Scope of Work for the Rathdrum Prairie Project Plan in 2010

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1. Statement of the Current Technical Knowledge and Need for Additional Studies

The Rathdrum Prairie (RP) modeling project began in 2004 in response to concerns related to the rapidly-increasing urban and suburban development in this part of Idaho, and the uncertainty as to the water use demands that will be associated with this development. The results of the project to date include the successful development of a calibrated ground water flow model, and the establishment of a long-term ground water monitoring network (Figure 1). A complete description of the model can be found in Heish and others (2007).

A couple of remaining technical issues have been identified. These issues are characterized in the following questions:

What is the Idaho-centric water budget?
What are the fluxes from Coeur d'Alene Lake and Lake Pend Oreille into the aquifer?
What is the stratigraphy in the area north of the North Idaho College campus, which is known as the Coeur d'Alene Lake Outlet Area?
What is the relationship between lake stage, water levels in the aquifer, and ground water temperature in the Coeur d'Alene Lake Outlet Area?
What is the mechanism(s) for attenuation of metals in the soils and aquifer materials that are in the pathway of seepage in the Coeur d'Alene Lake Outlet Area?

The answers to these questions will help IDWR meet the objectives of Idaho's Comprehensive Aquifer Management Program (CAMP), and will allow the RP model to be refined, which will ultimately improve IDWR's ability to better manage the water resources of the Rathdrum Prairie.

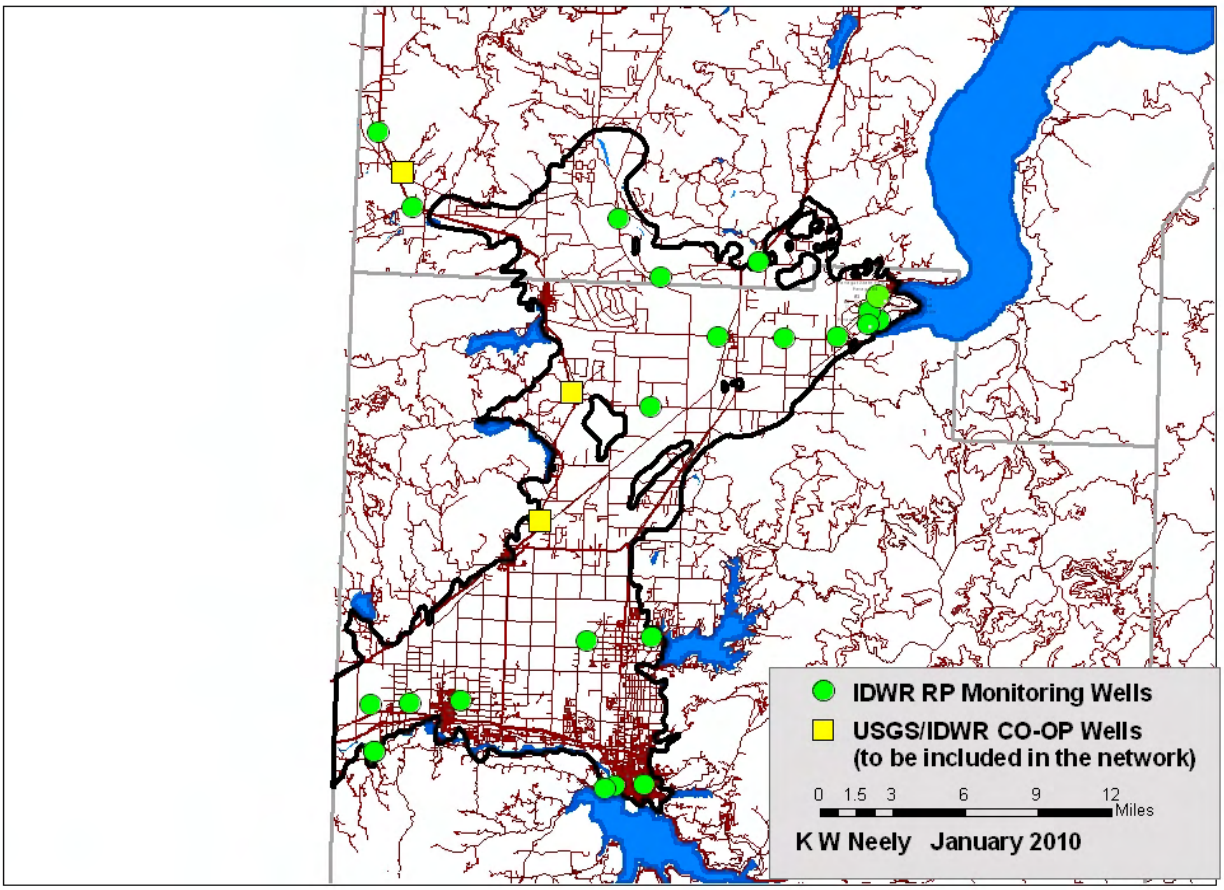

Figure 1. Map of the Rathdrum Prairie showing the monitoring network.

