Executive Summary

Spokane County (the County), in conjunction with Stevens and Pend Oreille County (Tri-Counties), is considering setting up a water bank to address existing and potential regulatory constraints on existing and new water use in Water Resource Inventory Area (WRIA) 55, the Little Spokane Watershed. One of the options for water bank seeding that has been discussed with the Tri-Counties and other members of the project Policy Advisory Group (PAG) is potential use of a water source from WRIA 62, the Pend Oreille River Watershed. A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature, as Ecology has not closed the Pend Oreille River to further consumptive appropriations.
Aspect has conducted an appraisal-level evaluation of necessary infrastructure and potential fatal flaws associated with conveying water from the Pend Oreille River to the upper headwaters of the Little Spokane River. An interim project flow criteria has been estimated at a 10 cubic feet per second (cfs) average mitigation flow rate for a combination of bank seeding and additional instream flow mitigation, based on consideration of future water demand and preliminary estimates of stream channel capacity. Both surface water and groundwater supply options near the City of Newport may be feasible.

**Consideration of Existing Conditions and Water Availability**

There are several key existing conditions and water availability issues relevant to project feasibility. These include:

- **The watershed boundary**—and the upper headwaters of the Little Spokane River—reaches within approximately three miles of the mainstem of the Pend Oreille River, with about 110 feet of elevation difference at the topographic divide.

- **Subsurface geology** in the project area includes both unconsolidated aquifer materials and bedrock near the surface that will need to be considered if a groundwater source and wellfield option is pursued.

- **Surface soils** mapped in the project area include relatively permeable, well-drained areas where infiltration of water may be possible to support aquifer recharge and river baseflows. Site-specific field investigations would be needed to ascertain if infiltration is a feasible option for providing local recharge and associated instream flow enhancement. The alternatives discussed below focus on direct discharge to the Little Spokane River.

- **Ecology** has not closed the Pend Oreille River to further consumptive appropriations, but has provisioned recent water right decisions with a curtailment flow of 7,700 cfs at the Newport gage (USGS #12395500), based on a Surface Water Source Limitation (SWSL) recommended by the Washington State Department of Fish and Wildlife (WDFW).  

- **The mainstem of the Little Spokane River** has several constituents on the 303(d) list (Category 5), requiring a Total Maximum Daily Load (TMDL) to be established or other water quality improvements to be implemented. These include dissolved oxygen in the upper reaches near Scotia Road, pH, fecal coliform, and temperature further downstream, and PCBs in the lower reaches of the river. The Pend Oreille River has also been listed on the 303(d) list for temperature at Newport. PCBs have been noted as an issue by Ecology, but the listing does not occur at Newport and is further downstream at Usk. Any introduction of Pend Oreille source water into the Little Spokane watershed will need to address TMDL concerns related to the project in both rivers.

- **If a groundwater source is pursued as an option**, existing groundwater quality will need further evaluation. A cursory review of the potential for existing groundwater contamination was conducted. While the review did not suggest that this would be a major concern, if wellfield investigations move forward, additional investigation can be completed.

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1 A SWSL is a permit-specific condition recommended by WDFW and applied by Ecology as a permit condition under the public interest test for issuing a new water right. It is not an instream flow rule. A SWSL on one water right may be applied to another water right, or a separate permit-specific SWSL may be applied, or none at all, depending on whether mitigation of instream flows is provided as a part of the project.
to support an evaluation of groundwater contamination risk based on specific test well locations proposed for further study.

**Design Considerations**
The feasibility of accommodating the interbasin transfer at the quantities proposed may be limited by a number of factors including:

- Available freeboard in natural downstream conveyance channel (available volume between instantaneous stream flow and ordinary high water);
- Water source-based constraints (water quality, physical water availability);
- Legal availability of water from Pend Oreille River; and
- Maximum conveyance infrastructure limitations.

An objective of this appraisal study has been to identify how these factors may be addressed through existing information, future data collection and analysis, and infrastructure improvements.

**Alternatives Analysis**
For purposes of evaluating feasibility and developing costs, four concept alternatives were analyzed based on two source water alternatives (a surface water supply or a groundwater supply) and two discharge locations (discharge to a large wetland in the upper headwaters and discharge to the river approximately two miles downstream). These are documented in detail in this memorandum.

