



Project Completion Report

Grant Number: #G1500053

Grant Title: WRIA #1 Surface to Groundwater Relationship

Recipient: Bertrand Watershed Improvement District

Effective Date: January 1, 2015 **End Date:** December 31, 2017

Final Award Amount: \$183,613.73 **Final Expenditure Amount:** \$ 180,340.03

#1 - Surface to Groundwater Conversions

The Bertrand Watershed Improvement District (WID) Board identified three farmers with surface water diversions in the upper Bertrand who were interested in switching from surface water diversions to groundwater withdrawals to maximize streamflows for salmon. These farmers have adjacent property owners that may also wish to change from surface water use to groundwater use. The WID did not plan to identify these farmers within the grant contract as they have not yet consented to participate. Any expense of public funds involving a landowner will follow proper state contracting procedures.

The WID proposed to:

- 1) Conduct a feasibility analysis for each of the 3 potential partners in a surface to groundwater transfer and outline the potential costs of each project. Costs of developing the individual plans and analyzing their value to streamflow enhancement and cost effectiveness will average \$7,500 per partner, total estimated \$22,500.
- 2) The WID Board (Board) will offer to provide to each potential partner a level of cost share. The Board estimates offering each interested landowner a cost share estimated at 50% - 75%, capped at a maximum. The maximum amount will be developed based on the feasibility analysis per project partner. Funds will be paid for engineering and capital improvements to facilitate the preparation of change/transfer applications for two or more surface to groundwater transfers. These funds would be used for well construction, pumps, pipes, and monitoring equipment. An estimated \$44,321 would be available for these costs depending on the amount needed to conduct the feasibility analysis.

Estimated Cost: \$66,821

Actual Cost: \$56,398.63

Final Progress Report:

- We identified and met with three private property owners who have surface water rights. Letters were sent to these landowners outlining their options and what projects

the Bertrand WID, through the Augmentation Grant, would be able to assist them with. Meetings with the Project Engineer and Hydrogeologist took place.

- We worked with property owners to determine how the surface to ground transfer may benefit them individually, as well as being a benefit to the stream.
- The three candidates for conversion were presented plans as to how the surface to ground transfer may benefit them individually, as well as being a benefit to the stream. Decision making for these farms was in process for 9 months.
- All three farms indicated a willingness to participate. Plans for each farm were developed.
- Water right change applications were prepared for the three target surface water rights and planned to be submitted to Ecology.
- Task was put on hold due to legal questions about the ability to complete the project in February 2017.

#2 – Groundwater Monitoring

Through the development of, "A Farmer's Guide to the Water Right Transfer Process" and the implementation of the initial project, it was found that, due to data limitations, very conservative methods needed to be applied when estimating the anticipated benefit to stream flows resulting from a surface to groundwater transfer (i.e. one needs to significantly *underestimate* the benefit to stream flows when switching from a surface water diversion to well withdrawals).

Increased data and improved analysis is required to evaluate and quantify the anticipated benefits to streamflow resulting from surface to groundwater right transfers. An in-depth analysis is needed to collect additional data that will be used to better define the overall benefits to streamflow from the proposed water right changes. It is a goal of the WRIA 1 Joint Board to develop a groundwater model of the Lynden, Everson, Nooksack, and Sumas (LENS) area. The Bertrand WID is funding part of this model through this agreement and a \$50,000 proviso from the Environmental Legacy Stewardship Account (Ecology Grant G1500050).

A great deal of critical information appears to be available for portions of the model domain. However, it is likely that additional data must be collected from land owner wells and surface waters to successfully develop a model sufficiently representative of the groundwater system for important decision-making down the road. We anticipated that the scope of services for this task would include the following:

- 2.1 Work with interested stakeholder groups located in the model domain to identify wells with owners that will allow the installation of long-term monitoring equipment, synoptic water level measurements, and/or possible aquifer testing activities. Estimated due date: May 31, 2015.
- 2.2 Develop, establish and operate surface and groundwater data collection networks in the model domain. Estimated due date: May 31, 2015.
- 2.3 Add instrumentation to up to 20 wells located at various distances from creeks and distances along creeks with continuous water-level data recorders. Download the data from each data recorder roughly every three months for approximately one year. The downloaded water level data will be compiled into an excel database. The wells will be identified by March 31, 2015 and data collection anticipated to be collected by March 31, 2016.
- 2.4 Complete short-term (6 to 10 hours) aquifer pumping tests in up to 15 of the identified wells using the pumps installed in the wells. Measure water level drawdown and recovery in the pumping wells and any appropriate nearby wells prior to, during and following the aquifer tests. Estimated due date: June 30, 2015

2.5 Analyze the aquifer testing data to determine pertinent aquifer parameters (transmissivity, hydraulic conductivity, and storage). Compile the aquifer testing data into a comprehensive excel database. Estimated due date: December 31, 2015.

