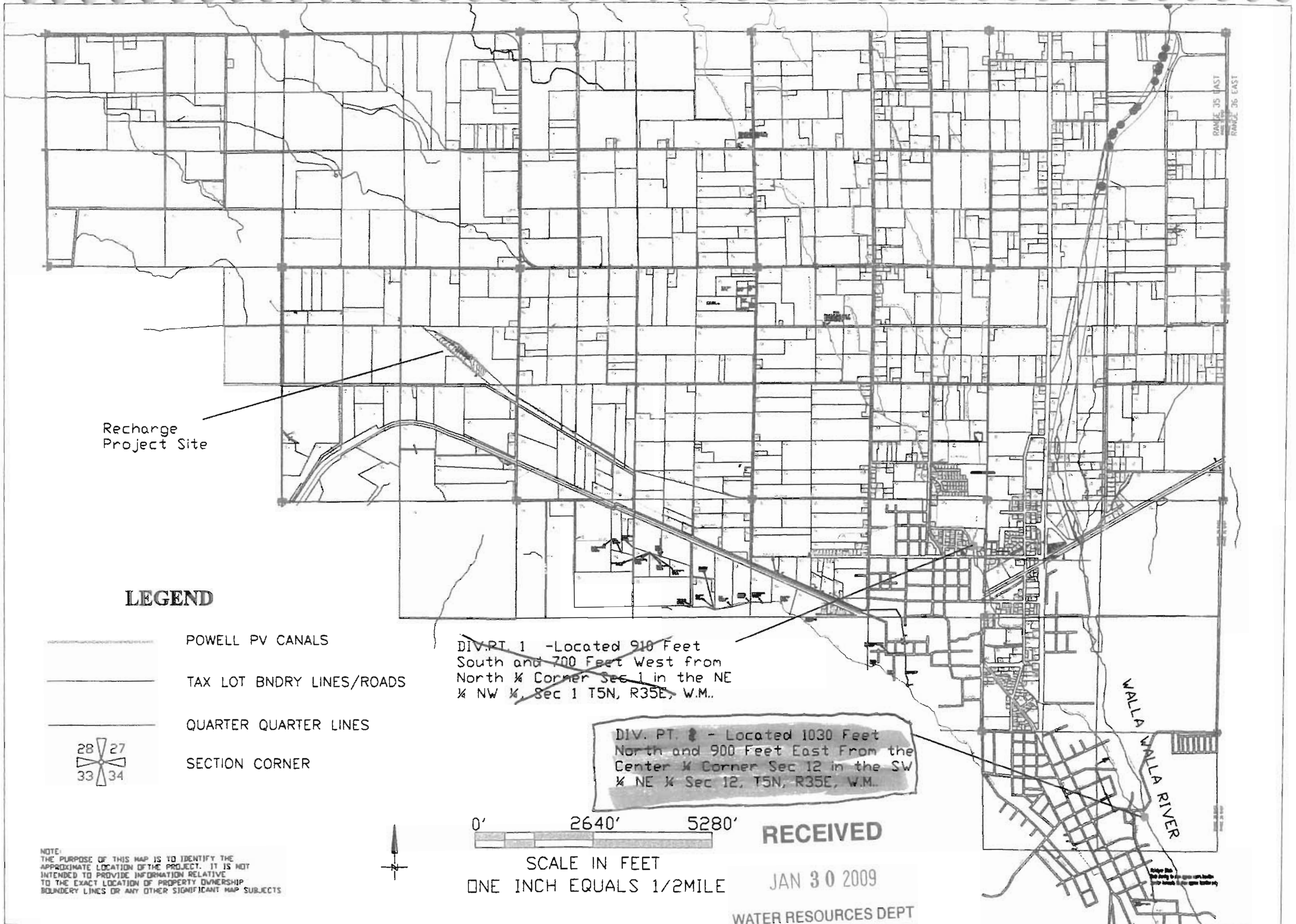
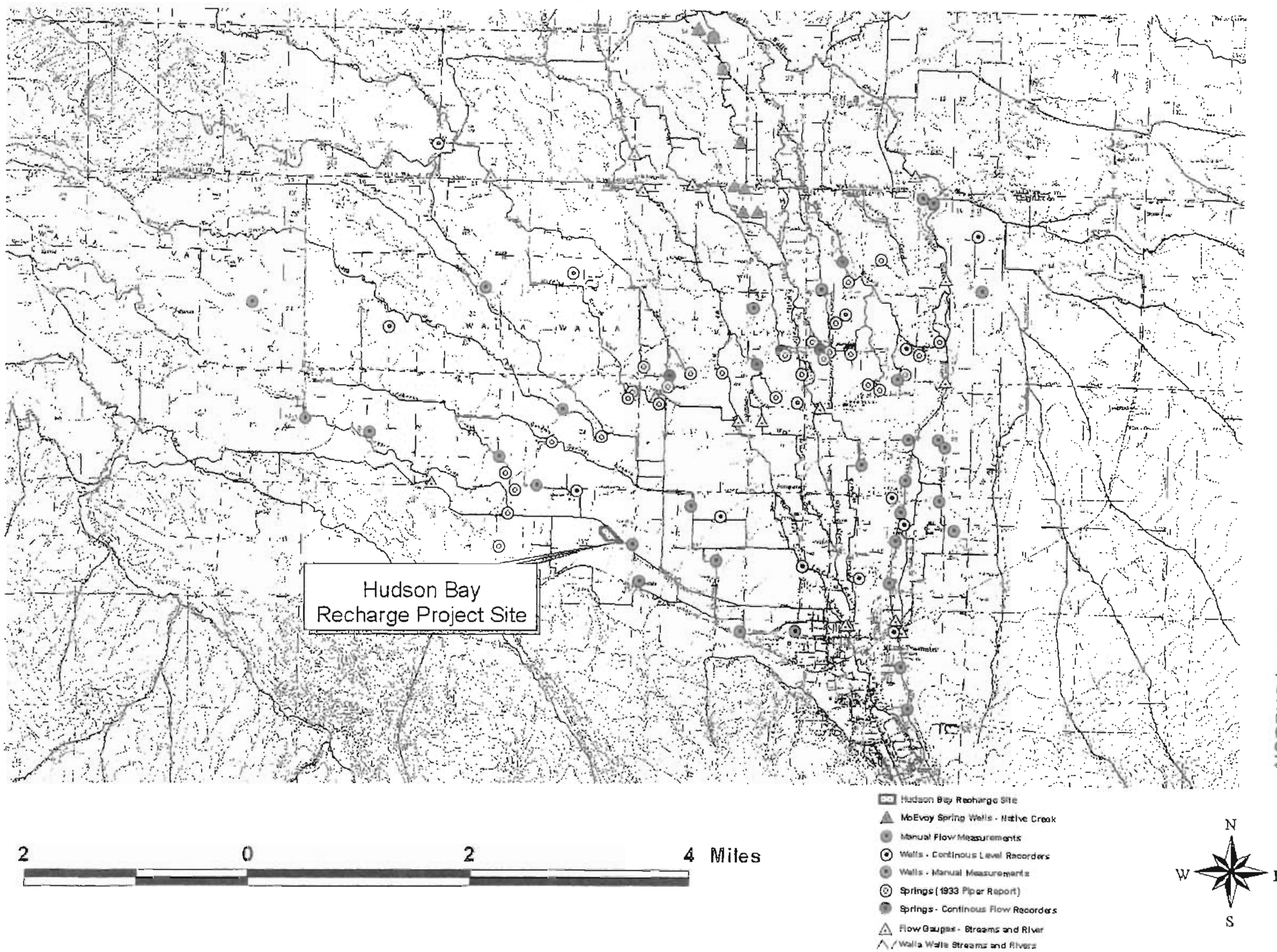


Figure 2 WWBW Monitoring and Recharge Site Map

FIGURE 2. WWBWC Monitoring Network and Hudson Bay Recharge Project 2003



Attachment 1. Project Layout, 690-350-0020(3)(a)(E) and (I) and 690-350-0020(3)(b)(B)

Prepared by Bernard Hewes, Licensed Engineer in the State of Oregon.

This project entails diverting water from an existing irrigation ditch to three pits to be excavated for the purpose of infiltrating the water into the shallow aquifer. Project features include a concrete check structure in the existing White Ditch, a concrete flow measuring flume, an open ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit.

These items were sized to handle 50 cubic feet per second (cfs) of water. This is the amount anticipated will be available from excess flow in the Walla Walla River and that the Hudson Bay District is able to deliver.

Data gathered to design the project consisted of a site topographic survey and installing two sites for testing the water infiltration capacity of the natural materials and determining the layers in the soil profile. In addition the Soil Survey of Umatilla County Area, Oregon was consulted. This is a US Dept. of Agriculture, Natural Resources Conservation Service publication giving general soils information.

The topographic survey data was used to prepare a topographic map with one foot contour intervals at a scale of 1" = 60'. This information was used to help determine the location of the project features.

Two test pits were excavated to a depth of 6'-7' each. A 24" diameter by 5' long section of corrugated metal pipe was set on end in the bottom of the pit and about one foot of fill placed around it to hold it in place. Water was pumped into the pipe at a rate that would sustain a water depth of one foot in the pipe. Both flow rate and total flow was measured. The test was run for 6.25 hours in the first pit and 3.5 hours for the second pit.

PIT #1
Soil profile:
0-12" sandy loam
12"-36" gravelly sandy loam, approximately 50% of the material volume is gravel size particles with an estimated D 50 size of about 0.75"
36"-48" sandy loam, in parts of the trench this layer does not exist
48"-?" gravelly sandy loam approximately 20% of the volume is gravel size particles

The inflow rate at the end of the test period was 4.0 gallons per minute (gpm). This resulted in an infiltration rate of 1.7 gpm/sq. ft./ foot of head.

PIT #2
Soil profile:
0"-13" gravelly sandy loam
13"-39" cobbly sandy loam, the D50 of the gravel is approximately 1"
39"-52" gravelly sandy loam
52"-? sand gravel mix D 50 estimated to be about 0.25"

In this pit the inflow rate of 11.9 gpm was maintained for 3.5 hours and at no time did water puddle in the bottom of the pipe. The infiltration rate is in excess of 3.8 gpm/sq. ft.

The area needed for infiltrating the water was determined assuming an infiltration rate for the entire area of 3.0 gpm/sq.ft./ per foot of head. For an inflow rate of 50 cfs the infiltration area needs to be

7480 square feet. The infiltration rate of 3.0 gpm/sq.ft. was chosen because the pits will be located in the area with soil surface texture similar to test pit #2.

Due to the possibility of fine soil particles plugging the infiltration area, unknowns concerning the long-term infiltration rate and that the amount of water available is not yet known extra infiltration area is being provided. Three separate pits with bottom dimensions of 50 feet X 100 feet are proposed. This will provide an infiltration area of 15,000 square feet.

The pits will be excavated to a depth of about 5 feet to get below the second sandy loam layer noted in both test pits. This will allow the water depth to be 2.5 feet - 3.5 feet. That will increase the rate of infiltration over the test values derived with one foot of water depth. The overall safety factor for the infiltration area is well over 2.

Inflow to the system will be measured with a ramp flume and continuously recorded. The ramp flume is sized to provide 5% flow rate accuracy over a flow range of 10 cfs-50 cfs

Any outflow from the last pit will be safely returned to the White Ditch through a 12-inch pipe. The pipe will be on a slope that will keep water from flowing out of White Ditch.

Engineering Attachments:

Attachment 1A: Location Map
Attachment 1B: Site Plan
Attachment 1C: Structure Details
Attachment 1D: Structure Reinforcing Steel
Attachment 1E: Signed and Stamped Copy of *Project Engineering Report*

Attachment 2. Water Rights Statement, 690-350-0020(3)(a)(F) and (G)

Water Right Applicant:

Hudson Bay District Improvement Co.

P.O. Box 110
Milton-Freewater, Oregon 97862
Project Contact: John Zerba, WBDIC Board Member
Telephone: (541)-938-6100
Operations Contact: Jon Brough, WBDIC District Manager
Telephone: (541)-520-2856
Recharge Project Manager (WWBWC), Bob Bower, Hydrologist
Telephone: (541)-938-2170

Source of Water:

Walla Walla River, a tributary of the Colombia River, within the Umatilla River Basin.

Purpose of Use:

Artificial Groundwater Recharge using water diverted during the fall, winter, and spring freshet flows on the Walla Walla River and utilizing the HBDIC recharge structure near Milton-Freewater, Oregon.

Proposed Period of Use:

November 1 through May 15 and as Further limited below

Point of Diversion Location:

~~NE ¼ NW ¼, Section 1, SW ¼ NE ¼~~ Section 12, T5N, R35E, W.M.; ~~DIV.PT. 1 910 Feet South and 700 Feet West from North ¼ Corner Section 1~~; DIV. PT. 2 – 1030 Feet North and 900 Feet East From the Center ¼ Corner Section 12.

Minimum Instream Flow Information:

When water is diverted under this permit, the use is further limited to times when there is, at a minimum, the following streamflows in the Tum-a-lum branch (mainstem) of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam.

Utilizing the Minimum Perennial Streamflows information (table 1, page 31) in OWRD Umatilla Basin Report (OWRD, 1988) and HBDIC's current winter water diversion permit (Permit Number 53662) the following represent the minimum instream flows at Nursery Bridge Dam:

- November – 64 cfs
- December through January – 95 cfs
- February through May 15 – 132 cfs

Nursery Bridge is located just downstream of Nursery Bridge and is downstream of the Little Walla Walla Diversion, the East Side Canal and the District's Canal, also described as point of diversion 1 in this application.

In order for diversion to occur under this permit, the above described streamflows must be met in the Tum-a-lum branch of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and following past Nursery Bridge Dam (see OWRD permit (Permit Number 53662 for operating and maintenance requirements for this station). Said streamflows shall be measured at the gauging station described below. In the event the primary gage experiences mechanical difficulties, stream flows at Nursery Bridge Dam shall be calculated by subtracting from the streamflows at Little Walla Walla Diversion (Cemetery Bridge) from those streamflows recorded at either the WWBWC gauge at Grove School Bridge or a combination of streamflows at OWRD's North and South Fork stations (#s).

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Attachment 3. Land Use Approval, 690-350-0020(3)(a)(H)

The HBDIC recharge project staff has consulted with both the Umatilla County Planning department and the current landowner (Hulette Johnson). Attached you will find two documents addressing the anticipated land use and zoning issues needed for construction and operation of this project. The first (Attachment 3A) a Land Use Form approved by the Umatilla County Planning Department. This was originally submitted as a requirement in the funding request to the Oregon Watershed Enhancement Board. The second Attachment (Attachment 3B) was is a lease agreement between the HBDIC and the current landowner and water right holder, Hulette Johnson.

Land Use Attachments

Attachment 3A: Umatilla County Land Use Approval
Attachment 3B: Lease Agreement with Landowner

Attachment 4. Proposed Test Program, 690-350-0020(3)(b)(A)

Introduction

The Walla Walla Basin Watershed Council (WWBWC), in cooperation with the Hudson Bay Improvement District (HBID), has proposed to test shallow aquifer recharge at a site located adjacent to the Hudson Bay Canal in section 33, T6N, R35E. At the test site a series of three infiltration pits will be built. Water will be supplied to these pits via a diversion from the canal. Recharge activities are proposed for winter and spring months when the Walla Walla River (the source of water for the canal) is at peak annual flows. The proposed shallow aquifer recharge testing will be done under an ASR Testing Limited License granted by Oregon Water Resources Department (OWRD) (OAR 690-350-0020).

Preliminary Test Site-Specific Hydrogeologic Characterization

Site-specific hydrogeologic characterization is designed to identify and define local conditions to provide a technical basis for designing the monitoring which will be used to evaluate testing. For this project a number of characterization needs are outlined in the 3 July 2003 hydrogeologic assessment letter report (Attachment 6). These needs include determining the physical properties of the geologic units underlying the test site, investigating the presence of a possible semi-confined aquifer in the upper part of the suprabasalt aquifer system, identifying aquifer hydraulic properties, and establishing suprabasalt aquifer baseline conditions, including seasonal variation, for groundwater depth, flow direction, and quality. These, and other site characterization issues, will be addressed using test site-specific hydrogeologic characterization data collected predominantly using:

1. Test pits, boreholes, and wells constructed for the direct observation of ` subsurface conditions
2. Infiltration tests (constant and falling head) designed to evaluate spatial variability at a site both laterally and vertically (note, the water source for this activity may require a temporary permit)
3. Aquifer testing and water level measurements to evaluate baseline aquifer physical conditions before testing
4. Surface and ground water quality data collected to evaluate the affect (if any) of test site operation on area groundwater quality
5. Well and canal records describing water use in the project area
6. Water flow metering at the test site that indicates surface water in-flow and out-flow during testing

At this time, geophysical investigations are not being considered because of the lack of subsurface control and ground truth data that could be used to constrain geophysical interpretations. The following sections describe proposed soils, geologic, hydrogeologic, surface water, and water quality characterization for this project.

Soil Characteristics

The HBDIC recharge project will be constructed by excavating the top 5 feet (72 inches) of soil from each of the recharge pits (See Engineering Design Report, ATTACHMENT 1). Test Pits constructed and evaluated in the Engineering Design Report provide site-specific soil profile information. Additionally, the "Soil Survey of Umatilla County Area, Oregon, (USDA, 1988) provides some general information about soil in the upper 60 inches at the project site. The two soils present at the site are: Freewater (29A) and Cowsly (22C). As the entire soil layer will be removed during construction, it was not found useful to further characterize the specific soil properties further.

Geology

Geologic features control the physical characteristics of aquifer hosting materials, and therefore the distribution and movement of groundwater through an aquifer. Understanding the nature and occurrence of these features, both regionally and locally, provide constraints on testing, data interpretation, monitoring, mitigation, and final design. The objective of geologic characterization is to develop a three dimensional physical framework that describes the materials hosting the vadose zone and groundwater at the test site. Within this framework, or conceptual model, the nature and distribution of those factors thought to control groundwater movement and distribution will be evaluated.

Site-specific geologic characterization will be accomplished largely through the analysis of data collected during the drilling of several proposed boreholes at the site and comparison of that data to information collected during the preparation of the hydrogeologic assessment report. A minimum of three boreholes are proposed for the immediate vicinity of the test site. One of these boreholes will be located on the inferred up-gradient side of the test site, two will be located on the inferred down-gradient side (Attachment 5C). As testing progresses, additional boreholes may be drilled to collect additional characterization, testing, and/or monitoring data. Subsurface hydrogeologic conditions will be interpreted via drilling cuttings and spilt-spoon sample logging.

The project hydrogeologic assessment identified work needed to complete site-specific hydrogeologic characterization. Hydrogeologic characterization targets, and the rational for them, are described below.

It is likely that the uppermost, unconfined part of the shallow aquifer system, is hosted by predominantly uncemented alluvial gravel beneath the test site. However, it is not clear from the available data how deep the alluvial gravels extend and what their properties are beneath the test site. Identifying the three-dimensional extent of these strata is critical to the proposed testing because water probably will move more rapidly through these uncemented strata, both downwards and laterally, then in the deeper, more cemented Mio-Pliocene conglomerate that comprises the majority of the shallow aquifer system in the area.

Area data indicates that, if present, the unconfined part of the shallow aquifer system at the site may be relatively thin and underlain by a semi-confined zone at depths of less than 75 feet. Characterization will identify if this semi-confined zone is actually present, and if found, the nature of the confining layer separating it from the overlying unconfined zone and the basic hydrologic properties of the semi-confined zone. Knowing the nature and extent of the confined aquifer underlying the site is critical in evaluating if the proposed recharge will affect this deeper aquifer. If data collected indicates that the project could potentially affect this deeper aquifer, monitoring will need to be designed to not only assess shallower unconfined aquifer impacts but deeper confined aquifer impacts as well.

The nature and distribution of the confining layer atop the confined aquifer should be identified in order to support evaluation of the thickness and distribution of the unconfined aquifer (if present). If the unconfined aquifer is absent, or only present seasonally, we will still need to identify the nature and extent of the confining layer because, just as it inhibits upward movement of groundwater, it will restrict the downward movement of recharge water. Knowing where the confining layer is will provide information on where recharge water may potentially collect atop this layer and where it will potentially spread to.

Mapping for the assessment identified a potential depression in the top of the older Mio-Pliocene conglomerate below the western end, and west of, the test site. The depth, shape, and orientation of this feature will need to be evaluated because it will effect how the aquifer(s) underlying the test site responds to the testing. If an unconfined aquifer indeed underlies the site, this depression may act as a "reservoir" for water introduced into this aquifer. Alternatively, it may serve as a recharge pathway, hydrologically connecting the upper, unconfined part of the suprabasalt aquifer system with deeper, confined parts of the aquifer system.

Hydrogeology

Piezometers and/or observation wells will be constructed in the borings drilled for geologic characterization. If additional geologic characterization boreholes are drilled (either close to or more distal from the test site) one or more of these also may be converted to observation wells. All but one of the boreholes converted to monitoring wells will be completed as 2-inch observation wells that fully penetrate the unconfined aquifer (if present) or above the confining layer (if unconfined aquifer not present). At least one of the geologic characterization boreholes should be of sufficient size to accommodate a 4-inch diameter well which will be used for aquifer testing.

Test site-specific hydrogeologic work would be done, in large part, concurrently with the site-specific geology work. The hydrogeologic assessment concluded that the following information must be collected for the uppermost part of the suprabasalt system at the test site:

1. Depth, thickness, and lateral and vertical extent of the vadose zone and the uppermost aquifer(s) underlying a site.

2. Nature and effect of perching layers (if any) in the vadose zone.

3. Aquifer and vadose zone physical and hydrologic properties - including, grain size, matrix content, induration, hydraulic conductivity, transmissivity, and porosity

4. Groundwater flow direction and velocity, including both spatial and temporal variation

5. Anthropomorphic effects, primarily changes in groundwater pumping, surface water (including canals), and irrigation activities.

For characterization it is important to build monitoring (or observation) wells in such a way as to provide means for accurately measuring the target aquifer. Well construction considerations are listed below:

1. Most project observation wells will probably be 2 inch-diameter piezometer type installations. These should be built to ensure that they are monitoring the anticipated aquifer targets, and we recommend building to well construction standards and avoiding cost cutting measures designed to get more/cheaper wells (these commonly result in poorly built wells unsuitable for collection of the high quality data we feel is necessary to support the project).

2. For aquifer testing, a 4 inch-diameter observation well is the minimum recommended diameter and at least one such well should be built.

3. The minimum number of observation wells at the test site is 3, one up-gradient and 2 down-gradient. If funding can be procured we recommend that more than 3 observation wells be installed. Most, if not all, of these additional observation wells could be built in geotechnical borings drilled for geologic characterization.

In addition to the observation wells built near the test site, it seems likely that observation wells will eventually need to be built more distant from the site. The purpose of these observation wells would be to more accurately trace the down gradient migration of recharge water away from the test site. A minimum of 3 more distant observation wells, 1 up-gradient and 2 down-gradient is again recommended. These might include at least some previously built groundwater supply wells that would be available for use. However, these should only be used if construction details can be verified and if they are not being used as water supply wells. Access to offsite observation well drilling locations will need to be acquired from willing landowners. The WWBWC currently has a network of existing wells that could be used for the purpose of tracking the recharge water distally from the site.

Aquifer testing designed to collect aquifer hydraulic property data will be part of site characterization. During aquifer testing, the 2-inch observation wells will be monitored to observe the effects of testing on the surrounding aquifer. Aquifer testing would include an 8-hour step-drawdown test to establish probable sustainable yields in the suprabasalt aquifer, followed by a 24 to 72 hour constant discharge test. Water level data collected during aquifer testing will be analyzed using standard analysis techniques.

Combining the interpretations developed in the completed hydrogeologic assessment with the drilling and testing data collected during site-specific characterization, a conceptual model of test site hydrogeologic conditions will be prepared.

Surface Water

One of the main objectives of the project is to increase surface water quantity (base flow) and improve its quality (temperature). To document that, surface water bodies that the project may influence need to be identified and monitoring points on them established and characterized (includes collection of baseline data). These locations will be used as monitoring locations during subsequent testing.

The hydrogeologic assessment identified three, down gradient, spring-feed streams, Goodman Spring Branch, Johnson Creek, and Dugger Creek, which are most likely to be affected by recharging the shallow aquifer. During test-site specific characterization these streams will be examined and monitoring points identified. At these points stream conditions will be photographed and stream conditions documented prior to the initiation of testing that will include the following parameters:

Flow volume and discharge

Water temperature

Water quality (temperature)

Hydrophilic plants and habitat quality

Sampling frequency will be designed to collect enough data to demonstrate the range of conditions likely at the monitoring points so that site background conditions can be documented enough to provide an adequate baseline to measure test results against.

Water Quality

Both surface and groundwater quality at the test site, and at likely down-gradient discharge points, needs to be documented. There are several reasons for this, including:

1. We do not want to introduce contaminated water into the shallow aquifer via recharge activities and violate antidegradation rules. We need to establish background water quality parameter concentrations and monitor source-water quality periodically during testing and operations.

2. Certain source-water conditions (e.g., turbidity) have the potential to degrade or even "plug" the recharge system. From an operational standpoint, one would monitor for those conditions and halt test operations when the source-water exceeded those conditions.

3. Up-gradient groundwater quality needs to be monitored so that the effects of recharge on water quality can be differentiated from those water quality conditions caused by recharge activities, including leaching of vadose zone constituents by recharge water.

Sampling Quality Assurance and Quality Control (QA/QC) protocols will need to be established and followed for characterization and later monitoring. QA/QC for the project, which is described in Attachment 5, includes:

- Sampling equipment
- Measurement techniques for field parameters
- Decontamination procedures
- Well purging guidance for groundwater samples
- Sampling methods
- Chain of custody and sample handling procedures
- Record keeping
- QA/QC guidelines

Characterization Conclusions

With the completion of site-specific characterization, updated monitoring and test plans will be prepared if necessary. These monitoring and test plans will be based on the results of the characterization effort which includes the generation of a site conceptual groundwater flow model that describes probable aquifer conditions, suprabasalt aquifer water level(s) and groundwater flow direction(s) (including seasonal variations), and discharge points for recharge water.

Preliminary Test Site Operation Plan

The objective of proposed artificial groundwater recharge testing to be done under the limited license is to evaluate the feasibility of restoring diminished shallow aquifer water levels and increasing decreased spring creek flows using infiltration pits and winter high flow water diverted from the Walla Walla River to these pits. Testing will be done over five years. If testing indicates shallow aquifer recharge and spring creek flow restoration is feasible using infiltration, test results will be used to design and implement larger scale artificial groundwater recharge at this, and potentially other sites in the area. Testing **will not include** removal of stored water by pumping or other artificial means.

This preliminary test plan describes how the test site will be operated during testing. Elements included in the preliminary test plan include: (1) site construction, (2) test operations, (3) mitigation activities, and (4) reporting. The preliminary test plan may be modified as testing proceeds.

Site Construction

The basic layout of the test site is shown on Figure 1. The site, located adjacent to the Hudson Bay Canal, will consist of three infiltration pits excavated approximately 3 feet into Quaternary alluvial gravel which immediately underlies the test site (Attachment 6). Water will be delivered to the pits via a diversion structure in the canal. Any water that does not infiltrate into the ground from these pits will be returned to the canal via a return ditch or pipe.

More detailed site construction information describing: (1) test site survey and layout (2) specifications for pits/basins/pits used for infiltration (3) water supply design (including diversion from canals if appropriate) (4) monitoring points (both on and off site) and (5) site access controls (fences, etc.) are described in detail in Attachment 1, (1A-1E), Engineering Design.

Test Operations

Test operations describe how the site will be used during testing and possible reasons for changing the test as new data and information is collected during the test. Test operations include:

1. Test timing, including timing of recharge and monitoring frequencies

2. Quantities of water used

3. Outside influences that effect test, including weather (probably freezing), elevated river turbidity, river flooding, trip wires for identifying potential offsite impacts before they occur so they can be mitigated and or testing suspended to prevent worsening conditions

4. Responsible parties for diversion and delivery of water, operation of test, monitoring, and data review

5. Permissions required to access offsite monitoring points

These are discussed further in the following paragraphs.

Test Timing, Monitoring, and Water Quantities

Testing is tentatively planned to begin in the winter of 2003/2004 and continue for 5 years. Test operation will generally be conducted in the winter when Walla Walla River flows are at their highest and irrigation activities are at their lowest. A maximum of approximately 50 cfs will be delivered to the test site during normal operation. However, in the event minimum Walla Walla River flows are not meet, water will not be diverted from the river for test site use. Depending on stream flows in any given year, recharge water may be delivered as early as December to as late as March/April. In addition, in the event of prolonged freezing weather, test site operation may be temporally suspended to avoid ice damage to the canal diversion on the Walla Walla River, the canal system itself, and/or the recharge pits and related structures.

Water quantities delivered to the test site will be monitored via a gauge at the diversion from the canal into the test site. The return canal from the test site back into the canal will also be monitored to determine the quantity of water that leaves the test site (if any) because it did not infiltrate into the ground. Based on this monitoring data, and estimated evaporation loses that could occur during operation; water quantities discharged to the ground will be calculated.

Groundwater levels in the immediate vicinity of the test site will be monitored before, during, and following recharge test events via three (at a minimum) observation wells constructed during characterization, potentially via existing water wells in the area if any can be found that can be used for shallow aquifer water level monitoring, and potentially with new observation wells built as the test progresses. During the recharge test event, tentatively scheduled for the winter/spring of 2003/2004 water levels will be measured as follows:

1. Throughout the calendar year water levels will be measured at least weekly, beginning with the granting of the limited license.

2. In the month prior to the anticipated start of recharge activity and in the month following the termination of recharge, water levels will be measured daily.

3. During recharge water levels will be measured daily, at a minimum.

Based on preliminary engineering design studies (Attachment 1) and the hydrogeologic assessment (Attachment 6) most, if not all, of the water delivered to the test site will probably infiltrate into the ground. However, because this project is a test project, the current plan is to initially operate the test site at approximately half capacity. The quantity of water discharged to the site will than be increased or decreased as experience and observations dictate. Final operating quantities will determined based on test results.

Water quality data will also be collected before, during, and following recharge events. Parameters to be collected, sampling timing, and other water quality monitoring information are presented in the Monitoring Plan (Attachment 5).

Outside Influences

The primary currently identified outside influences on testing are Walla Walla River flow levels, freezing conditions, source water turbidity levels, and increased groundwater water levels resulting from testing that impact surface activities and conditions. The likely effects of these on testing, and possible mitigation actions to be implemented during testing, are as follows:

Low flows in the Walla Walla River will impact testing because the use of Walla Walla River water for recharge will be conditional, based on river flows exceeding a certain threshold. When flows do not, water will not be delivered to the test site and testing will not occur.

High Walla Walla River flows may also effect testing. In the event of high flow during a flood or rapid snow melt event, turbidity will generally increase. The repeated delivery of turbid water to the test site infiltration pits may eventually lead to plugging of pore space and reduced infiltration capacity. To mitigate against this, delivery of recharge water may be terminated or scaled back during high flow events. Alternatively, the pits may be periodically re-excavated to remove these fines. The preferred mitigation strategy for dealing with this will be based on monitoring and performance data collected during testing.

The effects of freezing on the test are outlined earlier in this Attachment and repeated here. In the event of prolonged freezing weather, test site operation may be temporally suspended to avoid ice damage to the canal diversion on the Walla Walla River, the canal system itself, and/or the recharge pits and related structures and to avoid the risk of ice jams forming in the canal, backing up water in the canal, and causing flooding adjacent to the canal.

It is possible that recharge testing could cause groundwater levels to reach the ground surface at locations where human activity and habitat is negatively impacted. One of the main purposes of groundwater level monitoring is to identify increasing water levels in the test site area in order to: (1) directly observe the effects of recharge on water levels (2) use these observations (in conjunction with characterization data) to evaluate whether or not recharge is having an impact on groundwater levels that could lead to surface problems, and (3) identify when and where this type of problem may occur. If water level monitoring data suggest increased groundwater levels are approaching the ground surface and that flooding of low lying areas seems possible, the quantity of recharge test water being delivered to the infiltration pits will be reduced or, if necessary, terminated.

Responsible Parties and Access Permission

The test will be managed primarily by the Hudson Bay District Irrigation Company, lead by John Brough, Operations Manager, and the Walla Walla Basin Watershed Council (WWBWC) technical staff, lead by Mr. Bob Bower, Hydrologist. HBDIC and WWBWC staff (or a subcontractor working for the HBDIC and WWBWC) will compile monitoring and testing data, prepare reports as necessary to meet license requirements, and in consultation with Hudson Bay Irrigation District (HBDIC) staff make decisions regarding timing and quantity of water delivered to the site and when to suspend recharge activities. Submittal of all monitoring reports to OWRD will be the responsibility of HBDIC and WWBWC staff. The HBDIC and WWBWC may choose to subcontract report preparation and delivery to a subcontractor.

HBDIC staff will be responsible for operating all facilities associated with removing recharge test water from the Walla Walla River and delivering it to the test site, including operation of the diversion structure which routes water from the canal into the pits. HBDIC staff also will maintain all equipment associated with water delivery and pit operation, including reexcavation of the pits, if necessary.

Mitigation

As stated above, one of the objectives of monitoring is to identify likely unintended consequences of recharge testing before they occur. When the precursors to these consequences, such as changing water quality detrimental to aquatic habitat or groundwater levels rising to close to the surface in areas where shallow groundwater is not desired, can be detected soon enough via monitoring, recharge activities will be modified and/or terminated to mitigate against these effects.

Reporting

Data and observations collected during testing, including monitoring data, will be compiled into reports. The basic objective of these reports will be to describe what was done during the test, what was observed at the monitoring points, interpret the data collected, and recommend changes to testing, monitoring, and mitigation plans. These reports will be produced annually. Based on the proposed recharge schedule, annual reports will be submitted to OWRD in the summer following each winter recharge test.

More frequent reporting will be done when monitoring reveals the presence of an undesired effect from testing. If monitoring reveals that undesired consequences of testing are likely to occur, WWBWC staff (or designated representative) will report the monitoring information to OWRD staff.

At the conclusion of the 5-year recharge testing done under the limited license a final report will be prepared. The final reports will describes the project, data colleted during testing and monitoring, interpretations of how well the recharge project worked in achieving project goals, and recommendations for future operations. The final report will be submitted to OWRD in the summer following the fifth annual winter recharge event.

Attachment 5. Proposed Monitoring Program, 690-350-0020(3)(b)(A)

Overview of Basin Wide Monitoring Plan

In 2003, the WWBWC expanded its watershed monitoring strategy to include collecting basin line information for the numerous spring-creeks and district ditches spread out across the Walla Walla River valley (Oregon). Starting in June 2003, many new flow stations (15-minute stage and temperature recorders) were installed at or near the sources of nearly all the springs in the Oregon portion of the system (Figure 2). The WWBWC monitoring program has a total of 28 continuous flow stations with additional 15 continuous static well recorders with many more manual measurement locations. The objectives of this monitoring (specifically for the spring-creek and shallow aquifer system) is to accomplish the following:

1. Be able to discern between Walla Walla River Water (coming from districts water rights and use) and spring waters (emerging strictly from the shallow aquifer). It is understood that the application of irrigation water will undoubtedly show up as spring returns, but this monitoring is intended as a beginning to understanding this complicated system.
2. Collect baseline information on spring flow as it relates to seasonal and yearly fluctuations.
3. Many of the spring-creek monitoring stations were sited based on the presence of historical data collected by Piper (USGS, 1933). Where Piper had collected spring-creek flow, we attempted to locate our gauges as near as possible to his historic data sites. The intention is to allow us the ability to compare and contrast historical and current spring-creek conditions based on a significant period of time. Most of these Piper's original sites were located upstream of any irrigation with draws, making them key locations for us in this type of comparison.
4. Monitor water table levels continuously for daily, seasonal and yearly fluctuations and timing. Some of the wells being recorded have periods of record dating back to the 1930s, allowing us some opportunity to understand any long-term changes in the aquifer system.

Recharge Project Monitoring Plan

The proposed ground water recharge project exists inside this larger monitoring network and it is expected that this will help provide useful information in testing of the proposed testing (see below). Some of the sites shown in this larger network were specifically located to provide proximal and distal pre-construction and operation information for this project (Figure 2). Site specific monitoring includes observation wells and surface monitoring stations (Attachment 5B).

Monitoring for the site-specific proposed testing is designed to meet four basic objectives. These are to identify: (1) changes in the natural system caused by factors other than those related to testing, (2) changes in the natural system caused by the testing (track the test performance), (3) potential problems caused by the testing that may require modification or termination of the test and/or mitigation actions, and (4) events that effect test operations, such as a freezing or a flooding. To meet these objectives, monitoring will track:

1. Source water quality and volume coming onto the test site

2. Up-gradient groundwater water quality

3. Up-gradient groundwater level changes to provide the information needed to differentiate recharge test effects from other, natural and artificial, effects on the groundwater levels beneath test site

4. Down-gradient groundwater quality and levels, both near and distal to the test site

5. Surface water discharge and quality changes

Four basic types of monitoring points are planned for this project:

1. Source water

2. Test site groundwater

3. Distal groundwater

4. Surface water (e.g., springs).

Monitoring data collected at these points during testing will be evaluated against what is known about pre-test conditions to identify testing effects on the surrounding environment, differentiate those effects from others in the environment, and identify when changes in test operations appear necessary. Pre-test conditions will be determined during the planned site-specific characterization activities described in Attachment 4 and are partially described in the preliminary hydrogeologic assessment (Attachment 6).

This preliminary monitoring plan discusses monitoring activities to be undertaken at the four types of monitoring points and sampling and QA/QC protocols.

Sampling and Analysis Program

The groundwater-monitoring program proposed for the test project is outlined in the following sections. Annual reporting is proposed and a Water Quality Analysis Report will be prepared following five years of testing.

As stated in the introduction, four types of monitoring are proposed: (1) source water at the test site (2) site-specific groundwater (3) distal groundwater and (4) surface water (springs).

(1) Source Water at Test Site
Source water monitoring will be at the point of diversion onto the test site. Monitoring will include both water quantity and quality. The volume of water delivered to the test site will be monitored via a gauge at the diversion. Water quality samples will be collected at the gauge.

Proposed monitoring frequency is as follows:

> Gauge data will be recorded 15-minute readings via a continuous recording data logger. Rating measurements and tables will be generated for each surface flow site and continuously checked for shifts.
>
> Three source water quality-sampling events are proposed for each yearly seasonal recharge period. They are proposed for approximately: (1) one month prior to the projected beginning of the recharge period (2) during the mid part of the recharge period and (3) approximately one month following the end of the recharge period. The exact timing of these will be based on predicted Walla Walla River flows and may vary from year-to-year. OWRD and ODEQ staff will be notified by WWBWC staff of pending sampling events at least two weeks prior to each sampling event.

The results of source water quality monitoring will be used to determine if modifications to test operations are warranted. During testing different sampling frequencies may be tried to identify those that are most effective.

(2) Site Groundwater

Site groundwater monitoring, consisting of the collection of water quality and water level data, will be conducted at the three observations wells built during characterization. The purpose of site groundwater monitoring is to establish water quantity and quality impacts from testing to groundwater in the immediate vicinity of the site. In addition, up-gradient monitoring will be used to differentiate test impacts from those caused by other activities not controlled by the testing.

Proposed monitoring frequency is as follows:

> Water levels will be measured weekly throughout the year when recharge testing is not underway.
>
> In the month prior to, during, and the month following the yearly seasonal recharge period, water levels will be collected daily (at a minimum) for the first year of testing. Measurement frequency during subsequent years will be based on previous observations and proposed in annual reports.
>
> Three groundwater quality sampling events are proposed for each yearly seasonal recharge period. They are proposed for approximately: (1) one month prior to the projected beginning of the recharge period (2) during the mid part of the recharge period and (3) approximately one month following the end of the recharge period. The exact timing of these will be based on predicted Walla Walla River flows and may vary from year-to-year. OWRD and ODEQ staff will be notified by WWBWC staff of pending sampling events at least two weeks prior to each sampling event.

The proposed locations of site-specific groundwater observation wells are shown on Figure 1. The results of groundwater quality and level monitoring will be used to determine if modifications to test operations are warranted. During testing different sampling frequencies may be tried to identify those that are most effective.

(3) Distal Groundwater

Distal groundwater monitoring, consisting of the collection of water quality and water level data, will be conducted at observation wells more distal from the test site than the site observation wells. Initially, during the first year of recharge testing, these wells will probably be previously constructed water supply wells that can be used by WWBWC staff and can be shown to be open to only the shallow aquifer. If funding for new wells can be procured for subsequent years, dedicated distal groundwater observations wells may be built to improve the monitoring coverage.

A minimum of 3 distal observation wells will be used, 1 up-gradient and 2 well down-gradient. The locations of these will be determined during site specific characterization currently planned for the winter of 2003. Monitoring frequency is the same as proposed for site-specific groundwater monitoring. Figure 5B shows the approximate site locations for the site-specific observation wells.

Distal monitoring will be used to identify longer term quantity impacts from testing. This includes the formation and migration of a groundwater mound and recharge water plume at, and away from, the test site, towards intended and unintended receptors. Up-gradient monitoring will be a part of this so that testing effects can be differentiated from offsite events. Sampling frequency will be determined from characterization data and modified as more is learned during testing.

(4) Surface Water (Springs)
The WWBWC is currently monitoring most of the surface springs, creeks and rivers of Oregon's lower Walla Walla River basin (See Figure 2.) While this project will specifically Surface water monitoring in Dugger, Johnson and Goodman Spring-Creeks will be done to identify the effects of recharge on flow. This monitoring will include the collection of both water quality (specifically temperature), flow and habitat improvements (photo-documentation). As with groundwater monitoring, surface water monitoring will need up-gradient and pre-project condition monitoring information so that effects unrelated to test site operations/testing can be differentiated from those due to testing. Pre-project surface flow monitoring was started during the 2003 summer irrigation season at Dugger and Johnson Spring-Creeks in the form of a continuous.

Sampling Parameters
Sampling methods are specified in the following sections. The chemical monitoring parameters are to be conducted on a two-tiered system. Level 1 monitoring will be conducted during all three water quality-monitoring events (each recharge period). Consistently elevated concentrations of nitrate will be initiate the level 2 chemical analysis. Samples will be tested for chemicals in the level 2 list. Operation of the recharge project will depend on the absence/presence of the chemical parameters on this list. ATTACHMENT 5B describes the specific method and documents used to determine the level 1 and 2 chemical parameters (pesticides, herbicides, insecticides, fungicides, etc.) listed below.

Monitoring is proposed for the following parameters:

Physical Parameters (all monitoring types)

Static water level (in observation and WWBWC network well)

Standard field parameters, including pH, turbidity, electrical conductance, and temperature

Flow (in cubic feet per second)

Chemical Parameters –Level 1 (On-site monitoring only)

Total nitrogen as nitrate (screening parameter for Level 2 Chemical screening)

TKN

Total dissolved solids

Chemical oxygen demand

Chloride

Orthophosphate

Fecal Coliforms (Presence/absence only)

Chemical Parameters –Level 2 (On-site monitoring only)

Rubigan (Fenarimol)

Ridomil (Metalxyl)

Systhane/Rally (Myclobutanil)

Devrinol (Napropamide)

DDD-DDE-DDT

Elgetol (DNOC sodium salt)

Alar/B-Nine (Daminozide)

Lindane (Lindane)

Sampling dates will be coordinated for all monitoring points used in the project.

This list of analytes was selected to optimize routine sampling to address constituents commonly of concern (nutrients and salt) and provide prompt indication of potential impacts by analyzing for anions (nitrate and chloride) that are known as groundwater tracers (DEQ, 1995). Additional parameters will be proposed for future sampling if the results of the initial proposed sampling indicate this is necessary.

Sampling Procedure

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

Equipment

This section lists the equipment for groundwater monitoring.

Submersible pump (*Grundfos* or similar) or dedicated bailers/sampling line

Temperature measuring instrument (*Vemco* data logger)

pH and conductivity meter(s) with calibration reagents

Water level and flow meters (*Tru-traks, In-situ Mini-trolls*, *Stevens 420 loggers,* 0.01 foot resolution required)

Shipping cooler with ice packs or ice

Five-gallon pail marked at the 5-gallon level, stopwatch

Laboratory supplied sample containers with appropriate preservatives

Tap water, deionized water, phosphate-free soap, cleaning brushes, field note book, log sheets

Water Level

An electronic water level meter will be used to measure the depth to groundwater in each observation well to the nearest 0.01 foot. Static water levels must be measured at the indicated reference point prior to purging any water from the well. The reference points will be on the top of the observation well casings. The static water levels in all wells should be measured on the same day for each site. Coordination with quarterly sampling of other wells in the vicinity should be attempted. 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.

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 locations. 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. The procedures described in this section are specifically for field decontamination of sampling equipment. At a minimum, field-sampling equipment should be decontaminated following these procedures:

1. Wash the equipment in a solution of non-phosphate detergent (Liquinox® or equivalent) and distilled/deionized water. All surfaces that may come in direct contact with the samples shall be washed. Use a clean Nalgene and/or plastic tub to contain the wash solution and a scrub brush to mechanically remove loose particles. Wear clean latex or plastic gloves during all washing and rinsing operations.

2. Rinse twice with distilled/deionized water.

3. Dry the equipment before use, to the extent practicable.

Purging and Field Parameters (On site wells only)
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 ± 10 percent over three consecutive measurements. At this point, the observation well is considered adequately purged and can be sampled.
Occasionally, observation wells installed in low permeability formations may be purged nearly dry (within 6 inches of bottom of well) prior to stabilization of groundwater parameters and prior to purging at least three borehole volumes. If this happens at least one set (more if possible) of purge water groundwater parameters (pH, temperature, EC) need to be measured. Sample collection can be done after the water level has recovered at least 75 percent of the drawdown ensuring most of the well water is from the formation. Prior to groundwater sample collection several measurements are required as explained above. These include static water level and total depth, pH, temperature, and electrical conductivity.
All field instruments should be calibrated each day 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.

Water Sampling
Samples will be collected after sufficient water has been purged according to the procedure described above. 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. Discharge from a bailer should 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."

Sample Preservation and Holding Time. 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.

Resampling

In accordance with OAR 340-40-030(5), resampling is done if monitoring indicates a significant increase (or decrease for pH) in the concentration of a monitored parameter at a sampling point. Determining if a significant increase in parameter concentration has occurred is customarily done either by assessing concentrations in relation to established concentration limits or by using a statistical analysis. Since background or baseline conditions have yet to be established for the test site a concentration limit has not been set and insufficient data exists upon which to base a statistical analysis. The criteria to guide resampling decisions will be reevaluated is subsequent test project annual reports.

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.

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:

1. 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.

2. Chain-of-custody forms will be completed, being signed by all sample handlers.

3. Holding times for all constituents will be met.

4. Field blind duplicate results will be evaluated to make sure they are compatible.

5. 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.

Data Reporting and Statistical Analysis
The following procedures for reporting analysis are proposed for this project.

Record Keeping
All field notes, laboratory results, critical calculations, and published reports will be maintained at the WWBWC office for a period of five years following completion of the final testing and monitoring report. If possible, both paper and electronic copies will be maintained.

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:

1. Verification of analytical methods and detection limits, along with the date the analysis was performed

2. Review of document handling, sampling and analytical problems, and actions taken to correct any problems

3. Summarizing water level data in tabular and/or graphical form

4. Summarizing water quality analytical results in tabular form and/or graphical form

5. Performing data validation checks, as appropriate to the data set

6. Identifying any significant increases in parameter concentrations (will be done later in project only after enough data has been collected to warrant)

Annual Review and Reporting
All monitoring activities performed during the previous monitoring year will be included in an annual report to be submitted to OWRD during the summer following the preceding seasonal recharge period. The annual report will present the following 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 all field and laboratory data, including observed changes and groundwater flow direction and gradient

Discussion and conclusions, including recommended changes to recharge testing

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 tests have 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; or comparison of water quality between up-gradient and down-gradient wells. For the test site, insufficient data are available for a statistical analysis to be performed because concentration limits have not yet been established. Until that time, evaluation of dataset trends will be solely qualitative, but revisited in each annual report until a database has been compiled that is sufficient for statistical analysis.

Final Recharge Test Project Report
At the conclusion of five years of recharge testing under the limited license a final report will be prepared. The report will contain the data collected for the test project; analysis and interpretation of that data (including statistical analysis as appropriate), and a recommendation for proposed future artificial groundwater recharge activities at the test site. The report will be complete enough to serve as supplemental material to a permanent artificial groundwater recharge permit under OAR 690-350-0110, if such a permit is sought following completion of the test project.

Monitoring Plan Attachments

Attachment 5A. Methodology Water Quality Assessment and Evaluation
Attachment 5B. Figure 5A Map of On-site Recharge Well Locations
Attachment 5C Chemicals of interest for Hudson Bay Recharge Project

Attachment 6. Site Hydrogeology, 690-350-0020(3)(b)(C), (E), and (G) (attached)

Attachment 7. Source Water Quality, 690-350-0020(3)(b)(D)

Overview

This project will utilize winter-spring flow from the Walla Walla River as the *source* water for recharge during the project operation. The time period that Walla Walla River water will be used is November 15th through May 15th. A review of existing reports and data was conducted to identify any areas of concern regarding source water quality for the recharge project. What little information that exists for source water quality conditions is discussed below.

In 2003, the WWBWC tracked turbidity levels through a winter storm event (1/27/3 through 2/3/3) and found turbidity levels to be a potential issue on the Walla Walla River (mainstem) during peak flow events (WWBWC, Unpublished data). Turbidity could be problematic for project operations, as it may act to decrease the rate of infiltration by plugging and layering the bottom of the recharge pits. Turbidity may also be a preliminary screen for fecal contamination issues, as bacteria may use the large particles as a vector for mobilization.

The other known source water quality information was obtained from the Environmental Protection Agencies STORET database. STORET provided some historical water quality data that showed several parameters (circa 1960s) that were accounted for in the recharge project's monitoring plan (ATTACHMENT 5). STORET data that was collected nearest to the source water POD at the Little Walla Walla Diversion (*NE ¼ NW ¼, Section 1, SW ¼ NE ¼ Section 12, T5N, R35E, W.M.; DIV.PT. 1*) is attached in table form as ATTACHMENT 7A.

From the review of all known source water information, the parameters that appeared to be of concern are:

1. Fecal Coliforms
2. Turbidity

There was no other relevant information found for source water quality conditions. The monitoring plan covers the establishment of source water quality conditions during operation of the recharge facility. This will insure safe water quality conditions for the recharge project.

Attachment 7A Source Water Quality Information

Resources and References:

Cooperative Extension Washington State University. 2002. *2002 Crop Protection Guide for Tree Fruits in Washington.* Washington State University EB0419.

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Darnell, T., Montgomery, M. L., Witt, J. M., 1989, July. *Pesticides in Groundwater: Milton-Freewater, Umatilla County, Oregon.* Oregon State University

EPA STORET Water Quality Database information (http://www.epa.gov/storet/)

Jenkins, J. J., Thomson P. A., 1999, January. *OSU Extension Pesticide Properties Database.* . Oregon State University Extension EM 8709

Kerle, E.A., Vogue, P. A., Jenkins, J. J., 1996, October. *Understanding pesticide persistence and mobility for groundwater and surface water protection.* Oregon State University Extension EM 86561

MacNish, R.D. and R.A. Barker. *Digital model of the gravel aquifer, Walla Walla Basin.* United States Geological Survey, 1976.

MacNish, R.D. and R.A. Barker. *Digital simulation of a basalt aquifer system, Walla Walla River.* Water Supply Bulletin #44. Washington Department of Ecology, 1976.

Newcomb, R.C. *Geology and Groundwater Resources of the Walla Walla River Basin.* Water Supply Bulletin #21. Washington Department of Conservation, Division of Water Resources, 1965.

Oregon Water Resources Department. *Umatilla Basin Report.* 1988. *Government Printing Office 774-398/20006 Region NO. 8*

Piper, A.M., T.W. Robinson, and H.E. Thomas. *Groundwater in the Walla Walla Basin, OR-WA-Part I.* Department of the Interior, United States Geological Survey, 1933.