**Table ES-1. Concept Alternatives**

<table>
<thead>
<tr>
<th>Discharge Option</th>
<th>Alternative 1 (Surface Water Supply)</th>
<th>Alternative 2 (Groundwater Supply)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A (Headwaters)</td>
<td>Alternative 1A</td>
<td>Alternative 2A</td>
</tr>
<tr>
<td>Option B (Headwater Bypass)</td>
<td>Alternative 1B</td>
<td>Alternative 2B</td>
</tr>
</tbody>
</table>

Several options for source of supply, conveyance and discharge may be feasible to meet project objectives. Estimated capital and annual operations and maintenance costs for the various alternatives are provide in Table ES-2 below.

**Table ES-2. Preliminary Estimated Project Cost Summary**

<table>
<thead>
<tr>
<th></th>
<th>Total Cost</th>
<th>Unit Cost¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Cost</td>
<td>Annual O&amp;M</td>
</tr>
<tr>
<td>Alternative 1A</td>
<td>$17,725,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Alternative 1B</td>
<td>$21,475,000</td>
<td>$242,000</td>
</tr>
<tr>
<td>Alternative 2A</td>
<td>$14,965,000</td>
<td>$251,000</td>
</tr>
<tr>
<td>Alternative 2B</td>
<td>$19,841,000</td>
<td>$277,000</td>
</tr>
</tbody>
</table>

¹ – Unit costs developed by dividing total costs by annual quantity of 7,240 acre-feet.

The most cost-effective solution (Alternative 2A) includes construction of a groundwater wellfield near the Pend Oreille River with surface water discharge in the uppermost headwaters of the Little Spokane River. It is anticipated that capacity-related improvements to the natural conveyance,
including replacement of several culvert crossings, may be required. These improvements have been included in the analysis. Estimated costs for this alternative are approximately $15 million with $251,000 annual operations, maintenance and replacement costs. These costs translate to roughly $2,070 per acre-foot (capital) with $35 per acre-foot annual O&M.

Other more costly alternatives considered include bypassing the uppermost reaches of the Little Spokane River with additional pipeline conveyance (Alternative 2B), or using direct surface water as source of supply (Alternative 1A), or both (Alternative 2B).

1. Introduction and Project Overview

Project Background

Spokane County (the County), in conjunction with Stevens and Pend Oreille County (Tri-Counties), is considering setting up a water bank to address existing and potential regulatory constraints on existing and new water use in Water Resource Inventory Area (WRIA) 55, the Little Spokane Watershed. A water bank is a mechanism that facilitates transfer of water rights between sellers and buyers. As part of this process, the County convened a Policy Advisory Group (PAG) to allow interagency and stakeholder coordination and evaluation of water banking in the watershed.

One of the options for water bank seeding that has been discussed with the Tri-Counties and other members of the PAG is potential use of a water source from WRIA 62, the Pend Oreille River Watershed. A unique opportunity exists to potentially withdraw groundwater or divert surface water from the Pend Oreille watershed into the upper headwaters of the Little Spokane River, near the town of Newport (Figure 1). A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature, as Ecology has not closed the Pend Oreille River to further consumptive appropriations.

The watershed boundary, and the upper headwaters of the Little Spokane River, reaches within approximately three miles of the mainstem of the Pend Oreille River. According to Washington State’s WRIA 55 boundary GIS layer, the drainage divide between the Little Spokane Basin and Pend Oreille Basin is approximately 110 feet higher than the Pend Oreille River shoreline, and a pipeline and pumping station would be required to convey either groundwater or surface water. Water thus conveyed could serve as water for bank seeding and instream flow enhancement in WRIA 55 after transfer.

Aspect has conducted an appraisal level evaluation of necessary infrastructure and potential fatal flaws associated with conveying water from the Pend Oreille River to the upper headwaters of the Little Spokane River. An interim project flow criteria has been estimated at a 10 cubic feet per second (cfs) average mitigation flow rate for a combination of bank seeding and additional instream flow mitigation, based on consideration of future water demand and preliminary estimates of stream channel capacity. Both surface water and groundwater supply options in the vicinity of Newport may be feasible, as discussed in this memorandum.