2. Purpose, Objectives and Tasks

The ***Purpose*** of the current study is to complete the technical work needed to improve the RP ground water flow model and to address several unanswered questions about surface water/ground water relationships. T

Four ***Objectives*** were identified for addressing the remainder of the technical issues.

Objective 1: Calculate the Idaho-centric water budget using similar information developed for the existing ground water model.

Objective 2: Determine the fluxes from Lake Pend Oreille and Coeur d'Alene (CdA) Lake into the RP aquifer through the utilization of thermal modeling techniques.

Objective 3: Determine the stratigraphy in the CdA Lake Outlet Area by the construction of a new monitoring well.

Objective 4: Determine the mechanism(s) of metals attenuation in the subsurface soils and aquifer materials in the seepage pathway in the Lake Coeur d'Alene Outlet Area by collecting lithologic samples during the drilling of the CdA monitoring well and submitting them for laboratory analyses.

Ten ***Tasks*** will be completed, as the budget permits:

1. Complete the Idaho-centric water budget.
2. Finalize a long-term ground water level and ground water temperature monitoring network. The network is currently 90% complete. Transducers in wells are being downloaded two to three times a year.
3. Collect water temperature data from high-yield production wells in the Bayview, Athol, and Coeur d'Alene areas. These data will be used in conjunction with the ground water monitoring data currently being collected in these areas.
4. Acquire thermal modeling training from INL.
5. Conduct thermal modeling for the Lake Pend Oreille Outlet Area.
6. Rehabilitate the Farragut #6 well for monitoring.
7. Determine if an additional monitoring well is needed in the Lake Pend Oreille Outlet Area. If so, drill the well and install transducers.
8. If a new well is not needed in the Lake Pend Oreille Outlet Area, using remaining funding to drill a deep (250-300 ft) monitoring well in the CdA Lake Outlet Area. Collect core and cuttings as the well is being drilled. Conduct analyses on core. Deploy transducers.
9. Conduct thermal modeling for the Coeur d'Alene Lake Outlet Area.
10. Write a technical report describing the accomplishments and making recommendations for the future.

3. Detailed Method of Studies for the Four Objectives

A. Method of Study for Objective 1 – Determining the Idaho-centric water budget.

To accomplish this objective, water budget data will be compiled for the Idaho portion of the SVRP model area. These existing data were initially gathered and used for calibration of the current SVRP model.

B. Method of Study for Objective 2 – Determine the flux into the Rathdrum Prairie Aquifer from Lake Pend Oreille and Coeur d'Alene Lake.

Heish and others (2007) state "There also is significant uncertainty in the simulated seepages from Lake Pend Oreille and Coeur d'Alene Lake. Further investigations in these parts of the SVRP aquifer could provide valuable knowledge that can be used to improve the model in the future." The fluxes from these two lakes have been difficult to determine because of limited data and complex hydrogeology. In 2010, attempts will be made to quantify these fluxes through the use of thermal ground water modeling.

Lake Pend Oreille Flux Study

To determine the flux from Lake Pend Oreille, the existing monitoring network may be adequate, or additional monitoring wells may be required in the Farragut State Park area. The data being collected currently will be used in the initial thermal modeling runs. If the modeling indicates that more wells are needed, the Farragut #6 may be rehabilitated, and/or, a new monitoring well may be drilled.

Figure 2 shows the locations of monitoring wells in the Lake Pend Oreille Outlet Area (from Farragut State Park to the Eight Mile Prairie region). The Athol, Highway 54, Farragut #4, Farragut #9, and Farragut #10 wells have each been instrumented with two or more water level/temperature transducers, positioned at different depths in the wells. The Farragut #2 and Farragut #5 wells each have one transducer installed in them; extensive wiring in Farragut #2 and debris in Farragut #5 made deployments of multiple transducers risky. The possibility of cleaning out Farragut #6 will be investigated. However, in addition to the debris, the well is inside a concrete wellhouse which prevents access for a drill rig. All or part of the wellhouse will have to be removed in order to attempt a cleanout of the well. The Farragut #3, #7, and #8 wells are not available for monitoring.