Piper, A.M., T.W. Robinson, and H.E. Thomas. *Groundwater in the Walla Walla Basin, OR-WA-Part II.* Department of the Interior, United States Geological Survey, 1933.v

Richerson, P., Cole, D. 2000, June April 1999 Milton-Freewater Groundwater Quality Study: As part of the Statewide Groundwater Monitoring Program. State of Oregon Department of Environmental Quality

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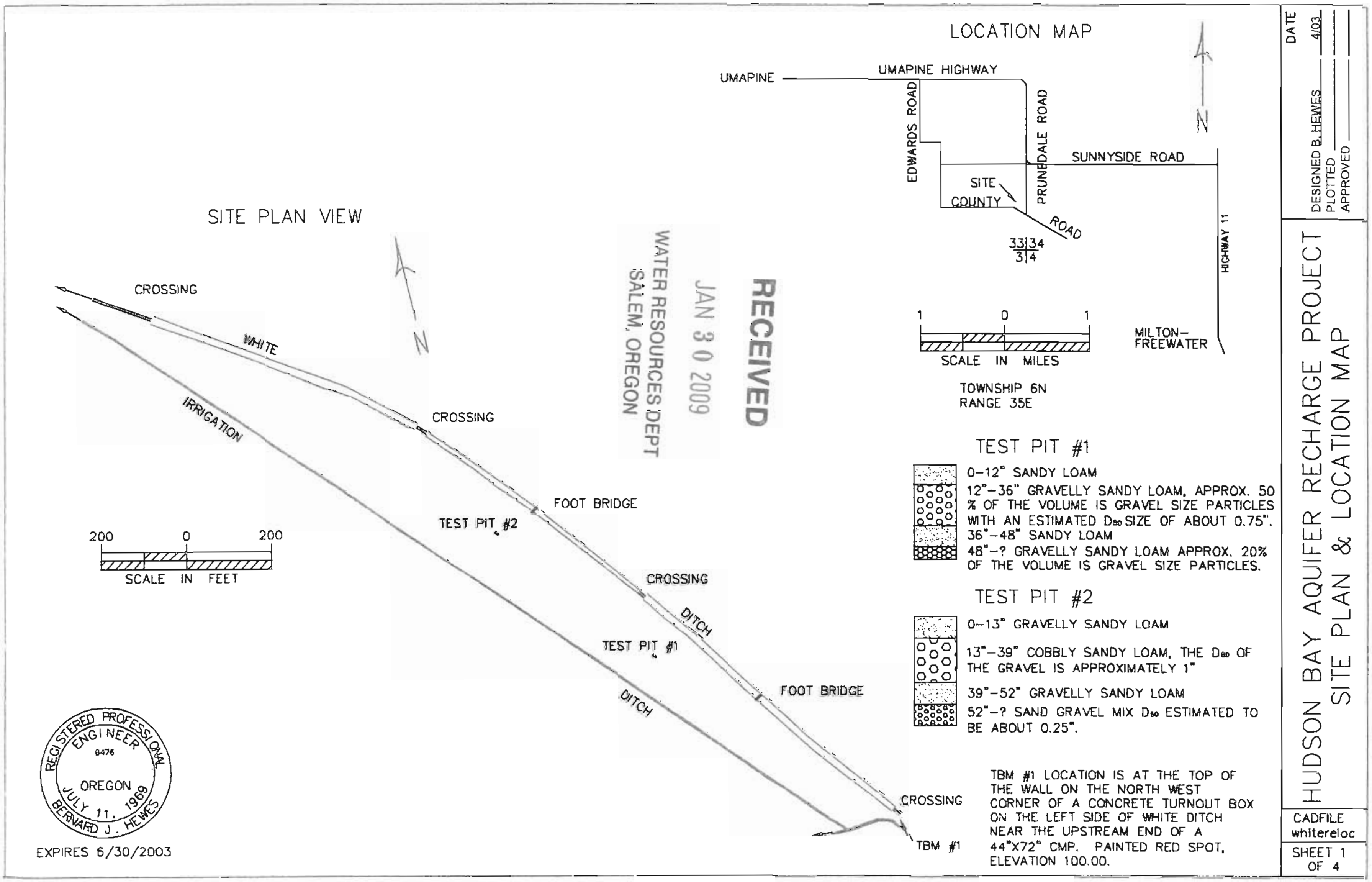
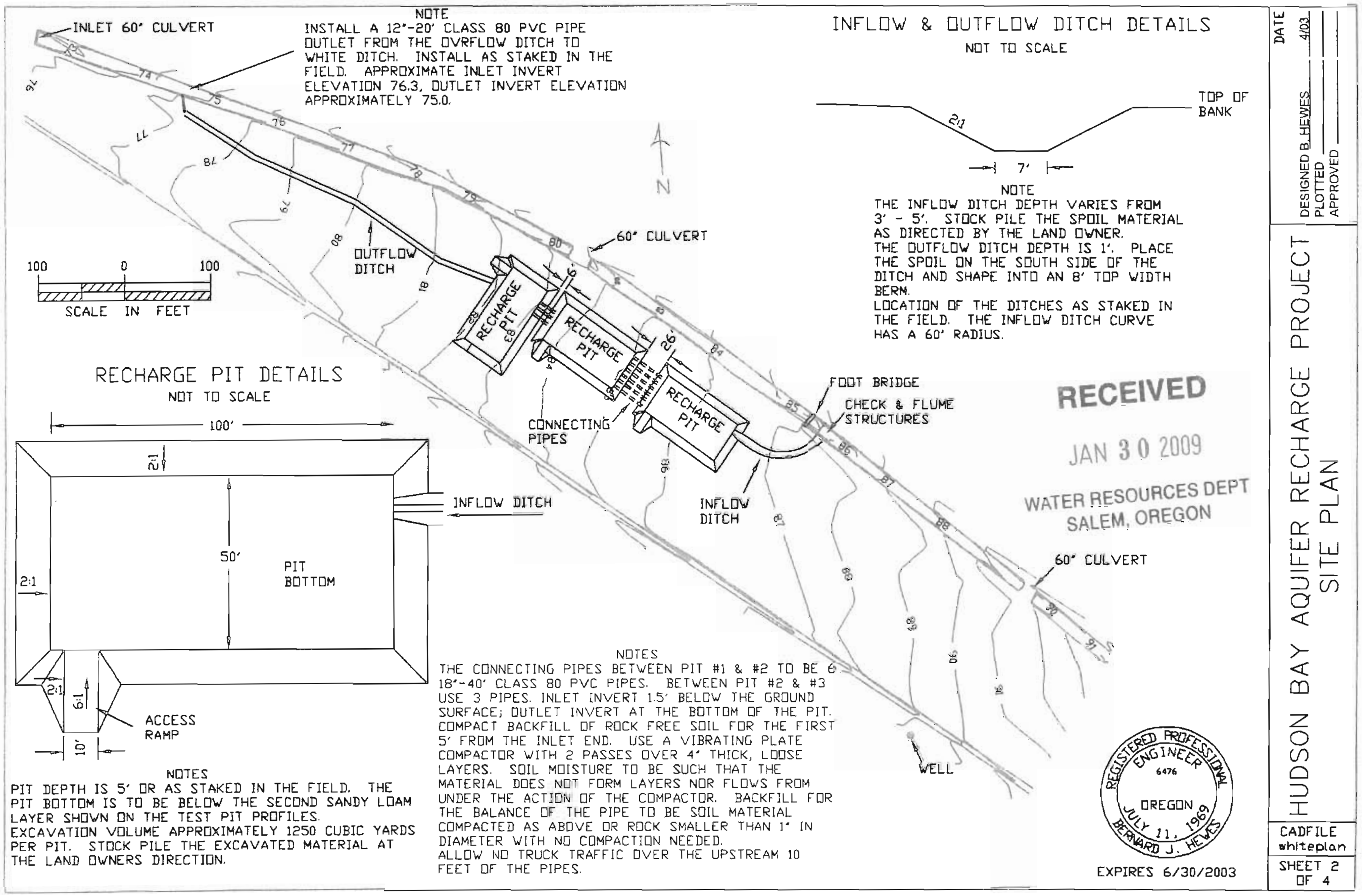
U.S. Geological Survey 1996, July. Fact Sheet 171-96: Article: *The Nitrate Connection.* US Government Printing Office 774-398/20006 Region NO. 8

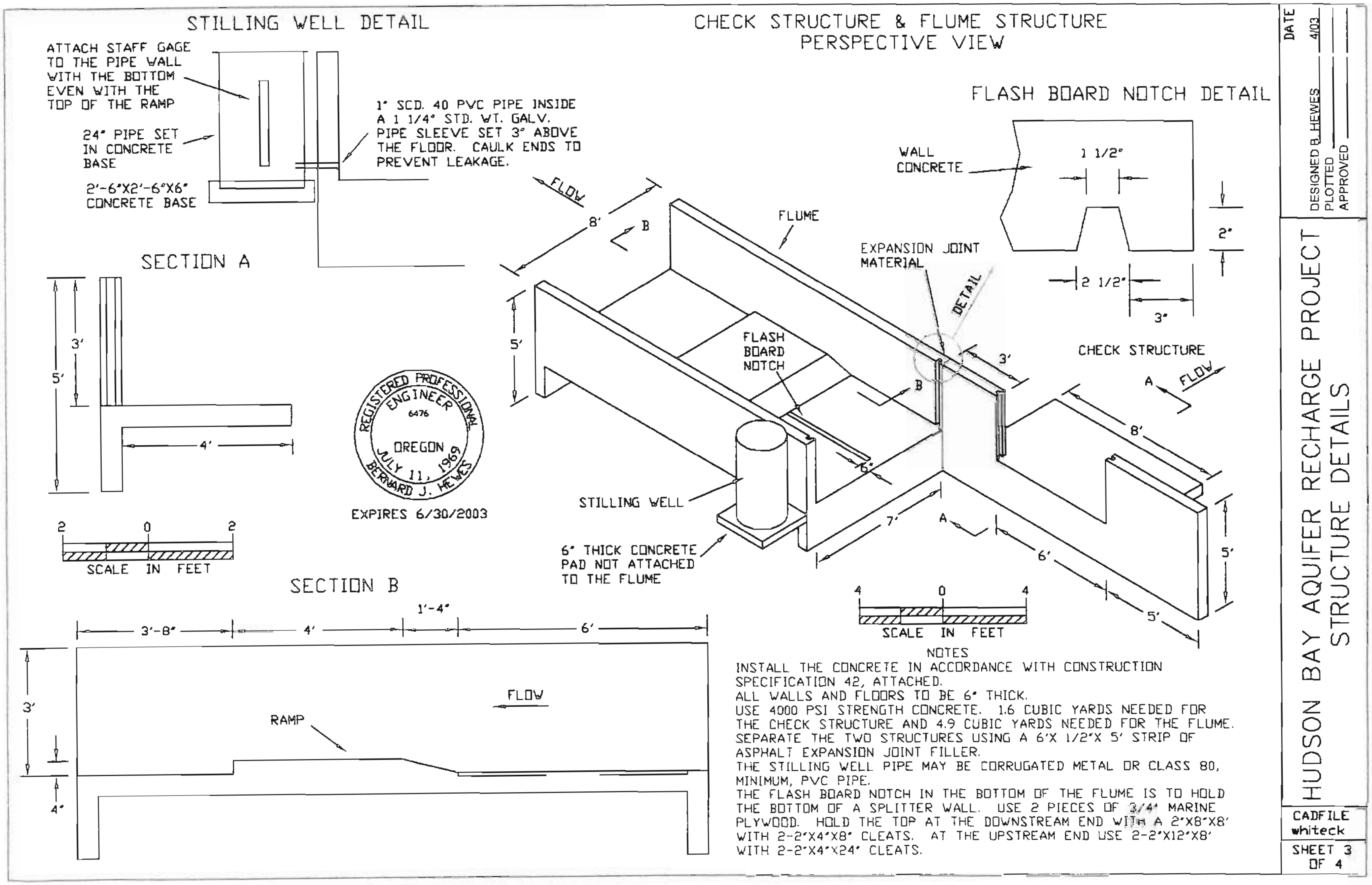
Attachments

Attachment 1A



Attachment 1B



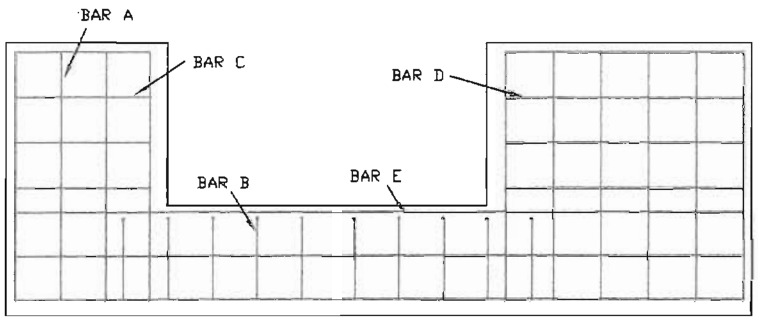


NOTES

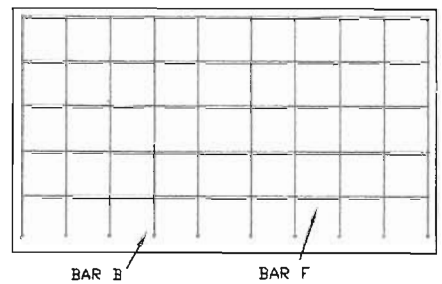
INSTALL THE CONCRETE IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION 42, ATTACHED.
ALL WALLS AND FLOORS TO BE 6" THICK.
USE 4000 PSI STRENGTH CONCRETE. 1.6 CUBIC YARDS NEEDED FOR THE CHECK STRUCTURE AND 4.9 CUBIC YARDS NEEDED FOR THE FLUME.
SEPARATE THE TWO STRUCTURES USING A 6'X 1/2"X 5' STRIP OF ASPHALT EXPANSION JOINT FILLER.
THE STILLING WELL PIPE MAY BE CORRUGATED METAL OR CLASS 80, MINIMUM, PVC PIPE.
THE FLASH BOARD NOTCH IN THE BOTTOM OF THE FLUME IS TO HOLD THE BOTTOM OF A SPLITTER WALL. USE 2 PIECES OF 3/4" MARINE PLYWOOD. HOLD THE TOP AT THE DOWNSTREAM END WITH A 2"X8"X8' WITH 2-2"X4"X8" CLEATS. AT THE UPSTREAM END USE 2-2"X12"X8' WITH 2-2"X4"X24" CLEATS.

Attachment 1D

CHECK STRUCTURE ELEVATION VIEW



APRON PLAN VIEW



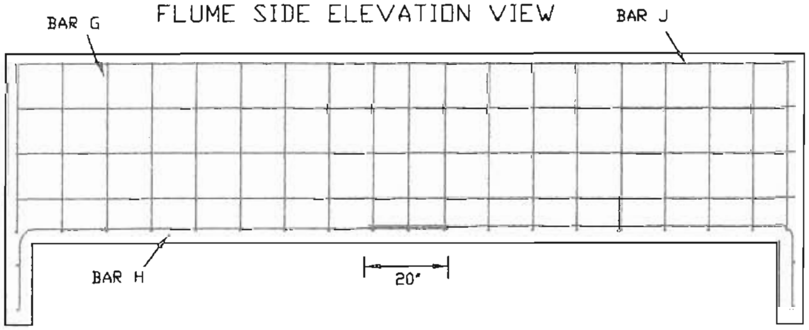
REINFORCING STEEL SCHEDULE

BAR	NO.	SHAPE	A	B	C
CHECK					
A	10	STRAIGHT	4'-7"	-	-
B	10	A|_B_	1'-7"	4'-1"	-
C	4	STRAIGHT	2'-6"	-	-
D	4	STRAIGHT	4'-6"	-	-
E	3	STRAIGHT	13'-8"	-	-
F	5	STRAIGHT	7'-8"	-	-
FLUME					
G	19	A|_B_|C	3'-1"	7'-6"	3'-1"
H	20	A|_B_	1'-6"	8'-1"	-
I	4	STRAIGHT	7'-6"	-	-
J	8	STRAIGHT	14'-6"	-	-

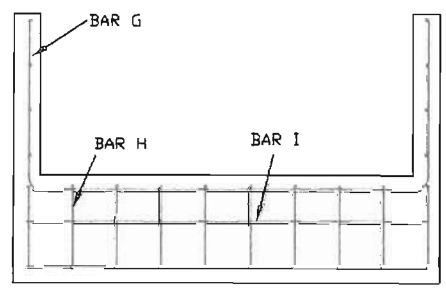
NOTES
ALL BARS TO BE NUMBER 4.
BARS TO BE PLACED IN THE CENTER OF THE WALLS AND FLOOR.
NEED 820 LINEAL FEET OF REINFORCING BARS WITHOUT ANY WASTE.

REGISTERED PROFESSIONAL ENGINEER 6476
OREGON
JULY 11, 1969
BERNARD J. HEWES
EXPIRES 6/30/2003

FLUME SIDE ELEVATION VIEW



FLUME END WALL ELEVATION VIEW



DATE 4/03
DESIGNED B. HEWES
PLOTTED
APPROVED

HUDSON BAY AQUIFER RECHARGE PROJECT
STRUCTURE REINFORCING STEEL

CADFILE whlteckst
SHEET 4 OF 4

Attachment 1 E

HUDSON BAY AQUIFER RECHARGE PROJECT

ENGINEERING REPORT

This project entails diverting water from an existing irrigation ditch to three pits to be excavated for the purpose of infiltrating the water into the shallow aquifer. Project features include a concrete check structure in the existing White Ditch, a concrete flow measuring flume, an open ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit.

These items were sized to handle 50 cubic feet per second (cfs) of water. This is the amount anticipated will be available from excess flow in the Walla Walla River and that the Hudson Bay District is able to deliver.

Data gathered to design the project consisted of a site topographic survey and installing two sites for testing the water infiltration capacity of the natural materials and determining the layers in the soil profile. In addition the Soil Survey of Umatilla County Area, Oregon was consulted. This is a US Dept. of Agriculture, Natural Resources Conservation Service publication giving general soils information.

The topographic survey data was used to prepare a topographic map with one foot contour intervals at a scale of 1" = 60'. This information was used to help determine the location of the project features.

Two test pits were excavated to a depth of 6'-7' each. A 24" diameter by 5' long section of corrugated metal pipe was set on end in the bottom of the pit and about one foot of fill placed around it to hold it in place. Water was pumped into the pipe at a rate that would sustain a water depth of one foot in the pipe. Both flow rate and total flow was measured. The test was run for 6.25 hours in the first pit and 3.5 hours for the second pit.

<u>PIT #1</u>
Soil profile:
0-12" sandy loam
12"-36" gravelly sandy loam, approximately 50% of the material volume is gravel size particles with an estimated D_{50} size of about 0.75"
36"-48" sandy loam, in parts of the trench this layer does not exist
48"-?" gravelly sandy loam approximately 20% of the volume is gravel size particles

The inflow rate at the end of the test period was 4.0 gallons per minute (gpm). This resulted in an infiltration rate of 1.7 gpm/sq. ft./ foot of head.

PIT #2

Soil profile:
0"-13" gravelly sandy loam
13"-39" cobbly sandy loam, the D_{50} of the gravel is approximately 1"
39"-52" gravelly sandy loam
52"-? sand gravel mix D_{50} estimated to be about 0.25"

In this pit the inflow rate of 11.9 gpm was maintained for 3.5 hours and at no time did water puddle in the bottom of the pipe. The infiltration rate is in excess of 3.8 gpm/sq. ft.

The area needed for infiltrating the water was determined assuming an infiltration rate for the entire area of 3.0 gpm/sq.ft./ per foot of head. For an inflow rate of 50 cfs the infiltration area needs to be 7480 square feet. The infiltration rate of 3.0 gpm/sq.ft. was chosen because the pits will be located in the area with soil surface texture similar to test pit #2.

Due to the possibility of fine soil particles plugging the infiltration area, unknowns concerning the long term infiltration rate and that the amount of water available is not yet known extra infiltration area is being provided. Three separate pits with bottom dimensions of 50 feet X 100 feet are proposed. This will provide an infiltration area of 15,000 square feet.

The pits will be excavated to a depth of about 5 feet to get below the second sandy loam layer noted in both test pits. This will allow the water depth to be 2.5 feet - 3.5 feet. That will increase the rate of infiltration over the test values derived with one foot of water depth. The overall safety factor for the infiltration area is well over 2.

Inflow to the system will be measured with a ramp flume and continuously recorded. The ramp flume is sized to provide 5% flow rate accuracy over a flow range of 10 cfs-50 cfs

Any outflow from the last pit will be safely returned to the White Ditch through a 12-inch pipe. The pipe will be on a slope that will keep water from flowing out of White Ditch.

By: Bernard J. Hewes
Bernard J. Hewes

Date: 8/21/03

REGISTERED PROFESSIONAL ENGINEER 6476
OREGON
JULY 11, 1986
BERNARD J. HEWES

Attachment 3A

LAND USE INFORMATION SHEET

This information is needed to determine if the proposed project complies with statewide planning goals and is compatible with local comprehensive plans (ORS 192.180)

CITY/COUNTY LAND USE INFORMATION (to be completed by local planning official):

Recharge Hudson Bay project

Please check below the one that applies:

- ☐ This project is not regulated by the local comprehensive plan and zoning ordinance.
- ☒ This project has been reviewed and is compatible with the local comprehensive zoning ordinance. (Please cite appropriate plan policies, ordinance section, and case numbers.) 152.056
- ☐ This project has been reviewed and is not compatible with the local comprehensive plan and zoning ordinance. (Cite appropriate plan policies, ordinance section, and case numbers).
- ☐ Compatibility of this project with the local planning ordinance cannot be determined until the following local approvals are obtained:

______ Conditional Use Permit	______ Development Permit
______ Plan Amendment	______ Zone Change
______ Other	

An application has ___ has not ___ been made for the local approvals checked above.

* Signature of Local Official: Patty Perry

Title: Senior Planner Date: 5-27-03

Must be authorized signature from your local City/County Planning Department

RECEIVED

JAN 30 2009

WATER RESOURCES DEPT
SALEM, OREGON

ATTACHMENT 5A: Methodology to Determine Chemical Constituents for Water Quality Assessment and Evaluation

Introduction:

The Artificial Groundwater Recharge rules (OAR 690-350-120) require both up front water quality and a water quality-monitoring plan. Further, for any recharge project the rules (OAR 690-350-120 (3) (b) require an applicant to either obtain a water quality permit (typically a water pollution control facility (WPCF) permit) or show that a permit is not necessary. Also, rules OAR 690-350-120 (3)(g) require a "Project Description Report" (ATTACHMENT 5) that outlines the proposed groundwater quality-monitoring plan. This attachment is intended to specifically help clarify the method by which the list of chemical constituents was determined.

Project Area Sample Chemical Review Methodology

Working with Tom Darnell, OSU Extension agent in Milton-Freewater, a chemical constituents review was conducted in order to determine what types of chemicals should be examined in the surface and groundwater monitoring for the project. Several steps were followed to determine which chemicals were of interest.

Review Steps

1. Reviewed the ODEO Report: *April 1999 Milton-Freewater Groundwater Quality Study: As part of the Statewide Groundwater Monitoring Program* (Richardson, et. al., 2000). Particular attention was focused on the constituents tested, testing protocol and timing, and the results-conclusions.
2. Reviewed *OSU Extension Pesticide Properties Database* and determined which were used in the Milton-Freewater area and a list was comprised. (Table 4A1, 4A2)
3. Determined which were currently and/or historically used in the area utilizing past chemical studies in the basin (see references). This included interviewing the current landowner on the site-specific history of chemical use on that property (see signed written statement below).
4. Determined which chemicals were important to monitor for during the recharge period (winter-spring). Considered each chemical's typical seasonal application period, solubility in water, soil half-life, and soil movement ratings.
5. Considered project design (top soil removed), and finalized list of chemicals of interest.

Final List of Chemicals to Monitor for Recharge Project

Chemicals Currently Used:

Rubigan (Fenarimol)
Ridomil (Metalxyl)
Systhane/Rally (Myclobutanil)
Devrinol (Napropamide)

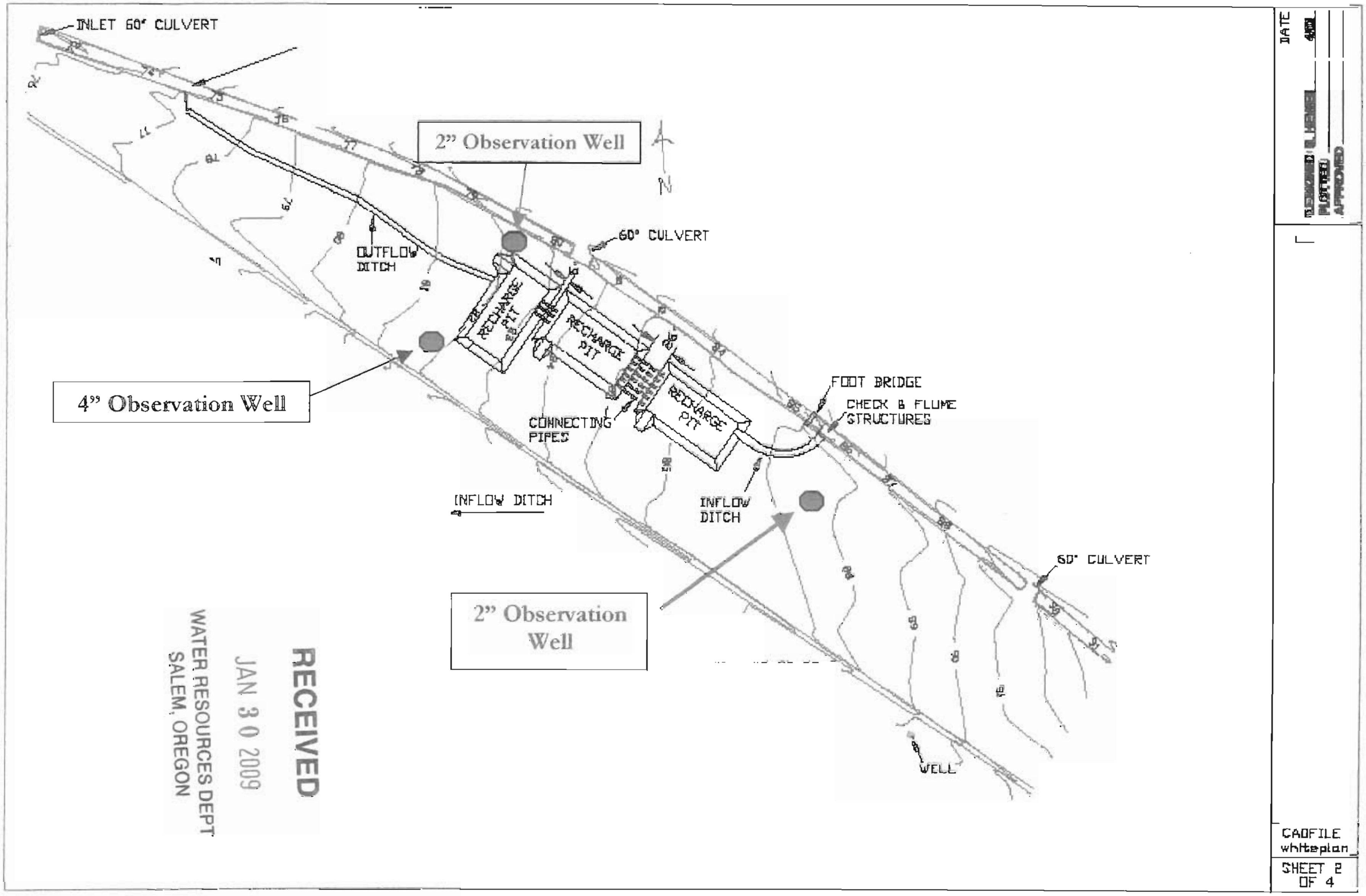
Chemicals Historically Used:

DDD-DDE-DDT
Elgetol (DNOC sodium salt)
Alar/B-Nine (Daminozide)
Lindane (Lindane)

Laboratory Resources

Nitrate Analysis:	Walla Walla County-City Health Department 310 W. Popular, P. O. Box 1753 Walla Walla, WA 99362 Telephone (509) 527-3290
Chemical Analysis:	KUO Testing Labs, INC. 337 south 1st Avenue Othello, WA 99344 Telephone: (509)-488-0118

Attachment 5B Map of On-Site Monitoring Well Locations



Attachment 5D

History of Chemical[1] Use: Recharge Site Specific

Landowner Statement of Past Use:

"Gentleman,

I have been the owner of a certain parcel of land in the valley with an address known as 84140 Prunedale Rd., Milton-Freewater, Oregon, 97862.

I have owned this land since 1978 at which time we took over the existing orchard of apples and farmed it for two years at which time we began removing various blocks of tress and replanting with new varieties. In the past few years we raised Nursery Tree Stock and began leveling the land to its present condition, letting it lay in a dormant stage for a year and then planting cover crops to enrich the soil for a future cherry orchard.

The pesticides applications were the normal tree fruit pesticides as allowed by regulations of the industry. The herbicide applications were Round-Up, Simizine and Paraquat. No other chemicals were used on this parcel of land during my ownership. If you should have other questions, please contact me at the following: (541)-278-6305, (509)-386-6175, or (541)-558-3752 or email at:
Hjohnson@co.umatilla.or.us"

Landowner: [signature] Date: 10-17-03

[1] Chemical is defined here to include insecticides, fertilizers, herbicides, rodenticides, fungicides, and all other non-natural chemicals.

ATTACHMENT 7A: Source Water Quality Data

1STORET RETRIEVAL DATE 99/06/23
402388 28AWALL03780
46 01 08.6 118 24 45.1 4
WALLA WALLA RIVER AT HWY 11 (MILTON-FREEWATER)
41059 OREGON UMATILLA
PACIFIC NORTHWEST 131007
COLUMBIA RIVER BASIN BELOW YAKIMA RIVER
21400000 17070102007 00
0000 FEET DEPTH

[ ] Grey areas samples that correspond to Recharge Project

INITIAL DATE	67/04/24	67/08/21	67/12/11	68/04/02	68/08/05	68/12/16	69/03/04	69/12/10	70/04/28
INITIAL TIME	1235	1400	1440	1615	1750	1100	1510	1145	930
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	8	25.5	7	8.5	25	5	8.6	5	6
00011 WATER TEMP FAHN	46.4$	77.9$	44.6$	47.3$	77.0$	41.0$	47.5$	41.0$	42.8$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU	250	2		10	3	8		7	1
00080 COLOR PT-CO UNITS	20	4		3	5	3		1	3
00095 CNDUCTVY AT 25C MICROMHO	67	225	200	72	243	69	95		71
00300 DO MG/L	10.3	12.2	10.6	11.4	10.7	12.2	11.6	11.7	12.7
00301 DO SATUR PERCENT	89	150	89	99	131	95	99	94	105
00310 BOD 5 DAY MG/L	0.7	1.3	0.9	0.5	1.3	1.6	0.8	1.5	1.5
00400 PH SU	7.3	8.3	7.7	7.5	8.40L	7.2	7.6	7.5	7.5
00410 T ALK CACO3 MG/L	30	108		33	105	30		54	31
00500 RESIDUE TOTAL MG/L	518			99	184	101		118	87
00530 RESIDUE TOT NFLT MG/L	368	11		10	10	21		18	12
00610 NH3+NH4- N TOTAL MG/L	0.13	0.34		0.38	0.32	0.17		0.08	0.12
00612 UN-IONZD NH3-N MG/L	.0004$	.036$		.002$	.040$	.0003$		.0003$	.0005$
00619 UN-IONZD NH3-NH3 MG/L	.0005$	.043$		.002$	.049$	.0004$		.0004$	.0006$
00620 NO3-N TOTAL MG/L	0.03	0.02		0.07	0.38	0.54		0.73	0.13
00660 ORTHOPO4 PO4 MG/L	0.06	0.16		0.1	0.18	0.56		0.16	0.03
00760 SWL PBI MG/L	1K	1K	29	1K					
00940 CHLORIDE TOTAL MG/L	2			1	8	2		2	1
00945 SULFATE SO4-TOT MG/L	8	33		4	14	4		6	3
22413 HARDNESS TOTLDISS WTR MG/L	28			37	99	35		49	24
31505 TOT COLI MPN CONF /100ML	620	2400	7000	60	230	2300	620	450K	620
31615 FEC COLI MPNECMED /100ML			230						60
31677 FECSTREP MPNADEVA /100ML								240	

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/12	73/06/13	73/09/24
INITIAL TIME	1400	1645	2000	1620	1610	1130	845	1055	1400
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	24	5.5	15.5	26	9	20.5	2.5	16.5	16
00011 WATER TEMP FAHN	75.2$	41.9$	59.9$	78.8$	48.2$	68.9$	36.5$	61.7$	60.8$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU		5	3	1	28	2	15	3	2
00080 COLOR PT-CO UNITS		0	1	2	10	5	5	5	0
00094 CNDUCTVY FIELD MICROMHO							90		
(SAMPLE CONTINUED FROM PREVIOUS PAGE)									

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/12	73/06/13	73/09/24
INITIAL TIME	1400	1645	2000	1620	1610	1130	845	1055	1400
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00095 CNDUCTVY AT 25C MICROMHO	236	66	51	200	67	221	87		
00300 DO MG/L	12.5	11.5	9.5	14.2	11	12.5	12.9	11.7	11.5
00301 DO SATUR PERCENT	151	95	99	172	97	137	97	117.0$	115.0$
00310 BOD 5 DAY MG/L	2	0.7	0.8	2.3	0.7	0.9	1.4		
00400 PH SU	8.6	7.5	7.3	8.9	7.1	8.4	7.3		
00410 T ALK CACO3 MG/L		29	21	96	23	92	29	82	95
00500 RESIDUE TOTAL MG/L		89	75	172	280	170	100	153	164
00530 RESIDUE TOT NFLT MG/L		12	12	4	106	8	32	10	3
00610 NH3+NH4- N TOTAL MG/L		0.34	0.06	0.66	0.09	0.14	0.04	0.1	0.17
00612 UN-IONZD NH3-N MG/L		.001$	.0003$	.215$	.0002$	.013$	.00008$		
00619 UN-IONZD NH3-NH3 MG/L		.002$	.0004$	.261$	.0002$	.016$	.00010$		
00620 NO3-N TOTAL MG/L		0.02	0.1	0.15	0.3	0.51	0.14	0.36	0.39
00625 TOT KJEL N MG/L							0.2		
00650 T PO4 PO4 MG/L							0.3		
00660 ORTHOPO4 PO4 MG/L		0.06	0.09	0.13	0.09	0.04	0.09	0.1	0.14
00930 SODIUM NA,DISS MG/L					2.4		2.8		
00935 PTSSIUM K,DISS MG/L					2		1.5		
00940 CHLORIDE TOTAL MG/L		1	0.7	5	0.8	3	1	6	4
00945 SULFATE SO4-TOT MG/L		3	.1K	11	3	11	2	6	4
22413 HARDNESS TOTLDISS WTR MG/L		26	19	80	22	84	28	71	79
31505 TOT COLI MPN CONF /100ML	230	2400	2400	230	620	620	290		
31615 FEC COLI MPNECMED /100ML	230	45K	45K	45K	45K		60		

ATTACHMENT 7A: Source Water Quality Data

1STORET RETRIEVAL DATE 99/06/23
402389 28AWALL04860
45 54 13.6 118 22 02.9 4
WALLA WALLA RIVER U/S MILTON-FREEWATER
41059 OREGON UMATILLA
PACIFIC NORTHWEST 131007
COLUMBIA RIVER BASIN BELOW YAKIMA RIVER
21400000 17070102011 00
0000 FEET DEPTH

INITIAL DATE	67/04/24	67/08/21	67/12/11	68/04/03	68/08/06	68/12/16	69/03/04	69/12/10
INITIAL TIME	1300	1520	1700	810	905	1030	1540	1055
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	6	21	5	6.5	16	5	6.4	3
00011 WATER TEMP FAHN	42.8$	69.8$	41.0$	43.7$	60.8$	41.0$	43.5$	37.4$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU	5	7	15	2	5	9	12	2
00080 COLOR PT-CO UNITS	6	2	4	4	4	3	2	0
00095 CNDUCTVY AT 25C MICROMHO	59	180	69	57	93	57	63	
00300 DO MG/L	11.2	8.7	11.9	11.6	9.7	11.1	11.6	12.9
00301 DO SATUR PERCENT	94	101	98	98	102	87	99	100
00310 BOD 5 DAY MG/L	0.6	0.8	1.1	0.6	0.4	0.2	0.7	1.2
00400 PH SU	7.4	7.5	7.5	7.3	7.3	7	7.5	7.7
00410 T ALK CACO3 MG/L	26	32	32	26	40	16	27	33
00500 RESIDUE TOTAL MG/L	89	101	83	113	98	92	81	67
00530 RESIDUE TOT NFLT MG/L	2	8	6	7	22	26	7	6
00610 NH3+NH4- N TOTAL MG/L	0.14	0.17	0.32	0.12	0.18	0.11	0.06	0.03
00612 UN-IONZD NH3-N MG/L	.0005$	.002$	.001$	.0003$	.001$	.0001$	.0003$	.0002$
00619 UN-IONZD NH3-NH3 MG/L	.0006$	.003$	.002$	.0004$	.001$	.0002$	.0003$	.0002$
00620 NO3-N TOTAL MG/L	0.01	0.02	0.02	0.03	0.04	0.39	0.3	0.12
00660 ORTHOPO4 PO4 MG/L	0.02	0.1	0.1	0.07	.01K	0.01	0.11	0.1
00760 SWL PBI MG/L	8	1K	1					
00940 CHLORIDE TOTAL MG/L	1	5	1	1	6	2	2	0.8
00945 SULFATE SO4-TOT MG/L	3	0.6	4	2	15	3	1	3
22413 HARDNESS TOTLDISS WTR MG/L	23	36	29	24	32	25	26	31
31505 TOT COLI MPN CONF /100ML	230	620	210	230	620	210	60	60
31615 FEC COLI MPNECMED /100ML			210					
31677 FECSTREP MPNADEVA /100ML								5K

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1420	1745	1630	1930	1745	1745
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	10.5	20.5		10.5	27	4.7
00011 WATER TEMP FAHN	50.9$	68.9$		50.9$	80.6$	40.5$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10
00070 TURB JKSN JTU	7	2	1	1	2	1.0K
00080 COLOR PT-CO UNITS	5	5	1K	5	15	1K
00094 CNDUCTVY FIELD MICROMHO	49	80		55	170	80
00095 CNDUCTVY AT 25C MICROMHO	53	90		54	195	72
00300 DO MG/L	10.8	9		10.8	8.7	11.9
00301 DO SATUR PERCENT	101	103		102	106	95
00310 BOD 5 DAY MG/L	1	0.3		0.6	3	0.4
00400 PH SU	7.5	8		7.3	8	7.7
00410 T ALK CACO3 MG/L	17	34	33	20	65	34

INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1420	1745	1630	1930	1745	1745
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00500 RESIDUE TOTAL MG/L	62	76	68	64	180	87
00530 RESIDUE TOT NFLT MG/L	39	4	1K	5	38	3
00610 NH3+NH4- N TOTAL MG/L	0.03	0.02	0.06	0.01	0.19	0.02
00612 UN-IONZD NH3-N MG/L	.0002$	.0008$		.00004$	.012$	.0001$
00619 UN-IONZD NH3-NH3 MG/L	.0002$	.0010$		.00005$	.014$	.0001$
00620 NO3-N TOTAL MG/L	0.01	0.05	0.06	0.1	0.72	0.12
00650 T PO4 PO4 MG/L	0.2	0.2		0.3	0.5	0.1
00660 ORTHOPO4 PO4 MG/L	0.01	0.14	0.08	0.09	0.08	0.11
00930 SODIUM NA,DISS MG/L	2.1	3		2.4	8.4	3
00935 PTSSIUM K,DISS MG/L	1.6	2.4		1.3	3.5	2
00940 CHLORIDE TOTAL MG/L	0.4	0.9	1	1	6	1
00945 SULFATE SO4-TOT MG/L	2	1	2	2	8	2
22413 HARDNESS TOTLDISS WTR MG/L	14	27	27	19	60	27
31505 TOT COLI MPN CONF /100ML	60	7000L		230	7000	2400
31615 FEC COLI MPNECMED /100ML	45K	620		45	7000	230

Attachment 3B

LAND LEASE

1. PARTIES

The parties to this Lease are HULETTE M. JOHNSON, SHIRLEY A. JOHNSON, and H. MARC JOHNSON, hereinafter referred to as Landlord, and HUDSON BAY DISTRICT IMPROVEMENT COMPANY, and Oregon Non-profit Improvement District, hereinafter referred to as Tenant.

2. DATE

This Lease will begin the first of the following month, after the Tenant has obtained a water right certificate for the purpose of ground water recharge for this site from the State of Oregon.

3. DESCRIPTION OF LEASED PREMISES

Landlord leases to Tenant and Tenant leases from Landlord, under the terms and conditions stated herein, the real property in Umatilla County, State of Oregon, described in Exhibit "A" attached hereto and by such reference incorporated herein.

4. TERM OF LEASE

The term of this Lease will be from the date of this lease for a period of five(5) years. Tenant shall have the option to renew this lease with notice to Landlord of not less than 90 days prior to the end of the initial term and any renewal terms for future additional five year terms upon the mutual agreement of renegotiated rental terms for each renewal period.

5. POSSESSION

The Tenant shall be granted possession of the property upon execution of this document by all parties, together with the receipt of the initial lease payment as prescribed in RENT.

6. RENT

Tenant shall pay advance annual rent payments in the amount of three thousand six hundred dollars($3,600) plus annual assessment for irrigation water for surface water rights delivered by Tenant to 84140 Prunedale Road, beginning with INV # 1276C for 2003. Landlord shall pay same assessment to Tenant upon receipt of said annual assessment payment from Tenant. Tenant shall make each annual payment for the term of this lease to Landlords address, 52833 Sunquist Road, Milton-Freewater, Oregon, 97862, or otherwise as notified. The initial payment shall be due on the date this agreement is executed by Tenant and Landlord, and Tenant it therefore granted possession to said real property.

7. INSURANCE

Tenant shall maintain liability insurance on the leased property in an amount acceptable to the Landlord and shall provide proof of such insurance naming Landlords as additional insureds. Tenant shall also be responsible for necessary insurance on laborers. Tenant shall also be responsible for insurance coverage on personal property kept or installed upon this leased premises.

8. USE OF PREMISES

Tenant agrees that they will use the property for ground water recharge/storage, ponding.

9. LANDLORDS OBLIGATIONS

Landlord shall install electricity, pump, collection pond and mainline with the assistance of Tenant necessary to connect the source of irrigation water provided by Tenant to the existing delivery systems of Landlord's.

If there is a mortgage or other encumbrance on said premises, Landlord covenants to keep same in good standing, at all times, to make payments when due and not to suffer or permit default in said encumbrance.

Landlord shall pay all property taxes upon the real property subject to this lease in a timely manner.

10. TENANT'S OBLIGATIONS

Tenant shall provide all labor and materials for the construction of the ground water recharge pond, Landlord's irrigation collection pond and pumping station or other improvements required by Tenant, including maintenance of bridges and culverts.

Tenant shall pay all taxes of any kind and necessary insurance for labor to maintain to maintain improvements including any increase in property taxes as a result of said improvements as made by Tenant.

Tenant shall pay for all maintenance and operation of improvements constructed on said premises.

Tenant agrees that earth material excavated from the recharge pond shall be placed along the edges of the recharge area to produce a basin-like pond. Excess material shall be placed in other areas of Landlords property as directed by Landlord and spread evenly where located so that agricultural activities may continue.

Tenant upon termination of lease, shall replace all soil to a level topography using stored material from the sides of said 'recharge' pond, together with other off site soil as approved by Landlord, necessary to return the recharge pond to a level premise ~~for agricultural growing activities~~.

Tenant shall pay for all costs incurred for control of noxious weeds and vegetation around perimeter of ponding areas, and shall spray the perimeter of said pond including the banks of the Hudson Bay Canal and the Pleasantview Canal including bridges and culverts to maintain a clean ground cover as directed by Landlord

Tenant shall provide signage for trespass prevention and notice of man-made hazard upon premises at the commencement of work efforts at the recharge area.

Tenant shall install any and all fences and gates necessary as may be required by an insurance company or others around the recharge pond.

11. LIENS

Tenant shall pay, as due, all claims for work done on and for services rendered or materials furnished to the leased premises incurred and owing by Tenant and shall keep the premises free of any liens resulting from acts of the Tenant.

12. COVENANTS OF TITLE

Landlord covenants that he is the owner of the above described property free of any encumbrance that would impair or interfere with Tenant's rights under this Lease, and that Landlord has full right and authority to lease the premises described herein.

13. WASTE

Tenant shall not commit or permit to be committed any waste, strip, damage to or misuse of the premises.

14. INDEMNIFICATION

Tenant shall indemnify, hold harmless and defend Landlords from all claims, loss or liability arising out of or related to any activity of Tenant on the leased premises or any condition of the leased premises in the possession or under the control of the Tenant.

15. ASSIGNMENT

No part of the leased property may be assigned, mortgaged, or subleased, nor may a right of use of any portion of the property be conferred on any third person by any other means without the prior written consent of Landlord. This provision shall apply to all transfers to and by trustees in bankruptcy, receivers, administrators, executors, and legatees. No consent in one instance shall prevent the provision from applying to a subsequent instance.

16. DEFAULT

The following shall be events of default:

Failure to pay rent when due.

Failure of either Landlord or Tenant to comply with any other term or condition or fulfill any other obligation of this Lease within twenty(20) days after written notice by Landlord or Tenant specifying the nature of the default with reasonable particularity.

Abandonment by the Tenant of the property

If the default is of such a nature that it cannot be completely remedied within the twenty-day period and the defaulting party thereafter proceeds with reasonable diligence and in good faith to effect the remedy as soon as practicable, default shall not be declared unless the defaulting party ceases to effect the remedy.

17. TAXES

The Landlord shall pay all real property taxes for real property for the term of this Lease. Tenant shall be liable to pay any taxes, personal or real, incurred as a result of improvements placed upon the leased premises.

18. NONWAIVER

Waiver by either party of strict performance of any provision of this Lease shall not be a waiver of or prejudice the party's right to require strict performance of the same provision in the future or of any other provision of this Lease.

19. ATTORNEY FEES

If suit or action is instituted in connection with any controversy arising out of the Lease, the prevailing party shall be entitled to recover, in addition to costs, such sums as the Court may adjudge reasonable as attorney fees.

20. SUCCESSION

Subject to the above-stated limitations on transfer of Tenant's interest, this Lease shall be binding upon and inure to the benefit of the parties, their respective successors and assigns.

21. INSPECTION OF PREMISES

The Landlord reserves the right to themselves and their agents to go upon the premises at reasonable and proper times to inspect the same for the purpose of determining that the Lease is being properly observed and that all of the terms of this lease are being performed by the Tenant.

22. IMPROVEMENTS

Any improvements to the real property by Tenant shall remain the property of the Landlord upon termination of this Lease, unless the Tenant obtains the written consent of Landlord to remove said improvements prior to the time the improvements are placed on the property. However, Tenant shall be responsible for refilling the recharge "pond" as set forth in paragraph 10 above.

23. TERMINATION

The Tenant agrees to deliver the property to the Landlord at the end of the term of this Lease and in as good a condition as when accepted, and pursuant to paragraph 10 above.

24. TIME IS OF THE ESSENCE

The parties acknowledge and agree that time is of the essence with respect to all of the terms, conditions, and provisions of this Lease.

25. NOTICES

Any notice required or permitted under this Lease shall be given when actually delivered or when deposited in the United States Mail as certified mail, addressed as follows:

LANDLORD: HULETTE M. JOHNSON, et., al.
52833 Sunquist Road
Milton-Freewater, Oregon 97862

TENANT: HUDSON BAY DISTRICT IMPROVEMENT COMPANY
P.O. Box 110
Milton-Freewater, Oregon 97862

26. WATER DUES

The annual irrigation water dues as billed to Landlord by Tenant shall be paid by Landlord to Tenant as billed. As part of the rent agreement in paragraph 6 above, Tenant shall pay Landlord an equal amount of said water dues within thirty(30) days of receipt of said water dues from Landlord, during the term of this Lease and any renewals thereof.

27. CAPTIONS AND HEADINGS

The captions and headings throughout this Lease are for convenience and reference only and the words contained therein shall in no way be held or deemed to define, limit, describe, explain or modify the meaning of any provisions of or the scope or intent of this Lease.

28. ENTIRE AGREEMENT

This document is the entire, final, and complete agreement of the parties pertaining to the Lease of the premises described herein, and supersedes and replaces all written and oral agreements theretofore made or existing by and between the parties or their representatives in so far as the premises are concerned.

IN WITNESS WHEREOF, the parties have executed this Lease on the 15th day of October, 2003.

LANDLORD:

HULETTE M. JOHNSON,

SHIRLEY M. JOHNSON

H. MARC JOHNSON

TENANT:

HUDSON BAY IMPROVEMENT CO.

BY: [signature]
it's Secretary/Treasurer

STATE OF OREGON)
)ss.
County of Umatilla)

On this 15th day of Oct 2003 personally appeared before me the above named ~~HULETTE M. JOHNSON, SHIRLEY M. JOHNSON,~~ and H. MARC JOHNSON and acknowledged the foregoing to be a voluntary act and deed.

OFFICIAL SEAL
KATHLEEN F. YENNEY
NOTARY PUBLIC-OREGON
COMMISSION NO. 337142
MY COMMISSION EXPIRES SEPT. 24, 2004

NOTARY PUBLIC FOR OREGON

My commission expires: 9-24-2004

STATE OF OREGON)
)ss.
County of Umatilla)

On this 15th day of Oct 2003, personally appeared before me the above named John C. Zerba ______, in his capacity as Secretary/Treasurer of HUDSON BAY IMPROVEMENT CO. and acknowledged the foregoing to be a voluntary act.

OFFICIAL SEAL
KATHLEEN F. YENNEY
NOTARY PUBLIC-OREGON
COMMISSION NO. 337142
MY COMMISSION EXPIRES SEPT. 24, 2004

NOTARY PUBLIC FOR OREGON
My Commission expires: 9-24-2004

STATE OF OREGON)
)ss
County of Umatilla)

OFFICIAL SEAL
JACQUELINE A. BUTTS
NOTARY PUBLIC-OREGON
COMMISSION NO. 368700
MY COMMISSION EXPIRES MAY 15, 2007

On this 22 day of october 2003, personally appeared before me the above named H. Marc Johnson, and acknowledged the foregoing to be a voluntary act and deed.

Jacqueline A Butts
NOTARY PUBLIC FOR OREGON

My commission expires may 15, 2007

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SALEM, OREGON

R 42 PAGE 1265

Exhibit "A"

TRACT I:

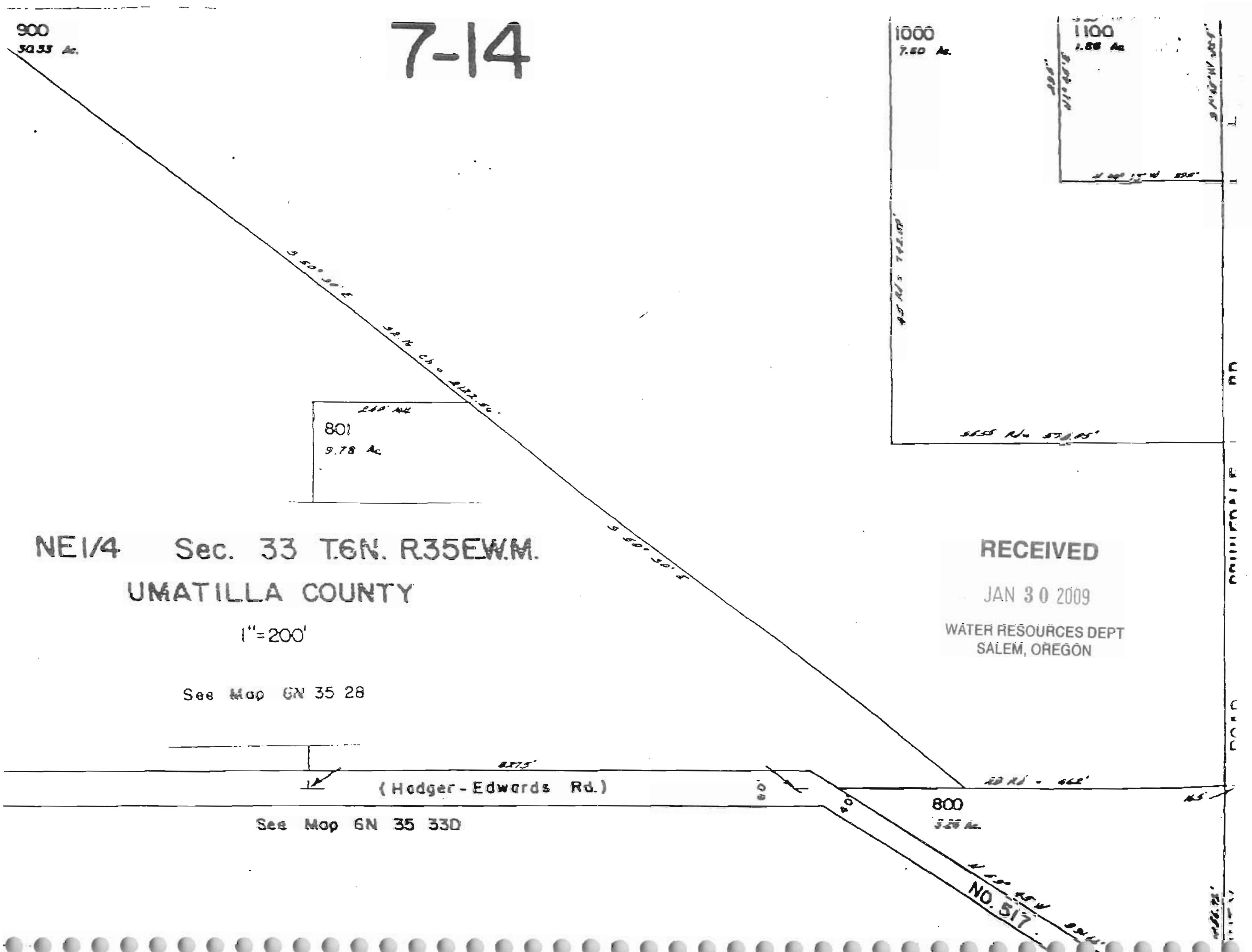
Township 6 North, Range 35, East of the Willamette Meridian:
Section 33: A tract of land located in the South Half of the Northeast Quarter, and being a portion of that tract of land conveyed to William J. Jackson, by Deed recorded in Book 369, Page 267, Deed Records, and being described as follows, to-wit:

Commencing at the quarter section corner on the line between Sections 33 & 34; running thence North 20 chains: thence West 33-16/100 chains; thence Southeasterly 32-16/100 chains, more or less, to a point on the center line; running East and West through said Section 33, said point being 7 chains West of the point of beginning; thence East 7 chains to the point of beginning. Excepting Therefrom, beginning at the Northeast corner of the Southeast Quarter of the Northeast Quarter of said Section 33: and running thence South 45 rods: then West 35-5/9 rods; thence North 45 rods; thence East 33-5/9 rods to the place of beginning. All being East of the Willamette Meridian, Umatilla County, Oregon. Subject to any and all water rights of way and roads.

TRACT III:

Beginning at the Northeast corner of the Southeast Quarter of the Northeast Quarter of Section 33, Township 6 North, Range 35; running thence South 45 rods; thence West 35 and 5/9 rods; thence North 45 rods; thence East 35 and 5/9 rods to the place of beginning. Excepting therefrom that tract of land conveyed to the State of Oregon, by and through its State Highway Commission by deed recorded in Book 130, Page 573 of the Deed Records of Umatilla County, Oregon. Also, excepting any portion of said premises lying within that strip of land conveyed to Walla Walla and Columbia River Railroad Company, by deed recorded in Book "D", Page 834 of the said Deed Records. All being East of the Willamette Meridian, in the County of Umatilla and State of Oregon;

Excepting any and all water rights of way.


7-14
900
50.33 Ac.
1000
7.50 Ac.
1100
1.86 Ac.
801
9.78 Ac.
800
NE1/4 Sec. 33 T.6N. R.35E.W.M.
UMATILLA COUNTY
1"=200'
See Map 6N 35 28
(Hodger-Edwards Rd.)
See Map 6N 35 33D
NO. 517
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Attachment 8B

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License No. __________

STATE OF OREGON

WATER RESOURCES DEPARTMENT

APPLICATION FOR LIMITED WATER USE LICENSE

Applicant(s): Hudson Bay District Irrigation Company

Contact Person: Jon Brough / John Zerba

Mailing Address: P.O. Box 110

Telephone No: 541 938-6105

I (We) make application for a Limited License to use or store the following described surface waters or groundwater-not otherwise exempt, or to use stored water of the State of Oregon for a use of a short-term or fixed duration:

1. **SOURCE(S) OF WATER for the proposed use:** Walla Walla River **a tributary of** Colombia River.

2. **TOTAL AMOUNT OF WATER to be diverted:** 50 **cubic feet per second, or** 50 **gallons per minute. If water is to be used from more than one source, give the quantity from each:** __________.

3. **INTENDED USE(S) OF WATER: (check all that apply)**
   - [ ] **Road construction or maintenance;**
   - [ ] **General construction;**
   - [ ] **Forestland and rangeland management; or**
   - [x] **Other:** Artificial Ground water Recharge

4. **DESCRIPTION OF PROPOSED PROJECT: Include a description of the intended place of use as shown on the accompanying site map, the method of water diversion, the type of equipment to be used (including pump horsepower, if applicable), length and dimensions of supply ditches and pipelines:** See attached application document

5. **PROJECT SCHEDULE:** (List day, month, and year)
Date water use will begin 11-04
Date project will be completed 11-09
Date need for water will be completed 11-09

NOTE: A completed water availability statement from the local watermaster, fees and a site map meeting the requirements of OAR 690-340-030 must accompany this request. The fee for this request is $100 for the first point of diversion plus $10 for each additional point of diversion. The license, if granted, will not be issued or replaced by a new license for a period of more than five consecutive years. The right granted will be subordinate to all other authorized uses that rely upon the same source, or water affected by the source, and may be revoked at any time it is determined the use causes injury to any other water right or minimum perennial streamflow.

REMARKS:

____

____

SIGNATURE of Applicant: [signature] **DATE:** 10-23-08
Title: Sec - Pres

I certify that I have examined the foregoing application and accompanying data, and hereby grant a Limited License to use said water as described in the application, subject to all water rights of record, and subject to any valid public interest concerns which may become evident.

This license shall be in effect beginning ______________, 20___, and shall expire ________________, 20___.

WITNESS my hand this _____________________, 20___.

____
Paul R. Cleary
Water Resources Department
Director

The licensee shall give notice to the Department (Watermaster) at least 15 days in advance of using the water under the Limited License and shall maintain a record of use. The record of use shall include, but need not be limited to, an estimate of the amount of water used, the period of use and the categories of beneficial use to which the water is applied. During the period of the Limited License, the record of use shall be available for review by the Department upon request.

The application was first received at the Water Resources Department at Salem, Oregon, on the _________ day of _______________, 20___, at ________ o'clock, ___M.

(Fall, 2000)
M:\groups\wr\forms\limited license appl

2/5/04

To: Department of Environmental Quality
Eastern Region Pendleton Office
700 SE Emigrant, Suite 330
Pendleton, OR 97801

ATTENTION: Phil Richardson, (OWRD File # LL-758)

From: Hudson Bay District Irrigation Company (HBDIC)
P.O. Box 110
Milton-Freewater, Oregon 97862

RE: Request for additional information; Artifical Ground Water Recharge Testing Project (OWRD File # LL-758)

To Whom It May Concern:

The purpose of this letter is to provide the additional information requested by ODEQ for the Artifical Ground Water Testing Project (Attachment 5A: Methodology to Determine Chemical Constituents For Water Quality Assessment and Evaluation and Attachment 5C: Chemicals of Interest for Hudson Bay Recharge Project). The following addresses each of the items requested in the 2/3/4 letter.