2.6 Establish stream gaging stations equipped with continuous stage recorders. The data collected from the stream gaging stations will be used as input into the revised surface water model and, consequently, affect input into the conceptual and numerical models. Stream gaging stations will be established by November 30, 2015.

2.7 Complete seepage runs, streambed conductivity and/or streamflow measurements in selected streams. Estimated due date: November 30, 2015.

2.8 Analyze the groundwater level time-series data, develop groundwater level hydrographs for each monitored well, develop contour maps of groundwater elevations for aquifers located in the model domain. Work completed by March 31, 2016.

Estimated Cost: \$50,000

Actual Cost: \$50,000

Final Progress Report:

- Long-term groundwater monitoring stations were set up at 12 locations.
- Six-day aquifer tests were conducted in five irrigation wells:

Test Name	Dates
Hammer Road	February 21-27
Stein Road	March 17-24
Berthusen Road	April 15-22
Northwood Water Association	June 12-13
Blaine GWMP-4	September 28 - October 2
Maberry Home Place	November 10-16

- Seepage runs: We made discharge measurements at five different sites along Kamm Creek, three along Ten Mile Creek, and two along Four Mile Creek.
- A QAPP was completed along with a “Report of Findings” on June 9, 2017
- The DRAFT conceptual model report was submitted to Whatcom County for review on June 30, 2016.
- Task #2 is completed. The groundwater model is still in development but using Joint Board funds to finish. The Contractor will provide the final Phase 4 product to the County before the end of 2018.

#3 – Augmentation Well

The Bertrand WID installed a groundwater well in the first phase of the Augmentation Project in an effort to test the ability of the WID to augment Bertrand Creek stream flows with groundwater during low-flow periods. The WID decided not to proceed with development of the streamflow augmentation project because of the uncertainty of the level of water quality treatment needed to address water quality (iron) concerns of the well water and the treatment cost. New technology in water treatment and continued interest in this concept makes this project more feasible and the WID returned to exploring this portion of the augmentation project.

3.1 The test well (previously constructed) may not be the ideal location for the Augmentation project. Four (4) alternative sites will be identified with costs associated with each location, including cost of water delivery to Bertrand Creek. The wells were identified by: July 31, 2015.

3.2 Treatment options were explored. The long term pump test for the previously constructed well

unveiled the need for an iron treatment system. During this test, high levels of iron were recorded. These levels were significantly higher than those recorded during the 24-hour stepped pump test. This discrepancy remains un-resolved. However, it is apparent that the levels of iron in the groundwater are not conducive to direct discharge into Bertrand Creek. Bertrand Creek has a measurable amount of iron within the system, but not to the levels found in the groundwater. Discussions with the WDFW were held to determine the impacts to fish species present in the Bertrand system. The transition of iron, once oxygenated, from being within the solution to becoming a precipitate is what is detrimental to fish. Furthermore, the deposition of iron bacteria along the drainage ways is not perceived as a benefit. For these reasons it was determined that an iron treatment system would be required, prior to discharge in the surface water system. New treatment options will be identified, evaluated, and explored.

3.3 Transmission options to convey the groundwater to Bertrand Creek were further developed. To minimize the direct impact to the surface water, a groundwater well needs to be installed at a distance from the surface water. This requires that the water be conveyed from the well to the creek. There are numerous ditches in the area that may work as conveyance options. These were explored as conveyance alternatives to minimize the cost of constructing infrastructure.

Task 3 was updated in April, 2017 as follows:

The Bertrand WID installed a groundwater well in the first phase of the Augmentation Project in an effort to test the ability of the WID to augment Bertrand Creek stream flows with groundwater during low-flow periods. The WID decided not to proceed with development of the streamflow augmentation project because of the uncertainty of the level of water quality treatment needed to address water quality (iron) concerns of the well water and the treatment cost.

3.1 The test well (previously constructed) may not be the ideal location for the Augmentation project. Three (3) alternative site were identified with costs associated, including cost of water delivery to Bertrand Creek. The wells were identified by: August 31, 2016.

3.2 It has been determined that currently operating wells, post-irrigation season, provide the best opportunity for streamflow augmentation. The pumping infrastructure already exists and in many cases there are distribution systems which can be easily modified to access the stream. A minimum of 2 wells will be identified and the Bertrand WID submitted a water right application (with well owner and property owner approval) to use these wells as augmentation sites to the Bertrand Creek or its tributaries.