This memorandum will be included as an appendix to the Little Spokane Water Banking Feasibility Study, submitted to the PAG in June 2015.
Appraisal Study Objectives and Approach
This appraisal study involves characterization of permitting, construction, and other project-related considerations associated with a potential transfer of water from the Pend Oreille watershed to the Little Spokane River.

The approach of this appraisal study involved the following:

1.) Review of available maps and data;
2.) Field reconnaissance and coordination with local agencies;
3.) Estimating mitigation flow criteria;
4.) Development of concept alternatives;
5.) Characterizing permitting constraints;
6.) Evaluating water quality; and
7.) Preliminary cost estimating.

This appraisal study is organized under the following headings:
- Study Area and Existing Conditions
- Basis of Planning
- Development of Concept Alternatives
- Project Economics
- Recommendations for Additional Design and Analysis

2. Study Area and Existing Conditions

Data Sources
This study and associated analysis contained herein are based upon readily available information, limited field reconnaissance and discussion with various stakeholders. Background data includes geologic mapping, USGS topographic mapping, USGS hydrogeologic investigations, County Assessor parcel mapping, Ecology watershed boundary mapping, Ecology well log documentation, USGS streamflow information, USDA/SCS soils mapping, and Washington Department of Natural Resources geologic mapping.

Site reconnaissance was conducted in March of 2015 by members of the Aspect Project Team, personnel from Department of Ecology and Spokane County. At that time, various pipeline alignments were considered along with potential water sources locations adjacent to the Pend Oreille River at the City of Newport’s waste water treatment facility. Additionally, the headwaters of the Little Spokane River including the uppermost reaches (approximately 2-miles) were observed at various locations. Photographs from site reconnaissance activities are provided in Attachment A.

Geographic Setting
The project location is generally located in the vicinity of the City of Newport (City), Pend Oreille County, Washington State. The City immediately borders the State of Idaho to the East and therefore this political boundary has been considered the eastern geographic limit of infrastructure/project planning. The apparent topographic basin divide between the Pend Oreille River and Little Spokane River is near the southwestern margin of the City (approximately 2-miles
southwest of the Pend Oreille River. Both the BNSF Railway and State Hwy 2 corridors generally bound the southern and eastern limits of the City. Downstream of the Little Spokane River side of the basin divide, these two corridors generally parallel natural drainage courses in the uppermost reaches of the watershed. The general project vicinity is shown in Figure 1.

**Property Ownership**
Property ownership in the project vicinity include the following:

- City of Newport
- Pend Oreille County
- Burlington Northern Santa Fe (BNSF) Railway
- State of Washington Department of Transportation (WSDOT)
- State of Washington Department of Natural Resources
- Private landowners

**Topography**
Based upon readily available USGS topographic quad mapping (40-foot contours), elevation differences between the Pend Oreille River and the lowest elevations at the basins divide between the Pend Oreille and Little Spokane River Basins may be as little as 110 feet (vertical) at a location approximately 1 mile southwest of the Pend Oreille River (in the general vicinity of Newport High school).

Topography on either side of the basin divide in the vicinity of the project is relatively flat with topographic gradients along drainage courses approximately 2% or less. Elevated terrain borders the topographic drainage courses along northwest and southeast representing a gradual saddle feature at the basin divide.

The uppermost headwaters of the Little Spokane River are characterized as having extremely flat gradients and are dominated by standing water and wetland complex.

**Hydrogeologic and Hydrologic Considerations**

**Hydrogeology**
Groundwater sources in WRIA 55 are derived from a combination of unconsolidated basin fill, and isolated basalt layers overlying crystalline bedrock. Figure 2 presents a surficial geology map of the project area that illustrates the combination of bedrock and unconsolidated deposits in the vicinity of the project site. Of particular note is the bedrock outcrop on the north side of the City, as this would be a preferred location for a potential groundwater wellfield, but would be limited by this occurrence. The City has a wellfield for its municipal water supply on the southeast side of town close to the mapped boarder of the Little Spokane and Pend Oreille watersheds. The City’s wellfield produces from alluvial aquifer wells that are approximately 80 to 100 feet deep. Well logs on file at Ecology indicate that the aquifer is sand-dominated, but there is significant heterogeneity, with a mix of sands, clays, and gravels observed during drilling. Production rates
from the wells are on the order one hundred to several hundred gallons per minute. Well logs from Washington State Department of Ecology online database are provided in Attachment B.