- Simazine has been included in Attachment 5C (see attached) along with the chemical properties needed to screen the chemical. If deemed appropriate, the chemical could be added to the final screening list. Also, ODEQ had sampled for this analyte during the 1999 study, and was found not to be a risk. (ODEQ, 1999).
- We concur that the four sampling events (once before, once shortly after, once during and once shortly before the end of the project) would be a more comprehensive way to screen for chemicals during the project. The final chemical list and their cost to process may pose some limitations as to the amount of samples we can collect. After we receive the final list, we can assess costs and notify ODEQ as to our financial constraints of adding a fourth sample.
- Nitrate has been used as a surrogate for solubility in other pesticides studies. However, we concur that unless it was possible to also know how it was applied and which chemicals most resembled its physical properties, that it may have less application for this project. We will still intend however to collect nitrate samples during recharge event(s) as a parameter of general water quality concern.

The additional information requested on the physical properties of the chemicals of concern is provided below.

Objective: In order to assess the **parameters of use** for each of the chemicals of concern (yellowed in Attachment 5C) in the project area. An assessment was conducted to better quantify the definition of "project area" and the types of crops/chemicals used over that area. The additional information requested on the chemicals of interest were:

- Application Method (see below)
- Time of year chemical applied (see below)
- Volume of chemical used per acre (see below)
- Concentration of chemical in application (see below)
- Percentage of project area receiving chemical (see below)
- Recharge site irrigation method (see below)
- Onsite use or offsite use (see below)
- Current or historic use (see Attachment 5C)

Collaborators: Bob Bower (Hydrologist/Artifical Recharge Testing Project Manager), WWBWC and Tom Darnell (Oregon State University Extension Agent).

Project Area: The project area was quantitatively defined to include the recharge testing site and the areas along that the ditch providing the surface recharge water. Total ditch length and land use was determined using a combination of recent aerial photographs (map wheel) and GIS mapping software. In order to calculate total project area, a 20-yard streamside buffer[1] was applied to both sides of the ditch for total area calculations.

- Total Length of Recharge Project area: 3.7 Miles
  - 2 miles in ag area (54% of total length)
  - 1.7 miles (46%) in Milton-Freewater city limits (no buffer value available).
- Total Ag chemical interest area: 14.6 acres
  - Apples: 5 acres
  - Cherries: 1.8 acres
  - Pasture/open ground: 7.7 acres (no chemicals of interest used)
  - Grapes: < 0.1 acre (minute use of chemicals of interest)
- Total of Project area with *potential* to receive chemicals: 47.3 % (city not included).

Specific area and use information:

APPLE ACRES

PRODUCT	SEASON	RATE/ACRE (MATERIAL)	%ACTIVE INGREDENT	AI/ACRE	TOTAL AMOUNT[2] 5 ACRES
Amid-Thin	May	.25 lb	8.4	.021 lb	.105 lb
Rally	April-May	5.0 oz	40.0	2.0 oz	10.0 oz
Rubigan	April-May	12.0 oz	12.0	1.44 oz	7.2 oz
Ridomil[3]	Oct	1.5 fl oz/1000sqft	49.0	32.0 oz	32.0 oz
Procure	April-May	12.0 oz	50.0	6.0 oz	30.0 oz
Intrepid	May	16.0 fl oz	22.6	3.6 oz	18.0 oz
Success	April	8.0 fl oz	22.8	1.8 oz	9.0 oz
Bayleton	April-May	6.0 oz	50.0	3.0 oz	15.0 oz
Provado	May	8.0 oz	17.4	1.4 oz	7.0 oz
Elgetol[4]	April	1.0 gal	N/A	N/A	N/A

[1] A recent United States District Court decision (Case No. CO1-0132C) stated: "The Court further finds that 20-yard buffer zones for ground use… will substantially contribute to the prevention of jeopardy." (http://agr.wa.gov/PestFert/EnvResources/docs/FinalOrder01-22-04.pdf)

[2] Total amount on five acres is the probable maximum amount of material (active ingredient). Actual use depends on variety, weather conditions and disease pressure. Rally, Rubigan. Procure and Bayleton are fungicides used to control apple scab and/or mildew. Apple orchards do not receive an application of each fungicide each season. The fungicides and insecticides are applied by air blast sprayer.

[3] Ridomil is soil applied, either by hand gun or herbicide sprayer, at the base of the tree. Total amount used is figured on 20 percent of the soil surface treated.

[4] Elgetol use was discontinued in 1986.

CHERRY ACRES

PRODUCT	SEASON	RATE/ACRE (MATERIAL)	%ACTIVE INGREDENT	AI/ACRE	TOTAL AMOUNT[5] 1.8 ACRES
Success	March-April	7.0 fl oz	22.8	1.6 fl oz	2.88 fl oz
Rally	March-April	5.0 oz	40.0	2.0 oz	3.6 oz
Rubigan	March-April	9.0 oz	12.0	1.08 oz	1.9 oz
Procure	March-April	13.0 oz	50.0	6.5 oz	11.7 oz

OTHER PROJECT AREA ACRES

The other project areas were estimated not to have any of the chemicals of interested (yellowed, Attachment 5C). The portion of the ditch passing through the city of Milton-Freewater was not considered for the agricultural chemicals of interest. This portion of the ditch would predominantly be surrounded by lawns and gardens. The types of chemicals used in these areas would include three from our original list: Dacamine (2,4 D), Round Up and Diazinon. These chemicals not typically applied during the recharge project time period and were thus determined to pose little risk. No chemicals were estimated to be used on the pasture/open acreage areas.

Project site irrigation method: Landowner has informed us that sprinkler irrigation has been used at the recharge site.

Project area irrigation method: All of the project Ag areas are in sprinkler irrigation. The small parcel with grapes are on a drip irrigation system.

Onsite use or offsite use: A letter from the landowner described the onsite use in which Simazine was listed. This chemical has been added to the comprehensive list.

Current or historic use: The original Attachment 5A and 5C included an assessment and categorization of chemicals based on historic and current use.

Thank you for your time and attention.

John Brough, HBDIC Director

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SALEM, OREGON

CC: Don Miller – OWRD
Tim Bailey – ODFW

[5] Total amount on 1.8 acres is the probable maximum amount of material (active ingredient). Actual use depends on pest populations and pressure and weather conditions. All pesticides are applied on ground by air blast sprayer.

2/5/+

ATTACHMENT 5A: Methodology to Determine Chemical Constituents for Water Quality Assessment and Evaluation

Introduction:

This attachment is intended to specifically help clarify the process by which the proposed list of chemical constituents were determined and to show that a ODEQ water quality permit will not be needed for this limited license groundwater recharge project.

Chemical Constituents Review Methodology

It should be **clearly reiterated** that during construction of the recharge pits/ponds, the top 60 inches (5 feet) of topsoil would be **removed**. This construction criteria assists the project in two ways: (1) it minimizes the chance of site specific chemicals being leached into the ground water during the recharge process, (2) it increases the rate at which recharge water can be applied by exposing the more transmissive substrate below this top soil layer.

Working with our local pesticides expert, (Tom Darnell, OSU Extension Agent in Milton-Freewater) a review was conducted to determine the types of chemicals to consider for during this project's water quality monitoring plan. A description of this review processed is presented below.

Chemical Review Process

1. Using the proposed water diversion time period (Nov 1st through May 15th), a comprehensive list of chemicals[1] was compiled for the project area. This included interviewing the current landowner on the site-specific history of chemical use on that property (see attached signed, written statement).
2. Chemicals were broken down into two classes: **current** chemicals were determined to be those that have been used in the past several years in the project area, and **historical** chemicals are not currently in use, but have were used at some point in the past. This "project area" is defined as the area starting at the Little Walla Walla diversion (on the Walla Walla River) through the lands adjacent to the ditch network to the project site. **Attachment** 5C lists this comprehensive list of chemicals in table form.
3. Reviewed the ODEO Report: *April 1999 Milton-Freewater Groundwater Quality Study: As part of the Statewide Groundwater Monitoring Program* (Richardson, et. al., 2000). ODEQ's well # UMA298 is located proximal to the proposed recharge site which provides excellent preexisting information for this project. **Attached** is a copy of the results and conclusions from that study.
4. Using information from OSU Pesticides database (and several other websites), the complete list of chemicals was further screened based on a set of sequential screening steps. Chemicals were selected for the final monitoring list if they appeared to meet all of the criteria listed below.

   a. Currently and Historically used chemicals were choosen if:
      i. Soil ½ life = > period when last used, and if
      ii. Pesticide Movement Rating[2] **> or = moderate**, and if
      iii. ODEQ **did not** sample for it in 1999 study (UMA 298 well)

5. Exception to above selection process

   a. ODEQ sampled and found a "positive" detection of **Dathal & Metabolites** as a part of the Phenoxyherbicide screen tests (ODEQ, 1999). The results noted:

      " Dacthal and its metabolites were detected in six samples as part of the Phenoxyherbicide screen. The maximum concentration detected (24.6 micrograms per liter) was much less than the 4,000 micrograms per liter healthy advisory level. Therefore, the concentration of dacthal and metabolites is not believed to represent problems to human health or the environment." (ODEQ, 1999)

---

[1] Chemicals defined to include fungicides, herbicides, miticides, pesticides, and growth regulators.
[2] The Pesticide Movement Rating as reported in OSU report, *(OSU, 1999)*

The plan **is to test** for this group of chemicals during the water quality monitoring portion of this project.

6. The final step in the review process was to evaluate **if** the final list of chemicals were "testable". Two private water quality-testing laboratories (Kuo and Edge Analytical) were contacted and asked if they were able to test for these chemicals in water samples. The results are noted in attachment 5C.

Screening process conclusions:

The final list of chemicals for testing is shown below. Screening and/or testing information for the chemicals Myclobutanil (Systhane, Rally), Triflumizole (Procure), Triadimefon (Bayleton), Imidacloprid (Provado), Methoxyfenozide (Intrepid), and Spinosad (Success) was not available at the time this document was completed. If this information becomes available in the future, and shows evidence that they should not or cannot be screened for, they would be dropped from the final testing list. Chemicals can also be added or deleted from the final list per request by ODEQ review staff.

Proposed List of Chemicals to Monitor for Recharge Project

Fenarimol (Rubigan)
DNOC sodium salt (Elgetol)
Metalxyl (Ridomil)
DCPA, (Dacthal @ Metabolites)
1-Naphthaleneacetamide (Amid-thin)
Myclobutanil (Systhane, Rally)
Triflumizole (Procure)
Triadimefon (Bayleton)
Imidacloprid (Provado)
Methoxyfenozide (Intrepid)
Spinosad (Success)

Pre-conditions: Using Nitrate as the Indicator

Agricultural fertilizers are the primary source of nitrate in groundwater. Nitrate concentrations greater than 2-3 mg/L in well water indicate that chemicals applied to the land surface are reaching the gorund water system, so detection of pesticides in these wells may be more likely. This relationship between nitrate concentration and pesticide detection may help identify wells at risk for contamination by pesticides. Laboratory analysis for nitrate is simpler and less costly than analysis of pesticides. Consequently, many more Central Columbia Plateau wells have been sampled for nitrate. (See attached report and *Rkyer, S.J. and Jones, J.L., 1995, Nitrate concentrations in ground water of the Central Columbia Plateau: U.S. Geological Survey Open-File Report 95-445, 4 p.)*

After the monitoring wells and recharge facility has been constructed and before operation of the project, a **preconditions water quality test** will be conducted of all chemical constituents (Levels 1 and 2 from Attachment 5 Monitoring Plan). Samples will be collected from the (1) source water entering project site, (2) upgradient on-site observation well, and (3) one of the two down gradient on-site observation wells.

Working in consultation with ODEQ staff, nitrate concentrations collected from this preconditions water quality test will used along with other published information in order to determine a Warning Concentration Level (WCL). This warning concentration level will be used to screen water quality during and after operation of the recharge project. If concentrations exceed this level, operation of the recharge facility will be stopped and a Level II water quality sampling will be done on both surface and groundwater location to determine if chemicals are present. Working with ODEQ, results will be reviewed and any operation changes will implemented to avoid chemical contamination of the groundwater.

Laboratory Resources

Nitrate Analysis: Walla Walla County-City Health Department
310 W. Popular, P. O. Box 1753
Walla Walla, WA 99362
Telephone (509) 527-3290

Chemical Analysis: KUO Testing Labs, INC.
337 south 1st Avenue
Othello, WA 99344
Telephone: (509)-488-0118

Edge Analytical
1151 Knudson
Burlington, WA 98233
(360) 757-1400
(800) 755-9295

References and additional chemical resources used for the screening process:

Darnell, T., Topielec, R. 1996, October. *Nitrates and Bacteria in Groundwater: A Second Look, Milton-Freewater Area, Umatilla County, Oregon.* Oregon State University Extension Service Water Quality Program.

Darnell, T. Hart, J. Vomocil, Jim. 1989. *Nitrates and Bacteria in Groundwater: Milton-Freewater, Umatilla County Oregon.* Oregon State University Extension Service.

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Attachment B

ATTACHMENT B: RECORD OF USE (2004-2008)

Recharge Seasons	Period of Operation	Hours of Diversion (actual)	Total Water Use ON HBDIC Recharge Site (acre-feet)	Water Use: Little Walla Walla Diversion to HBDIC Recharge (Conveyance Loss) (acre-feet)
Spring 2004	4/8/4 to 5/14/4	888	409	714
2004-2005	12/1/4 to 2/3/5	672	388	540
2004-2005	3/27/5 to 4/30/5	720	650	579
2005-2006	11/1/5 to 5/15/6	2544	2,813	2,046
2006-2007	11/1/6 to 5/15/7	3072	3,278	2,470
2007-2008	11/14/7 to 3/25/7	2400	1,939	1,930
2007-2008	4/10/8 to 5/15/8	840	820	676
	Total	11,136	10,297	8,955
			Sum of Recharge Project and Conveyance	19,252

Attachment C

Attachment C: HBDIC Recharge On-Site Operations and Expansions (2004-2008)

Recharge Seasons	Period of Operation	Days of Operation (actual)	Peak Recharge Rate (cfs)	Site Expansion Phase	Infiltration Area (feet^2)	Infiltration Area (acres)	Total Recharge Volume (acre-feet)	Total Recharge Volume (Gallons x 1,000)	Total Rechage (acre-feet (season))
Spring 2004	4/8/4 to 5/14/4	37	8.0	I	15,000	0.3	409	133,273	409 (2004)
2004-2005	12/1/4 to 2/3/5	28	6.8	I	15,000	0.3	388	126,398	1038(2004-5)
2004-2005	3/27/5 to 4/30/5	30	12.1	II	47,420	1.1	650	211,803	
2005-2006	11/1/5 to 5/15/6	106	13.2	II	47,420	1.1	2,813	916,619	2813 (2005-6)
2006-2007	11/1/6 to 5/15/7	128	12.8	II	47,420	1.1	3,278	1,068,140	3278 (2006-7)
2007-2008	11/14/7 to 3/25/7	100	18.4	II	61,987	1.4	1,939	631,962	2759 (2007-8)
2007-2008	4/10/8 to 5/15/8	35	16.8	III	61,987	1.4	820	267,125	
	Total	464					10,297	3,355,320	

Attachment D

Oregon Water Resources Department

Final Order
Regarding Limited License Request 758

Requested Water Use

On November 11, 2003 the Water Resources Department received completed LL request 758 from Hudson Bay District Irrigation Company for the use of 50.0 cfs from the Walla Walla River, located in the SW1/4, NE1/4, Section 12, Township 5 North, Range 35 East, W.M., for the purpose of artificial ground water recharge testing, for a period of five years, pursuant to ORS 537.143 and 537.144.

Department Review

The Department, in consultation with Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Environmental Quality (ODEQ), and Confederated Tribes of the Umatilla Indian Reservation (CTUIR), has determined that the requested use may be approved as conditioned and limited below.

The use of water for artificial ground water recharge testing, as requested in limited license application 758, is a use allowed under ORS 537.143.

Sufficient water is available, as required under 690-340-0030(1)(b), for this short-term, fixed duration use. The Director may revoke the right to use water for any reason described in ORS 537.143(2).

The Department provided public notice of the application in the Department's weekly public notice as required by OAR 690-340-0030(2). The Department has received comments related to the issuance of the limited license. The authorization of limited license 758, as conditioned below, will satisfactorily address the issues raised in those comments.

Conditions and Limitations

The use of water from the Walla Walla River shall be limited to 50.0 cfs for the purpose of testing artificial ground water recharge during a testing season of November 1 through May 15. Water may only be diverted when there is adequate flow in the Walla Walla River to honor all existing water rights. When water is diverted under this limited license, the use is further limited to times when there is, at a minimum, the following streamflows in the Tum A Lum reach of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past

This is a final order in other than contested case. Pursuant to ORS 536.075 and OAR 137-004-080 and OAR 690-01-005 you may either petition the Director for reconsideration of this order or petition for judicial review of this order. As provided in ORS 536.075, this order is subject to judicial review under ORS 183.484. Any petition for judicial review of the order must be filed within the 60 day time period specified by ORS 183.484(2).

Nursery Bridge Dam: November - 64 cfs, December and January - 95 cfs, February to May 15 - 150 cfs. Nursery Bridge Dam is located just downstream of Nursery Bridge and is downstream of the Little Walla Walla diversion. The District 5 Watermaster, based on gage and/or streamflow measurements, shall make the determination that the above described streamflows are flowing past Nursery Bridge Dam. Diversion under this limited license shall cease when said streamflows are not being met.

Based on a review of water quality information generated during the term of this limited license or from other sources, ODEQ can require the licensee to terminate the diversion of water into the recharge area. If monitoring data or other information results in identification of potential water quality concerns ODEQ may require modifications to the existing limited license and/or require a permit to address the water quality concerns prior to reinitiating artificial ground water recharge.

The licensee shall install, maintain and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife to prevent fish from entering the proposed diversion. See copy of enclosed fish screening criterial for information.

The use of water under a limited license shall not have priority over any water right exercised according to a permit or certificate, and shall be subordinate to all other authorized uses that rely upon the same source. The Director may be prompted by field regulatory activities or by any other reason to revoke the right to use water (ORS 537.143 (2) and OAR 690-340-0030 (6)).

The licensee shall give notice to the Watermaster at least 15 days, but no more than 60 days, in advance of using water. The notice shall include the location of the diversion, place of recharge, the quantity of water to be diverted and the intended use.

ORS 537.143(8) provides that a limited license cannot be issued for the same use for more than five consecutive years. This limited license provides for the maximum allowable time.

The licensee shall meter all water use and maintain a record of use, including the total number of hours of diversion and an estimate of the total quantity diverted. During the period of the limited license, the record of use shall be available for review by the Department upon request and shall be submitted to the Watermaster upon request.

Upon project completion, the licensee shall submit the record of use to the Water Resources Department.

The licensee shall conduct artificial ground water recharge testing in a manner consistent with the license application proposal. This includes monitoring the amount of water diverted from the Walla Walla River and the amount delivered to the recharge pits from the ditch.

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Order

Therefore, pursuant to ORS 537.143 and ORS 537.144, limited license 758 is issued as conditioned and limited above.

Issued February 18, 2004

Paul R. Cleary, Director
Water Resources Department

Enclosures - limited license and fish screen criteria

cc: Tony Justus, Watermaster, District 5
Tim Bailey, ODFW
Phil Richerson, ODEQ
Rick George, CTUIR

File

If you need further assistance, please contact the Water Rights Section at the address, phone number, or fax number below. When contacting the Department, be sure to reference your limited license number for better service.

Remember, the use of water under the terms of this limited license is not a secure source of water. Water use can be revoked at any time. Such revocation may be prompted by field regulatory activities or by any other reason.

Water Rights Section
Oregon Water Resources Department
158 12th ST NE
SALEM, OR 97310

Phone: (503)378-8455
Fax: (503)378-6203

FISH SCREENING CRITERIA FOR WATER DIVERSIONS

This summary describes ODFW fish screening criteria for all fish species.

Screen material openings for ditch (gravity) and pump screens must provide a minimum of 27% open area:

> **Perforated plate**: Openings shall not exceed 3/32 or 0.0938 inches (2.38 mm).
> **Mesh/Woven wire screen**: Square openings shall not exceed 3/32 or 0.0938 inches (2.38 mm) in the narrow direction, e.g., 3/32 inch x 3/32 inch open mesh.
> **Profile bar screen/Wedge wire**: Openings shall not exceed 0.0689 inches (1.75 mm) in the narrow direction.

Screen area must be large enough not to cause fish impact. Wetted screen area depends on the water flow rate and the approach velocity.

> **Approach velocity**: The water velocity perpendicular to and approximately three inches in front of the screen face.
> **Sweeping velocity**: The water velocity parallel to the screen face.
> **Bypass system**: Any pipe, flume, open channel or other means of conveyance that transports fish back to the body of water from which the fish were diverted.
> **Active pump screen**: Self cleaning screen that has a proven cleaning system.
> **Passive pump screen**: Screen that has no cleaning system other than periodic manual cleaning.

Screen approach velocity for ditch and active pump screens shall not exceed 0.4 fps (feet per second) or 0.12 mps (meters per second). The wetted screen area in square feet is calculated by dividing the maximum water flow rate in cubic feet per second (1 cfs = 449 gpm) by 0.4 fps.

Screen sweeping velocity for ditch screens shall exceed the approach velocity. Screens greater than 4 feet in length must be angled at 45 degrees or less relative to flow. An adequate bypass system must be provided for ditch screens to safely and rapidly collect and transport fish back to the stream.

Screen approach velocity for passive pump screens shall not exceed 0.2 fps or 0.06 mps. The wetted screen area in square feet is calculated by dividing the maximum water flow rate by 0.2 fps. Pump rate should be less than 1 cfs.

For further information please contact:

Bernie Kepshire
Oregon Department of Fish and Wildlife
7118 NE Vandenberg Avenue
Corvallis, OR 97330-9446
(541)757-4186 x255
bernard.m.kepshire@state.or.us

Attachment E

This page to be completed by the local Watermaster.

WATER AVAILABILITY STATEMENT

Name of Applicant: Hudson Bay District Irrigation Co. Application Number: ____________

1. To your knowledge, has the stream or basin that is the source for this application ever been regulated for prior rights?

   ☑ Yes ☐ No

   If yes, please explain:

   The Walla Walla River is typically short of water to serve all rights in July, August, September and October.

2. Has the stream or basin that is the source for this application ever been regulated for minimum stream flows?

   ☐ Yes ☑ No

   If yes, please explain:

3. Do you observe this stream system during regular fieldwork?

   ☑ Yes ☐ No

   If yes, what are your observations for the stream?

   Typically there is extra water from November to June.

4. Based on your observations, would there be water available in the quantity and at the times needed to supply the development proposed by this application?

   ☑ Yes ☐ No

   What would you recommend for conditions on a permit that may be issued approving this application?

   Limit diversion similarly to Hudson Bays permit #53662. Allow diversion when flows are in excess of 64cfs in November, 95cfs in December and January, and 132 cfs in February to May 15 each year.

5. Any other recommendations you would like to make?

Signature: Tony Justus WM District #: 5 Date: 10/31/03

Oregon Water Resources Department

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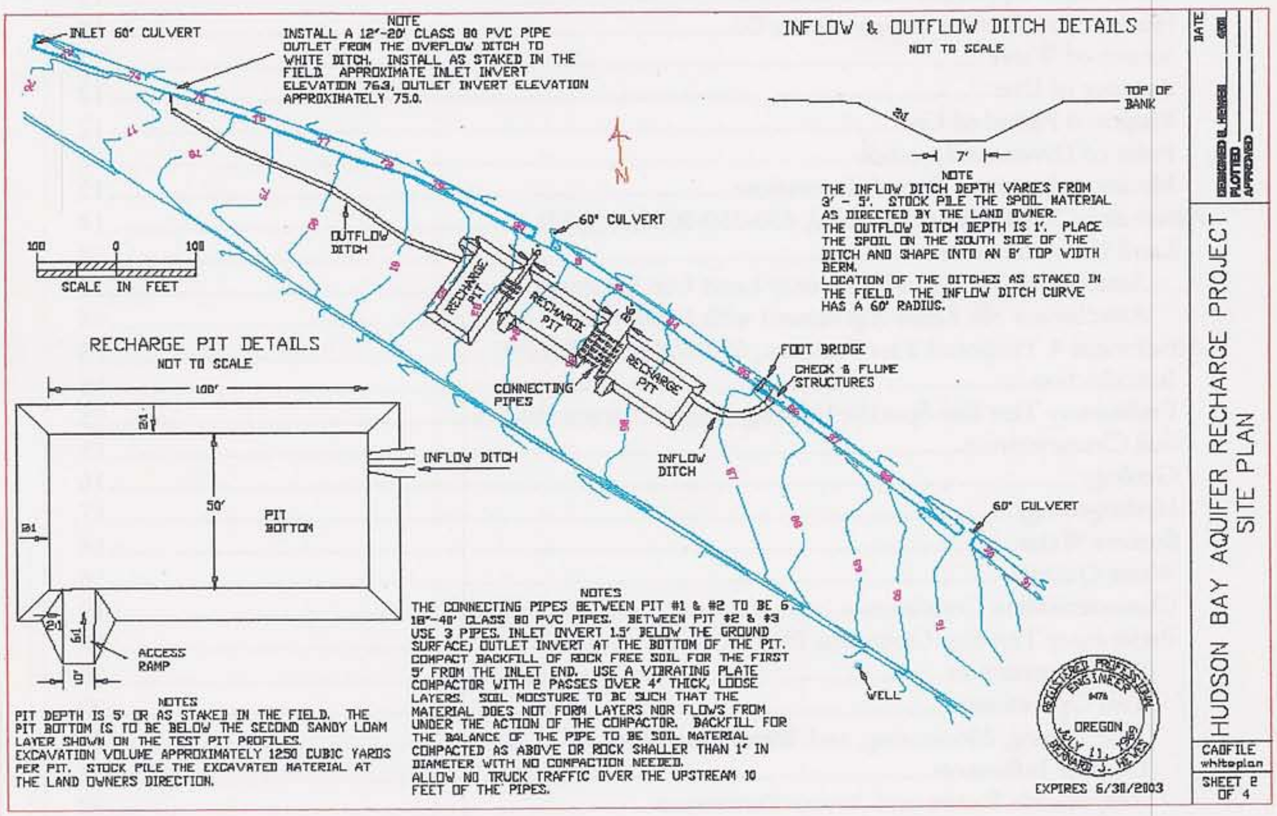
Bernie Kepshire
Oregon Department of Fish and Wildlife
7118 NE Vandenberg Avenue
Corvallis, OR 97330-9446
(541)757-4186 x255
bernard.m.kepshire@state.or.us

Hudson Bay Aquifer Recharge Project

An application for ASR Testing Limited License to Oregon Water Resources Department (OWRD) (OAR 690-350-0020)



Prepared for the HBDIC by:

Walla Walla Basin Watershed Council
Kennedy and Jenks Consultants, Inc.

October 20, 2003

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8B Application form - OWRD

Introduction

The Walla Walla Basin Watershed Council (WWBWC), in cooperation with the Hudson Bay District Improvement Company (HBDIC), has proposed to test shallow aquifer recharge at a site located adjacent to the HBDIC's *White Ditch* in section 33, T6N, R35E. At the test site a series of three infiltration pits will be built. Water will be supplied to these pits via a diversion from the canal. Recharge activities are proposed during the winter and spring months, when the Walla Walla River (the source of water for the canal) is running at higher flows. The proposed shallow aquifer recharge testing would be done under an ASR Testing Limited License granted by Oregon Water Resources Department (OWRD) (OAR 690-350-0020). By recharging shallow groundwater it is hoped that a portion of the recharge water will return to restore diminished spring-creek and Walla Walla River baseflows. Testing will not include removal of stored water by pumping or other artificial means.

The Limited License Application requires several supporting documents be attached (690-350-0020 (3)(b)), including (but not limited to) those describing proposed testing, groundwater conditions (including hydrogeologic conditions and groundwater quality), and source water quality. Information not included in this assessment report, but still needed for the application, will be collected during proposed site-specific hydrogeologic characterization, monitoring, and testing process. This limited license application is to gain approval of the proposed shallow aquifer recharge testing. The complete list of Attachments as called for in include:

Attachment 1. Project Layout and Size, 690-350-0020(3)(a)(E) and (I) and 690-350-0020(3)(b)(B)
Attachment 2. Water Rights Statement, 690-350-0020(3)(a)(F) and (G)
Attachment 3. Land Use Approval, 690-350-0020(3)(a)(H)
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Attachment 5. Proposed Monitoring Program, 690-350-0020(3)(b)(A)
Attachment 6. Site Hydrogeology, 690-350-0020(3)(b)(C), (E), and (G)
Attachment 7. Source Water Quality, 690-350-0020(3)(b)(D)

Overview of Watershed Conditions

The quantity, storage, timing, and availability of water are several major challenges facing watershed managers in the Walla Walla River Basin. The relationship between the Walla Walla River and its distributaries with that of the shallow alluvium aquifer has been shown to be highly interdependent (Piper, 1933, Newcomb, 1965, Barker & McNish, 1975, Bower et. al., 2001). The Walla Walla Basin Watershed Council, Walla Walla Watershed Alliance, and Hudson Bay District Improvement Company (HBDIC), working with their partners in OWRD, ODEQ and ODFW, propose to explore the utility of artificially recharging the shallow alluvial aquifer as a way to help offset the loss of natural recharge opportunities throughout the basin.

Surface water and shallow groundwater in the Walla Walla Basin (the Basin) form an interconnected system. In some areas, especially upstream areas where streams leave the mountains and highlands surrounding the Basin to flow out onto the Basin floor, streams historically probably branched out onto the Basin floor and some of the water they carried seeped into the ground, recharging the shallow groundwater system. This shallow groundwater, recharged near the edge of the Basin, formed the main source of clean, cool groundwater found further down basin where it returned to the surface via springs and base flow to the Walla Walla River. Through the years, the issuance of hundreds of surface and groundwater rights has resulted in the allocation of nearly all of the naturally available water in the basin. These allocations have pressured water resources, compelling the

Washington State Department of Ecology to close ground waters to further appropriations due to concerns about dropping water table levels. Other indicators of overstressed water resources include: (1) dry or dropping well levels, some wells in OWRD's inventory of state-observation-wells, (2) dry or dropping flow volumes in the spring branches, and (3) loss of natural and artificial groundwater recharge opportunities through irrigation efficiency and improved surface water management.

The state of Oregon has recognized use of artificial recharge as a tool "that can be an effective and efficient method for storing water for futures uses."(OWRD, Umatilla Basin Report, 1988). Artificial recharge has been shown to work in other areas of Umatilla County such as the County Line Water Improvement District Project, in operation since 1977. An OWRD review of this project states "It has been instrumental in arresting and reversing ground water level declines in a portion of the Ordnance Critical Ground Water Area." (OWRD, 1988). The USGS also noted the need for artificial recharge in the Walla Walla valley to offset increased water demands and loss of natural and artificial recharge mechanisms: "(Irrigation efficiency measures) can diminish the infiltration to recharge the ground water," wrote Newcomb in his important 1965 report. "Consequently, any such plans for changes in river regimen could well be required to provide for compensatory recharge or to sustain counter charges for their diminution of natural recharge and storage.

This project will comprise of three major components: Construction-Operation, Monitoring-Evaluation and Outreach-Education.

Construction-Operation: After receiving the appropriate permits and/or approval from OWRD, OWDF, ODEQ, USFWS, NOAA Fisheries and the Umatilla County Planning Department, a series of three pits specifically designed for passive artificial recharge will be constructed on land provided by the Hudson District Improvement Company (HBDIC). The land is being leased from one of the district's patrons by the HBDIC and a written agreement for the lease has been secured. The pits will be constructed in such a way to maximize recharge rates while minimizing the ground water quality impacts during the winter/spring recharge period. Project features include a concrete check structure in adjacent White Ditch, a concrete flow-measuring flume, an open connection ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit. These pits are designed to handle 50 cubic feet per second (cfs) of water anticipated to be available during the winter/spring Walla Walla River runoff. The actual volume of winter-spring water delivered will depend on the above-mentioned permitting and review process and the actual field verified constraints once in operation. Operation of this structure will be based on the instructions provided by OWRD in the operation permit and agreed to by the various project partners and agencies.

Monitoring-Evaluation: Monitoring of project will be conducted at several levels including: (1) on-site subsurface hydrologic and hydrogeologic monitoring, (2) off-site subsurface hydrologic and hydrogeologic monitoring, (3) off-site surface monitoring of springs through flow and photo-point measurements, (4) on/off-site water quality monitoring of key physical and chemical properties. The results of this intensive monitoring will be evaluated to identify impacts of the proposed project on groundwater levels and flow beneath and around the site, on surface water and spring discharges down gradient of the site, and on base flow to the Walla Walla River. Monitoring will also identify potential problems associated with the project

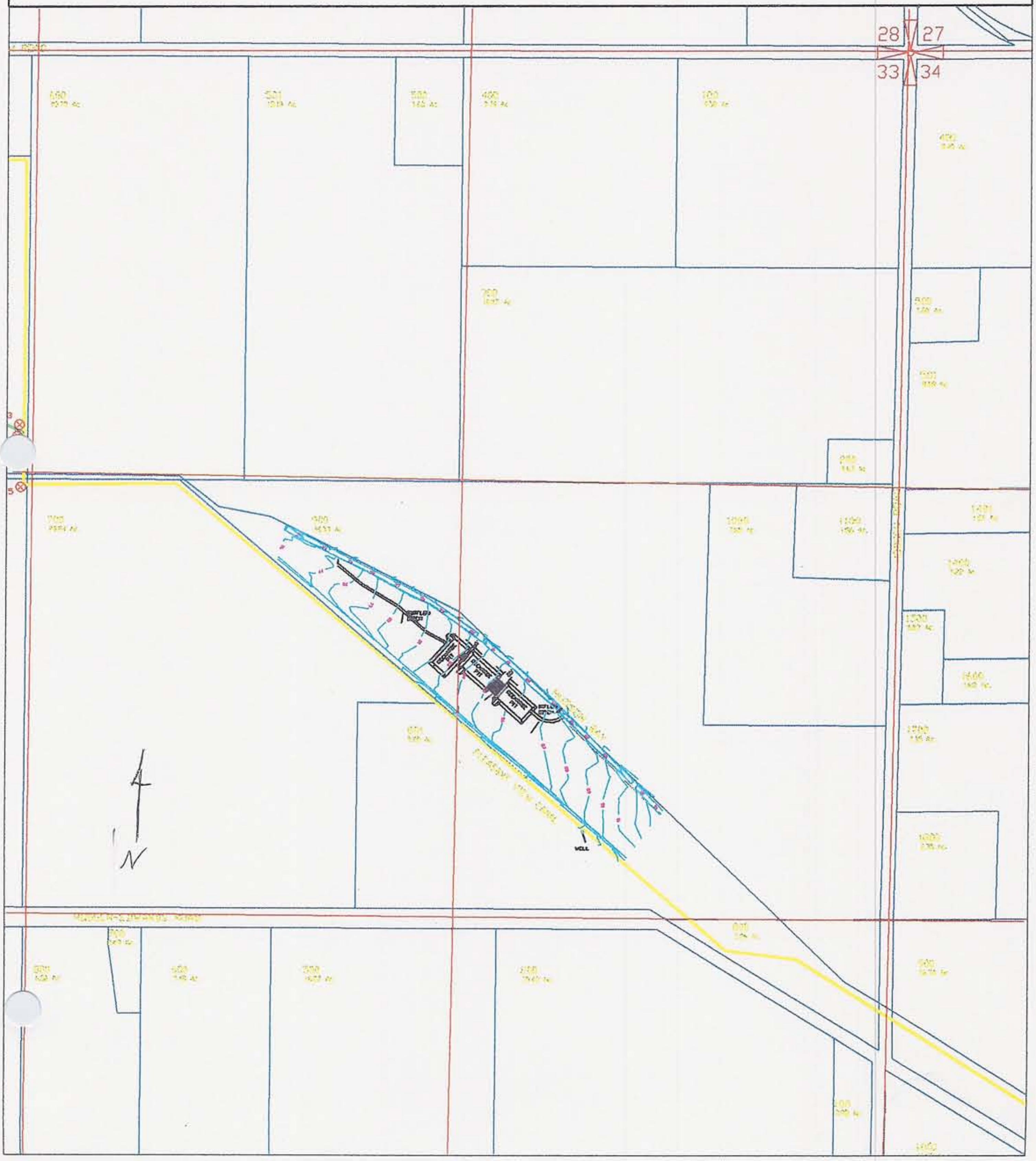
Outreach-Education: This project will also serve as an important outreach and education tool for the general public and water users of the Walla Walla valley. Particular focus and time will be spent on utilizing the site and the results for the recharge analysis to educate people on the role that ground water plays in the rivers and streams of the Walla Walla Watershed.

This project meets all of the habitat restoration actions from the *Oregon Aquatic Habitat Restoration and Enhancement Guide* including:

1. Change the trend of aquatic habitat function from one of a diminishing ability to support salmonids and other organisms to one that supports a complex, self-sustaining system. Such systems provide high quality habitat and ecological capacity for salmonids and other species; or
2. Correct or improve conditions caused by past management and/or disturbance events; or
3. Maximize beneficial habitat in the short term where watershed degradation has been extensive and natural processes will need substantial time to restore habitat; or
4. Create beneficial habitat and restore stream function to the fullest extent possible within developed areas where no reasonable expectation of returning to natural conditions exists.

HUDSON BAY AQUIFER RECHARGE PROJECT
LOCATED IN THE NE$\frac{1}{4}$ OF SEC33, T6 N, R35E W.M.

Figure 1 Scaled Map of Project and Surrounding Area



0 400 800

SCALE IN FEET

ONE INCH EQUALS 400FT

LEGEND

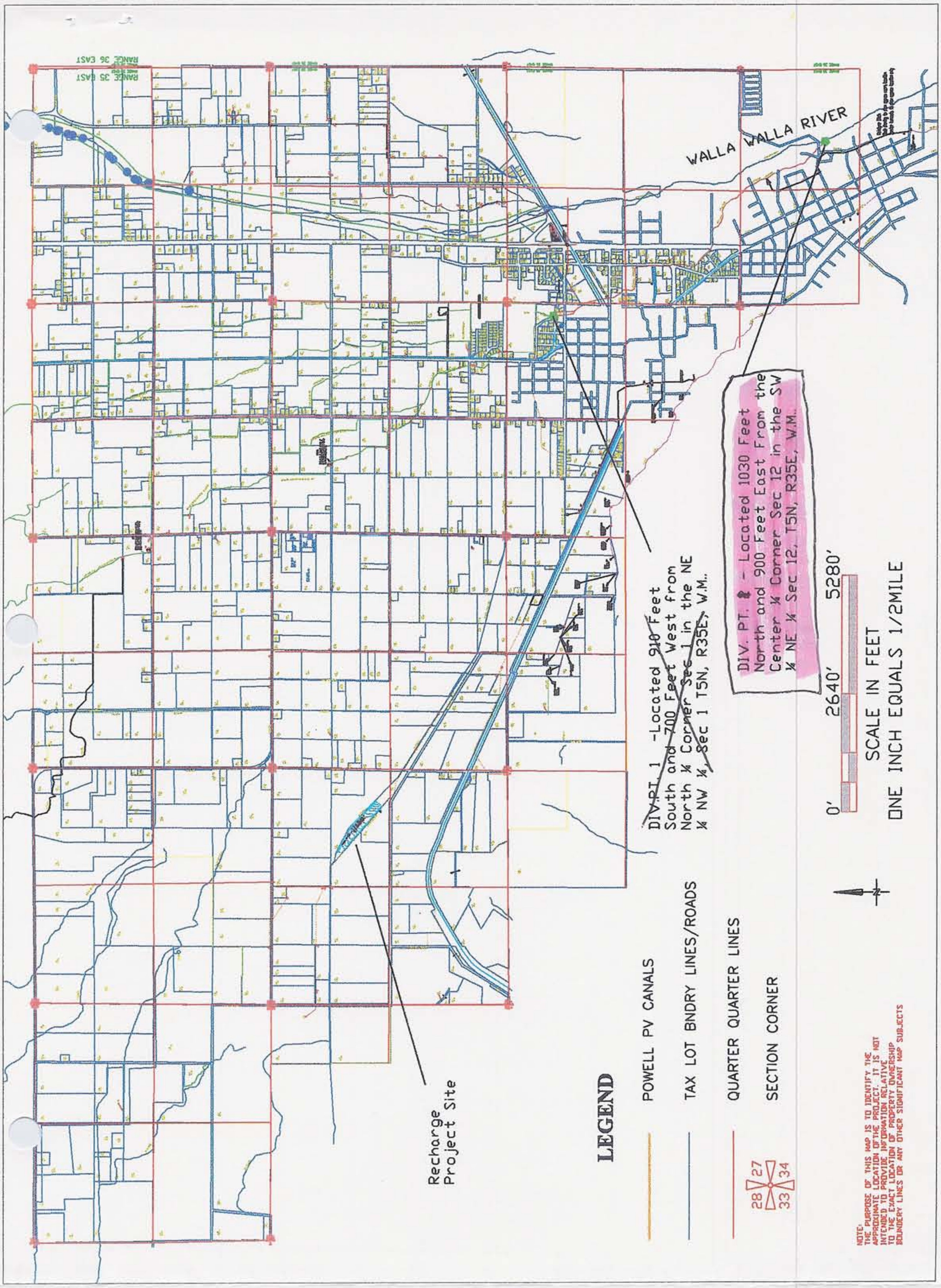
POWELL PV CANAL

TAX LOT BOUNDERY LINES

QUARTER QUARTER LINES

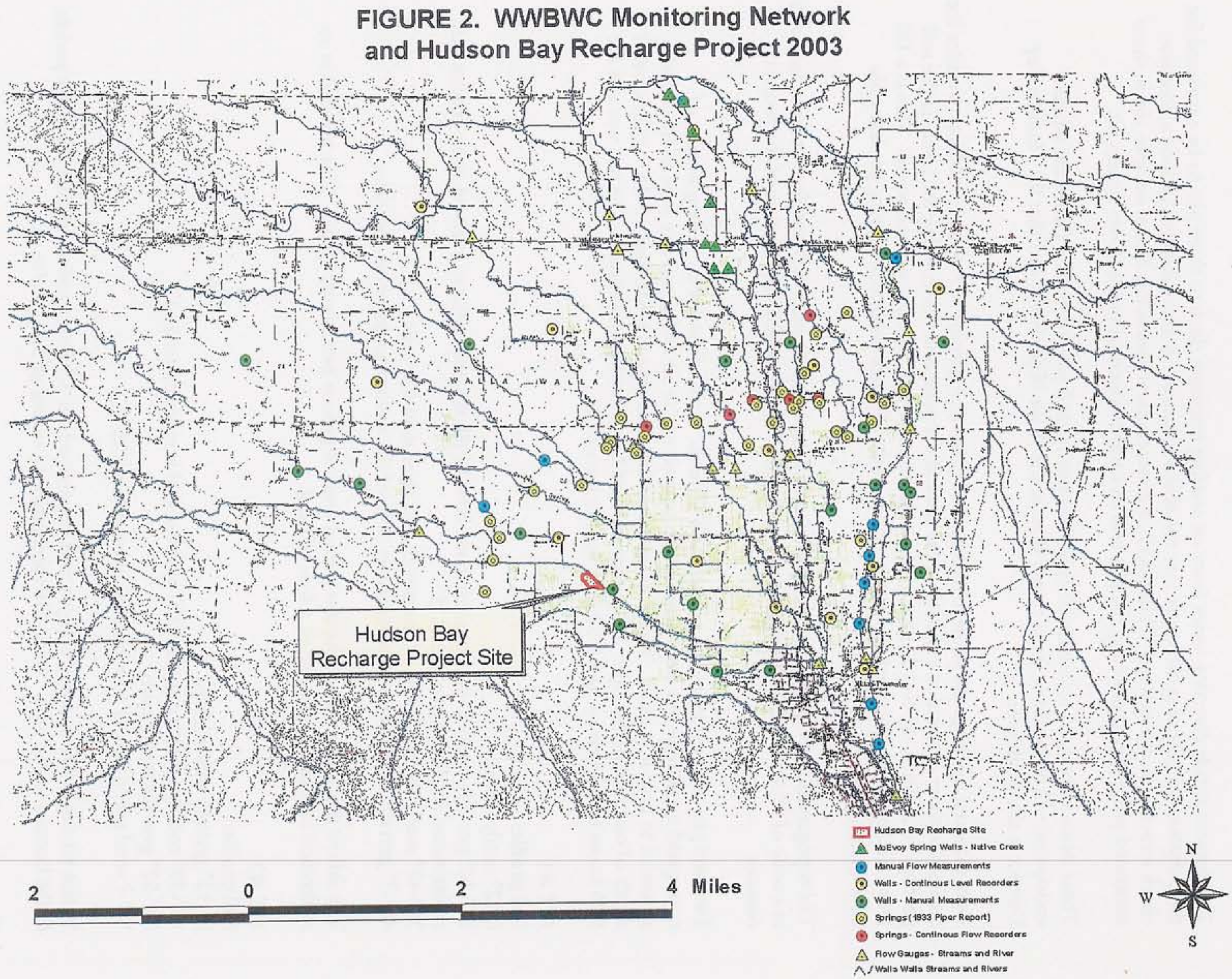
28 27 33 34 SECTION CORNER

NOTE:
THE PURPOSE OF THIS MAP IS TO IDENTIFY THE APPROXIMATE LOCATION OFTHE PROJECT. IT IS NOT INTENDED TO PROVIDE INFORMATION RELATIVE TO THE EXACT LOCATION OF PROPERTY OWNERSHIP BOUNDERY LINES OR ANY OTHER SIGNIFICANT MAP SUBJECTS



HUDSON BAY AQUIFER RECHARGE PROJECT
LOCATED IN THE NE1/4 OF SEC33, T6 N, R35E W.M.
FIGURE 1A

Figure 2 WWBW Monitoring and Recharge Site Map



Attachment 1. Project Layout, 690-350-0020(3)(a)(E) and (I) and 690-350-0020(3)(b)(B)

Prepared by Bernard Hewes, Licensed Engineer in the State of Oregon.

This project entails diverting water from an existing irrigation ditch to three pits to be excavated for the purpose of infiltrating the water into the shallow aquifer. Project features include a concrete check structure in the existing White Ditch, a concrete flow measuring flume, an open ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit.

These items were sized to handle 50 cubic feet per second (cfs) of water. This is the amount anticipated will be available from excess flow in the Walla Walla River and that the Hudson Bay District is able to deliver.

Data gathered to design the project consisted of a site topographic survey and installing two sites for testing the water infiltration capacity of the natural materials and determining the layers in the soil profile. In addition the Soil Survey of Umatilla County Area, Oregon was consulted. This is a US Dept. of Agriculture, Natural Resources Conservation Service publication giving general soils information.

The topographic survey data was used to prepare a topographic map with one foot contour intervals at a scale of 1" = 60'. This information was used to help determine the location of the project features.

Two test pits were excavated to a depth of 6'-7' each. A 24" diameter by 5' long section of corrugated metal pipe was set on end in the bottom of the pit and about one foot of fill placed around it to hold it in place. Water was pumped into the pipe at a rate that would sustain a water depth of one foot in the pipe. Both flow rate and total flow was measured. The test was run for 6.25 hours in the first pit and 3.5 hours for the second pit.

PIT #1
Soil profile:
0-12" sandy loam
12"-36" gravelly sandy loam, approximately 50% of the material volume is gravel size particles with an estimated D 50 size of about 0.75"
36"-48" sandy loam, in parts of the trench this layer does not exist
48"-?" gravelly sandy loam approximately 20% of the volume is gravel size particles

The inflow rate at the end of the test period was 4.0 gallons per minute (gpm). This resulted in an infiltration rate of 1.7 gpm/sq. ft./ foot of head.

PIT #2
Soil profile:
0"-13" gravelly sandy loam
13"-39" cobbly sandy loam, the D50 of the gravel is approximately 1"
39"-52" gravelly sandy loam
52"-? sand gravel mix D 50 estimated to be about 0.25"

In this pit the inflow rate of 11.9 gpm was maintained for 3.5 hours and at no time did water puddle in the bottom of the pipe. The infiltration rate is in excess of 3.8 gpm/sq. ft.

The area needed for infiltrating the water was determined assuming an infiltration rate for the entire area of 3.0 gpm/sq.ft./ per foot of head. For an inflow rate of 50 cfs the infiltration area needs to be

7480 square feet. The infiltration rate of 3.0 gpm/sq.ft. was chosen because the pits will be located in the area with soil surface texture similar to test pit #2.

Due to the possibility of fine soil particles plugging the infiltration area, unknowns concerning the long-term infiltration rate and that the amount of water available is not yet known extra infiltration area is being provided. Three separate pits with bottom dimensions of 50 feet X 100 feet are proposed. This will provide an infiltration area of 15,000 square feet.

The pits will be excavated to a depth of about 5 feet to get below the second sandy loam layer noted in both test pits. This will allow the water depth to be 2.5 feet - 3.5 feet. That will increase the rate of infiltration over the test values derived with one foot of water depth. The overall safety factor for the infiltration area is well over 2.

Inflow to the system will be measured with a ramp flume and continuously recorded. The ramp flume is sized to provide 5% flow rate accuracy over a flow range of 10 cfs-50 cfs

Any outflow from the last pit will be safely returned to the White Ditch through a 12-inch pipe. The pipe will be on a slope that will keep water from flowing out of White Ditch.

Engineering Attachments:

Attachment 1A: Location Map
Attachment 1B: Site Plan
Attachment 1C: Structure Details
Attachment 1D: Structure Reinforcing Steel
Attachment 1E: Signed and Stamped Copy of *Project Engineering Report*

Attachment 2. Water Rights Statement, 690-350-0020(3)(a)(F) and (G)

Water Right Applicant:

Hudson Bay District Improvement Co.

P.O. Box 110
Milton-Freewater, Oregon 97862
Project Contact: John Zerba, WBDIC Board Member
Telephone: (541)-938-6100
Operations Contact: Jon Brough, WBDIC District Manager
Telephone: (541)-520-2856
Recharge Project Manager (WWBWC), Bob Bower, Hydrologist
Telephone: (541)-938-2170

Source of Water:

Walla Walla River, a tributary of the Colombia River, within the Umatilla River Basin.

Purpose of Use:

Artificial Groundwater Recharge using water diverted during the fall, winter, and spring freshet flows on the Walla Walla River and utilizing the HBDIC recharge structure near Milton-Freewater, Oregon.

Proposed Period of Use:

November 1 through May 15 and as Further limited below

Point of Diversion Location:

~~NE ¼ NW ¼, Section 1, SW ¼ NE ¼~~ Section 12, T5N, R35E, W.M.; ~~DIV.PT. 1 910 Feet South and 700 Feet West from North ¼ Corner Section 1~~; DIV. PT. 2 – 1030 Feet North and 900 Feet East From the Center ¼ Corner Section 12.

Minimum Instream Flow Information:

When water is diverted under this permit, the use is further limited to times when there is, at a minimum, the following streamflows in the Tum-a-lum branch (mainstem) of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam.

Utilizing the Minimum Perennial Streamflows information (table 1, page 31) in OWRD Umatilla Basin Report (OWRD, 1988) and HBDIC's current winter water diversion permit (Permit Number 53662) the following represent the minimum instream flows at Nursery Bridge Dam:

- November – 64 cfs
- December through January – 95 cfs
- February through May 15 – 132 cfs

Nursery Bridge is located just downstream of Nursery Bridge and is downstream of the Little Walla Walla Diversion, the East Side Canal and the District's Canal, also described as point of diversion 1 in this application.

In order for diversion to occur under this permit, the above described streamflows must be met in the Tum-a-lum branch of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and following past Nursery Bridge Dam (see OWRD permit (Permit Number 53662 for operating and maintenance requirements for this station). Said streamflows shall be measured at the gauging station described below. In the event the primary gage experiences mechanical difficulties, stream flows at Nursery Bridge Dam shall be calculated by subtracting from the streamflows at Little Walla Walla Diversion (Cemetery Bridge) from those streamflows recorded at either the WWBWC gauge at Grove School Bridge or a combination of streamflows at OWRD's North and South Fork stations (#s).

Attachment 3. Land Use Approval, 690-350-0020(3)(a)(H)

The HBDIC recharge project staff has consulted with both the Umatilla County Planning department and the current landowner (Hulette Johnson). Attached you will find two documents addressing the anticipated land use and zoning issues needed for construction and operation of this project. The first (Attachment 3A) a Land Use Form approved by the Umatilla County Planning Department. This was originally submitted as a requirement in the funding request to the Oregon Watershed Enhancement Board. The second Attachment (Attachment 3B) was is a lease agreement between the HBDIC and the current landowner and water right holder, Hulette Johnson.

Land Use Attachments

Attachment 3A: Umatilla County Land Use Approval
Attachment 3B: Lease Agreement with Landowner

Attachment 4. Proposed Test Program, 690-350-0020(3)(b)(A)

Introduction

The Walla Walla Basin Watershed Council (WWBWC), in cooperation with the Hudson Bay Improvement District (HBID), has proposed to test shallow aquifer recharge at a site located adjacent to the Hudson Bay Canal in section 33, T6N, R35E. At the test site a series of three infiltration pits will be built. Water will be supplied to these pits via a diversion from the canal. Recharge activities are proposed for winter and spring months when the Walla Walla River (the source of water for the canal) is at peak annual flows. The proposed shallow aquifer recharge testing will be done under an ASR Testing Limited License granted by Oregon Water Resources Department (OWRD) (OAR 690-350-0020).

Preliminary Test Site-Specific Hydrogeologic Characterization

Site-specific hydrogeologic characterization is designed to identify and define local conditions to provide a technical basis for designing the monitoring which will be used to evaluate testing. For this project a number of characterization needs are outlined in the 3 July 2003 hydrogeologic assessment letter report (Attachment 6). These needs include determining the physical properties of the geologic units underlying the test site, investigating the presence of a possible semi-confined aquifer in the upper part of the suprabasalt aquifer system, identifying aquifer hydraulic properties, and establishing suprabasalt aquifer baseline conditions, including seasonal variation, for groundwater depth, flow direction, and quality. These, and other site characterization issues, will be addressed using test site-specific hydrogeologic characterization data collected predominantly using:

1. Test pits, boreholes, and wells constructed for the direct observation of ` subsurface conditions
2. Infiltration tests (constant and falling head) designed to evaluate spatial variability at a site both laterally and vertically (note, the water source for this activity may require a temporary permit)
3. Aquifer testing and water level measurements to evaluate baseline aquifer physical conditions before testing
4. Surface and ground water quality data collected to evaluate the affect (if any) of test site operation on area groundwater quality
5. Well and canal records describing water use in the project area
6. Water flow metering at the test site that indicates surface water in-flow and out-flow during testing

At this time, geophysical investigations are not being considered because of the lack of subsurface control and ground truth data that could be used to constrain geophysical interpretations. The following sections describe proposed soils, geologic, hydrogeologic, surface water, and water quality characterization for this project.

Soil Characteristics

The HBDIC recharge project will be constructed by excavating the top 5 feet (72 inches) of soil from each of the recharge pits (See Engineering Design Report, ATTACHMENT 1). Test Pits constructed and evaluated in the Engineering Design Report provide site-specific soil profile information. Additionally, the "Soil Survey of Umatilla County Area, Oregon, (USDA, 1988) provides some general information about soil in the upper 60 inches at the project site. The two soils present at the site are: Freewater (29A) and Cowsly (22C). As the entire soil layer will be removed during construction, it was not found useful to further characterize the specific soil properties further.

Geology

Geologic features control the physical characteristics of aquifer hosting materials, and therefore the distribution and movement of groundwater through an aquifer. Understanding the nature and occurrence of these features, both regionally and locally, provide constraints on testing, data interpretation, monitoring, mitigation, and final design. The objective of geologic characterization is to develop a three dimensional physical framework that describes the materials hosting the vadose zone and groundwater at the test site. Within this framework, or conceptual model, the nature and distribution of those factors thought to control groundwater movement and distribution will be evaluated.