INL will provide thermal modeling training to IDWR in late April, and modeling will begin shortly after the training is completed.

Coeur d'Alene Lake Flux Study

Figure 3 shows the locations of monitoring wells in the Coeur d'Alene Lake Outlet Area, and the target area for the new monitoring well. Transducer deployment is complete for

the three monitoring wells shown in Figure 3 and downloads of data are done two to three times a year.

Ground water temperature analyses by Nimmer and Ralston (2007) indicate that a relationship exists between lake stage and ground water temperature in the Coeur d'Alene Lake Outlet Area. Further understanding of this relationship may aid in determining the flux from Coeur d'Alene Lake into the Rathdrum Prairie Aquifer. A proposed monitoring well, drilled north of the existing NIC - Fort Grounds well, will help test this hypothesis. Prior to the drilling, existing geophysical data (gravity surveys) may be re-analyzed by Ken Sprenke (University of Idaho) to help identify the deepest portion of the alluvial/fluvial trough in the Coeur d'Alene Lake Outlet Area.

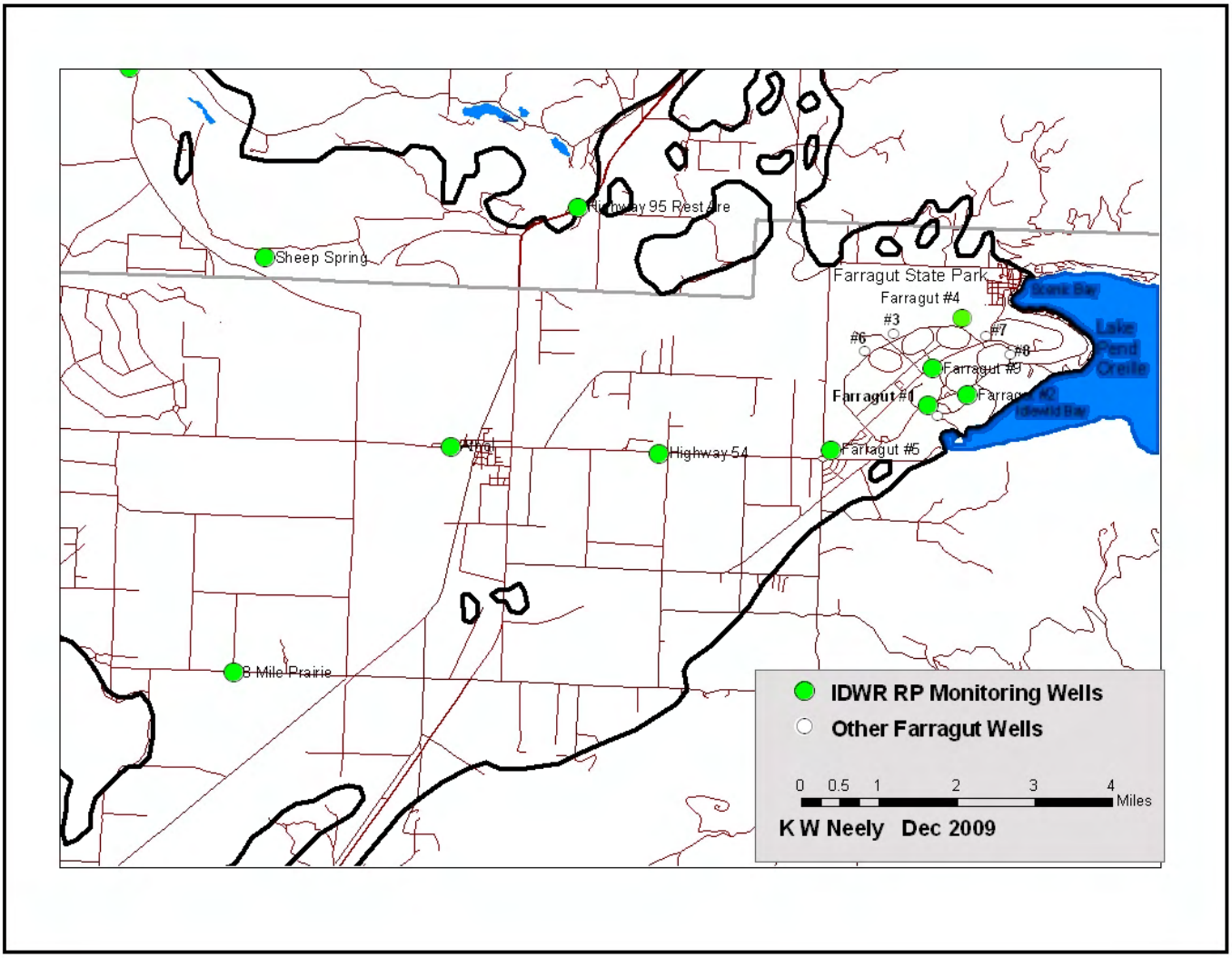

Figure 2. Monitoring well locations in the Lake Pend Oreille Outlet Area.