3.3 Design of the outfall to the stream from currently operating wells will be completed according to WDFW standards and scheduling of the pumping provided. Depth to groundwater in the wells and instream flows will be monitored throughout Fall 2017, and a report provided by December 31, 2017.

Estimated Cost: \$ 63,938.80

Actual Cost: \$ 60,595.90

Final Progress Report:

- We identified alternative well sites. The WID Board explored the use of existing wells after irrigation season for augmentation. The greatest stress on stream flows often occur after most crop irrigation takes place. We identified several irrigators who are willing to pump water into the Creek during this period. We researched WDFW's approved augmentation practices.
- Letters were sent to 8 potential candidates for augmentation. Responses were collected and field examinations conducted.
- Field examinations of 7 potential augmentation sites were completed. Input as to priority sites was requested from WDFW, Lummi Nation, and Nooksack Tribe. Priority sites were identified and permits for augmentation prepared.

- Fish biologists from WDFW, Nooksack Tribe, & Lummi Nation were asked for feedback. Joel Ingram (WDFW) and Treva Coe (Nooksack) provided responses. Their feedback was incorporated into the final QAPP.
- A water right application for processing thru Cost Reimbursement was submitted to Ecology in September 2016.
- Wells were selected for augmentation sites. Design for aeration was completed.
- The final SEPA document was submitted to Whatcom County April 2017.
- A draft QAPP was completed and submitted to peer reviewers. Reviewers included: Kasey Cykler (WDOE), Kara Kuhlman (Lummi), Treva Coe (Nooksack), Joel Ingram (WDFW), and Ryan Ericson (Whatcom County).
- Cost-reimbursement contracts with augmentation well landowners were in place June 2017. The contracts were delayed until final selection of the landowners were decided.
- Structural design for aeration was completed by a design engineer in June, 2017.
- A Final QAPP was completed and finalized April 3, 2017.
- The water right application was approved on August 23, 2017.
- Monitoring schedule was developed and samples collected and analyzed. The initial samples were collected and analyzed according to the QAPP protocols. Subsequent samples were only partially completed as planned due to miscommunication with the data collection team. The BWID, AESI, and Maberry Packing cooperated to collect the samples and record the flow data.
- Streamflow augmentation began on September 13, 2017. The streamflow augmentation continued through October 16th when a large rain event necessitated the need to remove the dissipation structures and stop the pumping.
- Report on “progress to date” presented at the September 21, 2017 Baker to Bay Symposium
- Presentation of the project at the December 13, 2017 Water Supply Symposium.

#4 - Consolidation

As mentioned in Task 1 above, there was a cooperative property owner who is willing to consider a surface to ground water transfer. This owner has neighbors who may also consider a similar transfer. It may be that the most viable and effective way to complete these potential transfers will be to consolidate the transferred water rights to a single well (point of withdrawal).

This consolidation of infrastructure would require cooperation and coordination of efforts.

4.1 Communication with key landowners. Determine number of landowners interested in a consolidation effort. Estimated due date: July 31, 2015

4.2 Evaluate and address engineering questions that would advance the idea of consolidating water withdrawals. Estimated due date of engineering report: October 30, 2015.

Estimated Cost: \$ 12,000

Actual Cost: \$1,276.30

Final Progress Report:

- Consolidation between several farmers was found to be unfeasible. We applied these funds to consolidation of diversions on a single farm leading to a more attractive Surface to Ground project. We explored one location where we had originally thought the idea of consolidating multiple landowners into a single well may make sense. After determining the status of each of these rights and desired uses, we determined that consolidation with multiple landowners in this location was not

feasible. We requested a transfer of the funding balance of this task to Task #1 and the transfer was approved on February 1, 2017.

- An amendment requesting the transfer of the balance of this task to Task #1 was prepared.
- An amendment transferring the balance of this task to Task #1 was finalized in May, 2016.

#5 – Administration

RECIPIENT will ensure proper administration and management of project.

The RECIPIENT will ensure that active involvement occurs through a number of activities including, but not limited to:

1. Facilitate the meetings and education of the RECIPIENT BOARD and watershed residents throughout the project.
2. Solicit and summarize feedback on projects from local governments, agencies, Lummi Nation, Nooksack Tribe, wildlife agencies, and local non-profits dedicated to stream restoration.
3. Ensure actions taken have the local support needed to move the RECIPIENT closer to the goal of a fully functioning natural system that meets the goals of all water, wildlife, and land managers.
4. The recipient will manage the facilitation contract and provide administrate support services for the grant project, including vouchers and quarterly reports.