Site-specific geologic characterization will be accomplished largely through the analysis of data collected during the drilling of several proposed boreholes at the site and comparison of that data to information collected during the preparation of the hydrogeologic assessment report. A minimum of three boreholes are proposed for the immediate vicinity of the test site. One of these boreholes will be located on the inferred up-gradient side of the test site, two will be located on the inferred down-gradient side (Attachment 5C). As testing progresses, additional boreholes may be drilled to collect additional characterization, testing, and/or monitoring data. Subsurface hydrogeologic conditions will be interpreted via drilling cuttings and spilt-spoon sample logging.

The project hydrogeologic assessment identified work needed to complete site-specific hydrogeologic characterization. Hydrogeologic characterization targets, and the rational for them, are described below.

It is likely that the uppermost, unconfined part of the shallow aquifer system, is hosted by predominantly uncemented alluvial gravel beneath the test site. However, it is not clear from the available data how deep the alluvial gravels extend and what their properties are beneath the test site. Identifying the three-dimensional extent of these strata is critical to the proposed testing because water probably will move more rapidly through these uncemented strata, both downwards and laterally, then in the deeper, more cemented Mio-Pliocene conglomerate that comprises the majority of the shallow aquifer system in the area.

Area data indicates that, if present, the unconfined part of the shallow aquifer system at the site may be relatively thin and underlain by a semi-confined zone at depths of less than 75 feet. Characterization will identify if this semi-confined zone is actually present, and if found, the nature of the confining layer separating it from the overlying unconfined zone and the basic hydrologic properties of the semi-confined zone. Knowing the nature and extent of the confined aquifer underlying the site is critical in evaluating if the proposed recharge will affect this deeper aquifer. If data collected indicates that the project could potentially affect this deeper aquifer, monitoring will need to be designed to not only assess shallower unconfined aquifer impacts but deeper confined aquifer impacts as well.

The nature and distribution of the confining layer atop the confined aquifer should be identified in order to support evaluation of the thickness and distribution of the unconfined aquifer (if present). If the unconfined aquifer is absent, or only present seasonally, we will still need to identify the nature and extent of the confining layer because, just as it inhibits upward movement of groundwater, it will restrict the downward movement of recharge water. Knowing where the confining layer is will provide information on where recharge water may potentially collect atop this layer and where it will potentially spread to.

Mapping for the assessment identified a potential depression in the top of the older Mio-Pliocene conglomerate below the western end, and west of, the test site. The depth, shape, and orientation of this feature will need to be evaluated because it will effect how the aquifer(s) underlying the test site responds to the testing. If an unconfined aquifer indeed underlies the site, this depression may act as a "reservoir" for water introduced into this aquifer. Alternatively, it may serve as a recharge pathway, hydrologically connecting the upper, unconfined part of the suprabasalt aquifer system with deeper, confined parts of the aquifer system.

Hydrogeology

Piezometers and/or observation wells will be constructed in the borings drilled for geologic characterization. If additional geologic characterization boreholes are drilled (either close to or more distal from the test site) one or more of these also may be converted to observation wells. All but one of the boreholes converted to monitoring wells will be completed as 2-inch observation wells that fully penetrate the unconfined aquifer (if present) or above the confining layer (if unconfined aquifer not present). At least one of the geologic characterization boreholes should be of sufficient size to accommodate a 4-inch diameter well which will be used for aquifer testing.

Test site-specific hydrogeologic work would be done, in large part, concurrently with the site-specific geology work. The hydrogeologic assessment concluded that the following information must be collected for the uppermost part of the suprabasalt system at the test site:

1. Depth, thickness, and lateral and vertical extent of the vadose zone and the uppermost aquifer(s) underlying a site.

2. Nature and effect of perching layers (if any) in the vadose zone.

3. Aquifer and vadose zone physical and hydrologic properties - including, grain size, matrix content, induration, hydraulic conductivity, transmissivity, and porosity

4. Groundwater flow direction and velocity, including both spatial and temporal variation

5. Anthropomorphic effects, primarily changes in groundwater pumping, surface water (including canals), and irrigation activities.

For characterization it is important to build monitoring (or observation) wells in such a way as to provide means for accurately measuring the target aquifer. Well construction considerations are listed below:

1. Most project observation wells will probably be 2 inch-diameter piezometer type installations. These should be built to ensure that they are monitoring the anticipated aquifer targets, and we recommend building to well construction standards and avoiding cost cutting measures designed to get more/cheaper wells (these commonly result in poorly built wells unsuitable for collection of the high quality data we feel is necessary to support the project).

2. For aquifer testing, a 4 inch-diameter observation well is the minimum recommended diameter and at least one such well should be built.

3. The minimum number of observation wells at the test site is 3, one up-gradient and 2 down-gradient. If funding can be procured we recommend that more than 3 observation wells be installed. Most, if not all, of these additional observation wells could be built in geotechnical borings drilled for geologic characterization.

In addition to the observation wells built near the test site, it seems likely that observation wells will eventually need to be built more distant from the site. The purpose of these observation wells would be to more accurately trace the down gradient migration of recharge water away from the test site. A minimum of 3 more distant observation wells, 1 up-gradient and 2 down-gradient is again recommended. These might include at least some previously built groundwater supply wells that would be available for use. However, these should only be used if construction details can be verified and if they are not being used as water supply wells. Access to offsite observation well drilling locations will need to be acquired from willing landowners. The WWBWC currently has a network of existing wells that could be used for the purpose of tracking the recharge water distally from the site.

Aquifer testing designed to collect aquifer hydraulic property data will be part of site characterization. During aquifer testing, the 2-inch observation wells will be monitored to observe the effects of testing on the surrounding aquifer. Aquifer testing would include an 8-hour step-drawdown test to establish probable sustainable yields in the suprabasalt aquifer, followed by a 24 to 72 hour constant discharge test. Water level data collected during aquifer testing will be analyzed using standard analysis techniques.

Combining the interpretations developed in the completed hydrogeologic assessment with the drilling and testing data collected during site-specific characterization, a conceptual model of test site hydrogeologic conditions will be prepared.

Surface Water

One of the main objectives of the project is to increase surface water quantity (base flow) and improve its quality (temperature). To document that, surface water bodies that the project may influence need to be identified and monitoring points on them established and characterized (includes collection of baseline data). These locations will be used as monitoring locations during subsequent testing.

The hydrogeologic assessment identified three, down gradient, spring-feed streams, Goodman Spring Branch, Johnson Creek, and Dugger Creek, which are most likely to be affected by recharging the shallow aquifer. During test-site specific characterization these streams will be examined and monitoring points identified. At these points stream conditions will be photographed and stream conditions documented prior to the initiation of testing that will include the following parameters:

Flow volume and discharge

Water temperature

Water quality (temperature)

Hydrophilic plants and habitat quality

Sampling frequency will be designed to collect enough data to demonstrate the range of conditions likely at the monitoring points so that site background conditions can be documented enough to provide an adequate baseline to measure test results against.

Water Quality

Both surface and groundwater quality at the test site, and at likely down-gradient discharge points, needs to be documented. There are several reasons for this, including:

1. We do not want to introduce contaminated water into the shallow aquifer via recharge activities and violate antidegradation rules. We need to establish background water quality parameter concentrations and monitor source-water quality periodically during testing and operations.

2. Certain source-water conditions (e.g., turbidity) have the potential to degrade or even "plug" the recharge system. From an operational standpoint, one would monitor for those conditions and halt test operations when the source-water exceeded those conditions.

3. Up-gradient groundwater quality needs to be monitored so that the effects of recharge on water quality can be differentiated from those water quality conditions caused by recharge activities, including leaching of vadose zone constituents by recharge water.

Sampling Quality Assurance and Quality Control (QA/QC) protocols will need to be established and followed for characterization and later monitoring. QA/QC for the project, which is described in Attachment 5, includes:

- Sampling equipment
- Measurement techniques for field parameters
- Decontamination procedures
- Well purging guidance for groundwater samples
- Sampling methods
- Chain of custody and sample handling procedures
- Record keeping
- QA/QC guidelines

Characterization Conclusions

With the completion of site-specific characterization, updated monitoring and test plans will be prepared if necessary. These monitoring and test plans will be based on the results of the characterization effort which includes the generation of a site conceptual groundwater flow model that describes probable aquifer conditions, suprabasalt aquifer water level(s) and groundwater flow direction(s) (including seasonal variations), and discharge points for recharge water.

Preliminary Test Site Operation Plan

The objective of proposed artificial groundwater recharge testing to be done under the limited license is to evaluate the feasibility of restoring diminished shallow aquifer water levels and increasing decreased spring creek flows using infiltration pits and winter high flow water diverted from the Walla Walla River to these pits. Testing will be done over five years. If testing indicates shallow aquifer recharge and spring creek flow restoration is feasible using infiltration, test results will be used to design and implement larger scale artificial groundwater recharge at this, and potentially other sites in the area. Testing **<u>will not include</u>** removal of stored water by pumping or other artificial means.

This preliminary test plan describes how the test site will be operated during testing. Elements included in the preliminary test plan include: (1) site construction, (2) test operations, (3) mitigation activities, and (4) reporting. The preliminary test plan may be modified as testing proceeds.

Site Construction

The basic layout of the test site is shown on Figure 1. The site, located adjacent to the Hudson Bay Canal, will consist of three infiltration pits excavated approximately 3 feet into Quaternary alluvial gravel which immediately underlies the test site (Attachment 6). Water will be delivered to the pits via a diversion structure in the canal. Any water that does not infiltrate into the ground from these pits will be returned to the canal via a return ditch or pipe.

More detailed site construction information describing: (1) test site survey and layout (2) specifications for pits/basins/pits used for infiltration (3) water supply design (including diversion from canals if appropriate) (4) monitoring points (both on and off site) and (5) site access controls (fences, etc.) are described in detail in Attachment 1, (1A-1E), Engineering Design.

Test Operations

Test operations describe how the site will be used during testing and possible reasons for changing the test as new data and information is collected during the test. Test operations include:

1. Test timing, including timing of recharge and monitoring frequencies

2. Quantities of water used

3. Outside influences that effect test, including weather (probably freezing), elevated river turbidity, river flooding, trip wires for identifying potential offsite impacts before they occur so they can be mitigated and or testing suspended to prevent worsening conditions

4. Responsible parties for diversion and delivery of water, operation of test, monitoring, and data review

5. Permissions required to access offsite monitoring points

These are discussed further in the following paragraphs.

Test Timing, Monitoring, and Water Quantities

Testing is tentatively planned to begin in the winter of 2003/2004 and continue for 5 years. Test operation will generally be conducted in the winter when Walla Walla River flows are at their highest and irrigation activities are at their lowest. A maximum of approximately 50 cfs will be delivered to the test site during normal operation. However, in the event minimum Walla Walla River flows are not meet, water will not be diverted from the river for test site use. Depending on stream flows in any given year, recharge water may be delivered as early as December to as late as March/April. In addition, in the event of prolonged freezing weather, test site operation may be temporally suspended to avoid ice damage to the canal diversion on the Walla Walla River, the canal system itself, and/or the recharge pits and related structures.

Water quantities delivered to the test site will be monitored via a gauge at the diversion from the canal into the test site. The return canal from the test site back into the canal will also be monitored to determine the quantity of water that leaves the test site (if any) because it did not infiltrate into the ground. Based on this monitoring data, and estimated evaporation loses that could occur during operation; water quantities discharged to the ground will be calculated.

Groundwater levels in the immediate vicinity of the test site will be monitored before, during, and following recharge test events via three (at a minimum) observation wells constructed during characterization, potentially via existing water wells in the area if any can be found that can be used for shallow aquifer water level monitoring, and potentially with new observation wells built as the test progresses. During the recharge test event, tentatively scheduled for the winter/spring of 2003/2004 water levels will be measured as follows:

1. Throughout the calendar year water levels will be measured at least weekly, beginning with the granting of the limited license.

2. In the month prior to the anticipated start of recharge activity and in the month following the termination of recharge, water levels will be measured daily.

3. During recharge water levels will be measured daily, at a minimum.

Based on preliminary engineering design studies (Attachment 1) and the hydrogeologic assessment (Attachment 6) most, if not all, of the water delivered to the test site will probably infiltrate into the ground. However, because this project is a test project, the current plan is to initially operate the test site at approximately half capacity. The quantity of water discharged to the site will than be increased or decreased as experience and observations dictate. Final operating quantities will determined based on test results.

Water quality data will also be collected before, during, and following recharge events. Parameters to be collected, sampling timing, and other water quality monitoring information are presented in the Monitoring Plan (Attachment 5).

Outside Influences

The primary currently identified outside influences on testing are Walla Walla River flow levels, freezing conditions, source water turbidity levels, and increased groundwater water levels resulting from testing that impact surface activities and conditions. The likely effects of these on testing, and possible mitigation actions to be implemented during testing, are as follows:

Low flows in the Walla Walla River will impact testing because the use of Walla Walla River water for recharge will be conditional, based on river flows exceeding a certain threshold. When flows do not, water will not be delivered to the test site and testing will not occur.

High Walla Walla River flows may also effect testing. In the event of high flow during a flood or rapid snow melt event, turbidity will generally increase. The repeated delivery of turbid water to the test site infiltration pits may eventually lead to plugging of pore space and reduced infiltration capacity. To mitigate against this, delivery of recharge water may be terminated or scaled back during high flow events. Alternatively, the pits may be periodically re-excavated to remove these fines. The preferred mitigation strategy for dealing with this will be based on monitoring and performance data collected during testing.

The effects of freezing on the test are outlined earlier in this Attachment and repeated here. In the event of prolonged freezing weather, test site operation may be temporally suspended to avoid ice damage to the canal diversion on the Walla Walla River, the canal system itself, and/or the recharge pits and related structures and to avoid the risk of ice jams forming in the canal, backing up water in the canal, and causing flooding adjacent to the canal.

It is possible that recharge testing could cause groundwater levels to reach the ground surface at locations where human activity and habitat is negatively impacted. One of the main purposes of groundwater level monitoring is to identify increasing water levels in the test site area in order to: (1) directly observe the effects of recharge on water levels (2) use these observations (in conjunction with characterization data) to evaluate whether or not recharge is having an impact on groundwater levels that could lead to surface problems, and (3) identify when and where this type of problem may occur. If water level monitoring data suggest increased groundwater levels are approaching the ground surface and that flooding of low lying areas seems possible, the quantity of recharge test water being delivered to the infiltration pits will be reduced or, if necessary, terminated.

Responsible Parties and Access Permission

The test will be managed primarily by the Hudson Bay District Irrigation Company, lead by John Brough, Operations Manager, and the Walla Walla Basin Watershed Council (WWBWC) technical staff, lead by Mr. Bob Bower, Hydrologist. HBDIC and WWBWC staff (or a subcontractor working for the HBDIC and WWBWC) will compile monitoring and testing data, prepare reports as necessary to meet license requirements, and in consultation with Hudson Bay Irrigation District (HBDIC) staff make decisions regarding timing and quantity of water delivered to the site and when to suspend recharge activities. Submittal of all monitoring reports to OWRD will be the responsibility of HBDIC and WWBWC staff. The HBDIC and WWBWC may choose to subcontract report preparation and delivery to a subcontractor.

HBDIC staff will be responsible for operating all facilities associated with removing recharge test water from the Walla Walla River and delivering it to the test site, including operation of the diversion structure which routes water from the canal into the pits. HBDIC staff also will maintain all equipment associated with water delivery and pit operation, including reexcavation of the pits, if necessary.

Mitigation

As stated above, one of the objectives of monitoring is to identify likely unintended consequences of recharge testing before they occur. When the precursors to these consequences, such as changing water quality detrimental to aquatic habitat or groundwater levels rising to close to the surface in areas where shallow groundwater is not desired, can be detected soon enough via monitoring, recharge activities will be modified and/or terminated to mitigate against these effects.

Reporting

Data and observations collected during testing, including monitoring data, will be compiled into reports. The basic objective of these reports will be to describe what was done during the test, what was observed at the monitoring points, interpret the data collected, and recommend changes to testing, monitoring, and mitigation plans. These reports will be produced annually. Based on the proposed recharge schedule, annual reports will be submitted to OWRD in the summer following each winter recharge test.

More frequent reporting will be done when monitoring reveals the presence of an undesired effect from testing. If monitoring reveals that undesired consequences of testing are likely to occur, WWBWC staff (or designated representative) will report the monitoring information to OWRD staff.

At the conclusion of the 5-year recharge testing done under the limited license a final report will be prepared. The final reports will describes the project, data colleted during testing and monitoring, interpretations of how well the recharge project worked in achieving project goals, and recommendations for future operations. The final report will be submitted to OWRD in the summer following the fifth annual winter recharge event.

Attachment 5. Proposed Monitoring Program, 690-350-0020(3)(b)(A)

Overview of Basin Wide Monitoring Plan

In 2003, the WWBWC expanded its watershed monitoring strategy to include collecting basin line information for the numerous spring-creeks and district ditches spread out across the Walla Walla River valley (Oregon). Starting in June 2003, many new flow stations (15-minute stage and temperature recorders) were installed at or near the sources of nearly all the springs in the Oregon portion of the system (Figure 2). The WWBWC monitoring program has a total of 28 continuous flow stations with additional 15 continuous static well recorders with many more manual measurement locations. The objectives of this monitoring (specifically for the spring-creek and shallow aquifer system) is to accomplish the following:

1. Be able to discern between Walla Walla River Water (coming from districts water rights and use) and spring waters (emerging strictly from the shallow aquifer). It is understood that the application of irrigation water will undoubtedly show up as spring returns, but this monitoring is intended as a beginning to understanding this complicated system.
2. Collect baseline information on spring flow as it relates to seasonal and yearly fluctuations.
3. Many of the spring-creek monitoring stations were sited based on the presence of historical data collected by Piper (USGS, 1933). Where Piper had collected spring-creek flow, we attempted to locate our gauges as near as possible to his historic data sites. The intention is to allow us the ability to compare and contrast historical and current spring-creek conditions based on a significant period of time. Most of these Piper's original sites were located upstream of any irrigation with draws, making them key locations for us in this type of comparison.
4. Monitor water table levels continuously for daily, seasonal and yearly fluctuations and timing. Some of the wells being recorded have periods of record dating back to the 1930s, allowing us some opportunity to understand any long-term changes in the aquifer system.

Recharge Project Monitoring Plan

The proposed ground water recharge project exists inside this larger monitoring network and it is expected that this will help provide useful information in testing of the proposed testing (see below). Some of the sites shown in this larger network were specifically located to provide proximal and distal pre-construction and operation information for this project (Figure 2). Site specific monitoring includes observation wells and surface monitoring stations (Attachment 5B).

Monitoring for the site-specific proposed testing is designed to meet four basic objectives. These are to identify: (1) changes in the natural system caused by factors other than those related to testing, (2) changes in the natural system caused by the testing (track the test performance), (3) potential problems caused by the testing that may require modification or termination of the test and/or mitigation actions, and (4) events that effect test operations, such as a freezing or a flooding. To meet these objectives, monitoring will track:

1. Source water quality and volume coming onto the test site

2. Up-gradient groundwater water quality

3. Up-gradient groundwater level changes to provide the information needed to differentiate recharge test effects from other, natural and artificial, effects on the groundwater levels beneath test site

4. Down-gradient groundwater quality and levels, both near and distal to the test site

5. Surface water discharge and quality changes

Four basic types of monitoring points are planned for this project:

1. Source water

2. Test site groundwater

3. Distal groundwater

4. Surface water (e.g., springs).

Monitoring data collected at these points during testing will be evaluated against what is known about pre-test conditions to identify testing effects on the surrounding environment, differentiate those effects from others in the environment, and identify when changes in test operations appear necessary. Pre-test conditions will be determined during the planned site-specific characterization activities described in Attachment 4 and are partially described in the preliminary hydrogeologic assessment (Attachment 6).

This preliminary monitoring plan discusses monitoring activities to be undertaken at the four types of monitoring points and sampling and QA/QC protocols.

Sampling and Analysis Program

The groundwater-monitoring program proposed for the test project is outlined in the following sections. Annual reporting is proposed and a Water Quality Analysis Report will be prepared following five years of testing.

As stated in the introduction, four types of monitoring are proposed: (1) source water at the test site (2) site-specific groundwater (3) distal groundwater and (4) surface water (springs).

(1) Source Water at Test Site
Source water monitoring will be at the point of diversion onto the test site. Monitoring will include both water quantity and quality. The volume of water delivered to the test site will be monitored via a gauge at the diversion. Water quality samples will be collected at the gauge.

Proposed monitoring frequency is as follows:

Gauge data will be recorded 15-minute readings via a continuous recording data logger. Rating measurements and tables will be generated for each surface flow site and continuously checked for shifts.

Three source water quality-sampling events are proposed for each yearly seasonal recharge period. They are proposed for approximately: (1) one month prior to the projected beginning of the recharge period (2) during the mid part of the recharge period and (3) approximately one month following the end of the recharge period. The exact timing of these will be based on predicted Walla Walla River flows and may vary from year-to-year. OWRD and ODEQ staff will be notified by WWBWC staff of pending sampling events at least two weeks prior to each sampling event.

The results of source water quality monitoring will be used to determine if modifications to test operations are warranted. During testing different sampling frequencies may be tried to identify those that are most effective.

(2) Site Groundwater
Site groundwater monitoring, consisting of the collection of water quality and water level data, will be conducted at the three observations wells built during characterization. The purpose of site groundwater monitoring is to establish water quantity and quality impacts from testing to groundwater in the immediate vicinity of the site. In addition, up-gradient monitoring will be used to differentiate test impacts from those caused by other activities not controlled by the testing.

Proposed monitoring frequency is as follows:

Water levels will be measured weekly throughout the year when recharge testing is not underway.

In the month prior to, during, and the month following the yearly seasonal recharge period, water levels will be collected daily (at a minimum) for the first year of testing. Measurement frequency during subsequent years will be based on previous observations and proposed in annual reports.

Three groundwater quality sampling events are proposed for each yearly seasonal recharge period. They are proposed for approximately: (1) one month prior to the projected beginning of the recharge period (2) during the mid part of the recharge period and (3) approximately one month following the end of the recharge period. The exact timing of these will be based on predicted Walla Walla River flows and may vary from year-to-year. OWRD and ODEQ staff will be notified by WWBWC staff of pending sampling events at least two weeks prior to each sampling event.

The proposed locations of site-specific groundwater observation wells are shown on Figure 1. The results of groundwater quality and level monitoring will be used to determine if modifications to test operations are warranted. During testing different sampling frequencies may be tried to identify those that are most effective.

(3) Distal Groundwater
Distal groundwater monitoring, consisting of the collection of water quality and water level data, will be conducted at observation wells more distal from the test site than the site observation wells. Initially, during the first year of recharge testing, these wells will probably be previously constructed water supply wells that can be used by WWBWC staff and can be shown to be open to only the shallow aquifer. If funding for new wells can be procured for subsequent years, dedicated distal groundwater observations wells may be built to improve the monitoring coverage.

A minimum of 3 distal observation wells will be used, 1 up-gradient and 2 well down-gradient. The locations of these will be determined during site specific characterization currently planned for the winter of 2003. Monitoring frequency is the same as proposed for site-specific groundwater monitoring. Figure 5B shows the approximate site locations for the site-specific observation wells.

Distal monitoring will be used to identify longer term quantity impacts from testing. This includes the formation and migration of a groundwater mound and recharge water plume at, and away from, the test site, towards intended and unintended receptors. Up-gradient monitoring will be a part of this so that testing effects can be differentiated from offsite events. Sampling frequency will be determined from characterization data and modified as more is learned during testing.

(4) Surface Water (Springs)
The WWBWC is currently monitoring most of the surface springs, creeks and rivers of Oregon's lower Walla Walla River basin (See Figure 2.) While this project will specifically Surface water monitoring in Dugger, Johnson and Goodman Spring-Creeks will be done to identify the effects of recharge on flow. This monitoring will include the collection of both water quality (specifically temperature), flow and habitat improvements (photo-documentation). As with groundwater monitoring, surface water monitoring will need up-gradient and pre-project condition monitoring information so that effects unrelated to test site operations/testing can be differentiated from those due to testing. Pre-project surface flow monitoring was started during the 2003 summer irrigation season at Dugger and Johnson Spring-Creeks in the form of a continuous.

Sampling Parameters
Sampling methods are specified in the following sections. The chemical monitoring parameters are to be conducted on a two-tiered system. Level 1 monitoring will be conducted during all three water quality-monitoring events (each recharge period). Consistently elevated concentrations of nitrate will be initiate the level 2 chemical analysis. Samples will be tested for chemicals in the level 2 list. Operation of the recharge project will depend on the absence/presence of the chemical parameters on this list. ATTACHMENT 5B describes the specific method and documents used to determine the level 1 and 2 chemical parameters (pesticides, herbicides, insecticides, fungicides, etc.) listed below.

Monitoring is proposed for the following parameters:

Physical Parameters (all monitoring types)

Static water level (in observation and WWBWC network well)

Standard field parameters, including pH, turbidity, electrical conductance, and temperature

Flow (in cubic feet per second)

Chemical Parameters –Level 1 (On-site monitoring only)

Total nitrogen as nitrate (screening parameter for Level 2 Chemical screening)

TKN

Total dissolved solids

Chemical oxygen demand

Chloride

Orthophosphate

Fecal Coliforms (Presence/absence only)

Chemical Parameters –Level 2 (On-site monitoring only)

Rubigan (Fenarimol)

Ridomil (Metalxyl)

Systhane/Rally (Myclobutanil)

Devrinol (Napropamide)

DDD-DDE-DDT

Elgetol (DNOC sodium salt)

Alar/B-Nine (Daminozide)

Lindane (Lindane)

Sampling dates will be coordinated for all monitoring points used in the project.

This list of analytes was selected to optimize routine sampling to address constituents commonly of concern (nutrients and salt) and provide prompt indication of potential impacts by analyzing for anions (nitrate and chloride) that are known as groundwater tracers (DEQ, 1995). Additional parameters will be proposed for future sampling if the results of the initial proposed sampling indicate this is necessary.

Sampling Procedure
Equipment and sampling procedures proposed for recharge test monitoring are provided in the following sections.

Equipment
This section lists the equipment for groundwater monitoring.

Submersible pump (*Grundfos* or similar) or dedicated bailers/sampling line

Temperature measuring instrument (*Vemco* data logger)

pH and conductivity meter(s) with calibration reagents

Water level and flow meters (*Tru-traks, In-situ Mini-trolls, Stevens 420 loggers,* 0.01 foot resolution required)

Shipping cooler with ice packs or ice

Five-gallon pail marked at the 5-gallon level, stopwatch

Laboratory supplied sample containers with appropriate preservatives

Tap water, deionized water, phosphate-free soap, cleaning brushes, field note book, log sheets

Water Level
An electronic water level meter will be used to measure the depth to groundwater in each observation well to the nearest 0.01 foot. Static water levels must be measured at the indicated reference point prior to purging any water from the well. The reference points will be on the top of the observation well casings. The static water levels in all wells should be measured on the same day for each site. Coordination with quarterly sampling of other wells in the vicinity should be attempted. 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.

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 locations. 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. The procedures described in this section are specifically for field decontamination of sampling equipment. At a minimum, field-sampling equipment should be decontaminated following these procedures:

1. Wash the equipment in a solution of non-phosphate detergent (Liquinox® or equivalent) and distilled/deionized water. All surfaces that may come in direct contact with the samples shall be washed. Use a clean Nalgene and/or plastic tub to contain the wash solution and a scrub brush to mechanically remove loose particles. Wear clean latex or plastic gloves during all washing and rinsing operations.

2. Rinse twice with distilled/deionized water.

3. Dry the equipment before use, to the extent practicable.

Purging and Field Parameters (On site wells only)

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 ± 10 percent over three consecutive measurements. At this point, the observation well is considered adequately purged and can be sampled.

Occasionally, observation wells installed in low permeability formations may be purged nearly dry (within 6 inches of bottom of well) prior to stabilization of groundwater parameters and prior to purging at least three borehole volumes. If this happens at least one set (more if possible) of purge water groundwater parameters (pH, temperature, EC) need to be measured. Sample collection can be done after the water level has recovered at least 75 percent of the drawdown ensuring most of the well water is from the formation. Prior to groundwater sample collection several measurements are required as explained above. These include static water level and total depth, pH, temperature, and electrical conductivity.

All field instruments should be calibrated each day 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.

Water Sampling

Samples will be collected after sufficient water has been purged according to the procedure described above. 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. Discharge from a bailer should 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."

Sample Preservation and Holding Time. 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.

Resampling

In accordance with OAR 340-40-030(5), resampling is done if monitoring indicates a significant increase (or decrease for pH) in the concentration of a monitored parameter at a sampling point. Determining if a significant increase in parameter concentration has occurred is customarily done either by assessing concentrations in relation to established concentration limits or by using a statistical analysis. Since background or baseline conditions have yet to be established for the test site a concentration limit has not been set and insufficient data exists upon which to base a statistical analysis. The criteria to guide resampling decisions will be reevaluated is subsequent test project annual reports.

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.

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:

1. 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.

2. Chain-of-custody forms will be completed, being signed by all sample handlers.

3. Holding times for all constituents will be met.

4. Field blind duplicate results will be evaluated to make sure they are compatible.

5. 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.

Data Reporting and Statistical Analysis
The following procedures for reporting analysis are proposed for this project.

Record Keeping
All field notes, laboratory results, critical calculations, and published reports will be maintained at the WWBWC office for a period of five years following completion of the final testing and monitoring report. If possible, both paper and electronic copies will be maintained.

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:

1. Verification of analytical methods and detection limits, along with the date the analysis was performed
2. Review of document handling, sampling and analytical problems, and actions taken to correct any problems
3. Summarizing water level data in tabular and/or graphical form
4. Summarizing water quality analytical results in tabular form and/or graphical form
5. Performing data validation checks, as appropriate to the data set
6. Identifying any significant increases in parameter concentrations (will be done later in project only after enough data has been collected to warrant)

Annual Review and Reporting
All monitoring activities performed during the previous monitoring year will be included in an annual report to be submitted to OWRD during the summer following the preceding seasonal recharge period. The annual report will present the following 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 all field and laboratory data, including observed changes and groundwater flow direction and gradient

Discussion and conclusions, including recommended changes to recharge testing

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 tests have 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; or comparison of water quality between up-gradient and down-gradient wells. For the test site, insufficient data are available for a statistical analysis to be performed because concentration limits have not yet been established. Until that time, evaluation of dataset trends will be solely qualitative, but revisited in each annual report until a database has been compiled that is sufficient for statistical analysis.

Final Recharge Test Project Report

At the conclusion of five years of recharge testing under the limited license a final report will be prepared. The report will contain the data collected for the test project; analysis and interpretation of that data (including statistical analysis as appropriate), and a recommendation for proposed future artificial groundwater recharge activities at the test site. The report will be complete enough to serve as supplemental material to a permanent artificial groundwater recharge permit under OAR 690-350-0110, if such a permit is sought following completion of the test project.

Monitoring Plan Attachments

Attachment 5A. Methodology Water Quality Assessment and Evaluation
Attachment 5B. Figure 5A Map of On-site Recharge Well Locations
Attachment 5C Chemicals of interest for Hudson Bay Recharge Project

Attachment 6. Site Hydrogeology, 690-350-0020(3)(b)(C), (E), and (G) (attached)

Attachment 7. Source Water Quality, 690-350-0020(3)(b)(D)

Overview

This project will utilize winter-spring flow from the Walla Walla River as the *source* water for recharge during the project operation. The time period that Walla Walla River water will be used is November 15th through May 15th. A review of existing reports and data was conducted to identify any areas of concern regarding source water quality for the recharge project. What little information that exists for source water quality conditions is discussed below.

In 2003, the WWBWC tracked turbidity levels through a winter storm event (1/27/3 through 2/3/3) and found turbidity levels to be a potential issue on the Walla Walla River (mainstem) during peak flow events (WWBWC, Unpublished data). Turbidity could be problematic for project operations, as it may act to decrease the rate of infiltration by plugging and layering the bottom of the recharge pits. Turbidity may also be a preliminary screen for fecal contamination issues, as bacteria may use the large particles as a vector for mobilization.

The other known source water quality information was obtained from the Environmental Protection Agencies STORET database. STORET provided some historical water quality data that showed several parameters (circa 1960s) that were accounted for in the recharge project's monitoring plan (ATTACHMENT 5). STORET data that was collected nearest to the source water POD at the Little Walla Walla Diversion (*NE ¼ NW ¼, Section 1, SW ¼ NE ¼ Section 12, T5N, R35E, W.M.; DIV.PT. 1*) is attached in table form as ATTACHMENT 7A.

From the review of all known source water information, the parameters that appeared to be of concern are:

1. Fecal Coliforms
2. Turbidity

There was no other relevant information found for source water quality conditions. The monitoring plan covers the establishment of source water quality conditions during operation of the recharge facility. This will insure safe water quality conditions for the recharge project.

Attachment 7A Source Water Quality Information

Resources and References:

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Darnell, T., Montgomery, M. L., Witt, J. M., 1989, July. *Pesticides in Groundwater: Milton-Freewater, Umatilla County, Oregon.* Oregon State University

EPA STORET Water Quality Database information (http://www.epa.gov/storet/)

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Kerle, E.A., Vogue, P. A., Jenkins, J. J., 1996, October. *Understanding pesticide persistence and mobility for groundwater and surface water protection.* Oregon State University Extension EM 86561

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Newcomb, R.C. *Geology and Groundwater Resources of the Walla Walla River Basin.* Water Supply Bulletin #21. Washington Department of Conservation, Division of Water Resources, 1965.

Oregon Water Resources Department. *Umatilla Basin Report.* 1988. *Government Printing Office 774-398/20006 Region NO. 8*

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Piper, A.M., T.W. Robinson, and H.E. Thomas. *Groundwater in the Walla Walla Basin, OR-WA-Part II.* Department of the Interior, United States Geological Survey, 1933.v

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U.S. Geological Survey 1996, July. Fact Sheet 171-96: Article: *The Nitrate Connection.* US Government Printing Office 774-398/20006 Region NO. 8

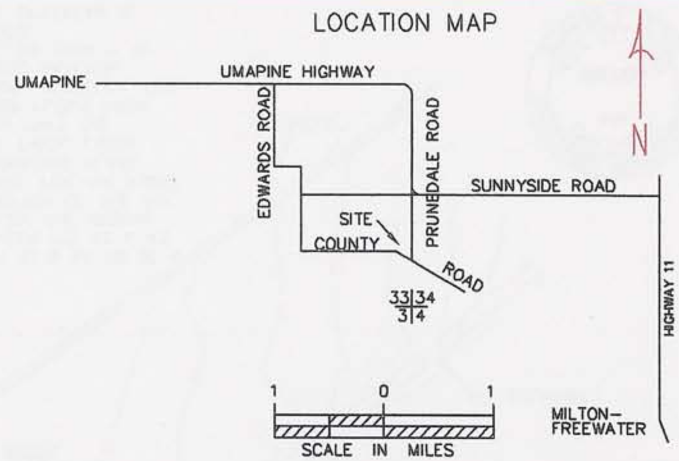
Attachments

Attachment 1A

HUDSON BAY AQUIFER RECHARGE PROJECT
SITE PLAN & LOCATION MAP

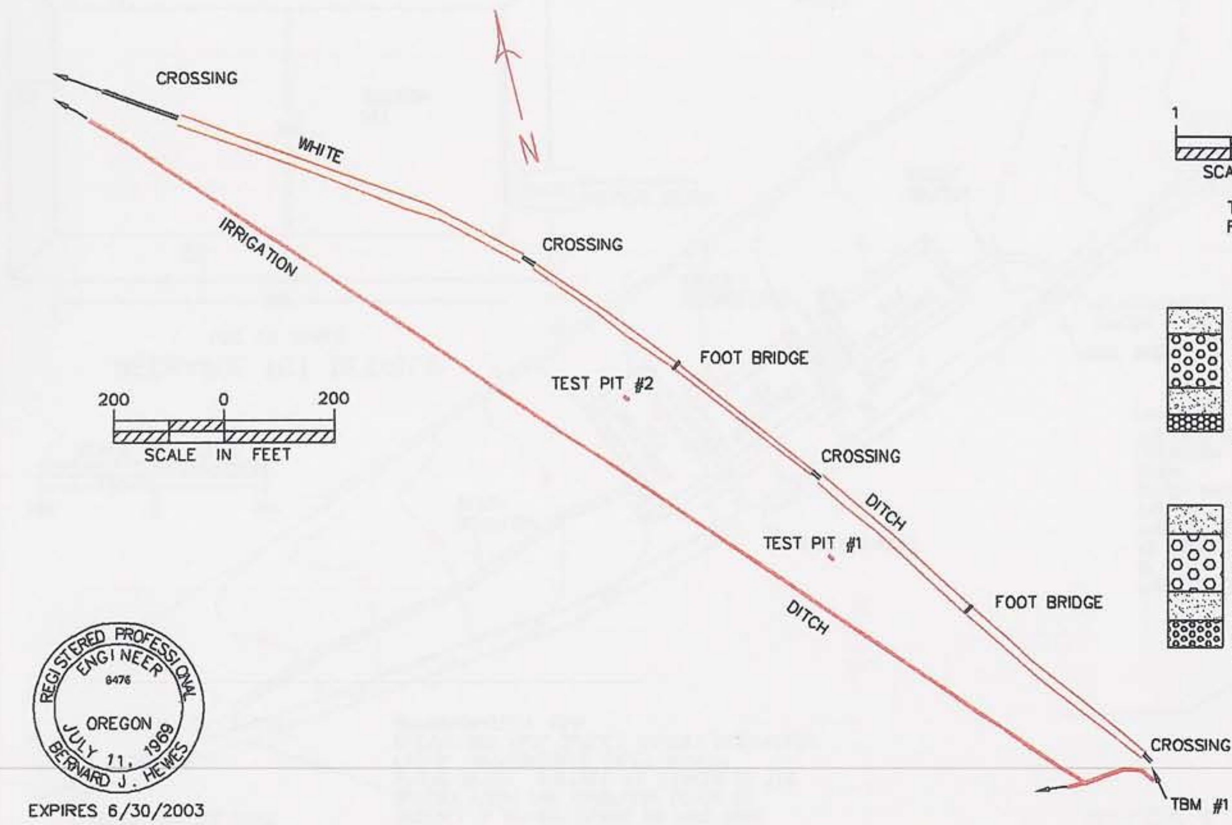
DATE	
DESIGNED B. HEWES	4/03
PLOTTED	
APPROVED	

LOCATION MAP



TOWNSHIP 6N
RANGE 35E

SITE PLAN VIEW



TEST PIT #1

0–12" SANDY LOAM
12"–36" GRAVELLY SANDY LOAM, APPROX. 50 % OF THE VOLUME IS GRAVEL SIZE PARTICLES WITH AN ESTIMATED D_{50} SIZE OF ABOUT 0.75".
36"–48" SANDY LOAM
48"–? GRAVELLY SANDY LOAM APPROX. 20% OF THE VOLUME IS GRAVEL SIZE PARTICLES.

TEST PIT #2

0–13" GRAVELLY SANDY LOAM
13"–39" COBBLY SANDY LOAM, THE D_{50} OF THE GRAVEL IS APPROXIMATELY 1"
39"–52" GRAVELLY SANDY LOAM
52"–? SAND GRAVEL MIX D_{50} ESTIMATED TO BE ABOUT 0.25".

TBM #1 LOCATION IS AT THE TOP OF THE WALL ON THE NORTH WEST CORNER OF A CONCRETE TURNOUT BOX ON THE LEFT SIDE OF WHITE DITCH NEAR THE UPSTREAM END OF A 44"X72" CMP. PAINTED RED SPOT. ELEVATION 100.00.

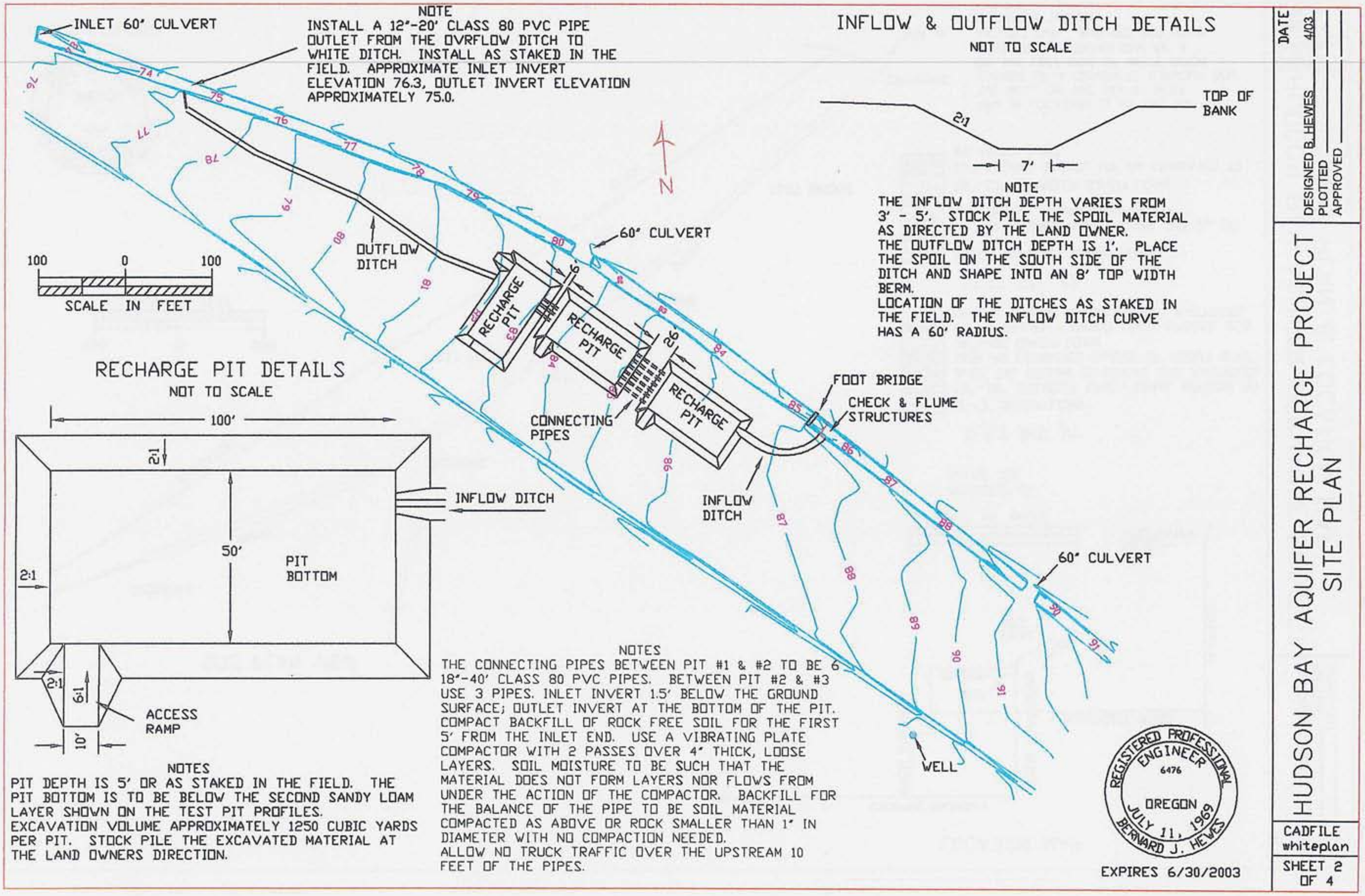
REGISTERED PROFESSIONAL ENGINEER 8476 OREGON JULY 11, 1969 BERNARD J. HEWES

EXPIRES 6/30/2003

CADFILE whitereloc

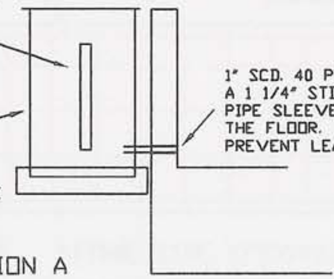
SHEET 1 OF 4

Attachment 1B

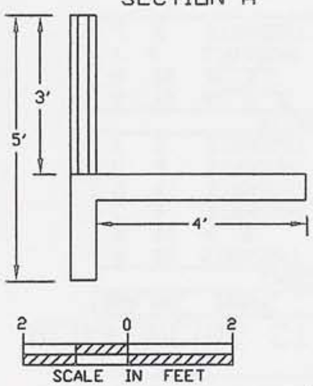


Attachment 1,C

STILLING WELL DETAIL

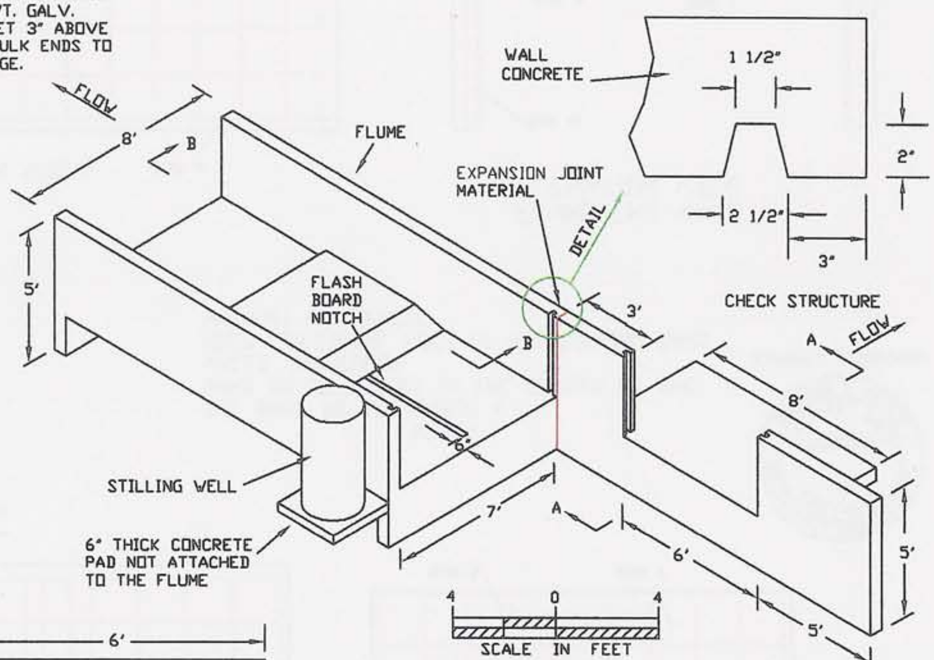


SECTION A



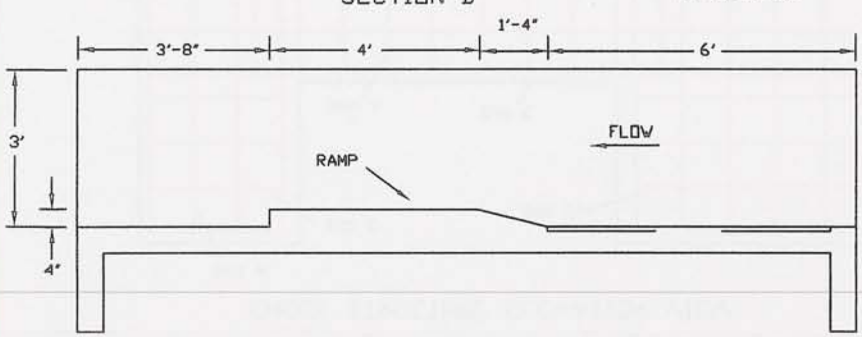
EXPIRES 6/30/2003

CHECK STRUCTURE & FLUME STRUCTURE PERSPECTIVE VIEW



FLASH BOARD NOTCH DETAIL

SECTION B



NOTES

INSTALL THE CONCRETE IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION 42, ATTACHED.
ALL WALLS AND FLOORS TO BE 6" THICK.
USE 4000 PSI STRENGTH CONCRETE. 1.6 CUBIC YARDS NEEDED FOR THE CHECK STRUCTURE AND 4.9 CUBIC YARDS NEEDED FOR THE FLUME.
SEPARATE THE TWO STRUCTURES USING A 6'X 1/2"X 5' STRIP OF ASPHALT EXPANSION JOINT FILLER.
THE STILLING WELL PIPE MAY BE CORRUGATED METAL OR CLASS 80, MINIMUM, PVC PIPE.
THE FLASH BOARD NOTCH IN THE BOTTOM OF THE FLUME IS TO HOLD THE BOTTOM OF A SPLITTER WALL. USE 2 PIECES OF 3/4" MARINE PLYWOOD. HOLD THE TOP AT THE DOWNSTREAM END WITH A 2"X8"X8' WITH 2-2"X4"X8" CLEATS. AT THE UPSTREAM END USE 2-2"X12"X8' WITH 2-2"X4"X24" CLEATS.

DATE	
DESIGNED B. HEWES	4/03
PLOTTED	
APPROVED	

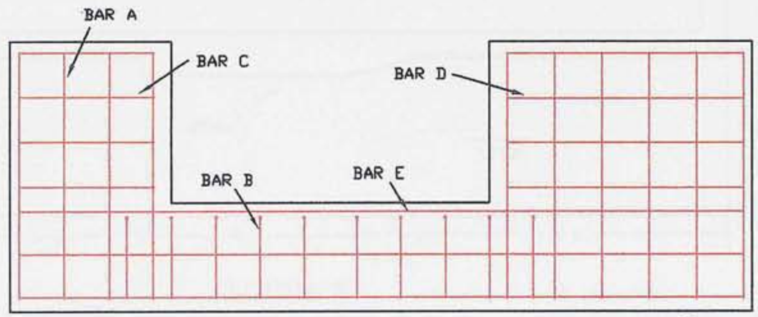
HUDSON BAY AQUIFER RECHARGE PROJECT
STRUCTURE DETAILS

CADFILE whiteck

SHEET 3 OF 4

Attachment 1D

CHECK STRUCTURE ELEVATION VIEW



APRON PLAN VIEW

REGISTERED PROFESSIONAL ENGINEER 6476 OREGON JULY 11, 1969 BERNARD J. HEWES

EXPIRES 6/30/2003

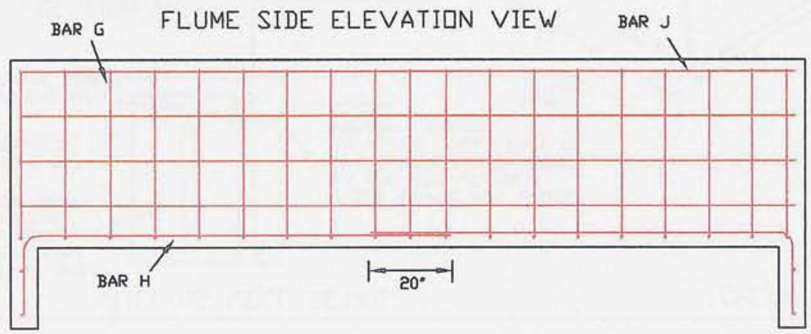
REINFORCING STEEL SCHEDULE

BAR	NO.	SHAPE	A	B	C
		CHECK			
A	10	STRAIGHT	4'-7"	-	-
B	10	AL B	1'-7"	4'-1"	-
C	4	STRAIGHT	2'-6"	-	-
D	4	STRAIGHT	4'-6"	-	-
E	3	STRAIGHT	13'-8"	-	-
F	5	STRAIGHT	7'-8"	-	-
		FLUME			
G	19	AL B JC	3'-1"	7'-6"	3'-1"
H	20	AL B	1'-6"	8'-1"	-
I	4	STRAIGHT	7'-6"	-	-
J	8	STRAIGHT	14'-6"	-	-

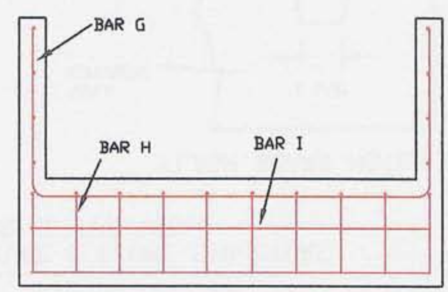
NOTES

ALL BARS TO BE NUMBER 4.
BARS TO BE PLACED IN THE CENTER OF THE WALLS AND FLOOR.
NEED 820 LINEAL FEET OF REINFORCING BARS WITHOUT ANY WASTE.

FLUME SIDE ELEVATION VIEW



FLUME END WALL ELEVATION VIEW



DATE	
DESIGNED B. HEWES	4/03
PLOTTED	
APPROVED	

HUDSON BAY AQUIFER RECHARGE PROJECT
STRUCTURE REINFORCING STEEL

CADFILE whiteckst

SHEET 4 OF 4

Attachment 1 E

HUDSON BAY AQUIFER RECHARGE PROJECT

ENGINEERING REPORT

This project entails diverting water from an existing irrigation ditch to three pits to be excavated for the purpose of infiltrating the water into the shallow aquifer. Project features include a concrete check structure in the existing White Ditch, a concrete flow measuring flume, an open ditch, three excavated pits, pipes connecting the pits and an outflow ditch from the down stream pit.

These items were sized to handle 50 cubic feet per second (cfs) of water. This is the amount anticipated will be available from excess flow in the Walla Walla River and that the Hudson Bay District is able to deliver.

Data gathered to design the project consisted of a site topographic survey and installing two sites for testing the water infiltration capacity of the natural materials and determining the layers in the soil profile. In addition the Soil Survey of Umatilla County Area, Oregon was consulted. This is a US Dept. of Agriculture, Natural Resources Conservation Service publication giving general soils information.

The topographic survey data was used to prepare a topographic map with one foot contour intervals at a scale of 1" = 60'. This information was used to help determine the location of the project features.

Two test pits were excavated to a depth of 6'-7' each. A 24" diameter by 5' long section of corrugated metal pipe was set on end in the bottom of the pit and about one foot of fill placed around it to hold it in place. Water was pumped into the pipe at a rate that would sustain a water depth of one foot in the pipe. Both flow rate and total flow was measured. The test was run for 6.25 hours in the first pit and 3.5 hours for the second pit.

PIT #1

Soil profile:

0-12" sandy loam

12"-36" gravelly sandy loam, approximately 50% of the material volume is gravel size particles with an estimated D_{50} size of about 0.75"

36"-48" sandy loam, in parts of the trench this layer does not exist

48"-?" gravelly sandy loam approximately 20% of the volume is gravel size particles

The inflow rate at the end of the test period was 4.0 gallons per minute (gpm). This resulted in an infiltration rate of 1.7 gpm/sq. ft./ foot of head.

PIT #2

Soil profile:

0"-13" gravelly sandy loam

13"-39" cobbly sandy loam, the D_{50} of the gravel is approximately 1"

39"-52" gravelly sandy loam

52"-? sand gravel mix D_{50} estimated to be about 0.25"

In this pit the inflow rate of 11.9 gpm was maintained for 3.5 hours and at no time did water puddle in the bottom of the pipe. The infiltration rate is in excess of 3.8 gpm/sq. ft.

The area needed for infiltrating the water was determined assuming an infiltration rate for the entire area of 3.0 gpm/sq.ft./ per foot of head. For an inflow rate of 50 cfs the infiltration area needs to be 7480 square feet. The infiltration rate of 3.0 gpm/sq.ft. was chosen because the pits will be located in the area with soil surface texture similar to test pit #2.

Due to the possibility of fine soil particles plugging the infiltration area, unknowns concerning the long term infiltration rate and that the amount of water available is not yet known extra infiltration area is being provided. Three separate pits with bottom dimensions of 50 feet X 100 feet are proposed. This will provide an infiltration area of 15,000 square feet.

The pits will be excavated to a depth of about 5 feet to get below the second sandy loam layer noted in both test pits. This will allow the water depth to be 2.5 feet - 3.5 feet. That will increase the rate of infiltration over the test values derived with one foot of water depth. The overall safety factor for the infiltration area is well over 2.

Inflow to the system will be measured with a ramp flume and continuously recorded. The ramp flume is sized to provide 5% flow rate accuracy over a flow range of 10 cfs-50 cfs

Any outflow from the last pit will be safely returned to the White Ditch through a 12-inch pipe. The pipe will be on a slope that will keep water from flowing out of White Ditch.

By: Bernard J. Hewes Date: 8/21/03

Bernard J. Hewes

REGISTERED PROFESSIONAL ENGINEER

6476

OREGON

JULY 11, 1989

BERNARD J. HEWES

Attachment 3A

LAND USE INFORMATION SHEET

This information is needed to determine if the proposed project complies with statewide planning goals and is compatible with local comprehensive plans (ORS 192.180)

CITY/COUNTY LAND USE INFORMATION (to be completed by local planning official):

Recharge · Hudson Bay project

Please check below the one that applies:

☐ This project is not regulated by the local comprehensive plan and zoning ordinance.