Figure 3 shows the distribution of surficial bedrock and the depth of basin fill in the watershed, based on a recent USGS Study: *Hydrogeology of the Little Spokane River Basin, Spokane, Stevens, and Pend Oreille Counties, Washington* (2013). Groundwater movement in the basin generally follows surface topography, moving from high to low elevation areas. The USGS identified several key hydrogeologic units that serve as water sources, including:

- **Upper Aquifer.** This unit is unconsolidated basin fill and serves as a common water source over much of the watershed. Its distribution is widespread in the Little Spokane headwaters. Its distribution generally overlaps with the extent of basin fill on Figure 3. Some of the outlying areas of basin fill were not considered of sufficient production by the USGS to be an ‘aquifer’, but do, in some cases, produce water sufficient for residential use.

- **Lower Aquifer.** This unit is also unconsolidated basin fill, and is separated in some cases from the Upper Aquifer by a confining unit. The Lower Aquifer occurs in highly localized areas, generally along the mainstem of the Little Spokane River and is not significant in the upper watershed.

- **Isolated basalt units of the Columbia River Basalt Group (Wanapum and Grand Rhonde).** Basalt occurrences are generally limited to the west central portion of the basin, in the Dragoon Creek drainage, outside of the area of interest for this project.

- **Bedrock.** Crystalline bedrock underlies all of the watershed, but tends to be exposed in the upland, outlying areas of WRIA 55. Bedrock in WRIA 55 typically produces small quantities of water, but is relied upon by a number of users as a residential water source.

Basin fill thicknesses (primarily Upper Aquifer) of over several hundred feet are present across significant portions of the watershed, and may allow opportunities for aquifer recharge through surficial infiltration.

Groundwater and surface water in WRIA 55 are assumed to be hydraulically connected, and as such additional groundwater appropriations have not been authorized by Ecology since 1996, based on associated reductions of instream flows expected from newly authorized withdrawals.

A range of surficial soil types have been previously identified, as illustrated in Figure 4. Many of these soils, such as the Orwig sandy loam (Unit 97) located near Surface Discharge Option 1, are well drained, permeable soils which may allow for a surface infiltration option as a component of instream flow mitigation/seeding; however, it is also known from area well logs that clay and silt lenses are present in some areas. Site specific field investigations would be needed to ascertain if infiltration is a feasible option for providing local recharge and associated instream flow enhancement. Further discussions regarding infiltration as a potential option for discharge into the Little Spokane Basin are provided under Section 5 of this memorandum.
Hydrology and River Morphology
A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature. Ecology has not closed the Pend Oreille River to further consumptive appropriations, but has provisioned recent water right decisions with a curtailment flow of 7,700 cfs at the Newport gage (USGS #12395500), based on a Surface Water Source Limitation (SWSL) recommended by the Washington State Department of Fish and Wildlife (WDFW). Figure 5 presents average and minimum daily mean discharges at the Newport gage, along with the WDFW recommended Surface Water Source Limitation (SWSL) flow of 7,700 cfs. As the graph indicates, there are periods where the minimum daily discharge has fallen below 7,700 cfs in drier years in spring and late summer to early fall, but there still appears to be opportunity for significant withdrawals or diversions to take place over much of the year, given the scale of flows in the mainstem. Figure 6 provides a comparison of the frequency that the Little Spokane at Dartford and the Pend Oreille River at Newport do not meet baseflows and recommended flows, respectively. As illustrated by the figure, recommend flows are met substantially more often in the Pend Oreille River at Newport versus baseflow at the Dartford gage on the Little Spokane River.

The uppermost headwaters of the Little Spokane River are characterized as very low gradient vegetated wetlands followed by reaches with some defined channel formation coincident with an apparently losing reach of the river, with very limited flow on the order of a few cubic feet per second. Limited information on streamflows in the upper headwaters of the Little Spokane drainage is available, and additional study is recommended as discussed in Section 7 of this memorandum.