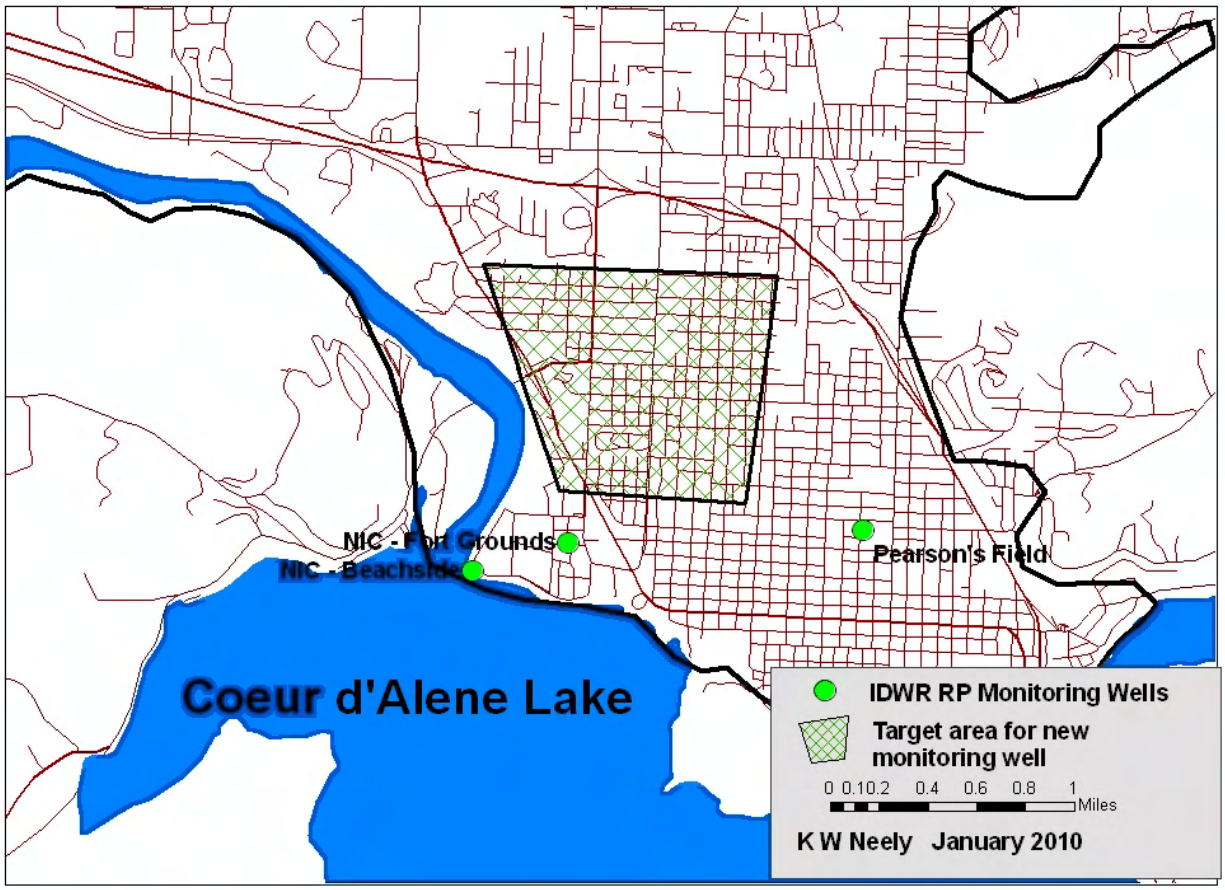

Figure 3. Monitoring well locations in the Coeur d'Alene Lake Outlet Area, and a region of possible locations for a new monitoring well.

Collection of Water Temperature Data at Public Supply Wells

Dr. Dale Ralston (Ralston Hydrologic Services, Inc.) proposed that water temperature readings be recorded at selected high yield production wells. His thesis is that wells producing 700 gpm or more should have water temperatures at the land surface that are equal, or very similar, to aquifer temperatures. Public Water System operators are currently required to record system information on a regular schedule. IDWR is

developing a contract with Dr. Ralston for coordinating with the system operators to collect the temperature data, which will be used in conjunction with the ground water temperature data currently being collected. The wells to be sampled are in Bayview, Athol, and Coeur d'Alene.