☒ This project has been reviewed and is compatible with the local comprehensive zoning ordinance. (Please cite appropriate plan policies, ordinance section, and case numbers.) 152.056

☐ This project has been reviewed and is not compatible with the local comprehensive plan and zoning ordinance. (Cite appropriate plan policies, ordinance section, and case numbers).

☐ Compatibility of this project with the local planning ordinance cannot be determined until the following local approvals are obtained:

______ Conditional Use Permit ______ Development Permit
______ Plan Amendment ______ Zone Change
______ Other

An application has ___ has not ___ been made for the local approvals checked above.

* Signature of Local Official: Patty Perry

Title: Senior Planner Date: 5-27-03

Must be authorized signature from your local City/County Planning Department

ATTACHMENT 5A: Methodology to Determine Chemical Constituents for Water Quality Assessment and Evaluation

Introduction:

The Artificial Groundwater Recharge rules (OAR 690-350-120) require both up front water quality and a water quality-monitoring plan. Further, for any recharge project the rules (OAR 690-350-120 (3) (b) require an applicant to either obtain a water quality permit (typically a water pollution control facility (WPCF) permit) or show that a permit is not necessary. Also, rules OAR 690-350-120 (3)(g) require a "Project Description Report" (ATTACHMENT 5) that outlines the proposed groundwater quality-monitoring plan. This attachment is intended to specifically help clarify the method by which the list of chemical constituents was determined.

Project Area Sample Chemical Review Methodology

Working with Tom Darnell, OSU Extension agent in Milton-Freewater, a chemical constituents review was conducted in order to determine what types of chemicals should be examined in the surface and groundwater monitoring for the project. Several steps were followed to determine which chemicals were of interest.

Review Steps

1. Reviewed the ODEO Report: *April 1999 Milton-Freewater Groundwater Quality Study: As part of the Statewide Groundwater Monitoring Program* (Richardson, et. al., 2000). Particular attention was focused on the constituents tested, testing protocol and timing, and the results-conclusions.
2. Reviewed *OSU Extension Pesticide Properties Database* and determined which were used in the Milton-Freewater area and a list was comprised. (Table 4A1, 4A2)
3. Determined which were currently and/or historically used in the area utilizing past chemical studies in the basin (see references). This included interviewing the current landowner on the site-specific history of chemical use on that property (see signed written statement below).
4. Determined which chemicals were important to monitor for during the recharge period (winter-spring). Considered each chemical's typical seasonal application period, solubility in water, soil half-life, and soil movement ratings.
5. Considered project design (top soil removed), and finalized list of chemicals of interest.

Final List of Chemicals to Monitor for Recharge Project

Chemicals Currently Used:

Rubigan (Fenarimol)
Ridomil (Metalxyl)
Systhane/Rally (Myclobutanil)
Devrinol (Napropamide)

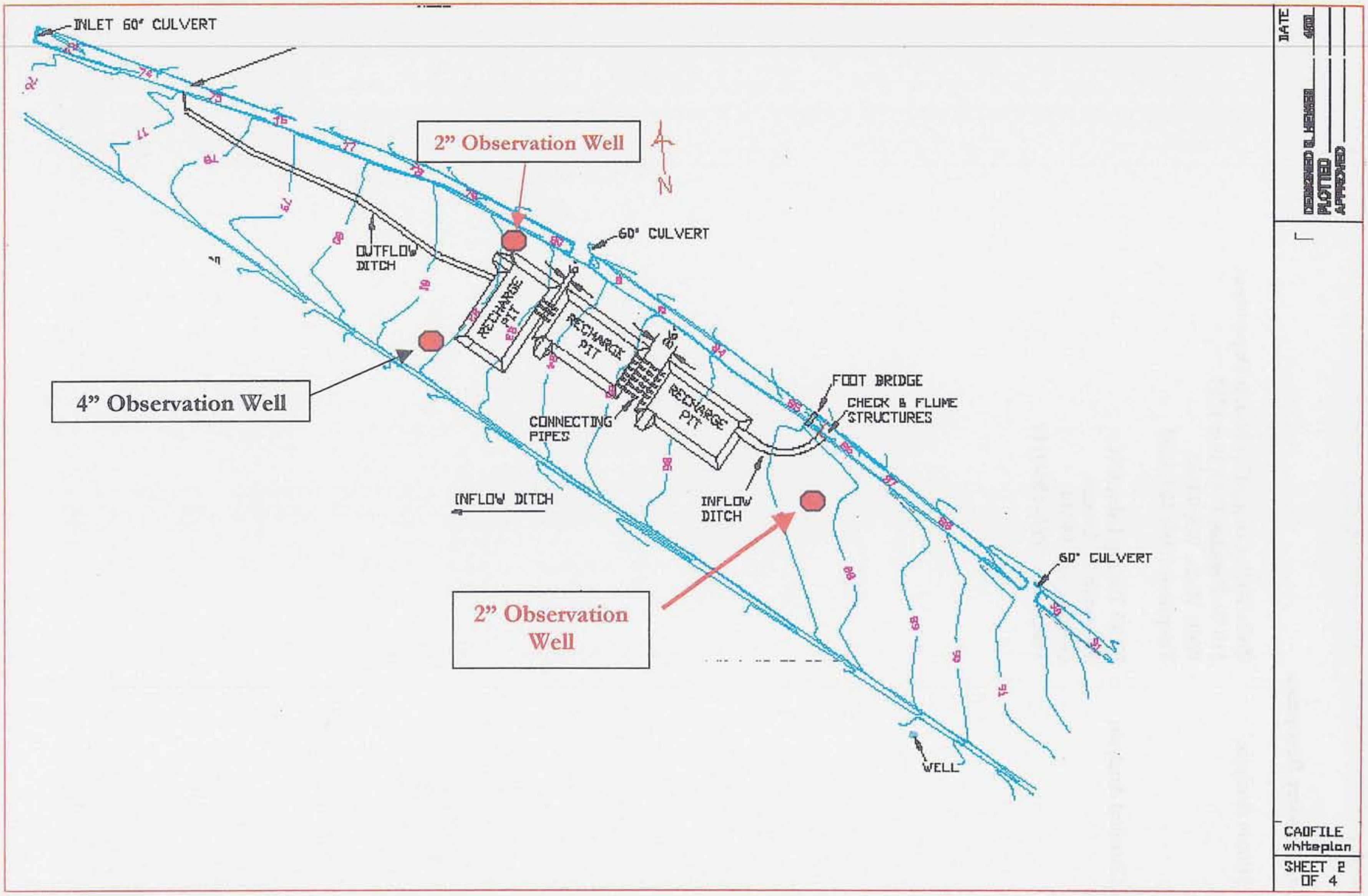
Chemicals Historically Used:

DDD-DDE-DDT
Elgetol (DNOC sodium salt)
Alar/B-Nine (Daminozide)
Lindane (Lindane)

Laboratory Resources

Nitrate Analysis:	Walla Walla County-City Health Department 310 W. Popular, P. O. Box 1753 Walla Walla, WA 99362 Telephone (509) 527-3290
Chemical Analysis:	KUO Testing Labs, INC. 337 south 1st Avenue Othello, WA 99344 Telephone: (509)-488-0118

Attachment 5B Map of On-Site Monitoring Well Locations



Attachment 5D

History of Chemical[1] Use: Recharge Site Specific

Landowner Statement of Past Use:

"Gentleman.

I have been the owner of a certain parcel of land in the valley with an address known as 84140 Prunedale Rd., Milton-Freewater. Oregon. 97862.

I have owned this land since 1978 at which time we took over the existing orchard of apples and farmed it for two years at which time we began removing various blocks of tress and replanting with new varieties. In the past few years we raised Nursery Tree Stock and began leveling the land to its present condition. letting it lay in a dormant stage for a year and then planting cover crops to enrich the soil for a future cherry orchard.

The pesticides applications were the normal tree fruit pesticides as allowed by regulations of the industry. The herbicide applications were Round-Up. Simizine and Paraquat. No other chemicals were used on this parcel of land during my ownership. If you should have other questions. please contact me at the following: (541)-278-6305. (509)-386-6175, or (541)-558-3752 or email at: Hjohnson@co.umatilla.or.us"

Landowner: ____________ Date: 10-17-03

[1] Chemical is defined here to include insecticides, fertilizers, herbicides, rodenticides, fungicides, and all other non-natural chemicals.

ATTACHMENT 7A: Source Water Quality Data

Grey areas samples that correspond to Recharge Project

1STORET RETRIEVAL DATE 99/06/23
402388 28AWALL03780
46 01 08.6 118 24 45.1 4
WALLA WALLA RIVER AT HWY 11 (MILTON-FREEWATER)
41059 OREGON UMATILLA
PACIFIC NORTHWEST 131007
COLUMBIA RIVER BASIN BELOW YAKIMA RIVER
21400000 17070102007 00
0000 FEET DEPTH

INITIAL DATE	67/04/24	67/08/21	67/12/11	68/04/02	68/08/05	68/12/16	69/03/04	69/12/10	70/04/28
INITIAL TIME	1235	1400	1440	1615	1750	1100	1510	1145	930
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	8	25.5	7	8.5	25	5	8.6	5	6
00011 WATER TEMP FAHN	46.4$	77.9$	44.6$	47.3$	77.0$	41.0$	47.5$	41.0$	42.8$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU	250	2		10	3	8		7	1
00080 COLOR PT-CO UNITS	20	4		3	5	3		1	3
00095 CNDUCTVY AT 25C MICROMHO	67	225	200	72	243	69	95		71
00300 DO MG/L	10.3	12.2	10.6	11.4	10.7	12.2	11.6	11.7	12.7
00301 DO SATUR PERCENT	89	150	89	99	131	95	99	94	105
00310 BOD 5 DAY MG/L	0.7	1.3	0.9	0.5	1.3	1.6	0.8	1.5	1.5
00400 PH SU	7.3	8.3	7.7	7.5	8.40L	7.2	7.6	7.5	7.5
00410 T ALK CACO3 MG/L	30	108		33	105	30		54	31
00500 RESIDUE TOTAL MG/L	518			99	184	101		118	87
00530 RESIDUE TOT NFLT MG/L	368	11		10	10	21		18	12
00610 NH3+NH4- N TOTAL MG/L	0.13	0.34		0.38	0.32	0.17		0.08	0.12
00612 UN-IONZD NH3-N MG/L	.0004$	.036$		.002$	.040$	.0003$		.0003$	.0005$
00619 UN-IONZD NH3-NH3 MG/L	.0005$	.043$		.002$	.049$	.0004$		.0004$	.0006$
00620 NO3-N TOTAL MG/L	0.03	0.02		0.07	0.38	0.54		0.73	0.13
00660 ORTHOPO4 PO4 MG/L	0.06	0.16		0.1	0.18	0.56		0.16	0.03
00760 SWL PBI MG/L	1K	1K	29	1K					
00940 CHLORIDE TOTAL MG/L	2			1	8	2		2	1
00945 SULFATE SO4-TOT MG/L	8	33		4	14	4		6	3
22413 HARDNESS TOTLDISS WTR MG/L	28			37	99	35		49	24
31505 TOT COLI MPN CONF /100ML	620	2400	7000	60	230	2300	620	450K	620
31615 FEC COLI MPNECMED /100ML			230						60
31677 FECSTREP MPNADEVA /100ML								240	

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/12	73/06/13	73/09/24
INITIAL TIME	1400	1645	2000	1620	1610	1130	845	1055	1400
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	24	5.5	15.5	26	9	20.5	2.5	16.5	16
00011 WATER TEMP FAHN	75.2$	41.9$	59.9$	78.8$	48.2$	68.9$	36.5$	61.7$	60.8$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU		5	3	1	28	2	15	3	2
00080 COLOR PT-CO UNITS		0	1	2	10	5	5	5	0
00094 CNDUCTVY FIELD MICROMHO							90		
(SAMPLE CONTINUED FROM PREVIOUS PAGE)									

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/12	73/06/13	73/09/24
INITIAL TIME	1400	1645	2000	1620	1610	1130	845	1055	1400
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00095 CNDUCTVY AT 25C MICROMHO	236	66	51	200	67	221	87		
00300 DO MG/L	12.5	11.5	9.5	14.2	11	12.5	12.9	11.7	11.5
00301 DO SATUR PERCENT	151	95	99	172	97	137	97	117.0$	115.0$
00310 BOD 5 DAY MG/L	2	0.7	0.8	2.3	0.7	0.9	1.4		
00400 PH SU	8.6	7.5	7.3	8.9	7.1	8.4	7.3		
00410 T ALK CACO3 MG/L		29	21	96	23	92	29	82	95
00500 RESIDUE TOTAL MG/L		89	75	172	280	170	100	153	164
00530 RESIDUE TOT NFLT MG/L		12	12	4	106	8	32	10	3
00610 NH3+NH4- N TOTAL MG/L		0.34	0.06	0.66	0.09	0.14	0.04	0.1	0.17
00612 UN-IONZD NH3-N MG/L		.001$	.0003$	.215$	.0002$	.013$	.00008$		
00619 UN-IONZD NH3-NH3 MG/L		.002$	.0004$	.261$	.0002$	.016$	.00010$		
00620 NO3-N TOTAL MG/L		0.02	0.1	0.15	0.3	0.51	0.14	0.36	0.39
00625 TOT KJEL N MG/L							0.2		
00650 T PO4 PO4 MG/L							0.3		
00660 ORTHOPO4 PO4 MG/L		0.06	0.09	0.13	0.09	0.04	0.09	0.1	0.14
00930 SODIUM NA,DISS MG/L					2.4		2.8		
00935 PTSSIUM K,DISS MG/L					2		1.5		
00940 CHLORIDE TOTAL MG/L		1	0.7	5	0.8	3	1	6	4
00945 SULFATE SO4-TOT MG/L		3	.1K	11	3	11	2	6	4
22413 HARDNESS TOTLDISS WTR MG/L		26	19	80	22	84	28	71	79
31505 TOT COLI MPN CONF /100ML	230	2400	2400	230	620	620	290		
31615 FEC COLI MPNECMED /100ML	230	45K	45K	45K	45K		60		

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1450	1710	1610	1945	1640	1715
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	12.5	27.5		11	28	7
00011 WATER TEMP FAHN	54.5$	81.5$		51.8$	82.4$	44.6$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10
00070 TURB JKSN JTU	35	4	12	2	2	1
00080 COLOR PT-CO UNITS	10	5	10	5	15	2
00094 CNDUCTVY FIELD MICROMHO	55	190			180	120
00095 CNDUCTVY AT 25C MICROMHO	60	220		61	201	112
00300 DO MG/L	10.5	9.6		10.2	10.3	11.1
00301 DO SATUR PERCENT	100	136		95	126	93
00310 BOD 5 DAY MG/L	0.9	1.5		0.3	1.8	0.2
00400 PH SU	7.5	8.4		7.3	8.4	8
00410 T ALK CACO3 MG/L	19	77	52	25	69	48
(SAMPLE CONTINUED FROM PREVIOUS PAGE)						
INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1450	1710	1610	1945	1640	1715
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00500 RESIDUE TOTAL MG/L	251	159	132	70	180	114
00530 RESIDUE TOT NFLT MG/L	205	12	22	7	44	5
00610 NH3+NH4- N TOTAL MG/L	.010K	0.02	0.06	.010K	0.09	0.02
00612 UN-IONZD NH3-N MG/L	.00007$	.003$		.00004$	.013$	.0003$
00619 UN-IONZD NH3-NH3 MG/L	.00009$	.004$		.00005$	.016$	.0004$
00620 NO3-N TOTAL MG/L	0.11	0.29	0.3	0.14	0.69	0.4
00650 T PO4 PO4 MG/L	0.5	0.2		0.3	0.5	0.1
00660 ORTHOPO4 PO4 MG/L	0.04	0.13	0.11	0.11	0.1	0.12
00930 SODIUM NA,DISS MG/L	2.2	8		2.7	8.9	4.6
00935 PTSSIUM K,DISS MG/L	1.6	4		1.6	3.1	2.8
00940 CHLORIDE TOTAL MG/L	0.4	3	2	2	4	2
00945 SULFATE SO4-TOT MG/L	1	6	6	2	8	4
22413 HARDNESS TOTLDISS WTR MG/L	16	69	48	20	63	40
31505 TOT COLI MPN CONF /100ML	230	620		620	2400	230
31615 FEC COLI MPNECMED /100ML	230	620		45	2400	60

ATTACHMENT 7A: Source Water Quality Data

1STORET RETRIEVAL DATE 99/06/23
402389 28AWALL04860
45 54 13.6 118 22 02.9 4
WALLA WALLA RIVER U/S MILTON-FREEWATER
41059 OREGON UMATILLA
PACIFIC NORTHWEST 131007
COLUMBIA RIVER BASIN BELOW YAKIMA RIVER
21400000 17070102011 00
0000 FEET DEPTH

INITIAL DATE	67/04/24	67/08/21	67/12/11	68/04/03	68/08/06	68/12/16	69/03/04	69/12/10
INITIAL TIME	1300	1520	1700	810	905	1030	1540	1055
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	6	21	5	6.5	16	5	6.4	3
00011 WATER TEMP FAHN	42.8$	69.8$	41.0$	43.7$	60.8$	41.0$	43.5$	37.4$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU	5	7	15	2	5	9	12	2
00080 COLOR PT-CO UNITS	6	2	4	4	4	3	2	0
00095 CNDUCTVY AT 25C MICROMHO	59	180	69	57	93	57	63	
00300 DO MG/L	11.2	8.7	11.9	11.6	9.7	11.1	11.6	12.9
00301 DO SATUR PERCENT	94	101	98	98	102	87	99	100
00310 BOD 5 DAY MG/L	0.6	0.8	1.1	0.6	0.4	0.2	0.7	1.2
00400 PH SU	7.4	7.5	7.5	7.3	7.3	7	7.5	7.7
00410 T ALK CACO3 MG/L	26	32	32	26	40	16	27	33
00500 RESIDUE TOTAL MG/L	89	101	83	113	98	92	81	67
00530 RESIDUE TOT NFLT MG/L	2	8	6	7	22	26	7	6
00610 NH3+NH4- N TOTAL MG/L	0.14	0.17	0.32	0.12	0.18	0.11	0.06	0.03
00612 UN-IONZD NH3-N MG/L	.0005$	.002$	.001$	.0003$	.001$	.0001$	.0003$	.0002$
00619 UN-IONZD NH3-NH3 MG/L	.0006$	.003$	.002$	.0004$	.001$	.0002$	.0003$	.0002$
00620 NO3-N TOTAL MG/L	0.01	0.02	0.02	0.03	0.04	0.39	0.3	0.12
00660 ORTHOPO4 PO4 MG/L	0.02	0.1	0.1	0.07	.01K	0.01	0.11	0.1
00760 SWL PBI MG/L	8	1K	1					
00940 CHLORIDE TOTAL MG/L	1	5	1	1	6	2	2	0.8
00945 SULFATE SO4-TOT MG/L	3	0.6	4	2	15	3	1	3
22413 HARDNESS TOTLDISS WTR MG/L	23	36	29	24	32	25	26	31
31505 TOT COLI MPN CONF /100ML	230	620	210	230	620	210	60	60
31615 FEC COLI MPNECMED /100ML			210					
31677 FECSTREP MPNADEVA /100ML								5K

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/11	73/06/13
INITIAL TIME	1445	1615	1930	1655	1550	1110	1730	1025
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	19.5	5	15.5	19	7.5	15.5	4	12.5
00011 WATER TEMP FAHN	67.1$	41.0$	59.9$	66.2$	45.5$	59.9$	39.2$	54.5$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10	10	10
00070 TURB JKSN JTU	1	3	5	1	10	1	5	1
00080 COLOR PT-CO UNITS	1	7	0	1	5	0	3	5
00094 CNDUCTVY FIELD MICROMHO							75	

INITIAL DATE	70/07/13	70/11/30	71/05/11	71/08/16	72/02/28	72/08/30	73/02/11	73/06/13
INITIAL TIME	1445	1615	1930	1655	1550	1110	1730	1025
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
00095 CNDUCTVY AT 25C MICROMHO	84	58	46	84	92	93	76	
00300 DO MG/L	9.8	11.5	9.9	9	11.3	9.9	12	10.7
00301 DO SATUR PERCENT	112	95	104	96	100	98	96	99.1$
00310 BOD 5 DAY MG/L	0.9	0.6	0.7	0.7	0.6	0.4	1.1	
00400 PH SU	8.1	7.5	7.3	7.6	7.1	7.6	7.3	
00410 T ALK CACO3 MG/L	35	26	19	38	21	36	26	34
00500 RESIDUE TOTAL MG/L	176	72	81	86	104	93	79	88
00530 RESIDUE TOT NFLT MG/L	6	4	8	3	13	4	8	6
00610 NH3+NH4- N TOTAL .MG/L	0.12	0.19	0.16	0.43	0.09	0.1	0.05	0.04
00612 UN-IONZD NH3-N MG/L	.006$	.0007$	.0009$	.006$	.0002$	.001$	.0001$	
00619 UN-IONZD NH3-NH3 MG/L	.007$	.0009$	.001$	.008$	.0002$	.001$	.0001$	
00620 NO3-N TOTAL MG/L	0.06	.010K	0.06	0.07	0.16	0.12	.030K	0.03
00625 TOT KJEL N MG/L							0.2	
00650 T PO4 PO4 MG/L							0.5	
00660 ORTHOPO4 PO4 MG/L	0.05	0.06	0.08	0.07	0.09	0.08	0.08	0.09
00930 SODIUM NA,DISS MG/L					2.1		2	
00935 PTSSIUM K,DISS MG/L					2		1.5	
00940 CHLORIDE TOTAL MG/L	3	1	1	0.9	0.6	1	0.3	3
00945 SULFATE SO4-TOT MG/L	2	1	.1K	0.5	2	2	0.9	0.8
22413 HARDNESS TOTLDISS WTR MG/L	270	22	18	40	19	32	23	26
31505 TOT COLI MPN CONF /100ML	620	2400	230	7000	130	620	620	
31615 FEC COLI MPNECMED /100ML	60	45K	60	60	45K		46	

ATTACHMENT 7A: Source Water Quality Data

INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1420	1745	1630	1930	1745	1745
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00010 WATER TEMP CENT	10.5	20.5		10.5	27	4.7
00011 WATER TEMP FAHN	50.9$	68.9$		50.9$	80.6$	40.5$
00027 COLLECT AGENCY CODE	10	10	10	10	10	10
00070 TURB JKSN JTU	7	2	1	1	2	1.0K
00080 COLOR PT-CO UNITS	5	5	1K	5	15	1K
00094 CNDUCTVY FIELD MICROMHO	49	80		55	170	80
00095 CNDUCTVY AT 25C MICROMHO	53	90		54	195	72
00300 DO MG/L	10.8	9		10.8	8.7	11.9
00301 DO SATUR PERCENT	101	103		102	106	95
00310 BOD 5 DAY MG/L	1	0.3		0.6	3	0.4
00400 PH SU	7.5	8		7.3	8	7.7
00410 T ALK CACO3 MG/L	17	34	33	20	65	34

INITIAL DATE	74/05/06	74/07/30	74/11/11	75/05/27	75/07/08	75/11/10
INITIAL TIME	1420	1745	1630	1930	1745	1745
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
00500 RESIDUE TOTAL MG/L	62	76	68	64	180	87
00530 RESIDUE TOT NFLT MG/L	39	4	1K	5	38	3
00610 NH3+NH4- N TOTAL MG/L	0.03	0.02	0.06	0.01	0.19	0.02
00612 UN-IONZD NH3-N MG/L	.0002$	.0008$		.00004$	.012$	.0001$
00619 UN-IONZD NH3-NH3 MG/L	.0002$	.0010$		.00005$	.014$	.0001$
00620 NO3-N TOTAL MG/L	0.01	0.05	0.06	0.1	0.72	0.12
00650 T PO4 PO4 MG/L	0.2	0.2		0.3	0.5	0.1
00660 ORTHOPO4 PO4 MG/L	0.01	0.14	0.08	0.09	0.08	0.11
00930 SODIUM NA,DISS MG/L	2.1	3		2.4	8.4	3
00935 PTSSIUM K,DISS MG/L	1.6	2.4		1.3	3.5	2
00940 CHLORIDE TOTAL MG/L	0.4	0.9	1	1	6	1
00945 SULFATE SO4-TOT MG/L	2	1	2	2	8	2
22413 HARDNESS TOTLDISS WTR MG/L	14	27	27	19	60	27
31505 TOT COLI MPN CONF /100ML	60	7000L		230	7000	2400
31615 FEC COLI MPNECMED /100ML	45K	620		45	7000	230

AHachment 3B

LAND LEASE

1. PARTIES

The parties to this Lease are HULETTE M. JOHNSON, SHIRLEY A. JOHNSON, and H. MARC JOHNSON, hereinafter referred to as Landlord, and HUDSON BAY DISTRICT IMPROVEMENT COMPANY, and Oregon Non-profit Improvement District, hereinafter referred to as Tenant.

2. DATE

This Lease will begin the first of the following month, after the Tenant has obtained a water right certificate for the purpose of ground water recharge for this site from the State of Oregon.

3. DESCRIPTION OF LEASED PREMISES

Landlord leases to Tenant and Tenant leases from Landlord, under the terms and conditions stated herein, the real property in Umatilla County, State of Oregon, described in Exhibit "A" *attached hereto and by such reference* incorporated herein.

4. TERM OF LEASE

The term of this Lease will be from the date of this lease for a period of five(5) years. Tenant shall have the option to renew this lease with notice to Landlord of not less than 90 days prior to the end of the initial term and any renewal terms for future additional five year terms upon the mutual agreement of renegotiated rental terms for each renewal period.

5. POSSESSION

The Tenant shall be granted possession of the property upon execution of this document by all parties, together with the receipt of the initial lease payment as prescribed in RENT.

6. RENT

Tenant shall pay advance annual rent payments in the amount of three thousand six hundred dollars($3,600) plus annual assessment for irrigation water for surface water rights delivered by Tenant to 84140 Prunedale Road, beginning with INV # 1276C for 2003. Landlord shall pay same assessment to Tenant upon receipt of said annual assessment payment from Tenant. Tenant shall make each annual payment for the term of this lease to Landlords address, 52833 Sunquist Road, Milton-Freewater, Oregon, 97862, or otherwise as notified. The initial payment shall be due on the date this agreement is executed by Tenant and Landlord, and Tenant it therefore granted possession to said real property.

7. INSURANCE

Tenant shall maintain liability insurance on the leased property in an amount acceptable to the Landlord and shall provide proof of such insurance naming Landlords as additional insureds. Tenant shall also be responsible for necessary insurance on laborers. Tenant shall also be responsible for insurance coverage on personal property kept or installed upon this leased premises.

8. USE OF PREMISES

Tenant agrees that they will use the property for ground water recharge/storage, ponding.

9. LANDLORDS OBLIGATIONS

Landlord shall install electricity, pump, collection pond and mainline with the assistance of Tenant necessary to connect the source of irrigation water provided by Tenant to the existing delivery systems of Landlord's.

If there is a mortgage or other encumbrance on said premises, Landlord covenants to keep same in good standing, at all times, to make payments when due and not to suffer or permit default in said encumbrance.

Landlord shall pay all property taxes upon the real property subject to this lease in a timely manner.

10. TENANT'S OBLIGATIONS

Tenant shall provide all labor and materials for the construction of the ground water recharge pond, Landlord's irrigation collection pond and pumping station or other improvements required by Tenant, including maintenance of bridges and culverts.

Tenant shall pay all taxes of any kind and necessary insurance for labor to maintain to maintain improvements including any increase in property taxes as a result of said improvements as made by Tenant.

Tenant shall pay for all maintenance and operation of improvements constructed on said premises.

Tenant agrees that earth material excavated from the recharge pond shall be placed along the edges of the recharge area to produce a basin-like pond. Excess material shall be placed in other areas of Landlords property as directed by Landlord and spread evenly where located so that agricultural activities may continue.

Tenant upon termination of lease, shall replace all soil to a level topography using stored material from the sides of said 'recharge' pond, together with other off site soil as approved by Landlord, necessary to return the recharge pond to a level premise ~~for agricultural growing activities.~~

Tenant shall pay for all costs incurred for control of noxious weeds and vegetation around perimeter of ponding areas, and shall spray the perimeter of said pond including the banks of the Hudson Bay Canal and the Pleasantview Canal including bridges and culverts to maintain a clean ground cover as directed by Landlord

Tenant shall provide signage for trespass prevention and notice of man-made hazard upon premises at the commencement of work efforts at the recharge area.

Tenant shall install any and all fences and gates necessary as may be required by an insurance company or others around the recharge pond.

11. LIENS

Tenant shall pay, as due, all claims for work done on and for services rendered or materials furnished to the leased premises incurred and owing by Tenant and shall keep the premises free of any liens resulting from acts of the Tenant.

12. COVENANTS OF TITLE

Landlord covenants that he is the owner of the above described property free of any encumbrance that would impair or interfere with Tenant's rights under this Lease, and that Landlord has full right and authority to lease the premises described herein.

13. WASTE

Tenant shall not commit or permit to be committed any waste, strip, damage to or misuse of the premises.

14. INDEMNIFICATION

Tenant shall indemnify, hold harmless and defend Landlords from all claims, loss or liability arising out of or related to any activity of Tenant on the leased premises or any condition of the leased premises in the possession or under the control of the Tenant.

15. ASSIGNMENT

No part of the leased property may be assigned, mortgaged, or subleased, nor may a right of use of any portion of the property be conferred on any third person by any other means without the prior written consent of Landlord. This provision shall apply to all transfers to and by trustees in bankruptcy, receivers, administrators, executors, and legatees. No consent in one instance shall prevent the provision from applying to a subsequent instance.

16. DEFAULT

The following shall be events of default:

Failure to pay rent when due.

Failure of either Landlord or Tenant to comply with any other term or condition or fulfill any other obligation of this Lease within twenty(20) days after written notice by Landlord or Tenant specifying the nature of the default with reasonable particularity.

Abandonment by the Tenant of the property

If the default is of such a nature that it cannot be completely remedied within the twenty-day period and the defaulting party thereafter proceeds with reasonable diligence and in good faith to effect the remedy as soon as practicable, default shall not be declared unless the defaulting party ceases to effect the remedy.

17. TAXES

The Landlord shall pay all real property taxes for real property for the term of this Lease. Tenant shall be liable to pay any taxes, personal or real, incurred as a result of improvements placed upon the leased premises.

18. NONWAIVER

Waiver by either party of strict performance of any provision of this Lease shall not be a waiver of or prejudice the party's right to require strict performance of the same provision in the future or of any other provision of this Lease.

19. ATTORNEY FEES

If suit or action is instituted in connection with any controversy arising out of the Lease, the prevailing party shall be entitled to recover, in addition to costs, such sums as the Court may adjudge reasonable as attorney fees.

20. SUCCESSION

Subject to the above-stated limitations on transfer of Tenant's interest, this Lease shall be binding upon and inure to the benefit of the parties, their respective successors and assigns.

21. INSPECTION OF PREMISES

The Landlord reserves the right to themselves and their agents to go upon the premises at reasonable and proper times to inspect the same for the purpose of determining that the Lease is being properly observed and that all of the terms of this lease are being performed by the Tenant.

22. IMPROVEMENTS

Any improvements to the real property by Tenant shall remain the property of the Landlord upon termination of this Lease, unless the Tenant obtains the written consent of Landlord to remove said improvements prior to the time the improvements are placed on the property. However, Tenant shall be responsible for refilling the recharge "pond" as set forth in paragraph 10 above.

23. TERMINATION

The Tenant agrees to deliver the property to the Landlord at the end of the term of this Lease and in as good a condition as when accepted, and pursuant to paragraph 10 above.

24. TIME IS OF THE ESSENCE

The parties acknowledge and agree that time is of the essence with respect to all of the terms, conditions, and provisions of this Lease.

25. NOTICES

Any notice required or permitted under this Lease shall be given when actually delivered or when deposited in the United States Mail as certified mail, addressed as follows:

LANDLORD: HULETTE M. JOHNSON, et., al.
52833 Sunquist Road
Milton-Freewater, Oregon 97862

TENANT: HUDSON BAY DISTRICT IMPROVEMENT COMPANY
P.O. Box 110
Milton-Freewater, Oregon 97862

26. WATER DUES

The annual irrigation water dues as billed to Landlord by Tenant shall be paid by Landlord to Tenant as billed. As part of the rent agreement in paragraph 6 above, Tènant shall pay Landlord an equal amount of said water dues within thirty(30) days of receipt of said water dues from Landlord, during the term of this Lease and any renewals thereof.

27. CAPTIONS AND HEADINGS

The captions and headings throughout this Lease are for convenience and reference only and the words contained therein shall in no way be held or deemed to define, limit, describe, explain or modify the meaning of any provisions of or the scope or intent of this Lease.

28. ENTIRE AGREEMENT

This document is the entire, final, and complete agreement of the parties pertaining to the Lease of the premises described herein, and supersedes and replaces all written and oral agreements theretofore made or existing by and between the parties or their representatives in so far as the premises are concerned.

IN WITNESS WHEREOF, the parties have executed this Lease on the 15th day of October, 2003.

LANDLORD:

HULETTE M. JOHNSON, SHIRLEY M. JOHNSON

H. MARC JOHNSON

TENANT:

HUDSON BAY IMPROVEMENT CO.

BY: John C. Zerba
it's Secretary/Treasurer

STATE OF OREGON)
)ss.
County of Umatilla)

On this 15th day of Oct 2003 personally appeared before me the above named HULETTE M. JOHNSON, SHIRLEY M. JOHNSON, and H. MARC JOHNSON and acknowledged the foregoing to be a voluntary act and deed.

only KFY

OFFICIAL SEAL
KATHLEEN F. YENNEY
NOTARY PUBLIC-OREGON
COMMISSION NO. 337142
MY COMMISSION EXPIRES SEPT. 24, 2004

Kathleen F. Yenney
NOTARY PUBLIC FOR OREGON

My commission expires: 9-24-2004

STATE OF OREGON)
)ss.
County of Umatilla)

On this 15th day of Oct 2003, personally appeared before me the above named John C. Zerba in his capacity as Secretary/Treasurer of HUDSON BAY IMPROVEMENT CO. and acknowledged the foregoing to be a voluntary act.

Kathleen F. Yenney
NOTARY PUBLIC FOR OREGON
My Commission expires: 9-24-2004

OFFICIAL SEAL
KATHLEEN F. YENNEY
NOTARY PUBLIC-OREGON
COMMISSION NO. 337142
MY COMMISSION EXPIRES SEPT. 24, 2004

Exhibit "A"

TRACT I:

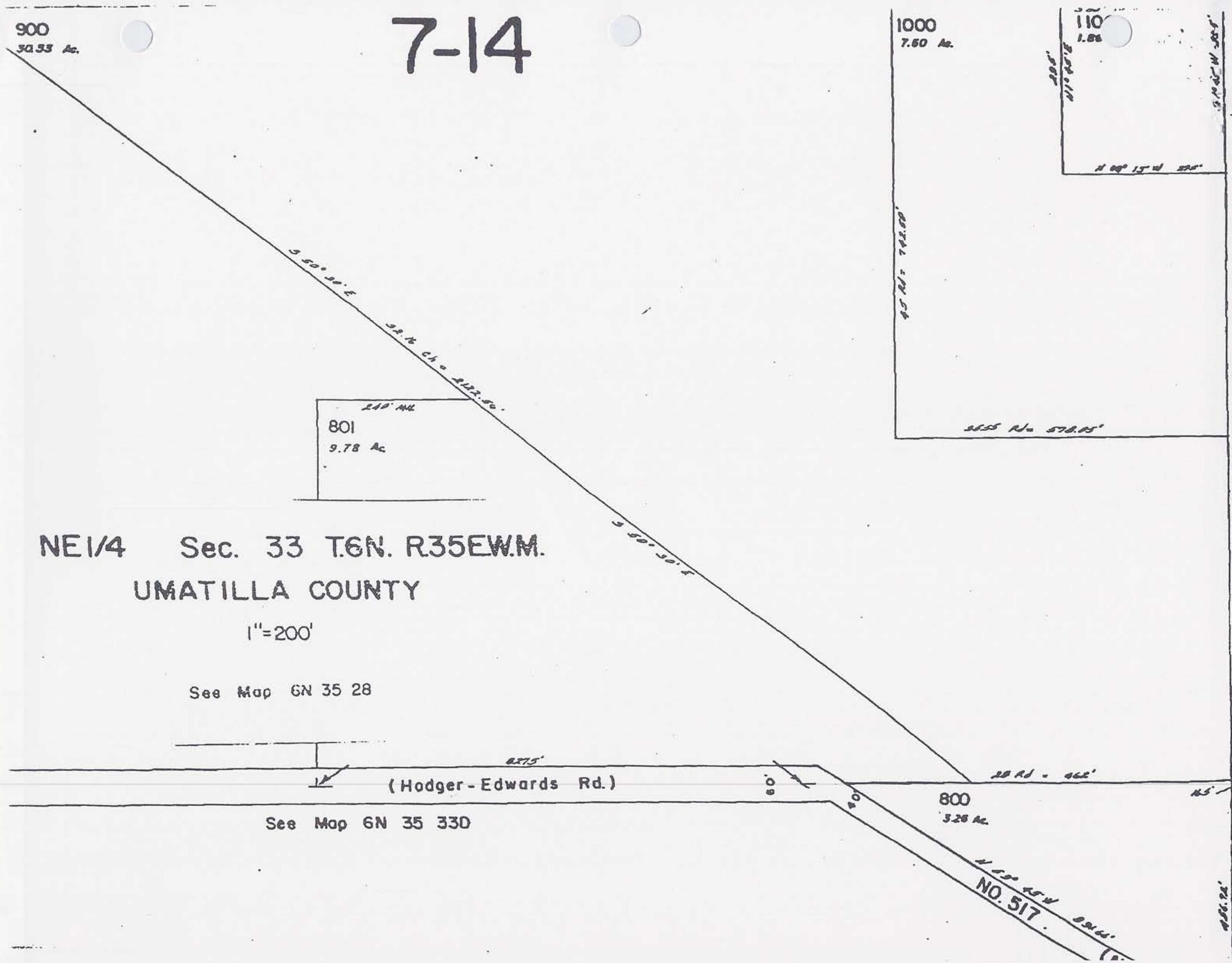
Township 6 North, Range 35, East of the Willamette Meridian:
Section 33: A tract of land located in the South Half of the Northeast Quarter, and being a portion of that tract of land conveyed to William J. Jackson, by Deed recorded in Book 369, Page 267, Deed Records, and being described as follows, to-wit:

Commencing at the quarter section corner on the line between Sections 33 & 34; running thence North 20 chains: thence West 33-16/100 chains; thence Southeasterly 32-16/100 chains, more or less, to a point on the center line; running East and West through said Section 33, said point being 7 chains West of the point of beginning; thence East 7 chains to the point of beginning. Excepting Therefrom, beginning at the Northeast corner of the Southeast Quarter of the Northeast Quarter of said Section 33: and running thence South 45 rods: then West 35-5/9 rods; thence North 45 rods; thence East 33-5/9 rods to the place of beginning. All being East of the Willamette Meridian, Umatilla County, Oregon. Subject to any and all water rights of way and roads.

TRACT III:

Beginning at the Northeast corner of the Southeast Quarter of the Northeast Quarter of Section 33, Township 6 North. Range 35; running thence South 45 rods; thence West 35 and 5/9 rods; thence North 45 rods; thence East 35 and 5/9 rods to the place of beginning. Excepting therefrom that tract of land conveyed to the State of Oregon, by and through its State Highway Commission by deed recorded in Book 130, Page 573 of the Deed Records of Umatilla County, Oregon. Also, excepting any portion of said premises lying within that strip of land conveyed to Walla Walla and Columbia River Railroad Company, by deed recorded in Book "D", Page 834 of the said Deed Records. All being East of the Willamette Meridian, in the County of Umatilla and State of Oregon;

Excepting any and all water rights of way.



7-14
900
30.33 Ac.
1000
7.60 Ac.
110
1.86
801
9.78 Ac.
800
3.26 Ac.
NE1/4 Sec. 33 T.6N. R35EW.M.
UMATILLA COUNTY
1"=200'
See Map 6N 35 28
(Hodger-Edwards Rd.)
See Map 6N 35 330
NO. 517.

Attachment 8B.

License No. ________

STATE OF OREGON

WATER RESOURCES DEPARTMENT

APPLICATION FOR LIMITED WATER USE LICENSE

Applicant(s): Hudson Bay District Irrigation Company

Contact Person: Jon Brough / John Zerba

Mailing Address: P.O. Box 110,

Telephone No: 541 938-6105

I (We) make application for a Limited License to use or store the following described surface waters or groundwater-not otherwise exempt, or to use stored water of the State of Oregon for a use of a short-term or fixed duration:

1. **SOURCE(S) OF WATER for the proposed use:** Walla Walla River **a tributary of** Colombia River.

2. **TOTAL AMOUNT OF WATER to be diverted:** 50 **cubic feet per second, or** 50 **gallons per minute. If water is to be used from more than one source, give the quantity from each:** ________.

3. **INTENDED USE(S) OF WATER: (check all that apply)**
   - ☐ **Road construction or maintenance;**
   - ☐ **General construction;**
   - ☐ **Forestland and rangeland management; or**
   - ☒ **Other:** Artificial Ground water Recharge.

4. **DESCRIPTION OF PROPOSED PROJECT: Include a description of the intended place of use as shown on the accompanying site map, the method of water diversion, the type of equipment to be used (including pump horsepower, if applicable), length and dimensions of supply ditches and pipelines:** See attached Application document

5. **PROJECT SCHEDULE: (List day, month, and year)**
Date water use will begin 11-04
Date project will be completed 11-09
Date need for water will be completed 11-09

NOTE: A completed water availability statement from the local watermaster, fees and a site map meeting the requirements of OAR 690-340-030 must accompany this request. The fee for this request is $100 for the first point of diversion plus $10 for each additional point of diversion. The license, if granted, will not be issued or replaced by a new license for a period of more than five consecutive years. The right granted will be subordinate to all other authorized uses that rely upon the same source, or water affected by the source, and may be revoked at any time it is determined the use causes injury to any other water right or minimum perennial streamflow.

REMARKS:

____

____

SIGNATURE of Applicant: [signature] **DATE:** 10-23-03
Title: Sec - Pres

I certify that I have examined the foregoing application and accompanying data, and hereby grant a Limited License to use said water as described in the application, subject to all water rights of record, and subject to any valid public interest concerns which may become evident.

This license shall be in effect beginning ______________, 20___, and shall expire ________________, 20___.

WITNESS my hand this ______________________, 20___.

____
Paul R. Cleary
Water Resources Department
Director

The licensee shall give notice to the Department (Watermaster) at least 15 days in advance of using the water under the Limited License and shall maintain a record of use. The record of use shall include, but need not be limited to, an estimate of the amount of water used, the period of use and the categories of beneficial use to which the water is applied. During the period of the Limited License, the record of use shall be available for review by the Department upon request.

The application was first received at the Water Resources Department at Salem, Oregon, on the _________ day of _______________, 20___, at _______ o'clock, ___M.

(Fall, 2000)
M:\groups\wr\forms\limited license appl

COPY

Kennedy/Jenks Consultants

Engineers & Scientists

1020 North Center Parkway
Suite F
Kennewick, Washington 99336
509-734-9763
FAX 509-734-9764

3 July 2003

Mr. Bob Bower
Hydrologist
Walla Walla Basin Watershed Council
PO Box 68
Milton-Freewater, Oregon 97862

Subject: Test Site Hydrogeologic Assessment
Sediment Aquifer Study
K/J 026046.10

Dear Bob:

Kennedy/Jenks Consultants is pleased to present this letter report to the Walla Walla Basin Watershed Council (WWBWC). This letter report presents the results of a hydrogeologic assessment of the proposed shallow aquifer recharge test site (the test site) adjacent to the Hudson Bay Canal southeast of the WWBWC Office. This letter report was prepared as part of our letter contract with the WWBWC dated 13 February 2003 and amended 1 April 2003.

Introduction

The WWBWC is planning to sponsor a shallow aquifer recharge field test in the Walla Walla Basin (the Basin) just west of Milton-Freewater, Oregon. This letter report presents a preliminary hydrogeologic assessment of the proposed test site and the surrounding area. The area covered by this letter report includes an approximately 30 square mile area bounded on the north by the Washington/Oregon border, on the south by the base of the Horse Heaven Hills and Blue Mountains, to the east by a north-south line approximately 1 mile east of the Walla Walla River, and to the west by a north-south line through Umapine, Oregon (Attachment 1).

The proposed test site is located on approximately 9 acres adjacent to the south side of the Hudson Bay Canal (the Canal) in the east half of section 33, T6N, R35E (Attachment 1). This site is approximately 2 miles west of Milton-Freewater, Oregon, in Umatilla County. The test site was chosen because of its proximity to the Canal which will supply water for the test and the willingness of the land owner (Mr. H. Johnson) to allow construction of test infiltration ponds on the property.

The proposed test will be done with a facility consisting of three individual infiltration ponds lined up, one after the other, adjacent to the Canal. Approximately 50 cubic feet/second (cfs) of water will be available for diversion from the Canal into the upstream (easternmost) pond via a diversion structure. Water will then cascade from one pond to the next (from east to west) until it infiltrates out of the bottom of the pond(s). Any water escaping the final pond will be directed back into the Canal via a return pipe. In-flow from, and out-flow to, the Canal will be metered.

Testing is proposed for winter and early spring months when Walla Walla River flows (ultimate source of recharge water) are at their peak.

It is anticipated that recharge testing will be conducted under an ASR Limited License granted to the WWBWC by Oregon Department of Water Resources (OWRD) under OAR 690-350-0020. One of the requirements of the Limited License Application is to provide a supplemental preliminary hydrogeologic report describing groundwater conditions at the test site (OAR 690-350-0020 (3)(a)(b)(C)). This letter report, which is based predominantly on previously written reports and publicly available information, was written to meet this requirement.

This letter report focuses on suprabasalt sediments, the target for shallow aquifer recharge, and is subdivided into sections describing regional geology and hydrogeology, test site hydrogeology, surface water in the test site area (including springs), and groundwater and surface water quality. The assessment was done under the supervision of Mr. Terry Tolan, RG. The assessment is based largely on previously prepared and readily available reports and information. Attachments to this report include:

- Location map for the project area (Attachment 1)
- Structure contour and isopach maps for selected geologic units comprising the upper part of the shallow aquifer system (Attachments 2, 3, 4, and 5)
- A table summarizing geologic interpretations, well construction information, and water pumping data taken from water supply well logs used to assess area hydrogeology (Attachment 6)
- Draft test and monitoring plan (Attachment 7)

In addition, a number of reports and papers were reviewed for information relevant to this assessment. These reports are listed below.

Barker, R.A., and Mac Nish, R.D., 1976, Digital model of the gravel aquifer, Walla Walla River Basin, Washington and Oregon: Washington Department of Ecology Water-Supply Bulletin 45, 49 p.

Bauer, H.H., and Vaccaro, J.J., 1990, Estimates of ground water recharge to the Columbia Plateau regional aquifer system, Washington, Oregon, and Idaho, for predevelopment and current land-use conditions: U.S. Geological Survey Water Resources Investigations Report 88-4108, 37 p.

Bjornstad, B.N., 1980, Sedimentology and depositional environment of the Touchet Beds, Walla Walla River basin, Washington: Richland, Washington, Rockwell Hanford Operations RHO-BWI-SA-44, 116 p.

Busacca, A.J., and MacDonald, E.V., 1994, Regional sedimentation of Late Quaternary loess on the Columbia Plateau - sediment source areas and loess distribution pattern, *in* , Lasmanis, R., and Cheney, E.S., eds., Regional geology of Washington State: Washington Department of Natural Resources, Division of Geology and Earth Resources Bulletin 80, p. 181-190.

Busacca, A.J., Gaylord, D.R., and Sweeney, M.R., 2002, Paired eolian deposits and megaflood features, Columbia Plateau, Washington: Friends of the Pleistocene 10th annual Pacific Northwest Cell Field Trip, 16-18 August 2002 Field Trip Guide, 80 p.

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Overview of the Test Site Area Geologic Setting

The most recent comprehensive geologic investigation of the suprabasalt sediments in the Basin, the strata which are the focus of this assessment, is Newcomb (1965). Our review of area geology is based on Newcomb (1965), more recent insights into area geology taken from reports describing regional suprabasalt sediment geology (Smith and others, 1989; Lindsey, 1996), and our ongoing work in the area on other projects. Since the emphasis of this hydrogeologic assessment is on the suprabasalt aquifer system, this section will focus primarily on the sedimentary strata and only briefly introduces the underlying Columbia River basalt.

Generally, suprabasalt sediments found in the Walla Walla Basin include (Figure 1):

- Holocene to Pliocene (?) alluvial gravel
- Pleistocene Cataclysmic Flood deposited sand and silt (Touchet Beds)
- Pleistocene loess (Palouse Formation)
- Miocene to Pliocene (?) conglomerate, sand, silt, and clay

Newcomb (1965) also described several terrace sequences within the Basin. These are not described in this letter report because they typically do not host aquifers. The basic physical characteristics and distribution of the uppermost 200 feet of the suprabasalt sediment sequence across the study area are briefly summarized in the following sections. We focus on the uppermost 200 feet of the suprabasalt sediment sequence because this is the stratigraphic interval that hosts the upper part of the shallow aquifer system, the primary target for proposed shallow aquifer recharge projects.

<u>Holocene to Pliocene (?) Alluvial gravel</u>

Basaltic, uncemented and nonindurated gravelly strata immediately underlies the groundsurface across much of the study area north of the base of the Horse heaven Hills. Based on the few outcrops of this unit described in reports (e.g., Newcomb, 1965), these strata are probably moderately to well bedded, have a silty to sandy matrix, and are generally uncemented. Our interpretation of borehole logs in the study area suggests the top of these strata appear to form a gently south-to-north dipping surface (Attachment 2). The alluvial gravel varies from absent to almost 120 feet-thick beneath the study area (Attachment 3). Many of the thicker accumulations of uncemented gravel appear to form elongate, linear tracts. Thickness variation in these strata are inferred to be the result of paleodeposition in stream channels, syndeposition folding and faulting, and post-deposition erosion and deformation.

These uncemented gravels are generally equivalent to Newcomb's (1965) younger alluvial sand and gravel and referred to in the remainder of this letter report as alluvial gravel. The alluvial gravel is interpreted to record deposition of sand and gravel in the Walla Walla Basin by streams draining off the adjacent Blue Mountains and Horse Heaven Hills. These streams were probably the recent ancestors of many of the modern streams in the Basin, including the Walla Walla River, Mill Creek, Cottonwood Creek, Dry Creek, and Pine Creek. The distribution of the alluvial gravel, in large part, probably reflects the orientation of the streams in which these strata were deposited.

The age of the alluvial gravel is not well constrained. Depending on where one is at in the Basin, the alluvial gravel unit appears to predate, be contemporaneous with, and younger than the Palouse Formation and Touchet Beds. If this is the case, the alluvial gravel may be late Pliocene to Holocene in age (e.g., greater than 2 million years to less than a few thousand or even hundreds of years old).

Pleistocene Cataclysmic Flood Deposits (Touchet Beds)

During the Pleistocene, Cataclysmic Floods (e.g., Missoula or Bretz Floods) periodically inundated the Walla Walla valley between approximately 1,000,000 and 12,000 years ago (Waitt and others, 1994). Sand and silt deposited in the Walla Walla Basin by these flood waters consist of well stratified, normally graded, interbedded felsic silt and felsic to basaltic fine to medium sand (Figure 2). Finer grained layers tend to be brown to tan colored, coarser layers brown to gray-brown colored. Individual beds (or layers) range from a few inches to less than 3 feet-thick. These strata do not commonly display significant cementing, although some pedogenic calcium carbonate (caliche or hardpan) is commonly observed in the upper parts of these deposits where they are exposed at the Earth's surface. A range of soft-sediment deformation features and cross-cutting clastic dikes are commonly found in this unit (Fecht and others, 1999).

These Cataclysmic Flood deposits, also known as Touchet Beds, form most of the small hills located across the Walla Walla valley floor and along the base of the Blue Mountains (Attachment 4) to an elevation of approximately 1100 feet above mean sea level (msl).

Pleistocene loess (Palouse Formation)

Massive to poorly stratified silt and very fine sand deposits that display evidence of pedogenic (soil forming) modification is found on the hills surrounding the Basin (Figure 3). Pedogenic calcium carbonate may also be found in these deposits which are thought to be eolian (wind-deposited) loess, also referred to as the Palouse Formation (Busacca and others, 2002). These loess deposits are thought to range from greater than 1 million years old to less than 10,000 year old, making it older than, and age-equivalent to, the Touchet Beds (Busacca and others, 2002).

The Palouse Formation may be present in the western to central parts of the study area and intercalated within Touchet Beds. However, we suspect loess is rare to absent in this area because of a lack of loess outcrops. The Palouse Formation does crop out on the highlands bordering the southern and eastern edge of the Basin. Some of the strata mapped on Attachment 4 may be part of the Palouse Formation, but it was not differentiated from the Touchet Beds because of a lack of borehole log information.

Mio-Pliocene strata

Variably indurated conglomerate, sand, silt, and clay is found in the subsurface beneath the Walla Walla Basin. Based on limited outcrop descriptions, field reconnaissance, and borehole log descriptions these indurated gravel and sand, may locally have a caliche cap, and is they predominantly are basaltic in composition (Figure 4). Based on drill cuttings collected from wells recently drilled near Milton-Freewater, Oregon, these strata may also contain some mica and quartz. These indurated gravelly strata (conglomerate) are continuous beneath the entire study area (Attachment 5), range between approximately 75 and 250 feet-thick, and are referred to as the Mio-Pliocene conglomerate. It is differentiated from younger alluvial gravel unit by its physical characteristics, including a greater degree of induration, cement, and weathering.

The Mio-Pliocene conglomerate, sand, silt, and clay are generally equivalent to Newcomb's (1965) old gravel unit and old clay units. Newcomb (1965) placed the old gravel unit stratigraphically above the old clay unit. However, review of driller's logs across the study area reveal: (1) the presence of interstratified silt and gravel lithologies throughout entire thickness of the Mio-Pliocene strata, (2) areas where strata correlative to one of the two units, old gravel and old clay, are absent, and/or (3) areas where the inferred contact between the old gravel and clay units varies greatly in depth over distances of less than one mile. Given this, it is likely that the top of the old clay unit and bottom of the old gravel unit is not a single, continuous surface as suggested by Newcomb (1965). It is more likely that these strata interfinger and that a distinctive old gravel unit and old clay unit can not always be differentiated.

The mixed conglomerate, sand, silt, and clay forming the Mio-Pliocene unit are assigned a Miocene to Pliocene age (approximately 10 to 2 million years old) based on degree of induration, evidence of greater weathering, and stratigraphic position. To our knowledge no absolute age dates are available for this unit. Mio-Pliocene deposits of the Walla Walla Basin probably record deposition by the ancestral Salmon/Clearwater/Snake and Walla Walla River systems and include river channel deposits, overbank and flood plain deposits, and lake deposits. The distribution of coarse channel deposits in this unit should reflect the orientation of the ancient streams in which these materials were deposited.

Columbia River Basalt Group

The basalt flows that crop out on the highland bordering the Basin and that underlie the sediment sequence in the Basin belong to the Miocene Columbia River Basalt Group. The top of the Columbia River basalt surface is generally found to lie at lower elevations from the south (where it crops out on the steep hillsides south and west of Milton Freewater at elevations of

850 feet and above) to the north beneath the suprabasalt sediment filling the Basin. Abrupt elevation changes in the top of basalt near the Basin edge are interpreted to reflect the presence of faults offsetting this surface. Because of the depth at which this unit is generally found within the study area, it is assumed for the purposes of this assessment that it is likely that the Columbia River basalt does not exert a significant influence over the hydrogeologic behavior of the shallow suprabasalt sediment aquifer system in the immediate area of the test site.