Estimated Cost: \$ 12,000

Actual Cost: \$12,069.20

Final Progress Report:

- Whatcom Farm Friends coordinated Bertrand WID meetings in October, November and December, 2015. Grant reports and project accounting was also provided.
- Whatcom Farm Friends, which was renamed Whatcom Family Farmers – Education in late 2015, coordinated Bertrand WID meetings in January and March, 2016. Grant reports and project accounting was also provided.
- Administration of the WID was transferred to Ag Water Board effective April 1st, 2016. Grant reports and project accounting was also provided. There were no personnel changes. The Bertrand WID remained the grant recipient. The Ag Water Board was then contracted to administer their projects rather than Whatcom Farm Friends (which no longer exists).
- A request to extend the deadline for Task #3 until December 2017 was submitted and accepted.
- Final grant report and project accounting was provided on January 31, 2018

Include a list of all reports, maps, plans, and other documents prepared under this grant, indicating for each whether it is in published or unpublished form as defined in the grant. Copies of each document must be submitted to Ecology.

Final temporary water right permit issued by Ecology – September 26, 2016

Affidavit of Legal notice for G1-28827 published in Lynden Tribune – October 26, 2016

Cost- Reimbursement Agreement (CRA) – February 23, 2017

Hydrogeologic Report for New Application – G1-28827, July 31, 2017

Hydraulic Project Approval permit - August 30, 2017

Bertrand Creek Flow at Rathbone Gage – AESI report – September 14, 2017

Associated Earth Sciences, Inc. (AESI), 2017, Bertrand Streamflow Augmentation Quality Assurance Project Plan (QAPP), Whatcom County, Washington, Report to Bertrand Watershed Improvement District (WID), June 6, 2017.

Associated Earth Sciences, Inc. (AESI), 2017, Annual Project Summary Report, Bertrand Streamflow Augmentation, Whatcom County, Washington, Report to Bertrand Watershed Improvement District (WID), November 8, 2017.

Final Budget Report

Time Frame	Projected	Actual	Difference
FY 15 Quarter 1 July 2014-September 2014	\$0.00	\$0.00	\$0.00
FY 15 Quarter 2 October 2014-Dec 2014	\$0.00	\$0.00	\$0.00
FY 15 Quarter 3 January 2015-March 2015	\$0.00	\$0.00	\$0.00
FY 15 Quarter 4 April 2015-June 2015	\$14,000.00	\$32,280.60	-\$18,280.60
Sub-total	\$14,000.00	\$32,280.60	-\$18,280.60
FY 16 Quarter 1 July 2015-September 2015	\$20,500.00	\$13,819.78	\$6,680.22
FY 16 Quarter 2 October 2015 –December 2015	\$16,500.00	\$15,361.35	\$1,138.65
FY 16 Quarter 3 January 2016-March 2016	\$33,223.70	\$9,167.14	\$24,056.56
FY 16 Quarter 4 April 2016-June 2016	\$17,097.30	\$23,905.37	-\$6,808.07
Sub-total	\$87,321.00	\$62,253.64	\$25,067.36
FY 17 Quarter 1 July 2016-September 2016	\$7,500.00	\$3,200.65	\$4,299.35
FY 17 Quarter 2 October 2016 –December 2016	\$27,000.00	\$27,801.66	-\$801.66
FY 17 Quarter 3 January 2017-March 2017	\$7,353.93	\$9,580.87	-\$2,226.94
FY 17 Quarter 4 April 2017-June 2017	\$6,500.00	\$11,194.96	-\$4,694.96
Sub-total	\$48,353.93	\$51,778.14	-\$3,424.21
FY 18 Quarter 1 July 2017-September 2017	\$13,723.80	\$10,940.64	\$2,783.16
FY 18 Quarter 2 October 2017 –December 2017	\$20,215.00	\$23,087.01	-\$2,872.01
Sub-total	\$33,938.80	\$34,027.65	-\$88.85
Total	\$183,613.73	\$180,340.03	\$3,273.70

Task	Projected	Actual	Difference
1	\$56,398.63	\$56,398.63	\$0.00
2	\$50,000.00	\$50,000.00	\$0.00
3	\$63,938.80	\$60,395.90	\$3,342.90
4	\$1,276.30	\$1,276.30	\$0.00
5	\$12,000.00	\$12,069.20	-\$69.20
Total	\$183,613.73	\$180,340.03	\$3,273.70

Photographs of Augmentation Project – Task #3



Riser on irrigation line and jump hose to the splash plate.



Splash plate dissipater to inject oxygen into groundwater before entering Bertrand Creek



Well field ¼ mile from stream used for augmentation project.



Bertrand Creek with additional 1.1 cfs added.