C. *Method of Study for Objective 3 – Determine the stratigraphy in the Coeur d'Alene Outlet Area north of NIC, and investigate the relationships between lake stage, aquifer water levels, and ground water temperature.*

The hydrogeology in the Coeur d'Alene Lake Outlet Area is complex and the well control for the deeper part of the stratigraphic section is limited. Grader (2008) identified a deep (300+ feet) trough filled with sedimentary material. However, the only well in the area that goes to that depth has just three lithologic entries. A new monitoring well that is carefully logged during the drilling will have the potential to test Grader's (2007) hypothesis about a deep aquifer facies. In addition to providing stratigraphic information, a new well in this area will be able to test the relationships between lake stage, ground water levels, and ground water temperatures that were identified in the shallow portion of the aquifer by Nimmer and Ralston (2007). All of this information will aid in the understanding of the hydrogeology in the Lake Coeur d'Alene Outlet Area.

D. *Method of Study for Objective 4 – Metals attenuation in the seepage pathway from Lake Coeur d'Alene into the RP aquifer at the NIC location.*

It is well documented that lakebed sediments of Coeur d'Alene Lake contains high concentrations of heavy metals and trace elements (antimony, arsenic, cadmium, copper, lead, mercury, silver, and zinc) as the result of mining in the Silver Valley. Since ground water quality testing downgradient of this outlet area has shown an absence of metals, it is clear that attenuation of the metals occurs in the subsurface. However, the mechanism of attenuation is unknown.

Therefore, an additional benefit of the new monitoring well described in Objective 3 will be the opportunity to investigate the mechanism(s) for the attenuation of metals in the soils and aquifer materials in the Coeur d'Alene Lake Outlet area. Core samples will be collected during the first 50 feet of drilling, and analyzed for selected metals and trace elements. In addition to the core data, ground water quality samples will be collected from the new well, and the NIC Beach, Fort Grounds (NIC), and Pearson's Field wells, and analyzed for metals and trace elements.

4. Budget

The 2010 budget for the technical work for this phase of the RP project is $76,300 (Table 1). The funding comes from two sources with different expiration dates. The State of Idaho has provided $10,400 through the CAMP for Rathdrum Prairie technical studies. Most of these funds, which are for Fiscal Year 2010 (which ends June 20, 2010), will be used for thermal model training. The Environmental Protection Agency (EPA) provided $891,000 for this project, of which $65,900 is remaining. This funding will be used for monitoring, thermal modeling, and project management. The EPA funding is available through the end of December, 2010

Table 1. Budget for the Rathdrum Prairie Aquifer Project, 2010.

Proposed Use of Current Funding			
Work Item	**EPA Funds**	**CAMP Funds**	**EPA and CAMP**
IDWR Salary and Benefits	$30,000		
INL Thermal Model Training		$10,000	
Farragut or CDA Monitoring well	$20,000		
Farragut #6 - building removal and drillout	$7,500		
Ralston Water Temp contract	$2,200		
IDWR Travel	$2,700		
Misc	$3,500	$400	
Total Planned Expenditures	$65,900	$10,400	$76,300

5. Schedule of Technical Activities

A 12-month Time Table has been developed in order to accomplish the objectives and tasks (Table 2).

Table 2. Time Table for the technical activities of the Rathdrum Aquifer Project, 2010.

	2010											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Idaho centric water budget	■	■										
Thermal ground H20 modeling training				■								
Conduct thermal monitoring					■	■	■	■	■			
Farragut 6 rehabilitation								■				
Drill Farragut or CDA Monitoring Well									■			
Transducer downloading			■			■			■			■
Technical report writing									■	■	■	
Final project wrap up												■

6. References

Grader, G., 2008, Geologic cross-sections of the Spokane River from Coeur d'Alene to the Idaho/Washington stateline: Towards a detailed hydrogeologic framework along the southern margin of the Spokane Valley-Rathdrum Prairie. 32 p.

Hsieh, P.A., Barber, M.E., Contor, B.A., Hossain, Md.A., Johnson, G.S., Jones, J.L., and Wylie, A.H., 2007, Ground-water flow model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho. U.S. Department of Interior, U.S. Geological Survey, Scientific Investigations Report 2007-5044, 78 p.

Nimmer, R.E., and Ralston, D., 2007, Ground-water elevation and temperature analysis of leakage from Coeur d'Alene Lake, Idaho. 11 p.