Structural Geology

The Walla Walla Basin is a structural basin that began to develop during Miocene time (approximately 16 million years ago) and has continued to develop to the present day (Kienle, 1980; USDOE, 1988). The Basin is bounded on the south by the Horse Heaven Hills, the east by the Blue Mountains, and to the north by the Palouse Slope. The southern and eastern edges of the Basin are fault controlled. The uppermost basalt which crops out around the edge of the Basin on the Horse Heaven Hills and Blue Mountains is down dropped at these bounding faults. The faults, and associated folds, found on the southern and eastern edge of the Basin probably extends into the subsurface beneath the Basin (Kienle, 1980; Swanson and others, 1981). The presence of these faults beneath the Basin are inferred to, in part, explain discontinuities seen in the distribution of suprabasalt sediments, especially Mio-Pliocene sedimentary strata, and the top of basalt.

Overview of the Study Area Hydrogeologic Setting

Groundwater in the Walla Walla Basin is found in two primary aquifer systems: (1) the suprabasalt sediment aquifer system which is primarily hosted by Mio-Pliocene conglomerate and to a lesser extent, the overlying alluvial gravel (2) the underlying Columbia River basalt aquifer system. The suprabasalt aquifer, which is the target for shallow aquifer recharge, is the focus of this section.

Physical properties

The majority of the suprabasalt aquifer is hosted by Mio-Pliocene conglomerate unit while the uppermost part of the aquifer is found, at least locally, in the younger alluvial gravel unit. The suprabasalt aquifer is generally characterized as unconfined, but it does, at least locally, display confined conditions. Variation between confined and unconfined conditions within the aquifer system is probably controlled by sediment lithology (e.g., facies – coarse versus fine) and induration (e.g., cementation, compaction). Groundwater movement into, and through, the suprabasalt aquifer also is inferred to be controlled by sediment lithology (e.g., facies - coarse versus fine) and induration (e.g., cementation, compaction).

Given the physical properties of the alluvial gravel (non-indurated sand and gravel) versus those of the Mio-Pliocene conglomerate (e.g., finer matrix and the presence of naturally occurring cement), Mio-Pliocene conglomerate probably has generally lower permeability and porosity than the alluvial gravel. Consequently, suprabasalt aquifer groundwater flow velocities are inferred to be less where the water table lies within the Mio-Pliocene conglomerate than where it lies within the younger, more permeable alluvial gravel. In addition, where the alluvial gravel is saturated, this uncemented, high permeability gravel and sand could form preferred pathways for groundwater movement and areas of increased infiltration capacity in the shallow parts of the suprabasalt aquifer system.

Very little hydraulic property information is available for the suprabasalt aquifer. Newcomb (1965) reports average effective porosity of 5 percent in the old gravel (e.g., the Mio-Pliocene conglomerate and sand). Given the physical characteristics of the overlying alluvial gravel, we suspect average effective porosity in it is higher. Modeling work by Barker and MacNish (1976) report estimated hydraulic conductivity and transmissivity of 1.5×10^{-4} feet/second to 7.6×10^{-3} feet/second and 10,000 $feet^2$/day to 60,000 $feet^2$/day, respectively, for the entire shallow aquifer. As with Newcomb's (1965) effective porosity estimate, we suspect hydraulic conductivity and transmissivity would be higher in saturated alluvial gravel than in saturated Mio-Pliocene conglomerate.

<u>Groundwater level and flow direction</u>

In the study, groundwater flow in the suprabasalt aquifer area is generally thought to be from south to north and northwest. There probably also is a component of groundwater movement towards the Walla Walla River where the suprabasalt water table near it is higher than the river. Where this occurs, the Walla Walla River is, in part, feed by groundwater discharge. However, along the course of the Walla Walla River through the study area, the suprabasalt water table may at least locally be below the bed of the river during much of the year. This is thought to be common between Milton-Freewater and the Stateline. When and where this occurs, such reaches of the river probably lose water to the suprabasalt aquifer.

WWBWC staff are collecting suprabasalt aquifer water level data from water supply wells located within the Basin between the Walla Walla River and Umapine. Water level data reported on well logs, and the few reports written for the Basin, suggest groundwater levels near the Walla Walla River (and many of the spring creeks) historically were relatively shallow, commonly less than 5 feet deep. With increased groundwater use over the past 20 years these water levels have generally declined, at least locally. This groundwater level decline is thought to account for, at least in part, the reduction in spring creek flow reported by many land owners in the Basin. Based on WWBWC water level data, the depth to suprabasalt aquifer groundwater ranges from 30 to 40 feet near Milton-Freewater, 3 to 10 feet along the Walla Walla River north of Milton-Freewater, 1 to 10 feet along the East and West Prongs of the Little Walla Walla, and 30 to 50 feet in the Umapine Area.

<u>Aquifer recharge</u>

Natural recharge to the suprabasalt aquifer is described by Newcomb (1965) to be from infiltration of surface water into the ground near the edge of the Basin where streams leave the adjacent basalt highlands and flow out onto the basin floor. The majority of this recharge probably occurs in the spring when streams flowing into the Basin reach peak discharges. Precipitation on parts of the Basin floor where the alluvial gravel and older, Mio-Pliocene strata lie at, or near, the surface also provides some natural recharge. With flood control and channelization of the Walla Walla River and smaller streams, natural recharge via infiltration from surface waters has probably decreased with continued development.

Artificial recharge of the suprabasalt aquifer has become an important component of the hydrologic system since the 1920's and 1930's. This recharge is thought to have historically contributed water to at least some shallow water wells and springs (Newcomb, 1965). Artificial recharge probably occurs through irrigation ditch leakage and infiltration past the root zone in irrigated fields. With the advent of ditch/channel lining and reduction in the practice of flood irrigation, this type of recharge has probably decreased.

Reduced natural and artificial recharge will, and probably does, at least in part account for decreased suprabasalt water table levels. These reduced levels probably account for reduced spring flows and base level discharge to the Walla Walla River. The objective of the proposed SASR project is to attempt to locally replenish groundwater in the suprabasalt aquifer and restore some spring flows and Walla Walla River baseflow.

Water Quality

The most up-to-date groundwater quality data for the study area is found in Richerson and Cole (2000), an Oregon Department of Environmental Quality (ODEQ) report prepared for the northern portion of Umatilla County between Milton-Freewater and the Stateline. Two water quality parameters presented in the ODEQ report suggest groundwater quality in the uppermost suprabasalt aquifer in the area is relatively good with regard to ODEQ standards. These parameters, total dissolved solids (TDS) and nitrate-N, range from 150 to 250 mg/l and 0.5 to 4.5 mg/l, respectively on the Oregon side of the Stateline. Concentrations of these parameters generally decrease from north to south toward where the Walla Walla River enters the valley. This trend suggests the introduction of low nitrate-N and TDS surface water into the groundwater system and supports Newcomb's (1965) conclusion that a significant amount of surface water recharge of shallow groundwater occurs where the Walla Walla River enters the Basin. The increase in TDS and nitrate-N concentrations as suprabasalt groundwater moves north into the Basin is inferred to be, at least in part, the result of the relative increase in recharge from irrigation water reaching the suprabasalt aquifer.

Test Site Hydrogeology

Geologic features control the physical characteristics of aquifer hosting materials, and therefore the distribution and movement of groundwater through an aquifer. Understanding the nature and occurrence of these features both regionally and locally provide constraints on testing, data interpretation, monitoring, mitigation, and final design. This section describes the basic hydrogeology in the immediate vicinity of the test site.

Information reviewed for this assessment report is interpreted to indicate that the uppermost 200 feet of the suprabasalt sediment sequence underlying the test site consists predominantly of gravelly strata assigned to the Mio-Pliocene conglomerate (Figure 5). Specific unit thicknesses and distribution in the immediate vicinity of the test site are as follows:

- Touchet Beds are thin to non-existent, being absent at, north, and east of the test site. A thin veneer of Touchet Beds are found northwest and south of the test site where the unit is 6 to 18 feet thick and less than 5 feet-thick, respectively. Given this distribution, the unit has no role in effecting recharge at the test site.

- The top of the alluvial gravel unit beneath the test site is essentially the ground surface. Beneath the test site these uncemented strata are interpreted to range from approximately 30 feet-thick at the east end to over 60 feet-thick at the west end (Figure 5). Based on our interpretations of well logs in the vicinity, this east to west thickening is inferred to be the result of these strata filling a depression in the top of the underlying, indurated Mio-Pliocene conglomerate.

- The origin of the low inferred to be in the top of the Mio-Pliocene conglomerate is not known. The location of the test site near the fault zone that bounds the base of the Horse Heaven Hills suggests this low could be a faulted depression formed in the top of the conglomerate. Alternatively, given the variable quality of driller's geologic descriptions we can not completely discount the possibility that this low is not present, it being the result of poor or inaccurate driller's descriptions. One of the objectives of site-specific characterization work will be to verify the presence of this feature. Mio-Pliocene conglomerate underlying the test site appears to be at least 100 feet-thick (Figure 5).

In the immediate vicinity of the test site the suprabasalt aquifer water table appears to be between 30 and 55 feet bgs. Based on our reconstruction of site-specific geology summarized in the preceding bullets and in Figure 5, this places the water table predominantly within the Mio-Pliocene conglomerate beneath the easternmost portion of the tests site. To the west, where the alluvial gravel thickens, the suprabasalt aquifer water table is interpreted to be within the alluvial gravel. In the test site area, suprabasalt aquifer groundwater flow is inferred to be from generally east to west-northwest. The degree of seasonal variability is not known

Review of first water and final water depth's reported on well logs in the immediate vicinity of the test site suggests the suprabasalt aquifer here consists of an unconfined zone overlying a deeper, semi-confined zone. The transition between these zones may lie approximately 75 feet bgs (Figure 5). The nature of the "confining" horizon(s) that causes this apparent change in aquifer character is not known, but inferred to be well cemented and/or fine grained layers within the upper 20 to 50 feet of the Mio-Pliocene conglomerate. Where the top of the Mio-Pliocene conglomerate drops into the low inferred to underlie and be situated west of the test site, this confining zone would be displaced to depths greater than 95 ft bgs and the overlying unconfined zone would be correspondingly thicker (Figure 5).

The assessment did not find any site-specific hydraulic properties data for any of the aquifers or the vadose zone underlying the Test Site. The only hydraulic properties data found are the general estimates provided in the regional discussions. These suggest porosity, hydraulic conductivity, and transmissivity of gravelly strata in the Basin of 5%, $1.5x10^{-4}$ to $7.0x10^{-3}$ ft/s, and 10,000 to 60,000 ft^2/d, respectively. A preliminary engineering report for the materials immediately below the test site (Hewes, 2003) indicates infiltration capacity in the alluvial gravel of 1.7 to 3.0 gpm/ft^2/foot of head. If these values persist across the entire thickness of the alluvial gravel, porosity, hydraulic conductivity, and transmissivity in the alluvial gravel beneath the test site is probably considerably higher than the regional estimates. If that is the case, the regional estimates are probably more indicative of Mio-Pliocene conglomerate hydraulic properties.

Well Assessment

The OWRD GRID database lists 176 wells in sections 33 and 34, T6N, R35E. Of these, 53 are listed in section 33. Most of these wells are less than 100 feet deep and appear to be open to the shallow aquifer groundwater system which is the target of shallow aquifer recharge. Less than 30 of the wells found in section 33 are in the inferred down gradient direction from the test site.

Surface Water

Surface water found in the vicinity of the test site includes: (1) the Canal, (2) Dugger Creek, (3) Johnson Creek, and (4) Goodman Spring Branch (Attachment 1). The basic characteristics of these four water bodies are discussed below:

- The Canal is an artificial stream operated to deliver irrigation water to users west of Milton-Freewater. The Canal has a capacity of up to approximately 100 cfs and many reaches of it are suspected to leak.
- Dugger Creek appears to be a natural creek that is currently feed by water leaking from, and/or discharged from, the Canal. The head of Dugger Creek is approximately ¾ to 1 mile west of the test site.
- Johnson Creek is a natural spring creek that flows from a spring located in the SE ¼ , SE ¼ , section 29, T6N, R35E, approximately ¾ to 1 mile west-northwest of the test site.
- Goodman Spring Branch is a natural creek that has been modified by channelization. It passes within less than ½ mile north of the test site, paralleling Sunnyside Road.

All three of the natural creeks are reported to have seen reduced flow in the past few years.

Water Quality

As described in the regional hydrogeologic setting, there is little water quality data for the area except what is reported in Richerson and Cole (2000). That report shows TDS and nitrate-N concentrations in groundwater beneath the test site of approximately 125 to 150 mg/l and 2 to 2.5 mg/l, respectively. These parameter concentrations compare to those of approximately 55 mg/l and <0.25 mg/l at Milton-Freewater, where the Walla Walla River enters the Basin. If, as Newcomb (1965) surmises and others suspect, groundwater chemistry near Milton-Freewater is affected by direct recharge from the Walla Walla River, this groundwater chemistry is probably reflective of surface water chemistry. Therefore, although not a direct measurement of surface water quality, this data is very suggestive of surface water quality and it suggests that recharge water delivered to the test site will be comparable to the water quality data reported in Richerson and Cole (2000).

Preliminary Conceptual Hydrogeologic Model and Possible Effects of Shallow Aquifer Recharge

The objective of this section is to briefly summarize a preliminary conceptual hydrogeologic model for the test site and speculate on possible effects of shallow aquifer recharge on the area surrounding the test site. One of the purpose of this is to identify data gaps to be filled by future site-specific work, including analysis of pilot test monitoring data. We anticipate that this conceptual model, and our assessment of recharge effects, will change as data is collected during subsequent characterization and monitoring activities.

Our conceptual model of how the test will work is summarized below:

1. Relatively good quality Walla Walla River water will be delivered to the test site during peak flow periods in the winter and early spring. This water will rapidly infiltrate from the ponds into the ground, moving downwards through the alluvial gravel.

2. If the alluvial gravel and Mio-Pliocene conglomerate contact is located below the water table at the site:

    a. There may be some lateral spreading of recharge water on the top of the Mio-Pliocene conglomerate,

    b. Spreading will probably be predominantly to the west, into the low spot inferred to be present in the top of the Mio-Pliocene conglomerate, and

    c. If this low turns out to be present, it may act to slow the movement of recharge water away from the test site and provide recharge pathways deeper into the Mio-Pliocene conglomerate than would be the case if the contact was flat.

3. If the water table is above the alluvial gravel and Mio-Pliocene contact, movement of groundwater offsite will be relatively rapid through a saturated alluvial gravel interval. If this is the case, the actual direction of movement can not be determined at this time.

4. Given the groundwater quality trends seen in Richerson and Cole (2000), we infer that recharge will generally improve groundwater quality in the test site area.

5. At this time we do not know what effect, if any, recharge will have on the spring creeks potentially down gradient of the test site. This is in large part due to the lack of site-specific data and information, including water levels, aquifer hydraulic properties, storage data, and ground water velocity and flow direction. These are specific targets of site characterization and pilot test monitoring data collection.

Conclusions and Recommendations

The test site is underlain by uncemented alluvial gravel which overlies indurated Mio-Pliocene conglomerate. Unfortunately, little test site-specific data is available upon which to build a detailed understanding of test site hydrogeology. For example:

- The depth of the suprabasalt aquifer water table at the test site is not well constrained, it could lie either above or below the alluvial gravel/Mio-Pliocene conglomerate contact.
- Although suprabasalt groundwater probably flows from the east to the west-northwest, suprabasalt groundwater flow direction, velocity, and seasonally variability are essentially unknown at the test site.
- A significant portion of the suprabasalt aquifer in the test site area displays at least some evidence of semi-confined conditions.
- The low in the top of the Mio-Pliocene conglomerate currently inferred to be present just west of the test site, based on very limited subsurface data. If present, it could serve to facilitate recharge to deeper parts of the suprabasalt aquifer. If it seems likely that it will, testing and monitoring will need to be designed to not only assess shallower aquifer impacts but also deeper semi-confined suprabasalt aquifer impacts.
- Suprabasalt aquifer and Walla Walla River (Hudson Bay Canal) water quality is generally good, although up-to-date water quality data, including most importantly up gradient and down gradient variations at the test site is unknown.

In addition to addressing the bullet listed above, we recommend that site-specific characterization and monitoring address the following issues:

- Identify the three-dimensional extent of the alluvial gravel and Mio-Pliocene conglomerate beneath the test site. This is important to understanding how recharge water will probably move as the uncemented strata may provide for more rapid water movement, both downwards and laterally towards springs, then likely in the more cemented Mio-Pliocene conglomerate.
- Evaluate the inferred low in the top of the Mio-Pliocene conglomerate just west of the test site. If this feature is present, it could affect the amount of recharge that may reach deeper portions of the suprabasalt aquifer.
- The nature and distribution of a possible confining layer within the upper portion of the Mio-Pliocene conglomerate should be investigated in order to better define the thickness and distribution of the unconfined aquifer. If the unconfined aquifer is absent, or only present seasonally, identifying the nature and extent of the confining layer is important since it will inhibit both downward or upward movement of groundwater. Knowing the

extent of this confining layer will provide information on where recharge water may tend to collect and spread atop this layer.

If you have any questions concerning the results of this report please do not hesitate to contact Terry Tolan in our Tri-Cities office at (509) 734-9763. It has been a pleasure working with you on this and we look forward to continuing to work with you on this project.

Very truly yours,

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Enclosure

cc: file

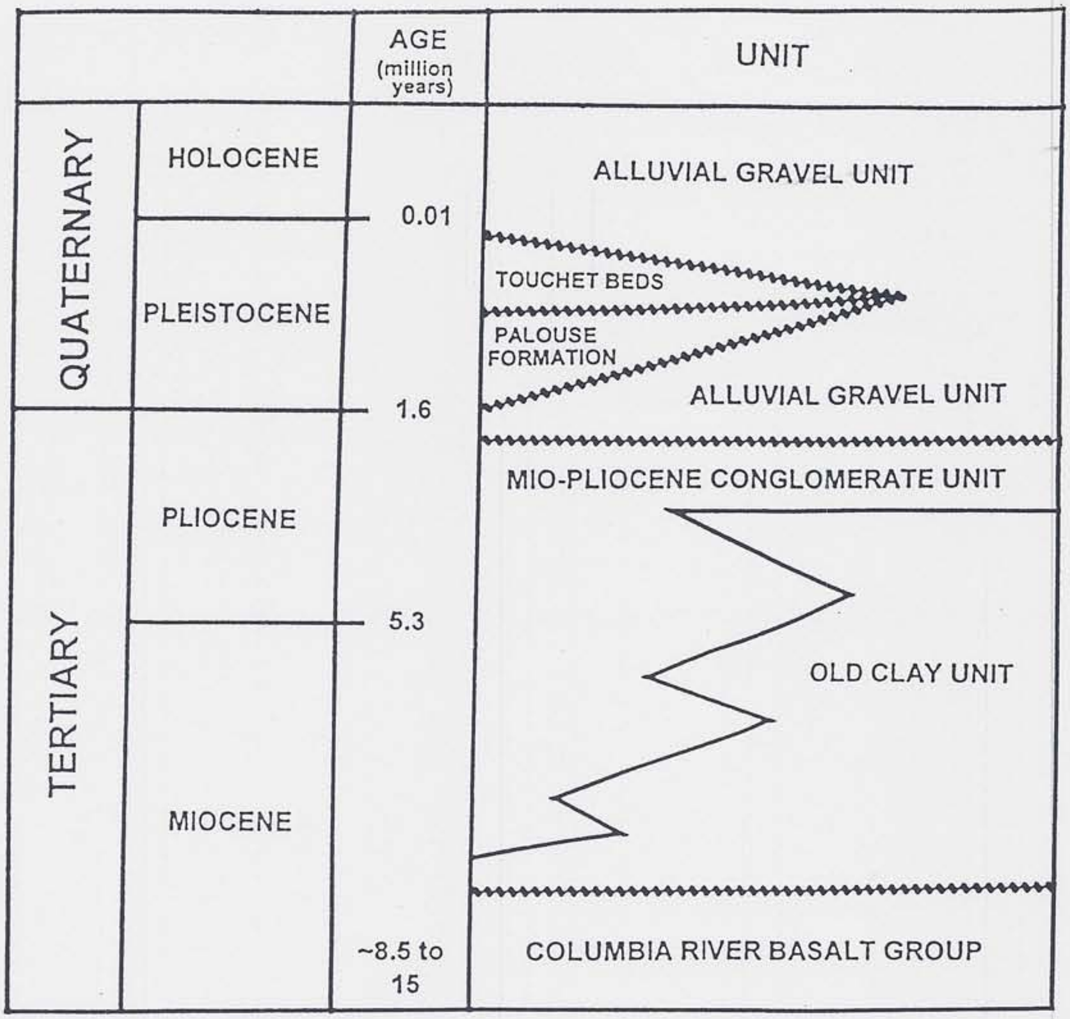

Figure 1. Stratigraphic chart for the suprabasalt sediments in the Walla Walla Basin.

Figure 2. Photograph of interbedded sand and silt typical of the Touchet Beds. Darker layers are sandy, lighter colored layers are silty.

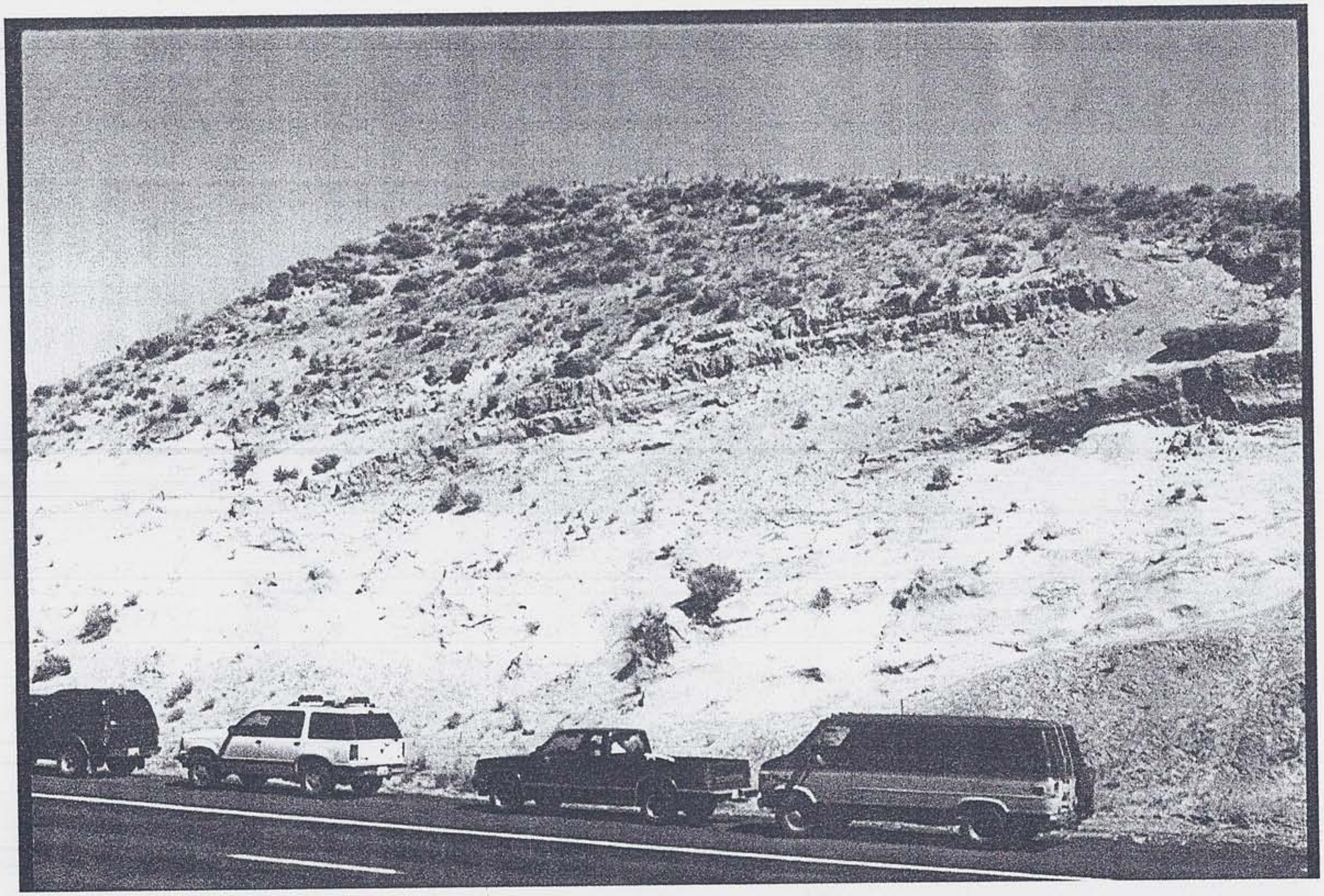

Figure 3. Photograph of massive bedded loess typical of the Palouse Formation.

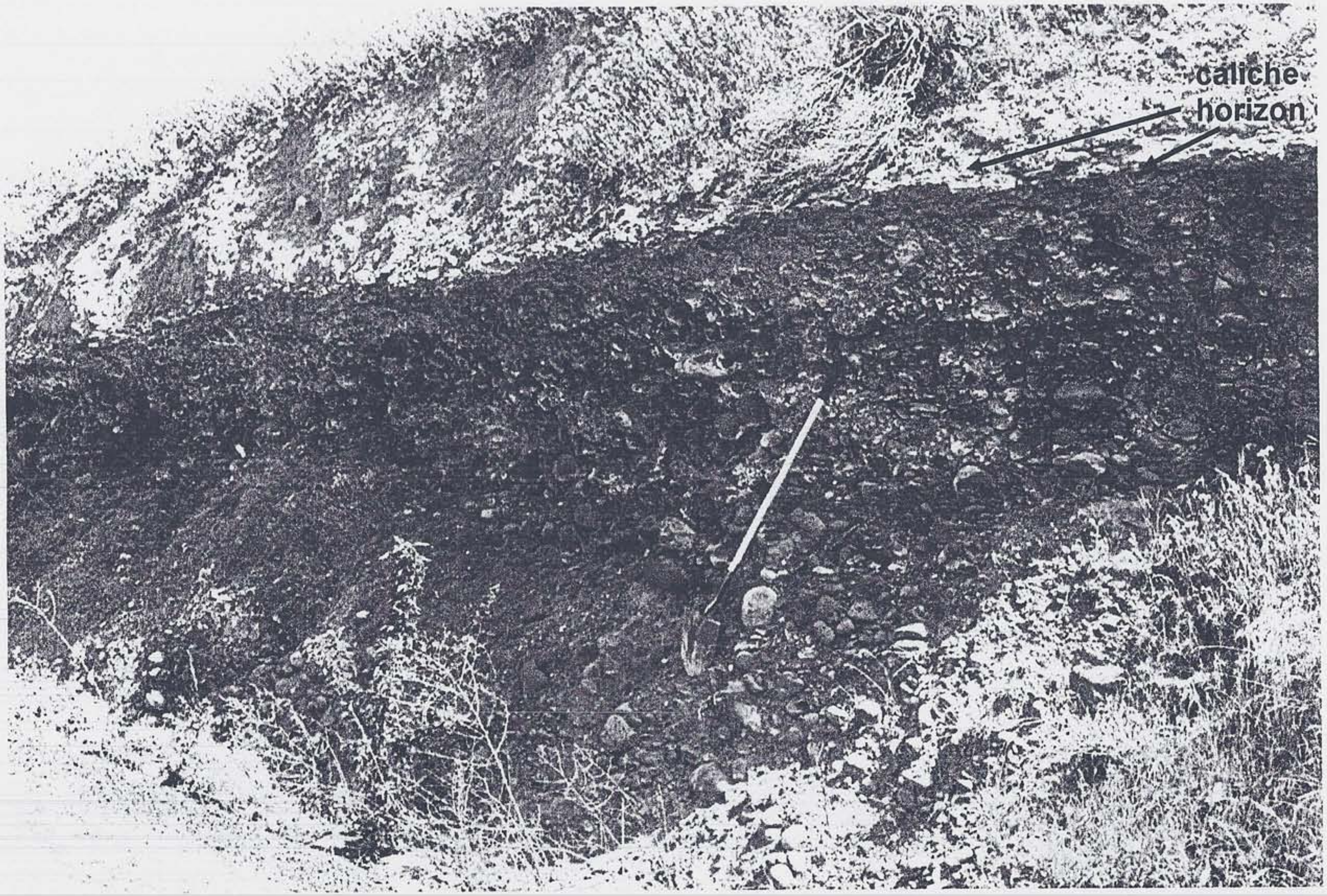

Figure 4. Photograph of indurated basaltic gravel interpreted to be the Mio-Pliocene conglomerate. Note the caliche horizon at the top of the outcrop.

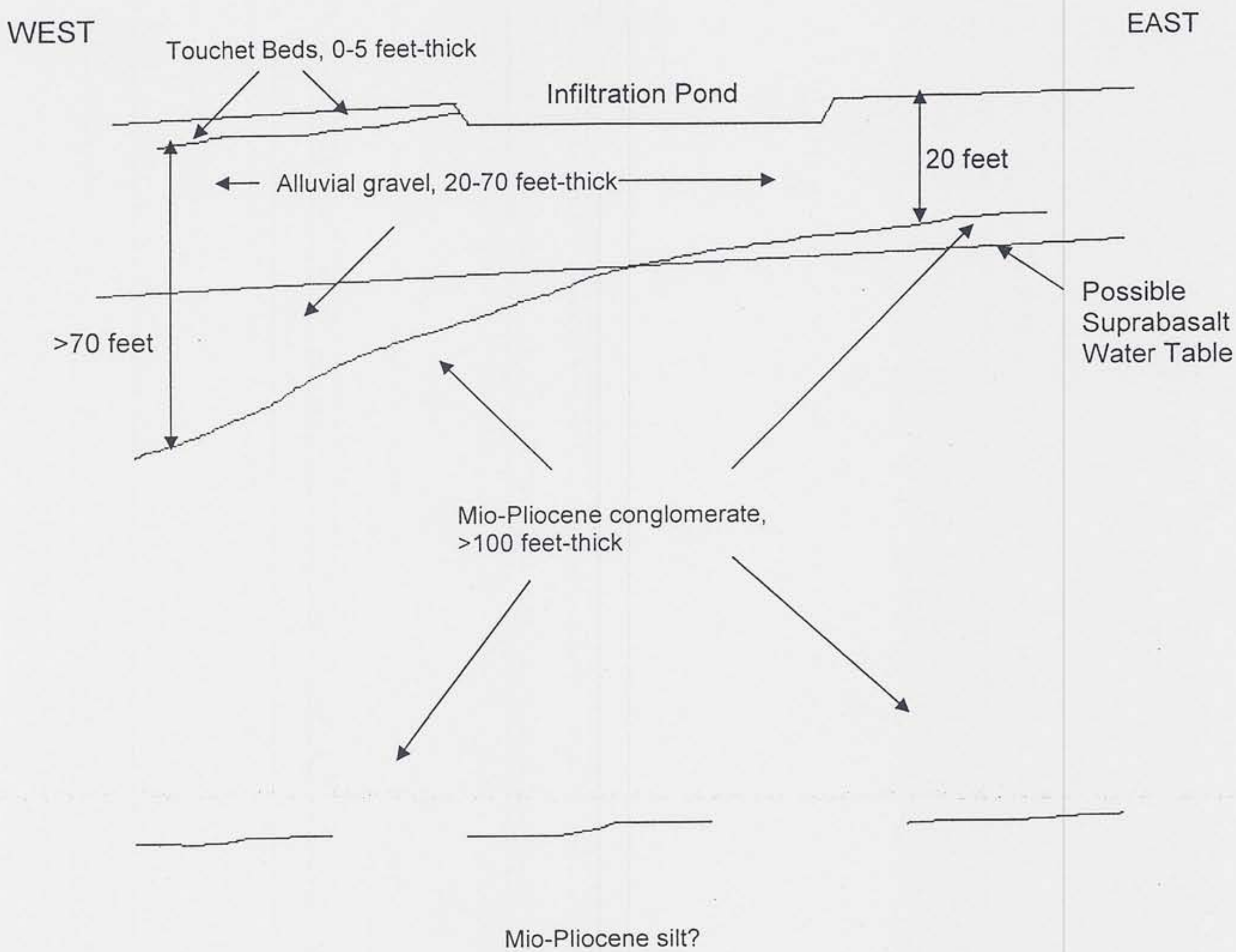

Figure 5. Schematic hydrogeologic cross-section of test site area.

Attachment 6

Well Data Table

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	first water	static water
U3885	5/35-1	1850613.13455	1536246.45310		990	NP	0	990	10	NP	0		
U3899	5/35-1	1852276.92661	1536137.15289		1020	1020	12	1008	16	992	175		
U3909	5/35-1	1848682.16421	1534619.09445		1000	1000	3	NP	0	997	157		
U3914	5/35-1	1850479.54541	1536720.08734		1000	NP	0	1000	3	997	157		
U3918	5/35-2	1843472.18763	1535068.43975		961	961	6	955	24	931	40		
U3922	5/35-2	1843314.30956	1536234.30863		948	NP	0	948	48	900	22		
U3930	5/35-2	1846751.19387	1533404.64769		1000	NP	0		0	1000	43		
U3934	5/35-2	1847783.47361	1534740.53912		1000	NP	0	1000	3	997	157		
U3937	5/35-2	1843824.37719	1536683.65393		948	NP	0	948	55	893	40		
U3940	5/35-3	1843071.42021	1535384.19590		958	958	2	956	10	946	120		
U3941	5/35-3	1842500.63023	1535882.11907		939	NP	0	939	34	905			
U3950	5/35-4				909	909	10	NP	0		0		
U3951	5/35-4	1834716.02653	1535177.73996		952	952	20	NP	0	932	132		
U3955	5/35-5	1828060.85832	1535869.97461		873	873	8	NP	0	NP	0		
U3962	5/35-12	1850503.83434	1529931.32998		1066	NP	0	1066	28	1038	42		
U3963	5/35-12	1852094.75959	1529554.85148		1068	NP	0	1068	21	1047	27		
U3965	5/35-12	1851961.17045	1527186.68031		1115	NP	0	NP	0	1115	41		
U4187	6/35-13	1852517.79188	1553631.25840	1987	808	808	9	NP	0	799	>141	14	17
U4195	6/35-13	1848225.17240	1554922.84501		810	810	34	NP	0	776	>162	39	29
U4202	6/35-13	1849184.58533	1555870.11348		813	813	44	769	36	740			
U4204	6/35-13	1850161.76518	1553825.56988	1961	818	818	37	NP	0	781	>85		40
U4206	6/35-13	1853319.32674	1553133.33523		817	?	?	?	?	?	?		
U4217	6/35-14	1844678.98787	1553441.21997	1985	800	NP	0	800	32	768	>68	92	24
U4219	6/35-14	1847508.64881	1553161.89721	1983	820	820	9	811	0	811	>114	23	7.5
U4224	6/35-14	1844934.02169	1554582.79992	1975	789	789	18	771	33	738	>74	24	34
U4249	6/35-15	1841686.37895	1555266.71729		768	NP	0	768	10	758			
U4256	6/35-16	1836304.48646	1554187.46077		762	762	14	748	4	744			
U4258	6/35-16	1837283.01236	1552921.13313	1967	800	800	46	NP	0	754	>104	62	62
U4273	6/35-17	1830490.89136	1552906.74304	1960	730	730	3.5	NP	0	726.5	>196		42
U4275	6/35-17	1828677.74041	1553223.32495	1959	725	725	25	700	15	685	>217		40
U4279	6/35-17	1831857.94961	1554316.97155	1954	730	730	9	NP	0	721	355		
U4282	6/35-18	1821842.44915	1553352.83573	1972	665	665	21	NP	0	644	>82	46	38
U4289	6/35-19	1826461.66703	1547568.02081	1984	723	723	46	NP	0	677	91	46	13
U4293	6/35-19	1824605.34583	1550330.91749	1977	698	698	3	695	57	638	>97	28	30
U4304	6/35-19	1825785.33295	1548632.88724	1957	710	710	12	NP	0	698	>88		18
U4305	6/35-19	1825137.77904	1549510.68254	1958	705	705	18	687	62	625	>120		50
U4317	6/35-20	1830318.21032	1547683.14151	1988	761	761	20	741	21	720	>64	80	38
U4319	6/35-21	1835570.59202	1550489.20845	1987	770	NP	0	770	22	748	>103	51	46
U4327	6/35-21	1832850.86561	1549194.10063	1968	761	761	6	NP	0	755	>104		31
U4329	6/35-21	1833455.24925	1549150.93037		767	767	17	NP	0	750	108		

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	first water	static water
U4332	6/35-21	1837527.64384	1552244.79904	1965	780	780	22	758	43	715	>98		32.5
U4345	6/35-21	1835081.32907	1547467.29020		797	797	9	788	5	783	354		
U4347	6/35-21	1833210.61778	1547668.75142	1951	785	785	20	NP	0	765	>169		22
U4348	6/35-21	1837412.52314	1550618.71923	1943	782	782	3	779	15	764	>153	40	44
U4367	6/35-22	1839168.11374	1549021.41958	1974	819	819	12	NP	0	807	330	21	26
U4369	6/35-22	1842636.12468	1552546.99087	1969	810	810	27	783	9	774	>82	47?	54
U4370	6/35-22	1840952.48451	1549194.10063		840	840	47	NP	0	793	37		
U4381	6/35-22	1841038.82504	1549597.02306		840	840	7	833	31	802	240		
U4404	6/35-23	1843360.86335	1549077.08306		840	840	35	805	15	790			
U4406	6/35-23	1847210.65956	1552125.34442	1979	815	815	4	811	36	775	>80	75	20
U4412	6/35-23	1843482.30802	1548154.10353	1975	840	840	9	831	36	795	>87	12	30
U4416	6/35-23	1845206.82242	1548105.52566		850	850	8	842	25	817	226		
U4452	6/35-23	1847635.71593	1547692.61376	1946	850	850	8	NP	0	842	144	NR	NR
U4461	6/35-24	1850683.97728	1550728.73065		846	846	65	NP	0	781			
U4462	6/35-24	1848631.56226	1549660.01751	1987	840	840	18	822	17	805	>111	65	29
U4464	6/35-24	1848340.09504	1548700.60457	1985	850	850	5	845	7	838	>100	5	16
U4469	6/35-24	1849748.85328	1548239.11480	1982	856	856	5	851	18	833	>82	15	10
U4471	6/35-24	1852663.52549	1552526.11185		813	813	34	NP	0	779			
U4478	6/35-24	1850356.07666	1549380.69475	1977	845	845	39	806	>61			39	32
U4479	6/35-24	1851291.20066	1551117.35361	1977	840	840	28	812	52	760	>25	28	27
U4482	6/35-24	1851145.46705	1552441.10058	1977	839	839	25	814	>80			43	29
U4506	6/35-24	1848908.86094	1552726.49556		843	843	49	NP	0	794			
U4538	6/35-25	1852420.63614	1544535.05220	1979	890	NP	0	890	100	790	90	65	27
U4590	6/35-25	1851764.83489	1547291.84634	1934	859	NP	0	859	27	832	63	NR	NR
U4599	6/35-25	1852967.13718	1543818.52862	1926	892	892	6	NP	0	886	>26	NR	6
U4610	6/35-25	1852262.75806	1546490.31148	pre-1917	870	870	20	NP	0	850	>155	NR	NR
U4642	6/35-26	1848157.92803	1542482.63719	1981	917	NP	0	917	7	910	>98	65	34
U4643	6/35-26	1843652.33057	1545324.44259	1977	865	NP	0	865	35	830	>67	38	28
U4644	6/35-26	1845000.36647	1542919.83802	1977	905	NP	0	905	24	881	>81	45	33
U4648	6/35-26	1845886.91260	1542519.07059	1974	908	NP	0	908	12	896	>103	61	49
U4653	6/35-26	1844077.38693	1542931.98249	1968	895	NP	0	895	20	875	>130	NR	54
U4690	6/35-26	1844878.92179	1545579.47641	1925	870	870	8	862	24	838	>68	NR	NR
U4691	6/35-26	1845291.83369	1546332.43340		863	863	10	NP	0	853			
U4707	6/35-27	1839687.61171	1545304.42671	1988	845	NP	0	845	42	803	>78	70	16
U4712	6/35-27	1840999.21421	1544041.40209	1982	865	NP	0	865	12	853	>138	49	34
U4714	6/35-27	1838133.11986	1545231.55991	1981	830	830	11	819	31	788	>113	44	32
U4715	6/35-27	1839204.86913	1547028.94110	1981	830	830	12	818	18	800	>125	45	20
U4718	6/35-27	1842760.16200	1542292.59876	1977	893	NP	0	893	41	852	>159	80	50
U4730	6/35-27	1841242.10356	1542183.29855		882	882	50	NP	0	832	330		
U4731	6/35-27	1842663.00626	1546518.87347		850	850	30	NP	0	820			

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	[illegible] water	static water
U4759	6/35-28	1834534.50577	1543941.71892	1981	910	NP	0	910	46	864	>79	NR	14
U4762	6/35-28			1978	800	800	14	NP	0	786	>301	180	93
U4763	6/35-28	1836563.50802	1544344.64135	1978	830	830	5	NP	0	830	>118	35	23
U4764	6/35-28			1977	805	805	12	793	43	750	>51	24	12
U4774	6/35-28	1837498.86367	1545006.58535	1971	832	832	14	NP	0	818	>90	34?	23
U4775	6/35-28	1837426.91323	1542358.80936		846	846	12	NP	0	834	130		
U4785	6/35-34	1843119.99808	1538335.30152	1908	930	930	2	NP	0	928	>98	NR	20
U4797	6/35-29	1829138.22319	1545193.65648	1988	750	NP	0	750	10	740	>330	70	67
U4799	6/35-29	1827598.48390	1542258.07875	1978	750	750	11	739	83	656	>67	90	62
U4801	6/35-29	1828893.59172	1544934.63491	1976	750	NP	0	NP	0	750	>110	43	31
U4806	6/35-29	1828461.88911	1545222.43665	1954	745	NP	0	NP	0	745	>109	NR	20
U4808	6/35-29	1827497.75329	1546301.69317		731	731	11	720	46	674			
U4819	6/35-30	1823900.23157	1543941.71892	1985	710	710	6	704	11	693	>83	60	39
U4824	6/35-30	1821971.95993	1543812.20814	1977	692	NP	0	692	77	615	>28	31	26
U4828	6/35-30	1822418.05262	1545064.14569	1971	690	690	3	687	15	672	>90	NR	32
U4839	6/35-30	1821871.22932	1545121.70604	1955	685	NP	0	685	36	649	>101	NR	40
U4840	6/35-30	1823813.89105	1546431.20395	1955	702	702	5	697	30	667	>205	35(?)	14
U4848	6/35-31	1825166.55922	1541236.38259	1966	761	761	15	746	30	716	>60	NR	30
U4853	6/35-32	1830635.48544	1537181.57710		856	856	12	NP	0	NP	0		
U4856	6/35-32	1827656.04425	1541610.52485	1981	762	762	16	746	17	729	>87	16	16
U4857	6/35-32	1829190.29380	1539853.35996		833	833	8	825	4	NP	0		
U4858	6/35-32	1830963.38606	1538845.36916	1979	840	840	12	828	23(?)	805?	>146	29	20
U4859	6/35-32	1832445.01110	1538918.23596	1970	815	815	6	NP	0	809	>132	30?	19
U4864	6/35-32				833	833	32	NP	0	801	193		
U4873	6/35-33	1837314.94259	1537655.21134	3/82	876	876	3	873	31	842	>171	110	67
U4876	6/35-34	1841771.96218	1540314.84973	1908	903	NP	0	903	44	859	>56	NR	42
U4879	6/35-33	1834594.58186	1538602.47981	3/80	837	837	2	835	8	827	265	125	70
U4880	6/35-33	1832462.33326	1541912.71667	12/79	804	804	18	NP	0	786	>112	65	16
U4881	6/35-33	1832566.45578	1539270.42552	10/79	817	817	3	814	38	776	>95	60	32
U4882	6/35-33	1835815.22350	1541092.48172	8/79	842	NP	0	842	35	807	>150	173	60
U4888	6/35-33	1833138.66734	1540991.75111	12/71	815	815	6	809	2	807	>97	24	24
U4897	6/35-33	1837266.36472	1538578.19087	4/53	870	870	3	867	29	838	>118		52
U4898	6/35-33	1833793.04700	1538371.73492	-/16	834	834	3	NP	0	831	>87		35
U4903	6/35-33	1835153.22736	1540630.60589	-/26	834	834	10	824	>65				
U4906	6/35-33	1832894.35640	1539270.42552	-/22	819	819	3	NP	0	816	>47		6
U4907	6/35-33	1833800.61134	1540991.75111	<-/20	821	821	10	811	>30				20
U4912	6/35-33	1833793.04700	1538031.68983	1916	835	NP	0	835	3	832	>137		
U4914	6/35-33	1837825.01022	1537400.17752	-/15	882	882	2	880	28	852	>60		20
U4917	6/35-33	1835201.80523	1539306.85892	1910	835	NP	0	835	95	740	>21		32
U4924	6/35-34	1839585.95802	1539233.99212	1988	893	NP	0	893	18	875	72	50	111

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	first water	static water
U4929	6/35-34	1842889.25319	1537448.75539	1982	925	NP	0	925	38	887	>214	148	110
U4936	6/35-34	1842743.51958	1538906.09149	1978	924	NP	0	924	120	804	>42	45	15
U4938	6/35-34	1843083.56467	1538019.54536	1977	932	NP	0	932	41	891	>101	35	36
U4939	6/35-34	1841152.59433	1537132.99923	1977	922	NP	0	922	70	852	>50	80	47
U4946	6/35-34	1839950.29205	1539768.34869	1973	891	NP	0	NP	0	891	>125	117	45
U4948	6/35-34	1842415.61896	1539962.66017	1971	895	NP	0	895	40(?)	855?	>88	61(?)	41
U4954	6/35-34	1840011.01438	1537157.28817		912	NP	0	912	20	892	169		
U4970	6/35-34	1842294.17428	1538311.01258	1960	923	NP	0	923	22	901	141	NR	40
U4971	6/35-34	1839646.68036	1537339.45518	1959	905	NP	0	905	20	885	>92	40	35
U4973	6/35-34	1842901.39766	1540144.82718	1959	915	NP	0	NP	0	915	>121	NR	23
U4975	6/35-34	1839525.23568	1536938.68775	1956	905	NP	0	905	26	879	>84	10	19
U5	6/35-30	1821986.35002	1546632.66516	1987	681	681	4	677	6	671	>111	40	39
U50011	6/35-13	1848856.68471	1553599.09805	1995	810	810	44	NP	0	766	>146	181	
U50016	6/35-33	1833222.25702	1537278.73284	11/95	865	865	29	836	10	826	>202	41	100
U50068	6/35-31	1822668.71473	1539671.19295	1996	738	738	42	696	>126?			90	60
U50069	5/35-12	1853357.78422	1531534.39969		1163	1163	11	NP	0	1152	115		
U5021	6/35-34	1838626.54508	1537436.61092	<1900	890	NP	0	890	1.5	888	>91		20
U5025	6/35-34	1838165.05532	1539404.01466	?	875	NP	0	875	3	872	>42		30
U50250	6/36-18	1854145.15053	1555865.84042		835	835	63	NP	0	772	144		
U5027	6/35-35	1843397.29675	1541183.17916		909	909	18	891	6		0		
U5039	6/35-35	1845063.11288	1537582.34453	1983	952	NP	0	952	98	854	>92	103	86
U5042	6/35-35	1845718.91413	1540132.68272	1982	933	NP	0	NP	0	933	226	80	70
U5043	6/35-35	1847625.59554	1537618.77793	1982	970	NP	0	970	34	936	>119	46	34
U5044	6/35-35	1845243.25582	1541462.50191	1982	918	NP	0	918	17	901	>85	75	60
U50473	6/35-36	1851706.13663	1539707.62635	1997	952	NP	0	952	18	934	>87	NR	38
U50478	6/35-34	1837837.15469	1539112.54744		875	NP	0	875	27	848	216		
U5048	6/35-35	1843970.11080	1536975.12115		947	NP	0	NP	0	947			
U5049	6/35-35	1845731.05860	1538869.65809	1981	947	NP	0	947	152 ?			114	50
U5050	6/35-35	1846069.07961	1541243.90150		922	NP	0	922	12	910			
U50516	5/35-4	1834752.45994	1536550.06479		921	921	55	NP	0	866	71		
U5052	6/35-35	1846567.00278	1541644.66893	1981	920	NP	0	920	30	890	>247	50	34
U5053	6/35-35	1843761.63078	1541608.23552	1979	908	NP	0	908	80	828	>20	80	45
U5057	6/35-35	1845158.24455	1541729.68020	1977	915	NP	0	915	30	885	>132	46	36
U50577	6/35-32	1831194.13094	1539100.40297		820	820	12	808	17	791	385		
U5058	6/35-35	1845706.76966	1537618.77793		958	NP	0	958	26	932	119		
U5059	6/35-35	1846629.74920	1540557.73908	1977	935	NP	0	935	27	908	>98	45	34
U50804	6/35-34			1997	930	NP	0	930	86(?)	844?	>96?	46	43
U5091	6/35-35			1960	944	NP	0	944	>167?			NR	60
U50953	6/35-34	1841529.07283	1538772.50235		905	NP	0	905	30	875	220		
U51035	6/35-13	1851655.53468	1554359.92645	1998	802	802	13	789	25	764	>120	14	5.5

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	first water	static water
U51045	6/35-21	1834951.81829	1551438.95418		761	NP	0	NP	0	761			
U5121	6/35-36	1849908.75543	1540436.29440	1987	944	NP	0	944	40	904	>80	35	50
U5126	6/35-36	1848801.58481	1541365.34617	1985	931	NP	0	931	60	870	>41	55	34
U5128	6/35-36	1848789.44034	1541790.40254	1985	924	NP	0	924	55	869	>47	78	36
U5132	6/35-36	1849495.84354	1537460.89986		981	NP	0	981	10	971			
U5148	6/35-36	1851086.76879	1537485.18879	1961	980	NP	0	980	20	960	>115	NR	30
U51581	5/35-3				954	954	2	952	83	869	15		
U5172	6/36-19	1855505.33090	1550813.74192		843	843	28		0	815			
U51921	6/35-22	1839499.08574	1547884.60272	1998	820	820	48	NP	0	772	>110	52	69'
U5200	6/36-30	1853962.98352	1544486.47433	1978	900	NP	0	900	47	853	118	85	28
U5211	6/36-30	1855651.06451	1545846.65470		889	889	6	NP	0	883	145		
U5227	6/36-31	1856466.76791	1539792.63762		970	970	26	NP	0	944	233		
U5230	6/36-31	1854147.17461	1537983.11196		974		0	NP	0	974	467		
U5238	6/36-31	1856187.44516	1539780.49316		968	968	20	NP	0	948	180		
U52581	6/35-15	1842434.66346	1555827.93068	1998	770	770	5	765	19	746	>91	24	30
U5268	6/35-28	1835757.66315	1546963.63716	1989	810	810	9	801	34	767	>77	98	26
U5316	6/35-35	1845075.25735	1540569.88355	1989	930	NP	0	930	36	894	>149	60	43
U53413	6/35-15	1840707.85304	1553424.78617		781	NP	0	NP	0	781			
U53462	6/35-34			1999	905	NP	0	905	71(?)	834	>122?	41	33
U53471	6/35-17	1828720.91067	1555108.42633	1999	695	695	8	687	18	669	>123	55	43
U5358	6/35-36	1850613.13455	1537898.10069	1990	980	NP	0	980	38	942	>65	80	35
U53647	6/35-36	1851861.99063	1541875.41381	1999	920	920	5	915	60	855	>55	46	34
U53762	6/35-36	1853078.46146	1537788.80048	2000	980	980	5	975	68	907	>60	45	19
U53769	6/35-34	1839828.84737	1539962.66017	2000	890	890	2	888	66	822	>182	NR	49
U53863	6/36-19	1854764.51838	1547814.05844		859	859	6		0	853			
U53932	6/35-30	1822475.61297	1546647.05525	2000	685	NP	0	685	25(?)	660	>101	75	47
U53996	6/35-27	1842335.10564	1544405.73611	2000	870	NP	0	870	65	805	>60	40	34
U54050	6/35-36	1848487.85273	1537995.25643		964	964	2	NP	0	962			
U54063	6/35-26	1845413.27836	1547255.41293		859	859	10	849	66	783			
U5408	5/35-12	1851779.00344	1529907.04104		1063	NP	0	1063	26	1037	8		
U54134	6/35-26	1847149.93722	1545713.06555		879	879	4	NP	0	875	260		
U54145	6/35-36	1849046.49824	1538553.90193	2001	965	NP	0	965	51	914	>71	NR	47
U54341	6/35-34	1838506.16975	1541337.11320		863	NP	0	863	2	861	349		
U54464	6/35-35	1843277.87615	1539999.09357		918	NP	0	918	37	881	202		
U5464	6/35-28	1834361.82473	1542056.61754		822	822	9	NP	0	813	295		
U5477	6/35-35			1990	951	NP	0	951	95	856	>77	35	30
U5496	6/35-28	1835685.71272	1544272.69092		820	820	9	NP	0	811	387		
U5512	6/35-34	1838520.55983	1541135.65198	7/90	865	NP	0	865	34	831	>146	NR	42
U5530	5/35-3	1839391.64654	1534813.40593		920	920	18	NP	0	902	90		
U5625	6/35-14	1843173.07390	1554145.59909		781	781	5	776	36	740			

Well ID	T/R-sec	easting	northing	year drilled	Surf elev	Touchet top	Touchet isopach	alluvial gravel top	alluvial gravel isopach	Mio-Pliocene conglomerate top	Mio-Pliocene conglomerate isopach	first water	static water
U5657	6/35-27	1841035.64761	1545365.14905	1992	852	852	4	848	11	837	>289	55	34
U5670	6/35-34				909	NP	0	909	8	901	187		
U5743	6/35-30	1826101.91486	1546287.30308	1992	723	723	12	711	25	686	>148	55	52
U5841	6/35-21	1834635.23638	1550618.71923	1995	765	765	3	762	65	697	>147	42	36
U5958	6/35-25	1849202.35224	1544280.01838		899	NP	0	899	24	875			
U5965	6/35-36	1848548.57507	1540812.77290	1993	938	NP	0	938	23	915	>82	NR	34
U6017	6/35-13	1852505.64741	1554444.93772		813	813	44	NP	0	769			
U6053	6/35-34	1838225.77765	1538881.80256		879	NP	0	879	9	870	260		
U6192	6/35-20	1831512.58753	1552417.48009	1978	738	738	16	722	10	712	324	16	13
U6194	6/35-20	1829109.44302	1551913.82705	1955	745	745	67	NP	0	678	>208		68
U6196	6/35-20	1831095.27501	1549942.38514	1976	770	770	46	NP	0	724	>79	68	42
U6208	6/35-21	1837513.25375	1548733.61785	1978	797	979	7	790	63	727	>80	50	59
U6217	6/35-33	1832991.51214	1539853.35996	8/94	816	NP	0	816	16	800	>186	68	50
U6281	6/35-26	1843202.98527	1543964.26223	1994	878	NP	0	878	16	862	>94	55	40
U6342	6/35-15	1839945.17843	1554504.04268	1995	765	NP	0	765	35	730	>67		30
U6355	6/35-34	1838614.40062	1538651.05768		886	NP	0	NP	0	886	243		
U6377	6/35-33	1835138.88942	1541293.94293	6/95	835	835	12	823	28	795	>52	55	32
U6405	6/35-29	1831253.56596	1546272.91299	1995	768	768	10	758	54(?)	704?	>59?	25	55
U6441	6/35-26	1846117.65748	1545275.86472	1981	878	NP	0	878	15	863	>85	65	36
U6443	6/35-27	1840379.84636	1542183.29855	1981	865	NP	0	865	30	835	>140	60	36
U6445	6/35-29	1830505.28145	1545193.65648	1981	765	NP	0	765	27	738	>116	47	43
U6447	6/35-30	1823727.55053	1544949.02500	1982	703	NP	0	703	24	679	>96	60	18
U6449	6/35-30	1823612.42983	1546186.57247	1986	698	698	2	696	33	663	>67	NR	54
U6466	6/35-35	1838772.27869	1537120.85476		938	938	3	935	27	908			
U6468	6/35-35	1843581.48784	1537643.06687	1966	951	NP	0	NP	0	951	69	NR	73
U6475	6/35-36	1851026.04645	1540399.86100		939	939	23	NP	0	916	141		
U6509	5/35-1	1850030.20011	1534971.28401		1004	NP	0	1004	33	971	62		

Attachment 7

Test and Monitoring Plan

PRELIMINARY CHARACTERIZATION, MONITORING, AND TESTING PLAN, HUDSON BAY DITCH SHALLOW AQUIFER RECHARGE PROJECT

Introduction

Surface water and shallow groundwater in the Walla Walla Basin (the Basin) form an interconnected system. In some areas, especially upstream areas where streams leave the mountains and highlands surrounding the Basin to flow out onto the Basin floor, streams historically probably branched out onto the Basin floor and some of the water they carried seeped into the ground, recharging the shallow groundwater system. This shallow groundwater, recharged near the edge of the Basin, formed the main source of clean, cool groundwater found further down basin where it returned to the surface via springs and base flow to the Walla Walla River. Over the past 100 or more years this system has been modified both as a result of efforts to increase water supply for human use and to control flooding.

Shallow aquifer recharge is being explored in the Basin in large part to restore some fraction of the natural historical shallow aquifer recharge that has been lost, in part, because of modifications to surface water drainages in the Basin. These modifications have benefited the economic and social values of the Basin, but at some cost to natural habitat. It is hoped that shallow aquifer recharge projects, by mimicking natural historical shallow aquifer recharge that occurred in the Basin, will directly benefit habitat in streams that were in part maintained by natural spring and groundwater discharge.

The Walla Walla Basin Watershed Council (WWBWC), in cooperation with the Hudson Bay Improvement District (HBID), has proposed to test shallow aquifer recharge at a site located adjacent to the Hudson Bay Canal in section 33, T6N, R35E. At the test site a series of three infiltration ponds will be built. Water will be supplied to these ponds via a diversion from the canal. Recharge activities are proposed for winter and spring months when the Walla Walla River (the source of water for the canal) displays peak annual flows. The proposed shallow aquifer recharge testing will be done under an ASR Testing Limited License granted by Oregon Water Resources Department (OWRD) (OAR 690-350-0020).

The Limited License Application requires several supporting documents be attached (690-350-0020 (3)(b)), including (but not limited to) those describing proposed testing, groundwater conditions (including hydrogeologic conditions and groundwater quality), and source water quality. Some of this information is reported in the 3 July 2003 hydrogeologic assessment report. Information not included in the assessment report, but still needed for the Application, will be collected during proposed site-specific hydrogeologic characterization, monitoring, and testing. Preliminary characterization, monitoring, and testing plans are described here. These, especially the monitoring and testing plans, will be modified as information is collected.

Preliminary Test Site Specific Hydrogeologic Characterization

Site-specific hydrogeologic characterization is designed to identify and define local conditions which provide a technical basis for designing the monitoring which will be used to evaluate testing. For this project a number of characterization needs are outlined in the 3 July 2003 hydrogeologic assessment letter report. These needs include determining the physical properties of the geologic units underlying the test site, investigating the presence of a possible semi-confined aquifer in the upper part of the suprabasalt aquifer system, identifying aquifer hydraulic properties, and establishing suprabasalt aquifer baseline conditions, including seasonal variation, for groundwater depth, flow direction, and quality. These, and other site characterization issues, will be addressed using test site-specific hydrogeologic characterization data collected predominantly using:

1. Test pits, boreholes, and wells constructed for the direct observation of subsurface conditions,

2. Infiltration tests (constant and falling head) designed to evaluate spatial variability at a site both laterally and vertically (note, the water source for this activity may require a temporary permit),

3. Aquifer testing and water level measurements to evaluate baseline aquifer physical conditions before testing,

4. Surface and ground water quality data collected to evaluate the affect (if any) of test site operation on area groundwater quality,

5. Well and canal records describing water use in the project area, and

6. Water flow metering at the test site that indicates surface water in-flow and out-flow during testing.

At this time, geophysical investigations are not being considered because of the lack of subsurface control and ground truth data that could be used to constrain geophysical interpretations. The following sections describe proposed soils, geologic, hydrogeologic, surface water, and water quality characterization for this project.

<u>Soils</u>

The nature and extent of surface soils effect how fast water can infiltrate into the ground. However, the infiltration ponds proposed at the test site will be excavated through the surface soil layer. Therefore, surface soil conditions and properties are largely irrelevant to the project except in as far as the amount of soil at the site controls the amount of excavation needed for the infiltration ponds. The proposed characterization work will simply look at surface soils to the extent necessary to determine how much soil will probably need to be removed for infiltration pond construction.

<u>Geology</u>

Geologic features control the physical characteristics of aquifer hosting materials, and therefore the distribution and movement of groundwater through an aquifer. Understanding the nature and occurrence of these features, both regionally and locally, provide constraints on testing, data interpretation, monitoring, mitigation, and final design. The objective of geologic characterization is to develop a three dimensional physical framework that describes the materials hosting the vadose zone and groundwater at the test site. Within this framework, or conceptual model, the nature and distribution of those factors thought to control groundwater movement and distribution will be evaluated.

Site-specific geologic characterization will be accomplished largely through the analysis of data collected during the drilling of several proposed boreholes at the site and comparison of that data to information collected during the preparation of the hydrogeologic assessment report. A minimum of three boreholes are proposed for the immediate vicinity of the test site. One of these boreholes will be located on the inferred up-gradient side of the test site, two will be located on the inferred down-gradient side. In the assessment report we also recommend that at least one more down gradient well be placed near the test site. In addition, we recommend the placement of several additional boreholes located more distally from the test site in both the inferred up- and down-gradient directions. Subsurface hydrogeologic conditions will be interpreted via drilling cuttings and spilt-spoon sample logging.

The project hydrogeologic assessment identified work needed to complete site-specific hydrogeologic characterization. Hydrogeologic characterization targets, and the rational for them, are described below.

- It is likely that the uppermost, unconfined part of the shallow aquifer system, is hosted by predominantly uncemented alluvial gravel beneath the test site. However, it is not clear from the available data how deep the alluvial gravels extend and what their properties are beneath the test site. Identifying the three-dimensional extent of these strata is critical to the proposed testing because water probably will move more rapidly through these uncemented strata, both downwards and laterally, then in the deeper, more cemented Mio-Pliocene conglomerate that comprises the majority of the shallow aquifer system in the area.

- Area data indicates that, if present, the unconfined part of the shallow aquifer system at the site may be relatively thin and underlain by a semi-confined zone at depths of less than 75 feet bgs. Characterization will identify if this semi-confined zone is actually present, and if found, the nature of the confining layer separating it from the overlying unconfined zone and the basic hydrologic properties of the semi-confined zone. Knowing the nature and extent of the confined aquifer underlying the site is critical in evaluating if the proposed recharge will affect this deeper aquifer. If data collected indicates that the project could potentially affect this deeper aquifer, monitoring will need to be designed to not only assess shallower unconfined aquifer impacts but deeper confined aquifer impacts as well.

- The nature and distribution of the confining layer atop the confined aquifer should be identified in order to support evaluation of the thickness and distribution of the unconfined aquifer (if present). If the unconfined aquifer is absent, or only present seasonally, we will still need to identify the nature and extent of the confining layer because, just as it inhibits upward movement of groundwater, it will restrict the downward movement of recharge water. Knowing where the confining layer is will provide information on where recharge water collecting on top of it will spread to.

- Mapping for the assessment identified a potential depression in the top of the older Mio-Pliocene conglomerate below the western end, and west of, the test site. The depth, shape, and orientation of this feature will need to be evaluated because it will effect how the aquifer(s) underlying the test site respond to the testing. If an unconfined aquifer indeed underlies the site, this depression may act as a "reservoir" for water introduced into this aquifer. Alternatively, it may serve as a recharge pathway, hydrologically connecting the upper, unconfined part of the suprabasalt aquifer system with deeper, confined parts of the aquifer system.

The assessment did not provide any site-specific geologic properties data for any of the geologic units hosting the vadose zone and upper part of the suprabasalt aquifer underlying the test site.

Hydrogeology

Piezometers (observation wells) will be constructed in at least three of the borings drilled for geologic characterization. If additional geologic characterization boreholes are drilled (either close to or more distal from the test site) we also recommend that at least three of these be converted to observation wells. All but one of the boreholes converted to monitoring wells should be completed as 2-inch observation wells that fully penetrate the unconfined aquifer (if present) or above the confining layer (if unconfined aquifer not present). At least one of the geologic characterization boreholes should be of sufficient size to accommodate a 4-inch diameter well which will be used for aquifer testing.

Test site-specific hydrogeologic work would be done, in large part, concurrently with the site-specific geology work. The hydrogeologic assessment concluded that the following information must be collected for the uppermost part of the suprabasalt system at the test site:

- Depth, thickness, and lateral and vertical extent of the vadose zone and the uppermost aquifer(s) underlying a site.
- Nature and effect of perching layers (if any) in the vadose zone.
- Aquifer and vadose zone physical and hydrologic properties - including, grain size, matrix content, induration, hydraulic conductivity, transmissivity, porosity
- Groundwater flow direction and velocity, including both spatial and temporal variation
- Anthropomorphic effects, primarily changes in groundwater pumping, surface water (including canals), and irrigation activities.

Ideally, several months to several years of baseline hydrogeologic data should be collected prior to testing so that an adequate site background condition can be established against which test data can be compared to evaluate test success. Water level data will be collected periodically, with the sampling frequency initially being small, later decreasing as testing progresses and more is learned about water level variation in the target aquifer.

For characterization it is important to build monitoring wells in such a way as to provide means for accurately measuring the target aquifer. Well construction considerations are listed below:

- Most project wells will probably be 2 inch-diameter piezometer type installations. These should be built to ensure that they are monitoring the anticipated aquifer targets, and we recommend building to well construction standards and avoiding cost cutting measures designed to get more/cheaper wells (these commonly result in poorly built wells unsuitable for collection of the high quality data we feel is necessary to support the project).
- For aquifer testing, a 4 inch-diameter well is the minimum recommended diameter and at least one should be built.

- The minimum number of wells at the test site is 3, one up gradient and 2 down gradient. We do not recommend this. At a minimum we recommend 4 wells, one up and three down gradient, with more eventually being built as the test progresses and potentially unanticipated changes in the groundwater system are identified. Most, if not all, of these wells would be built in geotechnical borings drilled for geologic characterization.

- In addition to the wells built near the test site, it seems likely that wells will eventually need to be built more distant from the site. The purpose of these wells would be to more accurately trace the down gradient migration of recharge water away from the test site. A minimum of 4 wells, 1 well up gradient and 3 wells down gradient is again recommended. These might include at least some previously built groundwater supply wells that would be available for use. However, these should only be used if construction details can be verified and if they are not being used as water supply wells. Access to offsite well drilling locations will need to be acquired from willing land owners. Many offsite wells used in characterization may be unused water supply wells from which data is collected upon which to base decisions for building new monitoring wells.

- Aquifer testing designed to collect aquifer hydraulic property data will be part of site characterization. During aquifer testing, the 2-inch observation wells will be monitored to observe the effects of testing on the surrounding aquifer. Aquifer testing would include an 8 hour step drawdown test to establish probable sustainable yields in the suprabasalt aquifer, followed by a 24 to 72 hour constant discharge test. Water level data collected during aquifer testing will be analyzed using standard analysis techniques.

Combining the interpretations developed in the completed hydrogeologic assessment with the drilling and testing data collected during site specific characterization, a conceptual model of Test Site hydrogeologic conditions will be prepared.

Surface Water

One of the main objectives of the project is to increase surface water quantity and improve its quality. To document that, surface water bodies that the project might influence need to be identified and monitoring points on them established and characterized (includes collection of baseline data). These locations will be used as monitoring locations during subsequent testing.

The hydrogeologic assessment identified three spring-feed streams that are those most likely to be effected by shallow aquifer recharge, Goodman Spring Branch, Johnson Creek, and Dugger Creek. During test-site specific characterization these streams will be examined and monitoring points identified. At these points stream conditions will be photographed and stream conditions documented prior to the initiation of testing. Documentation of pre-test background conditions will include the following parameters:

- Flow volume and discharge
- Water temperature
- Water quality
- Hydrophilic plants and habitat quality

Sampling frequency will be designed to collect enough data to demonstrate the range of conditions likely at the monitoring points so that site background conditions can be documented enough to provide an adequate baseline to measure test results against.

Water Quality

Both surface and groundwater quality at the test site, and at likely down-gradient discharge points, needs to be documented. There are several reasons for this, including:

- We do not want to introduce contaminated water into the shallow aquifer via recharge activities and violate antidegradation rules. We need to establish background water quality parameter concentrations and monitor source-water quality periodically during testing and operations.
- Certain source-water conditions (e.g., turbidity) have the potential to degrade or even "plug" the recharge system. From an operational standpoint, one would monitor for those conditions and halt test operations when the source-water exceeded those conditions.
- Up-gradient groundwater quality needs to be monitored so that the effects of recharge on water quality can be differentiated from those water quality conditions caused by recharge activities, including leaching of vadose zone constituents by recharge water.

Sampling Quality Assurance and Quality Control (QA/QC) protocols will need to be established and followed for characterization and later monitoring. The sampling QA/QC protocol will need to describe:

- Sampling equipment
- Measurement techniques for field parameters
- Decontamination procedures
- Well purging guidance for groundwater samples
- Sampling methods
- Chain of custody and sample handling procedures
- Record keeping
- QA/QC guidelines

Parameters to be tested for include TDS, pH, temp, nitrate-N, chloride, TKN, ...

Conclusion to Characterization

With the completion of site-specific characterization, final monitoring and test plans will be prepared. This monitoring and test plans will be based on the results of the characterization effort which includes the generation of a site conceptual groundwater flow model that describes probable aquifer conditions, suprabasalt aquifer water level(s) and groundwater flow direction(s) (including seasonal variations), and discharge points for recharge water.

Preliminary Site-Specific Surface Water and Groundwater Monitoring Plan

Monitoring for the proposed testing is designed to meet four basic objectives. These are to identify: (1) changes in the natural system caused by factors other than those related to testing, (2) changes in the natural system caused by the testing (track the test performance), (3) potential problems caused by the testing that may require termination of the test and/or mitigation actions, and (4) events that effect test operations, such as a freezing event. To meet these objectives, the results of site-specific characterization will be used to identify monitoring locations to track:

- Source water quality and volume coming onto the test site
- Up-gradient groundwater water quality
- Groundwater level changes migrating into the test area in order to provide the information needed to differentiate the effects of testing from other effects on the test site.
- Down-gradient groundwater quality and levels, both near and distal to the test site
- Surface water discharge and quality changes

Monitoring data collected at these points during testing will be evaluated against the established baseline to identify testing effects on the surrounding environment, differentiate those effects from others in the environment, and identify when changes in test operations appear necessary.

Four basic types of monitoring points are currently proposed, source water, test site groundwater, distal groundwater, and surface water (e.g., springs). Considerations for each are summarized below:

- Source water monitoring will be at the point of diversion onto the site. Sampling frequency will be periodic. For water quality, sampling frequency will be based on an analysis of characterization data that identifies when contaminants (if any) are likely to be present in the source water. The results of source water quality monitoring will be used to determine if modifications to test operations are warranted. The volume of water delivered to the test site and leaving the test site (via a return line to the Canal) also will be monitored to keep track of the volume of water that infiltrated into the ground via the ponds. During testing different sampling frequencies may be tried to identify those that are most effective.
- Site groundwater monitoring, consisting of water quality and level data, will be at monitoring wells established immediately adjacent to the test site to identify immediate quantity and quality impacts from testing. Up-gradient monitoring will be a part of this so that site impacts can be differentiated from offsite events. Sampling frequency will be determined from characterization data and modified as more is learned during testing.

- Distal groundwater monitoring, consisting of water quality and level data, will be at monitoring wells more distal from the test site. This monitoring will be used to identify longer term quantity and quality impacts from testing. This includes the formation and migration of a groundwater mound and recharge water plume at, and away from, the test site, towards intended and unintended receptors. Up-gradient monitoring will be a part of this so that testing effects can be differentiated from offsite events. Sampling frequency will be determined from characterization data and modified as more is learned during testing.

- Surface water monitoring, most likely in spring creeks, will be done to identify the effects of recharge on spring flow. This monitoring will include the collection of both water quality and flow parameters. As with groundwater monitoring, surface water monitoring will need up-gradient monitoring information so that effects unrelated to test site operations/testing can be differentiated from those due to testing. This monitoring will likely include a combination of flow volume and water quality.

Four basic elements are needed for the monitoring plan. These are summarized below and will be developed in greater detail following the collection of site-specific characterization data. The four basic monitoring plan elements are:

1. Identification of monitoring points and sampling frequency

2. Description of sampling procedures, including:

    a. Equipment to be used

    b. Water level measuring techniques

    c. Stream gauging techniques

    d. Sampling equipment decontamination

    e. Well Purging

    f. Field parameters to be collected at both surface and groundwater sites

    g. Sample collection methods at both surface and groundwater sites

    h. Chain of custody tracking

    i. Sample handling protocols

    j. Field record keeping

    k. QA/QC

3. Sampling point maintenance

4. Data Reporting and Analysis, including:

    a. Record keeping

b. Annual reporting, including review of previously collected data, reporting of unusual events, and guidelines for recommending changes to test operations as a result of data analysis

This monitoring plan outline will be expanded upon following the collection of site-specific hydrogeologic characterization data.

Preliminary Test Site Operation Plan

In addition to the monitoring plan, a test plan will need to be developed. The test plan should describe how the test site will be operated during testing. Elements included in the test plan will include: (1) site construction, (2) test operations, (3) mitigation activities, and (4) reporting. The test plan will be developed prior to the start of actual testing. However, completion of the plan is contingent on funding. Assuming funding for the project can be procured, construction planning elements would be completed in the Autumn of 2003.

The contents of each test plan element are outlined below:

1. Site construction information describes the site layout. Site construction planning will include:

    a. Test Site survey and layout

    b. Specifications for pits/basins/ponds used for infiltration

    c. Water supply design (including diversion from canals if appropriate)

    d. Monitoring points (both on and off site)

    e. Site access controls (fences, etc.)

2. Test Operations will describe how the site will be used during the test. The operations plan will also describe provisions for changing the test operation plan as new data and information is collected during the test. The test operation plan will include:

    a. Test timing, including timing of recharge and monitoring frequencies

    b. Quantities of water used

    c. Outside influences that effect test, including weather (probably freezing), river flooding, trip wires for identifying potential offsite impacts before they occur so they can be mitigated and or testing suspended to prevent worsening conditions

    d. Responsible parties for diversion and delivery of water, operation of test, monitoring, and data review

    e. Permissions required to access offsite monitoring points

3. Mitigation - As stated above, one of the objectives of monitoring is to identify likely unintended consequences of recharge before they occur. If the precursors to these

consequences, such as changing water quality detrimental to aquatic habitat or groundwater levels rising to close to the surface in areas where shallow groundwater is not desired, can be detected soon enough via monitoring, recharge activities will be modified and/or terminated to mitigate against these effects. The mitigation plan will describe what the undesirable consequences of the test are, how they will be detected, and how the testing will have to modified to mitigate against these undesirable effects.

4. Reporting - Data and observations collected during testing, including monitoring data, will be compiled into reports. The basic objective of these reports will be to describe what was done during the test, what was observed at the monitoring points, interpret the data collected, and recommend changes to testing, monitoring, and mitigation plans. We anticipate that these reports will be produced annually. However, in cases where monitoring reveals the presence of an undesired effect from testing, the operator will need to immediately report the monitoring information to WRD and implement any required mitigation actions. At the conclusion of testing a final report will be prepared that describes the project, data colleted during operation and monitoring, interpretations of who well the recharge project worked in achieving project goals, and recommendations for future operations.

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Northwest Region Portland Office
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October 30, 2008

Mr. Robert Bower
810 S. Main Street
Milton-Freewater, Oregon 97862

UIC Registration for: Infiltration recharge galleries at 84140 Prunedale Road, in Milton-Freewater.

Dear Mr. Bower:

Thank you for submitting a registration form for the Underground Injection Control (UIC) systems at your site. The following table shows your UIC identification number, combined with the injection system information you submitted. Generally, each facility is issued one UIC number; the various injection systems for that facility are then identified sequentially -1, -2, -3, etc. Please reference this number in future correspondence, and retain this letter, or a copy of it, on site, should your UIC systems be inspected.

UIC #	Type Code	Status	Location
13233-1	5R21	New infiltration gallery, natural backfill	southern
13233-2	5R21	New infiltration gallery, clean gravel backfill	south-central
13233-3	5R21	New infiltration gallery, Atlantis Rain Tank	north-central
13233-4	5R21	New infiltration gallery, Stormtech chambers	northern

Please note that you are required to do the following:

- Update registration information whenever a change of ownership, change of land use, modification, abandonment or closure of your injection system takes place. If ownership for your UIC systems changes, notify the next owner and DEQ about the registered injection system.
- Maintain and operate each injection system to protect groundwater resources.
- This authorization is for Walla Walla River recharge water only. It does not include runoff or leakage from a dumpster, loading dock, waste or material storage areas or from construction activities, wash water, process water, fueling areas or waste water discharges.
- Rule authorization will be revoked and a permit required if this site is found to be inside the delineated 2-year time of travel for a municipal well.

In the event a substance is spilled which may contaminate groundwater, contact the DEQ Eastern Region office (541) 388-6146, and call Oregon Emergency Management at (503) 378-6377 or (800) 452-0311.

Based on the information you have sent to DEQ, your injection system has qualified as rule authorized under OAR 340-44. Please check with your local government to see if they have additional requirements.

If you have any questions about this letter, please contact me at (503) 229-6371, or toll free inside Oregon at 1-800-452-4011.

Sincerely,

David Cole

David Cole, UIC Hydrogeologist
Water Quality Division

Cc: Eric Nigg, DEQ-ER
Phil Richerson, DEQ-ER

www.wwbwc.org
Walla Walla Basin Watershed Council
541-938-2170 or 7086 P.O.Box 68, Milton-Freewater, OR 97862

WWBWC-HBDIC's Infiltration Gallery Testing Project

In support of

UIC Permit Application to ODEQ

9/9/2008

Bob Bower
Hydrologist *MS-Eng.*

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Walla Walla Basin Watershed Council
541-938-2170 or 7086 P.O.Box 68, Milton-Freewater, OR 97862

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Introduction

The Walla Walla Basin Watershed Council (WWBWC) along with its project partners the Hudson Bay District Improvement Company (HBDIC) currently operate a shallow aquifer recharge site in the Walla Walla basin located in Umatilla County, Oregon (Figure 1). The site has been in operations since 2004 utilizing an Oregon Water Resources Department (OWRD) limited testing license[1] (Final Order #758). The site currently utilizes a series of spreading basins to recharge non-irrigation season water from the Walla Walla River into the shallow aquifer system (Figure 2). This project has been shown to effectively recharge the shallow aquifer to offset declining storage as well as help restore springs that feed streams in the Little Walla Walla River system. During the first five seasons of operation, water quality for this site has been tested by way of a monitoring program approved by ODEQ[2] during the original limited license application process (WWBWC, 2003). Results from this program has shown that source water quality recharged-at the sites has been of acceptable quality; meeting the standards established for this project by ODEQ staff.

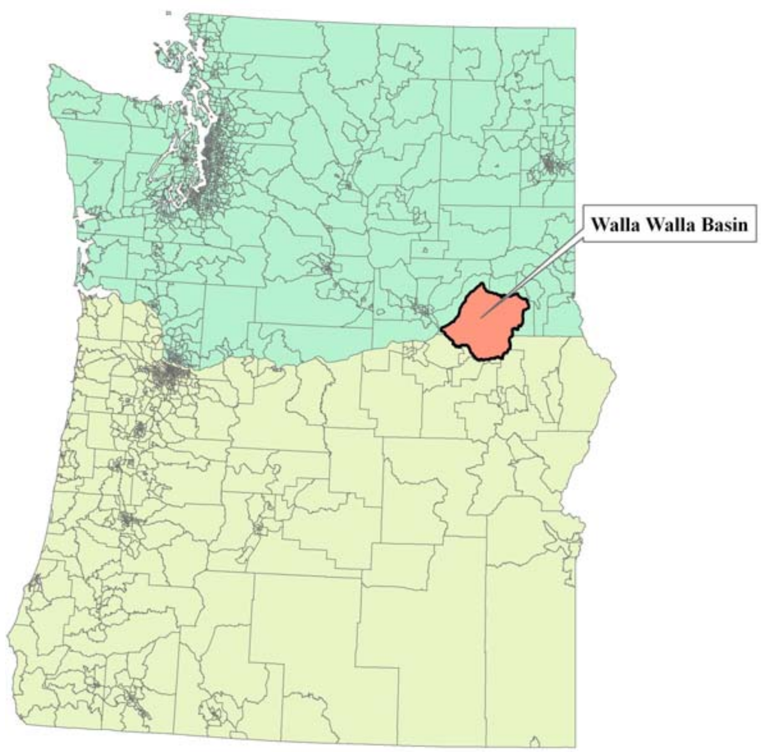

Figure 1. Walla Walla basin locater map, HBDIC Recharge site in Umatilla County.

[1] OAR 690-350-0020
[2] Phil Richerson, ODEQ, Pendleton Office. Phil.Richerson@state.or.us, 541-278-4604

Figure 2. Spring 2008 Photo of HBDIC Recharge Project spreading basins.

While spreading or infiltration basins are well established recharge method, they are not always the best solution for varying field and conservation project conditions. One such example of their limitations would be in the steeply rising land costs associated with the Walla Walla wine industry. The cost of fallow-agriculture ground that could be purchased and transformed into a spreading basin site for recharge has skyrocketed in recent years, making sites like the HBDIC location difficult to secure. Walla Walla basin water managers are therefore looking to develop aquifer recharge capabilities that can be used in and along right-of-way of ditch easements or small corner locations that are often owned by the district or its irrigator patrons.

Ideally, infiltration galleries coupled with a lined/piped deliver system could provide conservation during the times of scarcity (irrigation season) and aquifer recharge and storage during the times of water abundance (fall-winter-spring) without requiring large open tracks of land for infiltration basins. With careful water quality monitoring in place, the WWBWC-HBDIC recharge team would like to test various infiltration gallery designs in order to further develop this tool for our basin. The following study plan outlines the objectives and research outline for the testing of an infiltration gallery system at the HBDIC site. It is intended as supporting information to the WWBWC-HBDIC Underground Injection Control (UIC) permit application.

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Overview of HBDIC Recharge Project: Five years of Operations

The Hudson Bay Aquifer Recharge project was designed to test aquifer recharge as a tool to stabilize and restore declining aquifer levels and spring-creek flows in the Walla Walla River valley. Funding, technical-support and permitting has been provided by the Oregon Watershed Enhancement Board (OWEB), Walla Walla Watershed Alliance (NRCS funds), Oregon Water Resources Department (OWRD), Oregon Department of Environmental Quality (ODEQ), Oregon State University Extension, HBDIC and the WWBWC.

The Hudson Bay Aquifer Recharge Project has been operated successfully for five consecutive recharge seasons starting in 2004 through 2008. The current test project is operated under a Limited License Request (#758) from Oregon Water Resources Department. The conditions and limitation of the permit state:

"The use of water from the Walla Walla River shall be limited to 50 cfs for the purpose of testing artificial ground water recharge during a testing season of November 1 through May 15. Water may only be diverted when there is adequate flow in the Walla Walla River to honor all existing water rights. When water is diverted under this limited license, the use is further limited to times when there is, at a minimum, the following stream flows in the Tum a lum reach of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam: November – 64 cfs, December and January – 95 cfs, February to May 15 – 150 cfs."

The project currently consists of a series of four spreading basins (Figure 1) that utilize water delivered from the Walla Walla River via the HBDIC's ditch system to operate the site. The current total infiltration area of the basins is 1.25 acres with an estimated on-site infiltration rate of between 13-18 cfs. In the 2006-2007 recharge seasons, the best to date, the project recharged approximately 3,300 acre-feet in 132 days of operation.

The project also has an extensive surface and groundwater monitoring system associated with in that measure onsite conditions (Figure 3) as well as more distal downgradient and surrounding locations (Figure 4). Water level monitoring, geology, surface flow and spring discharge and a battery of water quality samples are taken to monitor and assess the HBDIC recharge project. There are four on-site dedicated observation wells where water quality and groundwater levels are monitored (OBS 1, 2, 3 and 4). Well logs for observation well #3 (closest to new infiltration gallery) and Observation well #1 (water quality monitoring well, 4" casing) can be found in Attachment 2. Water levels in these wells range seasonally depending on local groundwater use and when the HBDIC site is in operations. Well OBS #3 ranges from 25 feet below ground surface (bgs) during recharge operations to 60 feet bgs (WWBWC data).

Several reports review the monitoring system at the HBDIC project including:

- *Hudson Bay Aquifer Recharge Project: An application for ASR Testing Limited License to Oregon Water Resources Department (OWRD) (OAR 690-350-0020), and attachments*. October, 2003. Bower, ET. al. WWBWC
- *Hudson Bay Aquifer Recharge Testing Project: 2004 Annual Report*. November 2004. Bower. WWBWC
- *Hudson Bay Aquifer Recharge Testing* Project: 2004-5 Annual Report. November 2005. Bower. WWBWC
- *Hudson Bay Aquifer Recharge Testing Project*: 2004-2008 Review Report, November 2008. Bower, et. al., WWBWC.

As the compilation report is still being completed (due November 2008) a review of all the project data and analysis is not available at this time. However, in support of this application for a HBDIC infiltration gallery UIC permit, the next section will review what is the most relevant to support the WWBWC UIC permit application: the water quality monitoring we have done during the first five recharge seasons. This will provide the ODEQ UIC review staff with the pertinent information by which to assess the attached application.

HBDIC Recharge Site Water Quality Monitoring (2004-2008)

As the HBDIC Recharge Project represented the first of its kind in the State of Oregon, water quality sampling has been a priority monitoring focus since the conception. DEQ and WWBWC staff developed the parameters and testing protocols for this project during the original application process in 2003-4 (*Hudson Bay Aquifer Recharge Project: An application for ASR Testing Limited License to Oregon Water Resources Department (OWRD) (OAR 690-350-0020), and attachments*).

To summarize the program and the results from the past water quality monitoring it is best to separated sampling into two categories and list of constituents.

- **Baseline:**
    - nitrate
    - total kjeldahl nitrogen (TKN)
    - total dissolved solids (TDS)
    - chemical oxygen demand (COD)
    - chloride
    - orthophosphate
    - fecal coliform bacteria

- **Soluble Organic Compounds – Pesticides**

(Common/Trade names, EPA Drinking Water Method)

- 2,4 D acid, Dacamine, 515.1
- Dimethoate, Cygon, 525.2

- Metalaxyl, Ridomil, 525.2
- Napropamide, Devrinol, 525.2
- Simazine, Princep, Aquazine, 525.2
- 1-Naphthaleneacetamide, Amid-thin 525.2
- Diazinon, Diazinon, 525.2
- Fenarimol, Rubigan, 525.2
- Lindane, Lindane, 525.2
- Methidathinon, Supracide, 525.2
- Mevinphos, Phosdrin, 525.2
- Myclobutanil, Systhane, Rally 525.2
- Triflumizole, Procure, 525.2
- Azinphos-methyl, Guthion, 525.2
- Carbaryl, Sevin, 531.1
- Chlorpyrifos, Dursban, Lorsban, 525.2
- DDD (TDE) Rhotane, DDD, 525.2
- DDE degradation product, 525.2
- DDT Anofex, Gesarol, 525.2
- Dicofol, Kelthane, 525.2
- Malathion, Cythion, 525.2
- Methyl Parathion, Penncap, 525.2
- Phosmet, Imidan, 525.2
- Propargite, Omite, Comit, 525.2
- Triadimefon Dimethoate, Bayleton, 525.2
- Oxamyl, Vydate, 531.1
- Hexazinone DPX 3674, Pronone, and Velpar, 525.2
- Parathion-Ethyl, Niran, Phoskil (56), 525.2

These Soluble Organic Compounds (SOCs) were determined through a collaborative assessment process that involved the WWBWC, Oregon State Extension and the ODEQ to be the focus of the HBDIC recharge monitoring project. In additional to the SOC analytes listed above, there were additional compounds tested as reported by the standard EPA drinking water standard testing 508.1, 515.1, 525.2, and 531.1, a list of these compounds can be found in Attachment 1.

2004-2008 HBDIC Recharge Water Quality Results

The HBDIC Recharge project monitoring team and ODEQ have developed the monitoring program as an iterative process. More than 85 different SOC analytes have been tested at the site's source (surface) and groundwater monitoring locations during the five years of operations. The baseline chemistry results for site groundwater and source water are summarized in Table 1.

Table 1. HBDIC Baseline Chemistry Results (2004-2008)

Water Sample Sites: Ground/Surface	Analyte	Minimum	Maximum	Average	Units
Groundwater	Chloride	ND	0.8	0.6	mg/L
Groundwater	Chemical Oxygen Demand	ND	55.0	24.1	mg/L
Groundwater	Nitrate as Nitrate as Nitrogen	0.1	0.6	0.2	mg/L
Groundwater	Orthophosphate as P	ND	0.5	0.3	mg/L
Groundwater	TKN as Nitrogen	ND	1.6	ND	mg/L
Groundwater	Total Dissolved Solids	ND	84.0	61.2	mg/L
Surface	Chloride	ND	1.0	0.8	mg/L
Surface	Chemical Oxygen Demand	ND	21.0	ND	mg/L
Surface	Nitrate as Nitrogen	ND	0.5	0.2	mg/L
Surface	Orthophosphate as P	0.1	0.6	0.3	mg/L
Surface	TKN as Nitrogen	ND	ND	ND	mg/L
Surface	Total Dissolved Solids	ND	76.0	57.4	mg/L

ND - No Detection

**Data source: WWBWC, 2008.*

Fecal Coliforms were detected in both the source and groundwater monitoring sites. Additional monitoring was conducted at the HBDIC site as well as in other, more distal locations. The results indicated that low level fecal coliform detections were prevalent in many area surface and groundwater locations leading the monitoring team to determine fecal contamination to be a prevalent background condition (Table 2.)

Table 2. Surface and Groundwater Monitoring Fecal Coliform Results

	Surface			Groundwater			
Recharge Sampling Year	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Units**
2004	1.0	130.0	39.8	0.0	14.8	3.8	MPN/100 ML
2004-5	0.0	62.0	9.4	0.0	12.0	2.0	MPN/100 ML
2005-6	14.0	20.0	17.0	0.0	3.0	1.0	MPN/100 ML
2006-7	7.0	23.0	15.3	0.0	3.0	1.0	MPN/100 ML
2007-8	11.0	14.0	12.5	0.0	1.0	0.5	MPN/100 ML

**Data source: WWBWC, 2008.*

Pesticide or Soluble Organic Compounds sampling resulted in only **a single detection** in the 5 years of monitoring. On April 13, 2004 at the HBDIC Observation well #1, Di(ethylhexyl)-phthalate was detected at 2.2 ug/L. The Maximum Contaminant Level MCL for this compound is 6.0 ug/L according to EPA standards (2004). ODEQ staff concluded that this was likely a low-level detection arising from the newly installed PVC observation-well casing. The compound was not detected in subsequent monitoring of the recharge project's surface or observation sites.

Infiltration Gallery Study Plan

The WWBWC has been collaborating with other national and international recharge programs that are also seeking to improve designs for infiltration galleries for aquifer recharge purposes. After reviewing the available literature and discussing the main issues with our collaborative partners, we put together an infiltration gallery testing project for the

HBDIC site. The project will include four infiltration galleries each with different types of gallery materials. Each of these galleries will also include flow meters (to determine flow rate into each), and inspection ports where each can be checked for sediment accumulation and cleaned and maintained. The project will generally be run the same as the rest of the HBDIC recharge site between November 1sth and May 15th. A turbidity meter will also be installed and operated during the testing of the galleries to provide background information as to better understanding any clogging that may occur. The objectives of the study are as follows:

Research Objectives

- Determine most effective infiltration gallery design and materials in recharging water subsurface in the Walla Walla basin.
- Determine rates of infiltration and any potential clogging of each of the four test infiltration gallery designs.
- Test varies methods to clean infiltration galleries if clogging to decreases performance.
- Monitor surface and groundwater for quality and quantity changes related to operation of infiltration galleries.

Project Designs

Site designs for the infiltration galleries testing project (Upper Recharge Project) and site plans are included in Attachment 2 (Plates 1 through 7).

- **Plate 1** covers the original survey of the HBDIC recharge site before any of the spreading basins were build and the basic geologic information provided by the test pits (2003).
- **Plate 2** provides an overview of the entire HBDIC recharge site with four existing spreading basins and the new infiltration gallery testing project.
- **Plate 3** provides miscellaneous details as to the White Ditch inlet structure as well as inspection port and flow meter placements.
- **Plate 4** provides information for two of the four infiltration gallery designs. The designs outline the piping and the location of inspection ports and flow meters.
- **Plate 5** provides the layout and design information for the Atlantis Rain Tank (style of piping) and the Stormtech Chamber designs.
- **Plate 6** provides the design information for the check and screen structure that will divert the water from the ditch into the project.
- **Plate 7** provides general construction details for the check structure construction.

Operations and Additional Monitoring

The HBDIC Infiltration Gallery Testing Project will be operated by the instructions outlined in our OWRD/ODEQ-approved Limited Testing License. Water will be diverted to the infiltration galleries at the volumes and dates outlined in our current permit. The project has been designed to operate at approximately four cfs: one cfs for each of the four infiltration gallery designs. All water quality monitoring will be conducted as instructed in our current license. However the WWBWC will conduct the following additional testing in order to gather information relative to our four project objectives:

- **YSI Continuous Turbidity Meter Model # 6920 V2**[3] will be installed in the check structure piping that delivers the water to the four infiltration galleries.
- **Water Quality Samples: Total Suspended Solids (TSS)** will be collected weekly during recharge operations and sent to Edge Analytical[4] in order to establish a TSS-Turbidity regression relationship. This will be used with flow information to determine any correlation between source water turbidity with infiltration gallery performance (clogging).
- **Water Quality Samples: Total Organic Carbons** (**TOC**). Studies at the Orange County Aquifer Recharge Program[5] have shown biological clogging decrease infiltration-gallery performance. While the fall-winter-spring water temperatures at HBDIC make this issue unlikely, we will collect TOC and TSS to confirm biological clogging will not have an effect.
- **1.5 Meter PVC piezometers** will be installed at each of the infiltration galleries at the midpoint at horizontal spacing of 0.5 and 1.5 meters. These capped piezometers will provide us with water-level mounding information in the close vicinity of the galleries. Water level measurements will be collected using an etape.
- **Aqua Master Model 900R (Jennings Inc.) or McCrometer Model EO3000 Propeller Style flow meters** will be installed to measure flow capacity of each of the four infiltration gallery designs. Four of the same type of recorder will be purchased.
- **Site groundwater level and water quality monitoring** will continue to be monitored at the HBDIC Observation wells #1, #2, #3 and #4 at the White Ditch check and intake structures.

Summary

The HBDIC Infiltration Gallery Testing Project will be subject to the site's current water quality monitoring program with additional monitoring of the four different recharge gallery designs. Monitoring over the first five years has shown that the source water at the HBDIC recharge project is acceptable for a UIC permit for operations. The testing of the project will cover at a minimum of two full recharge seasons, November 1st 2008 through May 15th, 2009 and November 1st 2009 through May 15th, 2010 in order to establish enough data to address the main research objectives for the project. Any further monitoring and/or design ideas that ODEQ or OWRD considers essential for the safe operations and testing of these galleries can be incorporated into this application.

---

[3] https://www.ysi.com/ysi/Products/Product_Family/Product?productID=EMS_SEN02_6136

[4] http://www.edgeanalytical.com/

[5] Verbal communications with Adam Hutchinson, director of Orange County (CA) Aquifer Recharge Program. http://www.ocwd.com/Groundwater-Recharge/ca-34.aspx

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Attachment 1: Additional SOC compounds tested 2004-2008

DOH#	Compounds	Results	Units	SRL	Trigger	MCL	Comments
	Carbamates in drinking water						
146	Carbofuran		ug/L	1.8	1.8	40.0	EPA Regulated
148	Oxymal		ug/L	4.0	4.0	200.0	EPA Regulated
141	3-Hydroxycarbofuran		ug/L	2.0	2.0		EPA Unregulated
142	Aldicarb		ug/L	1.0	1.0		EPA Unregulated
143	Aldicarb Sulfone		ug/L	1.6	1.6		EPA Unregulated
144	Aldicarb Sulfoxide		ug/L	1.0	1.0		EPA Unregulated
145	Carbaryl		ug/L	2.0	2.0		EPA Unregulated
147	Methomyl		ug/L	1.0	4.0		EPA Unregulated
326	Propoxur(Baygon)		ug/L	1.0			State Unregulated
327	Methiocarb		ug/L	4.0			State Unregulated
	Synthetic Organic Compounds						
33	Endrin		ug/L	0.02	0.02	2.0	EPA Regulated
34	Lindane (BHC-Gamma)		ug/L	0.04	0.04	0.2	EPA Regulated
35	Methoxychlor		ug/L	0.20	0.20	40.0	EPA Regulated
117	Alachlor		ug/L	0.40	0.40	2.0	EPA Regulated
119	Atrazine		ug/L	0.20	0.20	3.0	EPA Regulated
120	Benzo(a)pyrene		ug/L	0.04	0.04	0.2	EPA Regulated
122	Chlordane Technical		ug/L	0.40	0.40	2.0	EPA Regulated
124	Di(ethylhexyl)-Adipate		ug/L	1.30	1.30	400.0	EPA Regulated
125	Di(ethylhexyl)-phthalate		ug/L	1.30	1.30	6.0	EPA Regulated
126	Heptachlor		ug/L	0.08	0.08	0.4	EPA Regulated
127	Heptachlor epoxide (A & B)		ug/L	0.04	0.04	0.2	EPA Regulated
128	Hexachlorobenzene		ug/L	0.20	0.20	1.0	EPA Regulated
129	Hexachlorocyclo-Pentadiene		ug/L	0.20	0.20	50.0	EPA Regulated
133	Simazine		ug/L	0.15	0.15	4.0	EPA Regulated
118	Aldrin		ug/L	0.20	0.20		EPA Unregulated
121	Butachlor		ug/L	0.40	0.40		EPA Unregulated
123	Dieldrin		ug/L	0.20	0.20		EPA Unregulated
130	Metolachlor		ug/L	1.00	1.00		EPA Unregulated
131	Metribuzin		ug/L	0.20	0.20		EPA Unregulated
132	Propachlor		ug/L	0.20	0.20		EPA Unregulated
179	Bromacil		ug/L	0.20	0.20		State Unregulated
183	Prometon		ug/L	0.20	0.20		State Unregulated
190	Terbacil		ug/L	0.20	0.20		State Unregulated
202	Diazinon		ug/L	0.20	0.20		State Unregulated
208	EPTC		ug/L	0.30	0.30		State Unregulated
232	4,4-DDD		ug/L	0.20	0.20		State Unregulated
233	4,4-DDE		ug/L	0.20	0.20		State Unregulated
234	4,4_DDT		ug/L	0.20	0.20		State Unregulated
236	Cyanazine		ug/L	0.20	0.20		State Unregulated

Attachment 1: Additional SOC compounds tested 2004-2008 (Continued)

DOH#	Compounds	Results	Units	SRL	Trigger	MCL	Comments
	Synthetic Organic Compounds						
239	Malathion		ug/L	0.20	0.20		State Unregulated
240	Parathion		ug/L	0.20	0.20		State Unregulated
243	Trifluralin		ug/L	0.20	0.20		State Unregulated
96	Napthalene		ug/L	0.10	0.10		PAHs
154	Fluorene		ug/L	0.20	0.20		PAHs
244	Acenaphthylene		ug/L	0.20	0.20		PAHs
245	Acenaphthene		ug/L	0.20	0.20		PAHs
246	Anthracene		ug/L	0.20	0.20		PAHs
247	Benz(a)anthracene		ug/L	0.10	0.10		PAHs
248	Benzo(b)fluoranthene		ug/L	0.20	0.20		PAHs
249	Benzo(g,h,i)perylene		ug/L	0.20	0.20		PAHs
250	Benzo(k)fluoranthene		ug/L	0.20	0.20		PAHs
251	Chrysene		ug/L	0.20	0.20		PAHs
252	Dibenzo(A,H)anthracene		ug/L	0.20	0.20		PAHs
253	Fluoranthene		ug/L	0.20	0.20		PAHs
255	Indeno(1,2,3-CD)Pyrene		ug/L	0.20	0.20		PAHs
256	Phenanthrene		ug/L	0.20	0.20		PAHs
257	Pyrene		ug/L	0.20	0.20		PAHs
258	Benzyl Butyl Phthalate		ug/L	0.60	0.60		Phthalates
259	Di-N-Butyl Phthalate		ug/L	0.60	0.60		Phthalates
260	Diethyl Phthalate		ug/L	0.60	0.60		Phthalates
261	Dimethyl Phthalate		ug/L	0.60	0.60		Phthalates
36	Toxaphene		ug/L	2.0	2.0	3.0	PCBs/Toxaphene
173	Aroclor 1221		ug/L	20.0	20.0		PCBs/Toxaphene
174	Aroclor 1232		ug/L	0.5	0.5		PCBs/Toxaphene
175	Aroclor 1242		ug/L	0.5	0.3		PCBs/Toxaphene
176	Aroclor 1248		ug/L	0.1	0.1		PCBs/Toxaphene
177	Aroclor 1254		ug/L	0.1	0.1		PCBs/Toxaphene
178	Aroclor 1260		ug/L	0.2	0.2		PCBs/Toxaphene
180	Aroclor 1016		ug/L	0.1	0.1		PCBs/Toxaphene
	Herbicides in Drinking Water						
37	2,4-D		ug/L	0.2	0.2	70.0	EPA Regulated
38	2,4,5-TP (Silvex)		ug/L	0.4	0.4	50.0	EPA Regulated
134	Pentachlorophenol		ug/L	0.1	0.1	1.0	EPA Regulated
137	Dalapon		ug/L	2.0	2.0	200.0	EPA Regulated
139	Dinoseb		ug/L	0.4	0.4	7.0	EPA Regulated
140	Picloram		ug/L	0.2	0.2	500.0	EPA Regulated
138	Dicamba		ug/L	0.2	0.2		EPA Unregulated
135	2,4 DB		ug/L	1.0	1.0		State Unregulated
136	2,4,5 T		ug/L	0.4	0.4		State Unregulated

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Attachment 1: Additional SOC compounds tested 2004-2008 (Continued)

DOH#	Compounds	Results	Units	SRL	Trigger	MCL	Comments
	Herbicides in Drinking Water						
220	Bentazon		ug/L	0.5	0.5		State Unregulated
221	Dichloroprop		ug/L	0.5	0.5		State Unregulated
223	Actiflorfin		ug/L	2.0	2.0		State Unregulated
225	Dacthal (DCPA)		ug/L	0.1	0.1		State Unregulated
226	3,5-Dichlorobenzoic Acid		ug/L	0.5	0.5		State Unregulated

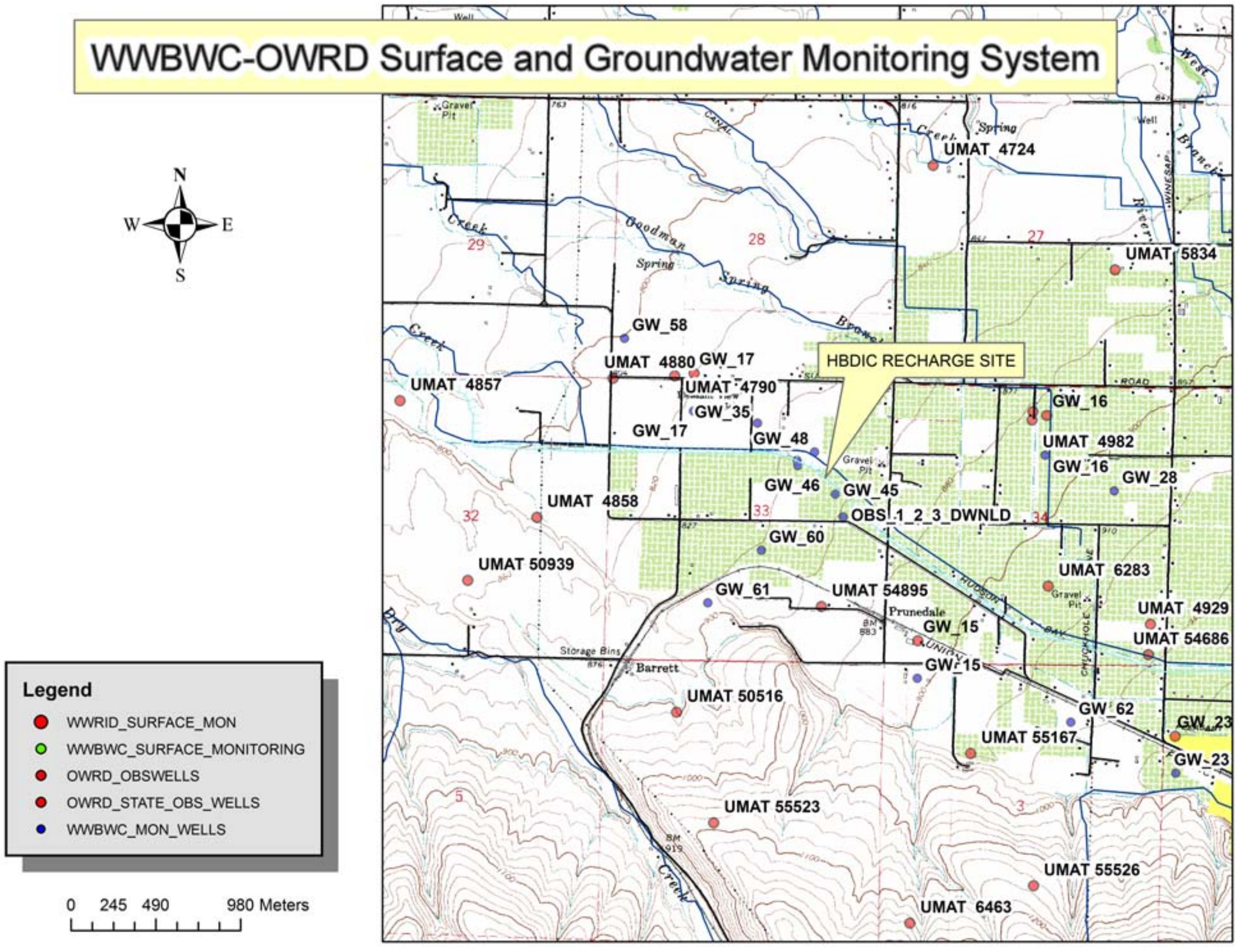
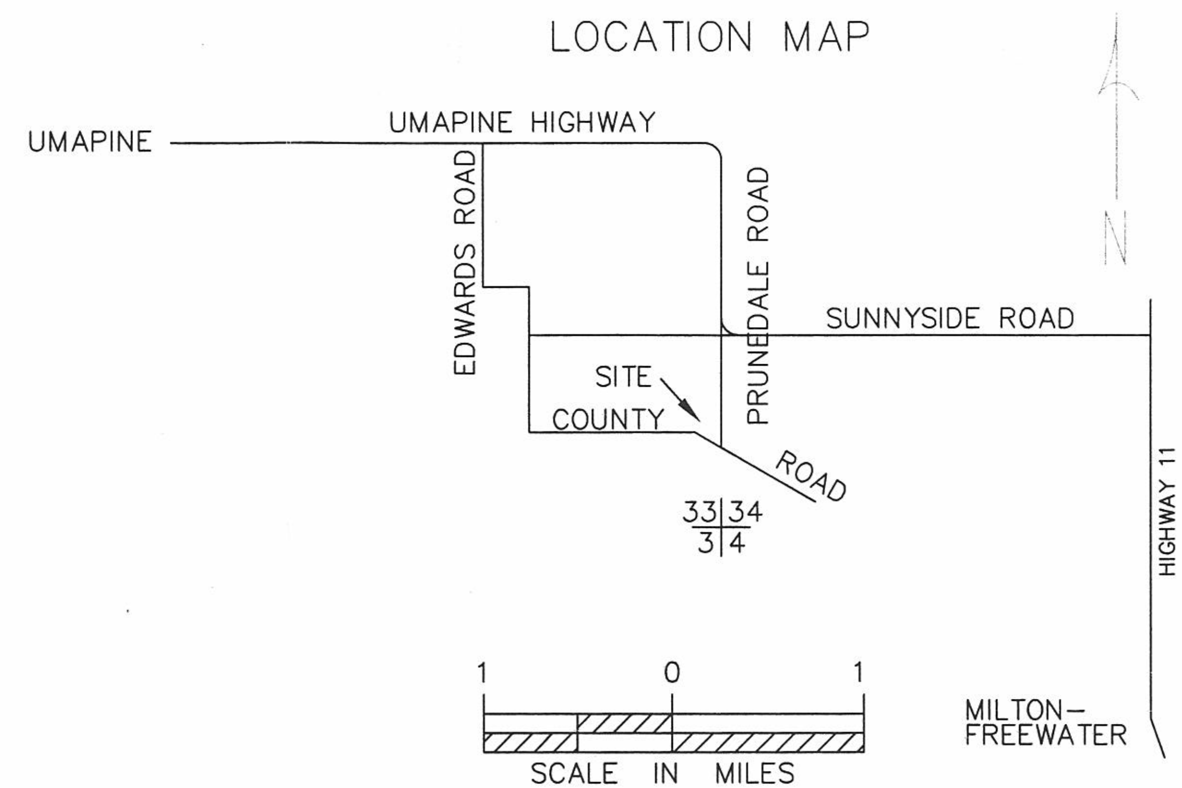


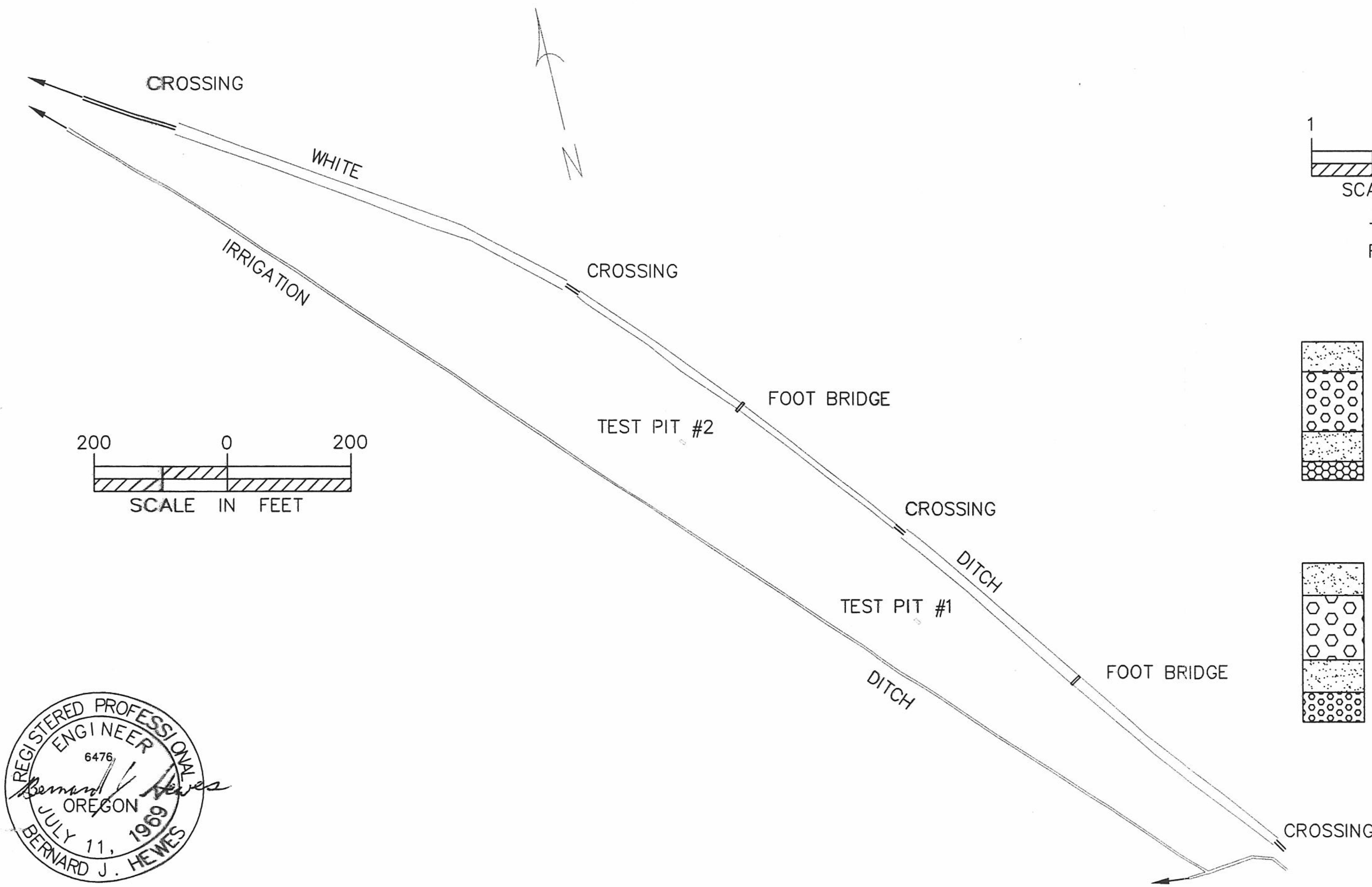
Figure 4. Map showing surface and groundwater monitoring locations relative to HBDIC Recharge Site.

LOCATION MAP



TOWNSHIP 6N
RANGE 35E

SITE PLAN VIEW



TEST PIT #1

- 0–12" SANDY LOAM
- 12"–36" GRAVELY SANDY LOAM, APPROX. 50% OF THE VOLUME IS GRAVEL SIZE PARTICLES WITH AN ESTIMATED D_{50} SIZE OF ABOUT 0.75".
- 36"–48" SANDY LOAM
- 48"–? GRAVELY SANDY LOAM APPROX. 20% OF THE VOLUME IS GRAVEL SIZE PARTICLES.

TEST PIT #2

- 0–13" GRAVELY SANDY LOAM
- 13"–39" COBBLY SANDY LOAM, THE D_{50} OF THE GRAVEL IS APPROXIMATELY 1"
- 39"–52" GRAVELY SANDY LOAM
- 52"–? SAND GRAVEL MIX D_{50} ESTIMATED TO BE ABOUT 0.25".

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OREGON
JULY 11, 1969
BERNARD J. HEWES

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APPROVED	

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SITE PLAN & LOCATION MAP
UMATILLA COUNTY, OREGON

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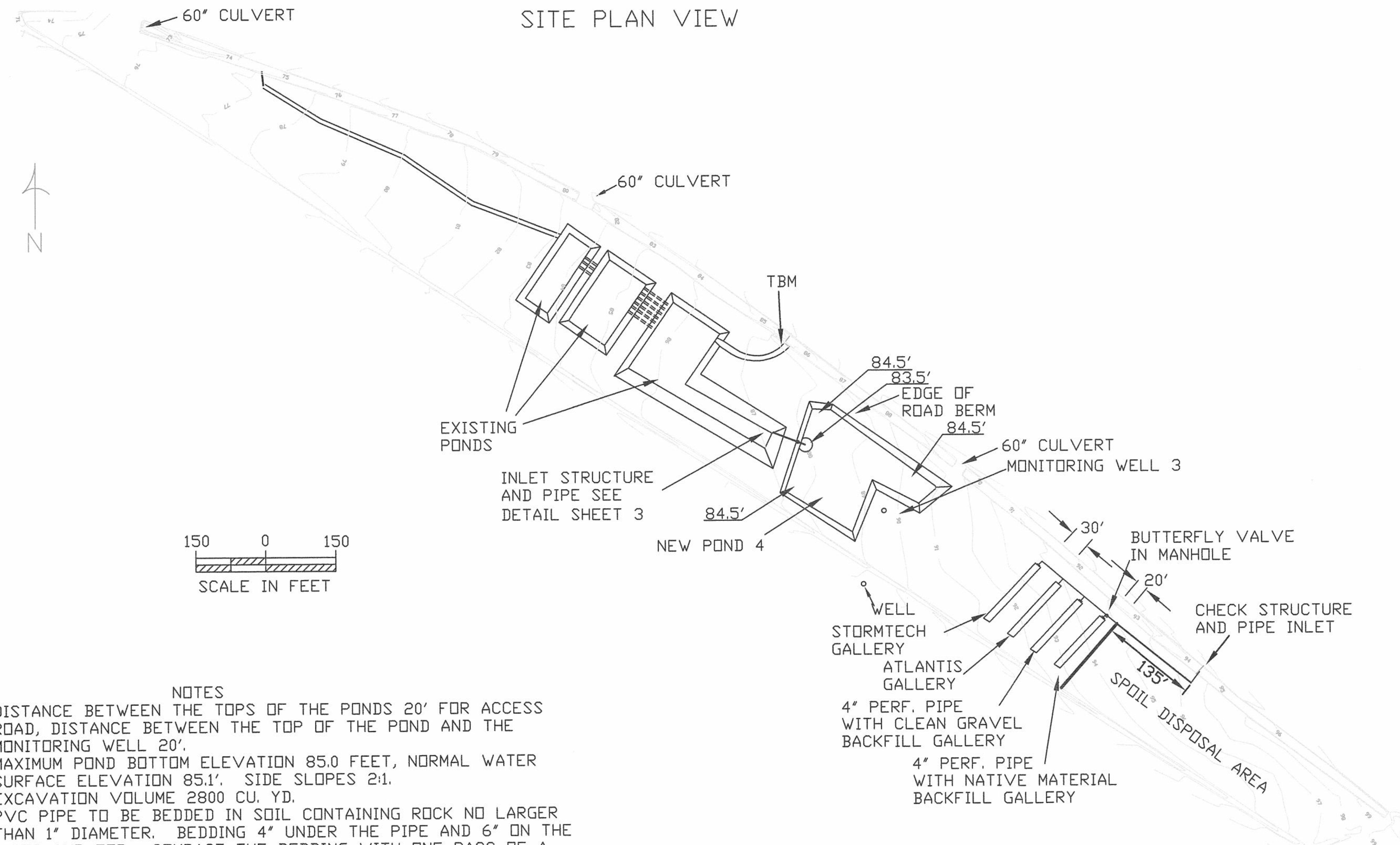
SHEET 1 OF 7

SITE PLAN VIEW



NOTES

DISTANCE BETWEEN THE TOPS OF THE PONDS 20′ FOR ACCESS ROAD, DISTANCE BETWEEN THE TOP OF THE POND AND THE MONITORING WELL 20′.
MAXIMUM POND BOTTOM ELEVATION 85.0 FEET, NORMAL WATER SURFACE ELEVATION 85.1′. SIDE SLOPES 2:1.
EXCAVATION VOLUME 2800 CU. YD.
PVC PIPE TO BE BEDDED IN SOIL CONTAINING ROCK NO LARGER THAN 1″ DIAMETER. BEDDING 4″ UNDER THE PIPE AND 6″ ON THE SIDES AND TOP. COMPACT THE BEDDING WITH ONE PASS OF A VIBRATING PLATE COMPACTOR OVER 6″ LOOSE LIFTS.
CONSIDER FLOW METERS: AQUA MASTER MODEL 900R FROM JENNINGS INC.
McCROMETER MODEL EO300 PROPELLER STYLE METER.
CHECK FOR COMPATIBILITY WITH YOUR EXISTING RECORDING AND CONTROL EQUIPMENT.
SPACE THE DIFFERENT KIND OF GALLERIES 30′.
TBM IS AT THE TOP OF THE RIGHT SIDE WALL, DOWNSTREAM END OF THE FLUME. ELEVATION 88.7 FEET.

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SITE PLAN
UMATILLA COUNTY, OREGON

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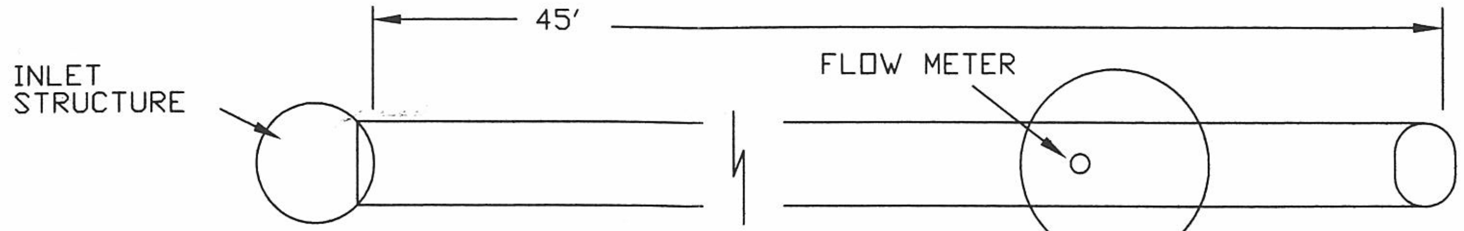
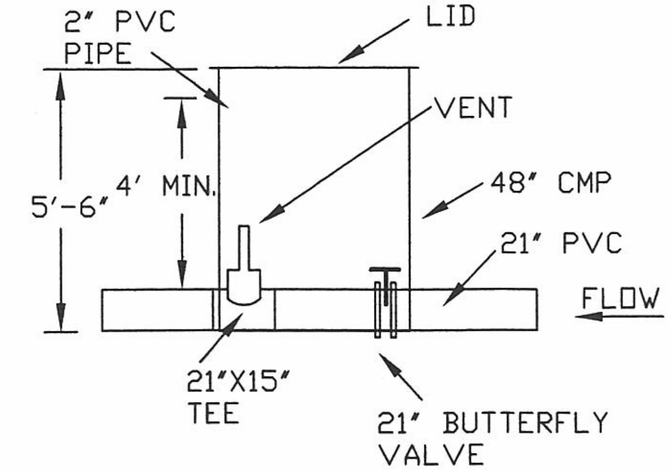
SHEET 2
OF 7

SUPPLY PIPE TO POND 4 PLAN VIEW

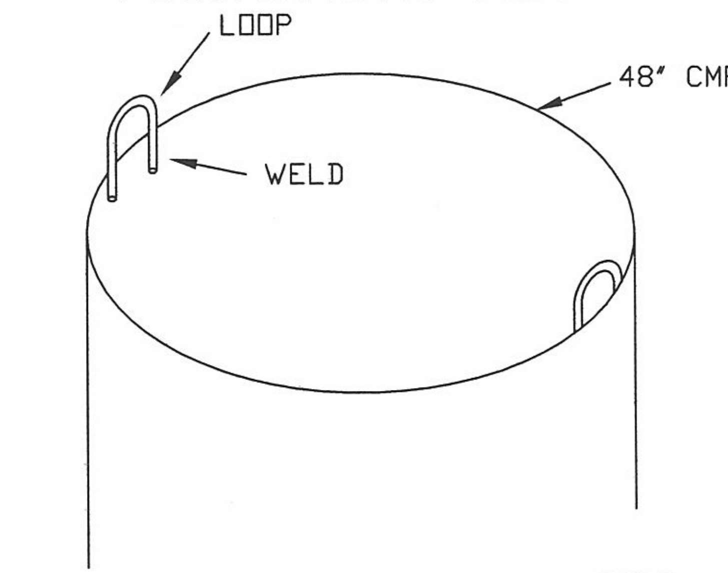


GALLERY SUPPLY PIPE VALVE DETAILS ELEVATION VIEW



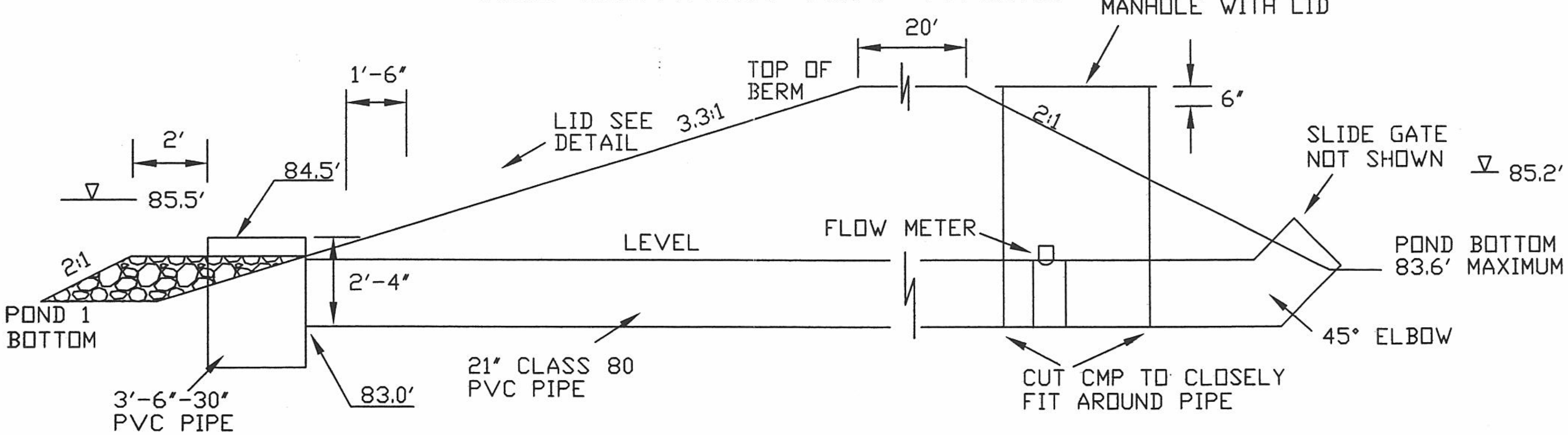
NOTES
CUT THE HOLE IN THE INLET STRUCTURE TO CLOSELY FIT AROUND THE SUPPLY PIPE. FILL THE SPACE BETWEEN THE STRUCTURE AND PIPES WITH CAULKING ON BOTH SIDES.
THE BOTTOM LIP OF THE 45° ELBOW CAN BE NO LESS THAN 0.2' BELOW THE TOP OF THE 21" PIPE.
LID FOR THE CMP MANHOLE TO BE GALVANIZED 1/8" THICK STEEL.
SLIDE GATE TO BE A WATERMAN C-8-4 OR EQUIVALENT. INSTALL A CATWALK FOR ACCESS TO THE SLIDE GATE.

MANHOLE LID HOLD DOWN PERSPECTIVE VIEW

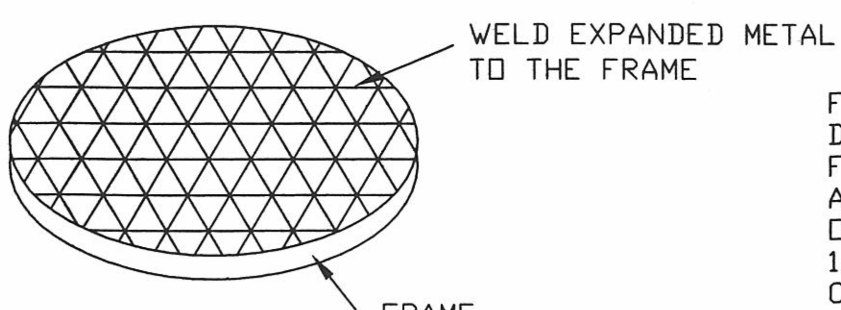


USE 1/2" DIAMETER ROD TO MAKE LOOPS.
DIAMETER OF THE LOOP 2"

SIDE ELEVATION VIEW TYPICAL



INLET STRUCTURE TRASH RACK DETAIL PERSPECTIVE VIEW



FRAME IS 1/8" X 3" STEEL, INSIDE DIAMETER 32". COVER TO BE FLATTENED EXPANDED METAL APPROXIMATELY 0.120" THICK; OPENINGS APPROXIMATELY 1/2" X 1 5/8 ".
CLEAN AND PAINT WITH 2 COATS OF HIGH ZINC COLD GALVANIZING PAINT.

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MISCELLANEOUS DETAILS
UMATILLA COUNTY, OREGON
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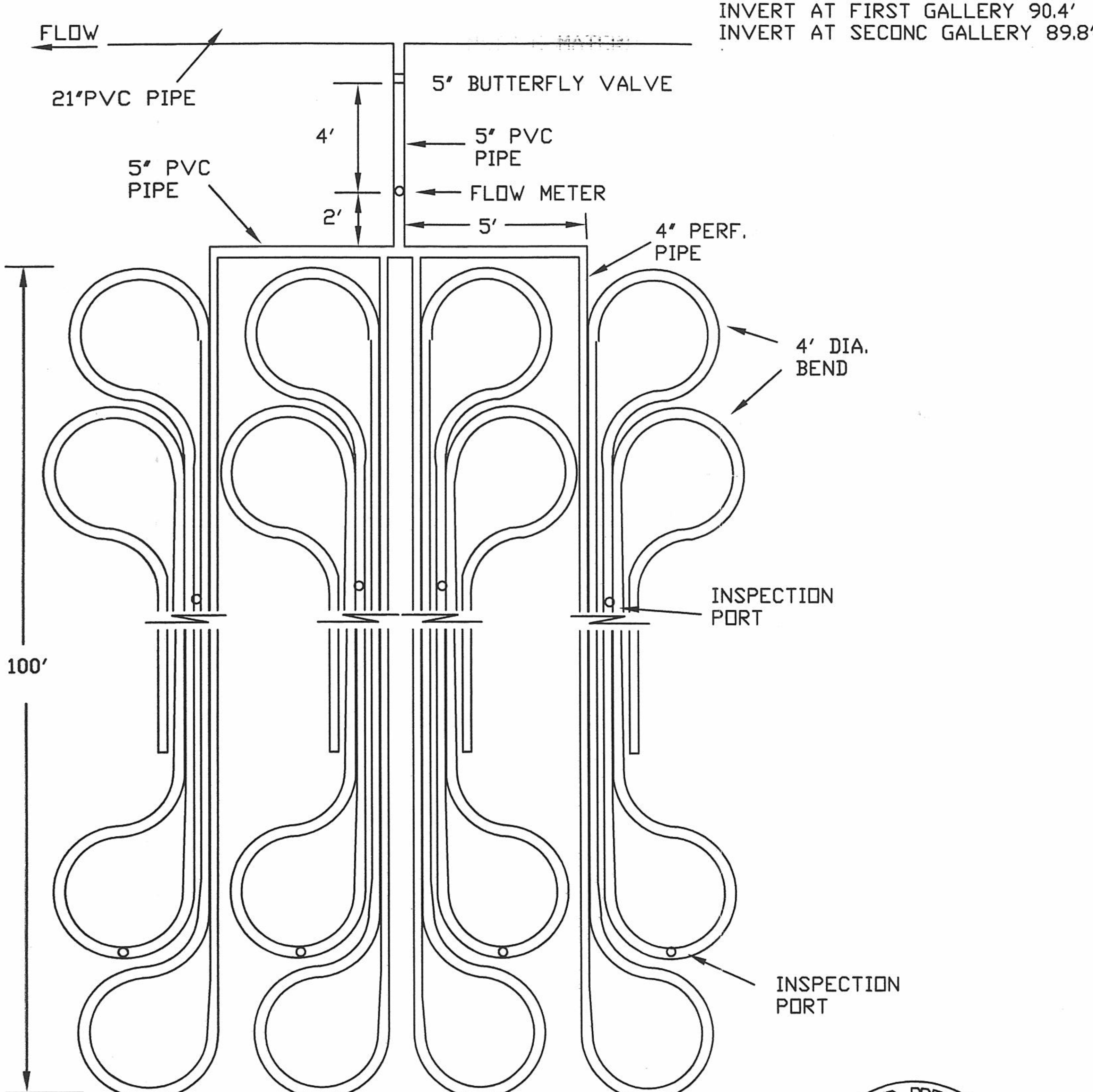
SHEET 3 OF 7

TYPICAL 4″ PERFORATED PIPE GALLERY PLAN VIEW

INVERT AT FIRST GALLERY 90.4′
INVERT AT SECONC GALLERY 89.8′



NOTE: ON THIS SIDE THE PERF. PIPE CHANGED TO SMOOTH DRAIN FIELD PIPE WITH A TEE FOR EACH PIPE ROW, 20 ROWS.

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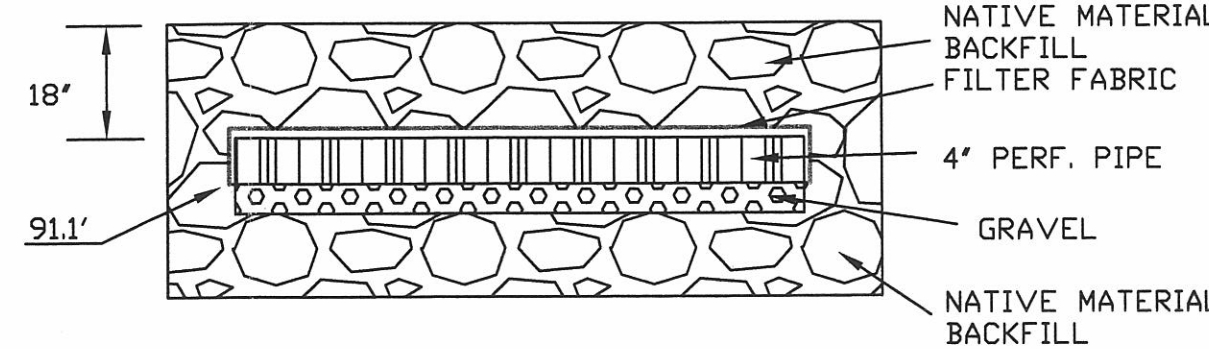
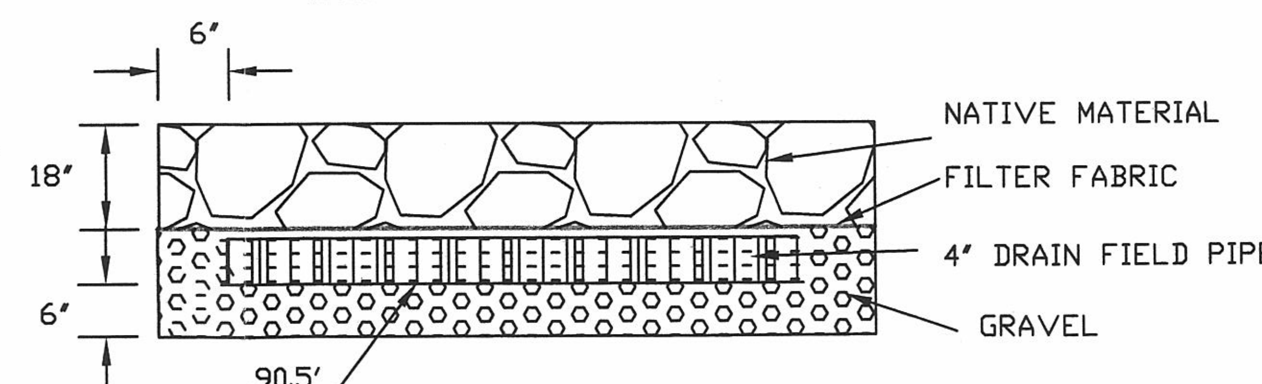
4″ PERFORATED PIPE WITH NATIVE MATERIAL BACKFILL ELEVATION VIEW



NOTES

NEED 2000′ OF ADS 4″ SINGLE WALL, PERFORATED, CORRUGATED POLYETHYLENE PIPE OR EQUIVALENT. CONNECT THE 4″ TO THE 5″ PIPE USING A MAR-MAC POLYSEAL PIPE COUPLER OR EQUIVALENT.
USE ONLY ENOUGH GRAVEL BEDDING TO PROVIDE A SMOOTH SURFACE TO LAY THE PIPE ON OR REMOVE ALL ROCK GREATER THAN 2″ IN DIAMETER FROM CONTACTING THE PIPE.
THE INSPECTION PORT TO BE INSTALLED WHERE THE TWO PIPE ROLLS CONNECT AND NEAR THE END AS SHOWN. CONNECT THE ROLLS WITH A 4″ TEE, USE 2′ OF VERTICAL 4″ PERF. PIPE WRAPPED WITH FILTER FABRIC FOR AN INSPECTION PORT. INSTALL A 4″ CAP ON THE END OF THE PIPE AND INSPECTION PORT.
THE FILTER FABRIC TO BE ADS 4000 NONWOVEN OR EQUIVALENT. ABOUT 75 SQ. YD. NEEDED.

4″ DRAIN FIELD PIPE WITH GRAVEL BEDDING ELEVATION VIEW



NOTES

NEED 2000′ OF 4″ PVC DRAIN FIELD PIPE. CONNECT THE 4″ TO THE 5″ PIPE USING A MAR-MAC POLYSEAL PIPE COUPLER OR EQUIVALENT.
THE INSPECTION PORTS TO BE INSTALLED NEAR THE MIDDLE OF ONE OF THE ROWS AND NEAR THE END. USE 2′ OF VERTICAL 4″ PIPE WRAPPED WITH FILTER FABRIC FOR AN INSPECTION PORT. INSTALL A 4″ CAP ON THE END OF THE PIPE AND INSPECTION PORT.
THE FILTER FABRIC TO BE ADS 4000 NONWOVEN OR EQUIVALENT. ABOUT 75 SQ. YD. NEEDED.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY BEING $\frac{3}{4}$″-2″, ABOUT 60 CU. YD. NEEDED.

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4″ PERF. & DRAIN FIELD PIPE DETAILS
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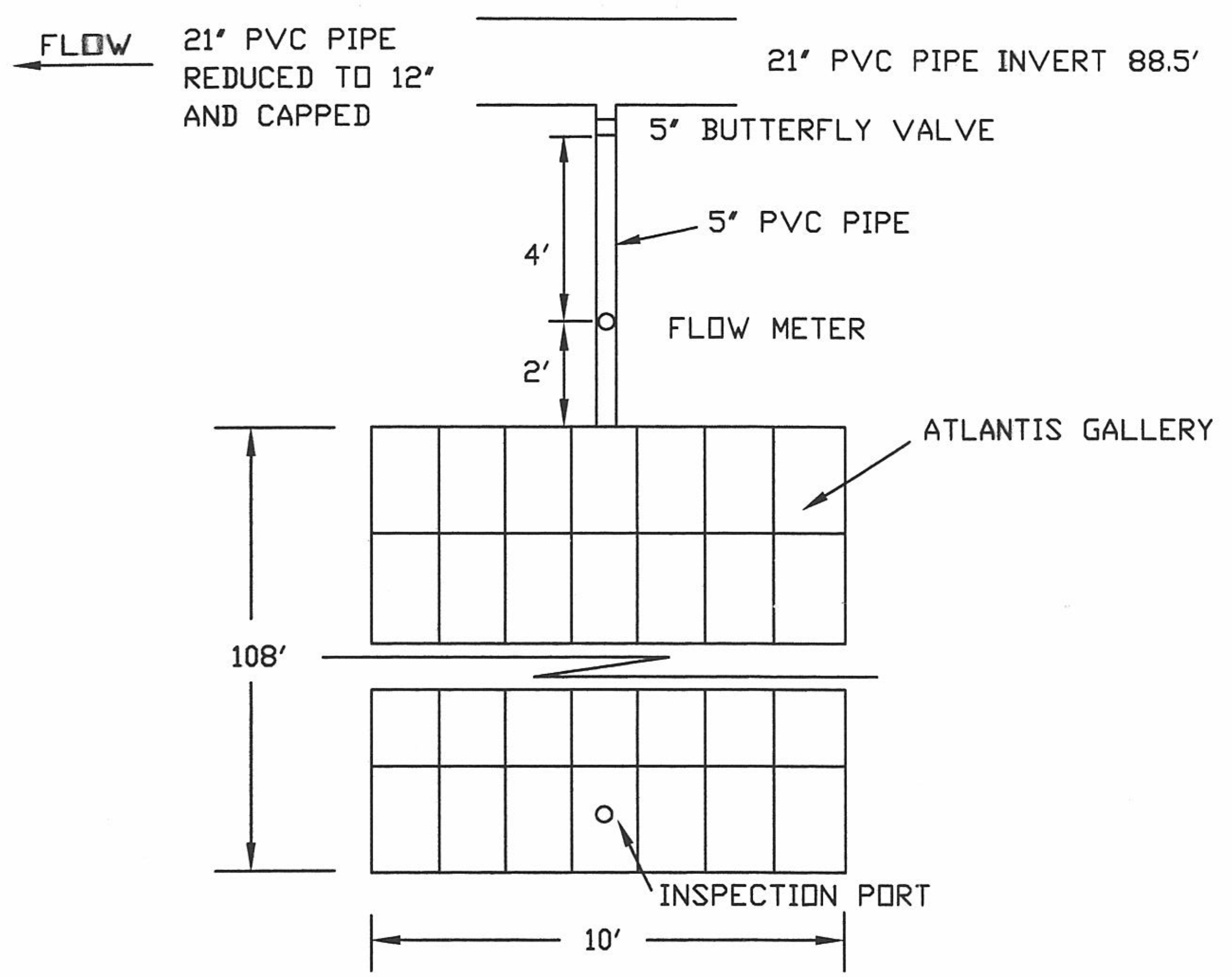
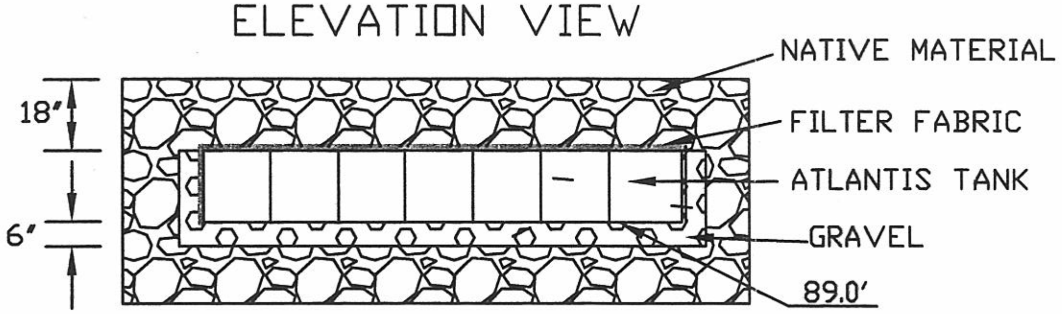
SHEET 4 OF 7

ATLANTIS RAIN TANK DETAIL
PLAN VIEW



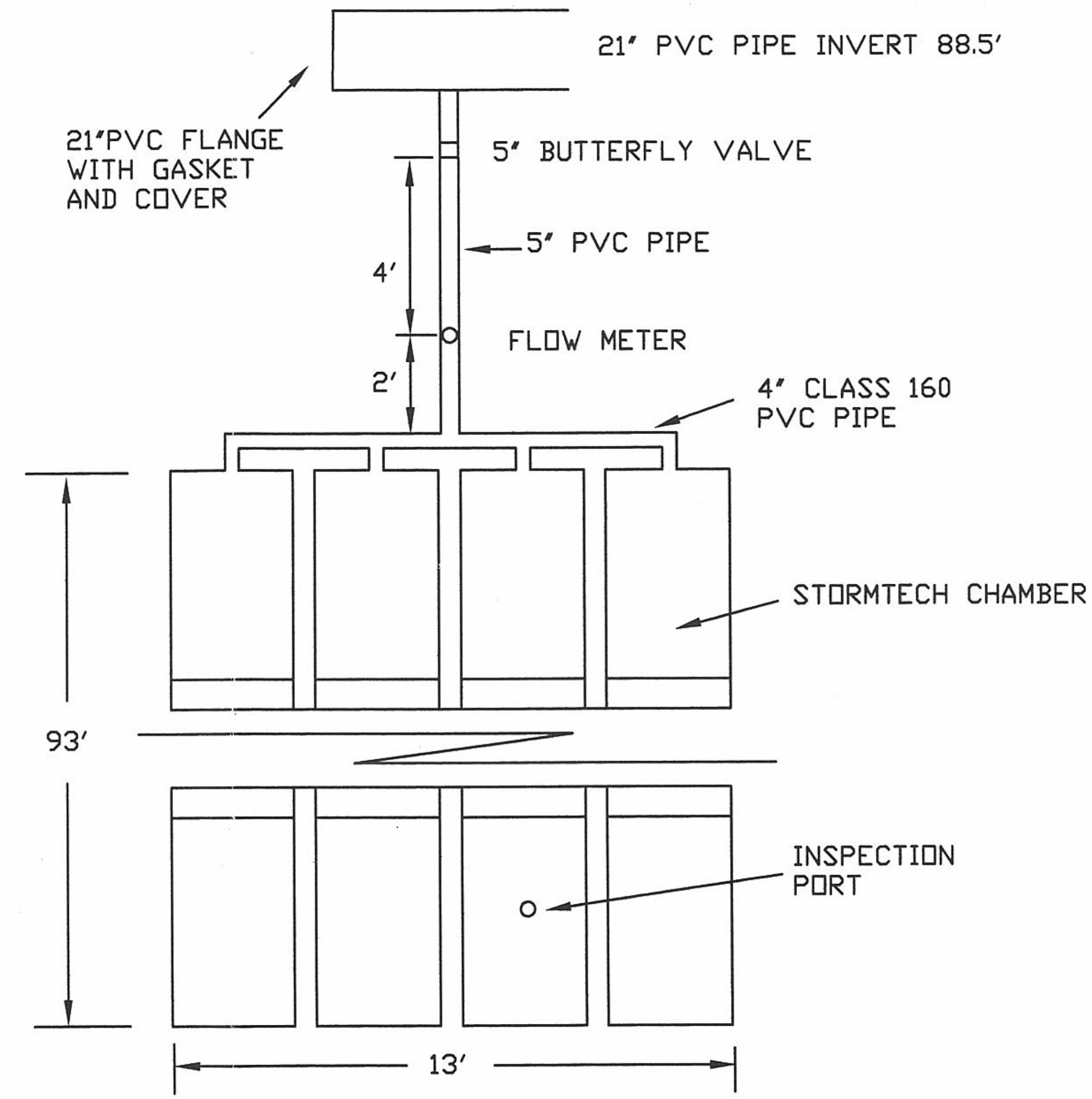
ELEVATION VIEW



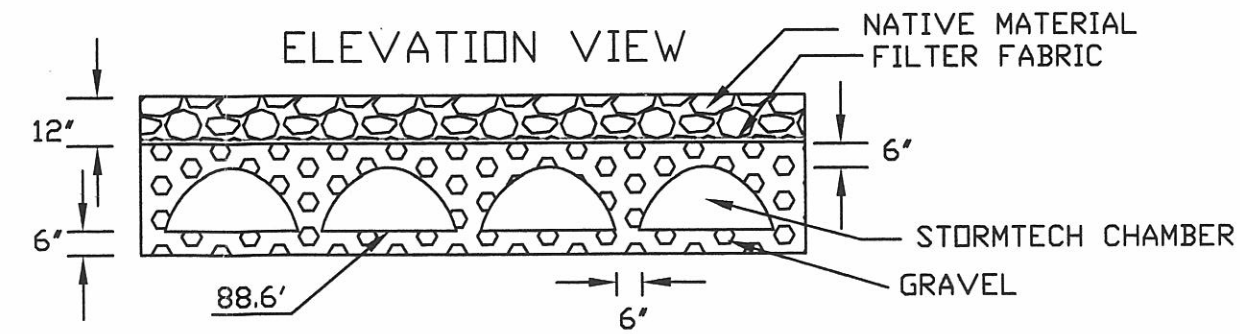
NOTES

ASSEMBLE AND INSTALL RAIN TANKS AND INSPECTION PORT AS DESCRIBED IN THE MANUFACTURERS LITERATURE. TANKS ARE 16" WIDE, 27" LONG AND 17¾" HIGH, NEED 336 TANKS FOR H-10 LOADING. USE 4" PVC PIPE FOR THE PORT, EXTEND 1' ABOVE GROUND AND PROTECT WITH A FENCE POST AND END CAP.
FILTER FABRIC TO BE ADS 4000 OR EQUIVALENT, NEED 160 SQ. YD.
FOLD AND TAPE THE CORNERS AS SHOWN IN THE LITERATURE.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY OF PARTICLES BETWEEN ¾"-2", NEED ABOUT 25 CU. YD.

STORMTECH CHAMBER
PLAN VIEW



ELEVATION VIEW



NOTES

ASSEMBLE AND INSTALL CHAMBERS AND INSPECTION PORT AS SHOWN IN THE MANUFACTURERS LITERATURE. TANKS ARE 34" WIDE, 7'-2" LONG AND 16" HIGH, NEED 50 CHAMBERS. IN LIEU OF THE SUBSURFACE PORT SHOWN IN THE LITERATURE EXTEND THE PORT 1' ABOVE GROUND AND PROTECT WITH A FENCE POST AND END CAP.
FILTER FABRIC TO BE ADS 4000 OR EQUIVALENT, NEED 190 SQ. YD.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY OF PARTICLES BETWEEN ¾"-2", NEED ABOUT 115 CU. YD.

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OREGON
JULY 11, 1969
BERNARD J. HEWES
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ATLANTIS & STORMTECH CHAMBERS DETAILS
UMATILLA COUNTY, OREGON

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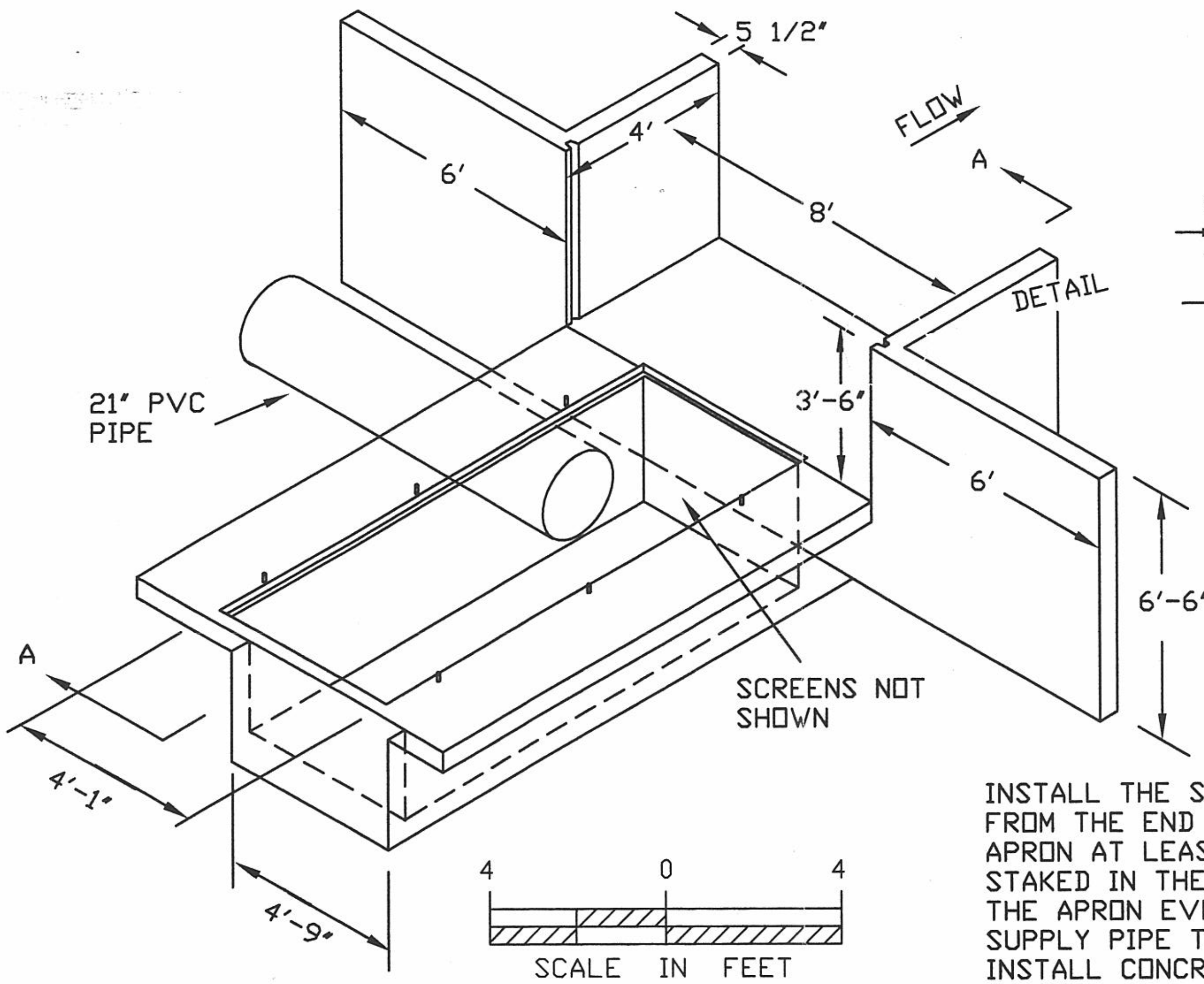
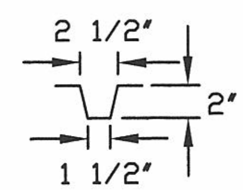
SHEET 5
OF 7

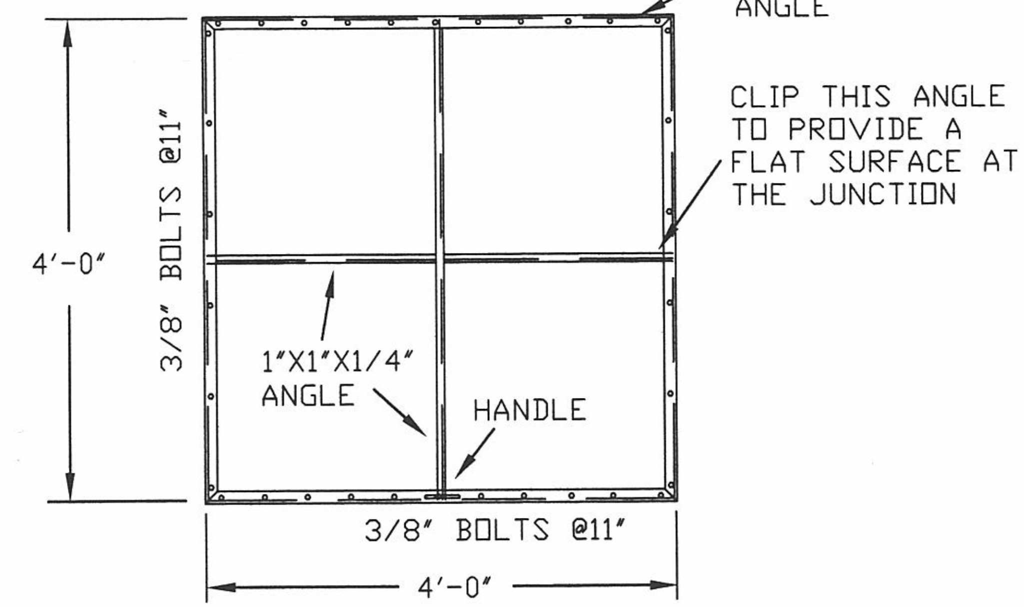
STRUCTURE PERSPECTIVE VIEW



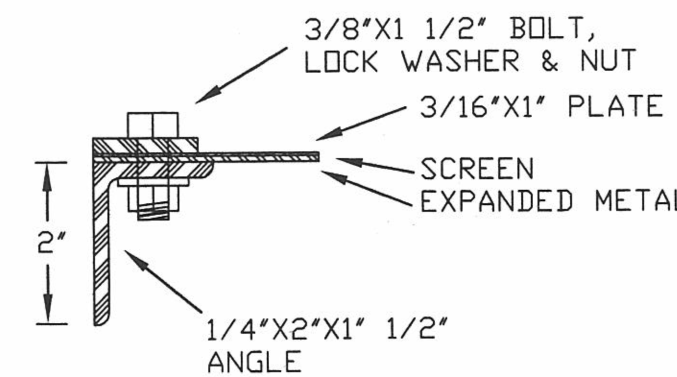


SCREEN FRAME DETAIL

3 NEEDED



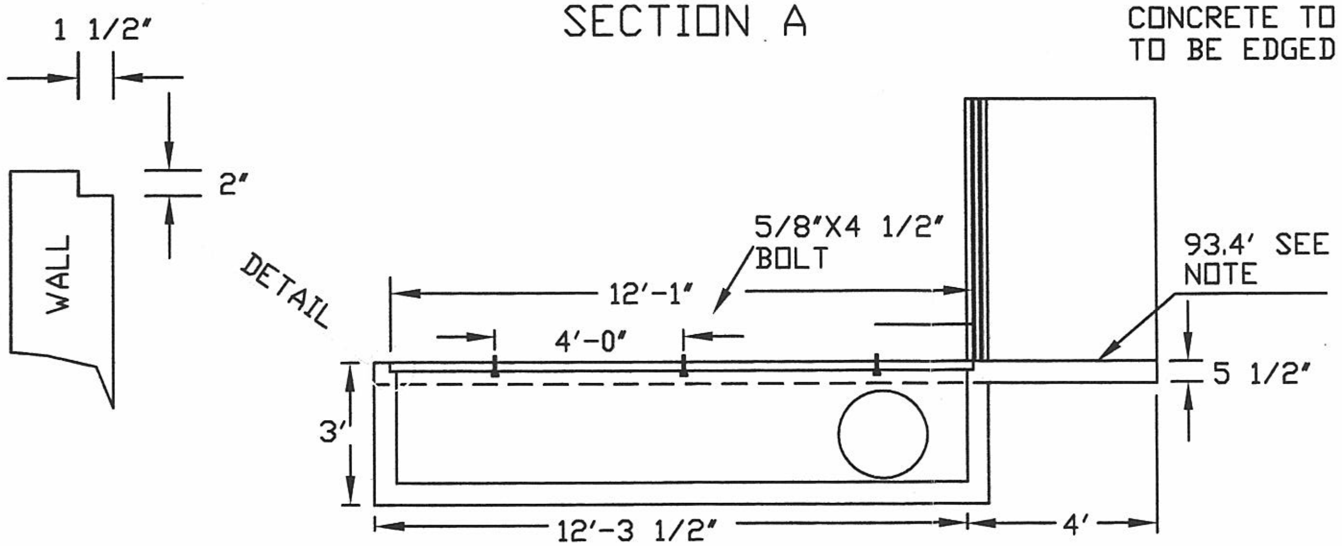
SCREEN FRAME DETAIL ELEVATION VIEW



NOTES

INSTALL THE STRUCTURE ABOUT 135' UPSTREAM FROM THE END OF THE SPOIL PILE WITH THE APRON AT LEAST AT AN ELEVATION OF 93.4' AS STAKED IN THE FIELD. SET THE ELEVATION OF THE APRON EVEN WITH THE CHANNEL BOTTOM.
SUPPLY PIPE TO BE 260'-21" CLASS 100 PVC.
INSTALL CONCRETE ACCORDING TO NATURAL RESOURCES CONSERVATION SERVICE SPECIFICATION 42, REINFORCED CONCRETE FOR MINOR STRUCTURES.
USE 4000 PSI STRENGTH CONCRETE, NEED 5.4 CU. YD.
CONCRETE TO BE VIBRATED, ALL EXPOSED EDGES TO BE EDGED WITH AN EDGING TOOL.

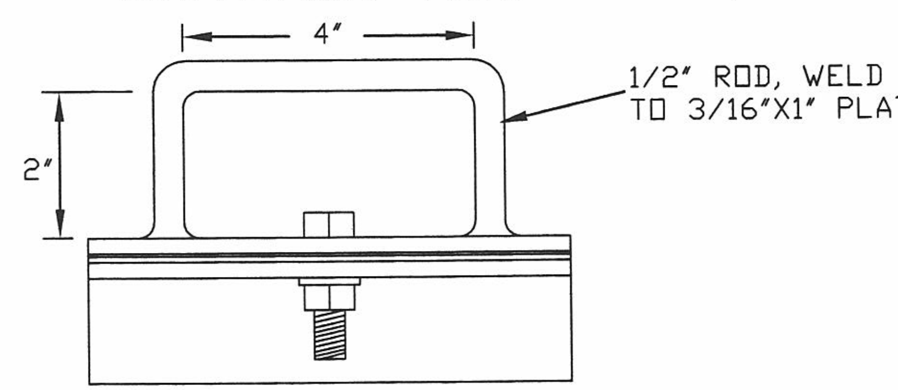
SECTION A



NOTE

NOTCH IS ON ALL 4 SIDES OF THE BOX.
BOLTS ARE TO HOLD DOWN THE SCREEN, USE A 1"X4"X¼"BAR WITH A 3/4" DIAMETER HOLE 1" FROM ONE END.

FRAME HANDLE DETAIL ELEVATION VIEW



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OREGON
JULY 11, 1969
BERNARD J. HEWES
EXPIRES 6/30/2009

NOTES

EXPANDED METAL TO BE CARBON STEEL, FLATTENED, 13 GAGE, 3/4" SHORT OPENING WIDTH.
SCREEN TO BE TYPE 304 STAINLESS STEEL, 20 GAGE MINIMUM WITH 3/32" HOLES SPACED 5/32" STAGGERED.

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CHECK & SCREEN STRUCTURE
UMATILLA COUNTY, OREGON
R H ENGINEERING

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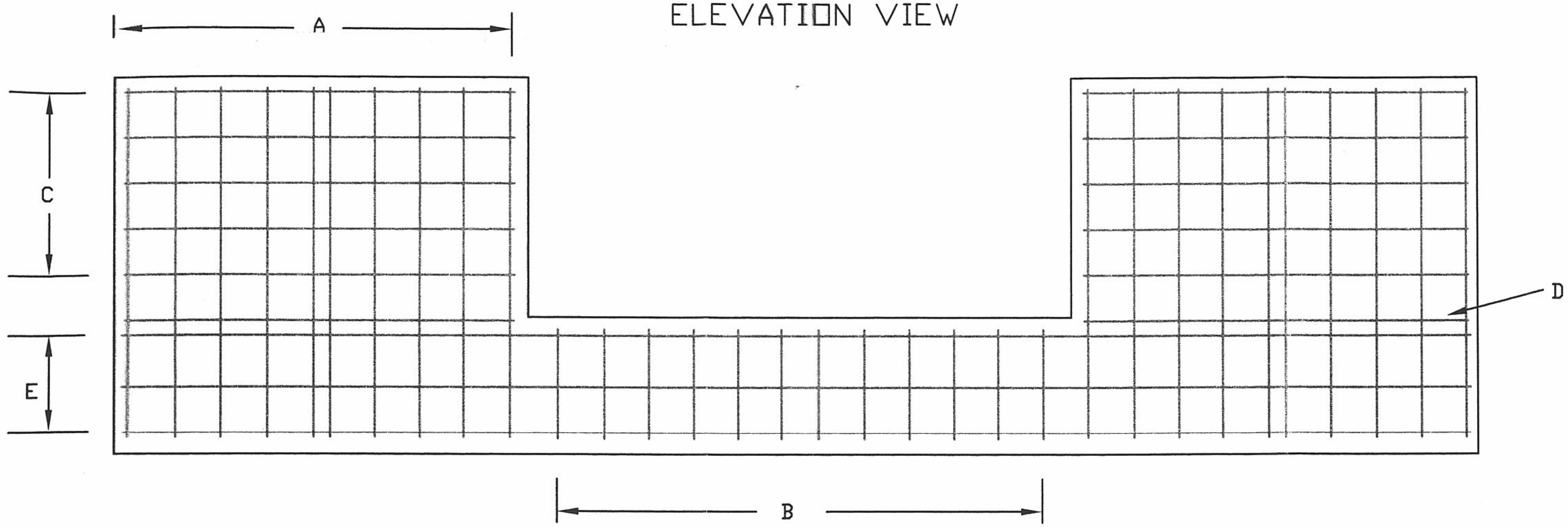
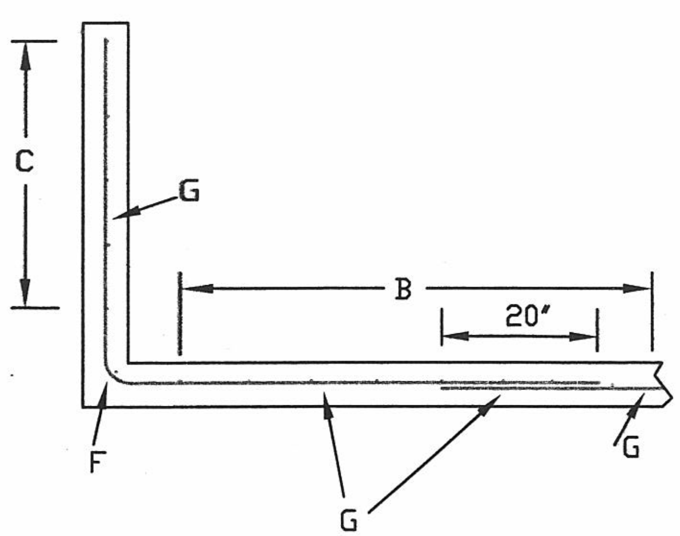
SHEET 6 OF 7

HEADWALL LOOKING DOWNSTREAM ELEVATION VIEW

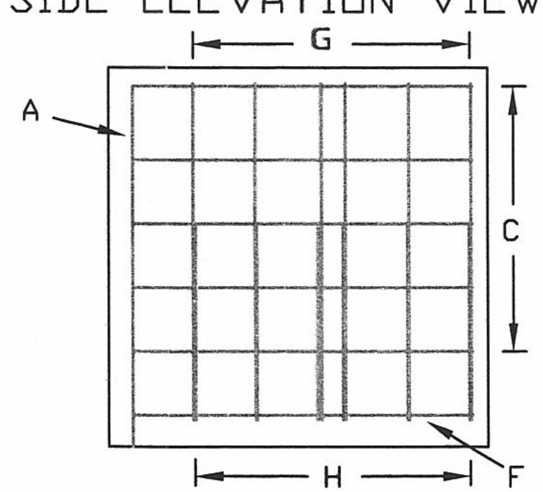


DOWNSTREAM SIDE WALL AND APRON

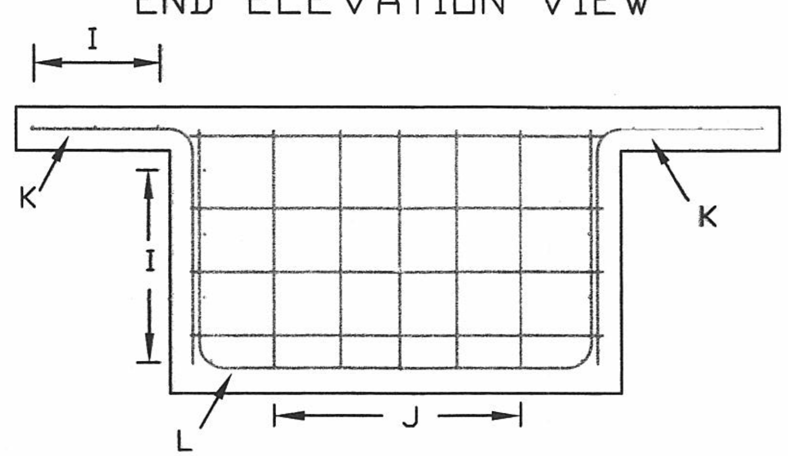
END ELEVATION VIEW



SIDE ELEVATION VIEW



SCREEN BOX END ELEVATION VIEW



REINFORCING STEEL SCHEDULE

ALL NUMBER 4 BARS, 8" NOMINAL SPACING

BAR	NO.	SHAPE	A	B	C
A	20	STRAIGHT	6'-1"	--	--
B	12	A B	2'-7"	3'-7"	--
C	10	A B	5'-7"	3'-9"	--
D	2	STRAIGHT	5'-8"	--	--
E	3	STRAIGHT	19'-8"	--	--
F	2	STRAIGHT	3'-7"	--	--
G	12	A B	3'-7"	5'-1"	--
H	12	A B	2'-0"	2'-0"	--
I	14	STRAIGHT	12'-0"	--	--
J	5	A B	2'-6"	3'-8"	--
K	38	A B	1'-9"	2'-6"	--
L	19	A B C	2'-6"	4'-3"	2'-6"

1080 FEET NEEDED WITHOUT ANY WASTE

REGISTERED PROFESSIONAL ENGINEER 6476 OREGON JULY 11, 1969 BERNARD J. HEWES

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REINFORCING STEEL DETAILS
UMATILLA COUNTY, OREGON

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