The upper reaches of the Little Spokane River likely contain both gaining and losing reaches. Observations made during field reconnaissance as part of this project (Attachment A) suggest that the uppermost headwaters of the Little Spokane may be gaining water from the groundwater system in the upper wetland areas. In contrast, review of aerial photos suggests that there are areas downstream of the initial wetlands where channel definition is diminished suggesting that a short losing reach may be present. This location is generally located approximately 2 miles downstream of the basin divide. Approximately 2.5 to 3 miles downstream of the basin divide, the stream appears to be significantly gaining water. This may be associated with surficial bedrock providing a barrier to groundwater flow that contributes to a strongly gaining reach and well-developed channel formation (Figure 3). This is a consideration for evaluating the capacity of the river to convey water, as discussed later in this memorandum. Little to no channel migration is evident in the aerial photographic record dating back to 1998.

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2 A SWSL is a permit-specific condition recommended by WDFW and applied by Ecology as a permit condition under the public interest test for issuing a new water right. It is not an instream flow rule. A SWSL on one water right may be applied to another water right, or a separate permit-specific SWSL may be applied, or none at all, depending on whether mitigation of instream flows is provided as a part of the project.
Observations made during field reconnaissance as part of this project suggest that the uppermost headwaters of the Little Spokane may be gaining water from the groundwater system in the upper wetland areas; however, the river appears to be losing surface water to groundwater at a point approximately 2 miles downstream of the basin divide. Approximately 2.5 to 3 miles downstream of the basin divide, the stream appears to be strongly gaining in conjunction with surficial bedrock contributing to a strongly gaining reach and well developed channel formation (Figure 3). This is a consideration for evaluating the capacity of the river to convey water, as discussed later in this memorandum. Little to no channel migration is evident in the aerial photographic record dating back to 1998.

Further study is required to characterize the river substrate and the potential for degradation/aggradation, which may lead to any perceptible channel migration based upon increased streamflow as a result of this project.

**Water Quality**

**Surface Water Quality**

The mainstem of the Little Spokane River has several constituents on the 303(d) list (Category 5), requiring a Total Maximum Daily Load (TMDL) to be established or other water quality improvements to be implemented. These include dissolved oxygen in the upper reaches near Scotia Road, pH, fecal coliform, and temperature further downstream, and PCBs in the lower reaches of the river. The federal Clean Water Act requires that Ecology set priorities for cleanup 303(d) listed waters by establishing a total maximum daily load (TMDL) for each constituent of concern and/or establishing a Water Quality Improvement plan.

The Pend Oreille River has also been listed on the 303(d) list for temperature at Newport. PCBs have been noted as an issue by Ecology, but the listing does not occur at Newport and is further downstream at Usk. Given the comparatively high flow of the Pend Oreille River (24,600 cfs mean flow) relative to the 10 cfs assumed to be appropriate for supporting Little Spokane water bank seeding, it is expected that water quality impacts from a surface water withdrawal or nearby groundwater withdrawal will be negligible. The more significant issue that will need to be addressed through further study focuses on mixing of a Pend Oreille surface or groundwater source with headwaters of the Little Spokane River. Any introduction of Pend Oreille source water into the Little Spokane watershed will need to address TMDL concerns related to the project in both rivers.

The project could also provide benefits in terms of upper watershed temperatures, particularly if a groundwater source is used. In addition, if a surface water source is used, measures to prevent introduction of milfoil or other invasive biota will need to be addressed.

**Potential for Groundwater Contamination**

If a groundwater source is pursued as an option, existing groundwater quality will need further evaluation. A cursory review of the potential for existing groundwater contamination was conducted through reviews of Ecology’s Cleanup Site Search Database, Environmental Information Management (EIM) System Database, and Facility/Site Database for sites of environmental interest to Ecology. Ecology’s EIM database did not have any soil or groundwater data for any sites within the City of Newport. Several cleanup sites were noted within the City of Newport. Of these cleanup sites, the Unocal Bulk Plant 0528 and Newport Industrial Park Development were the most noteworthy:
• Unocal Bulk Plant 0528 – Voluntary cleanup completed but Restrictive Covenant in place due to remaining petroleum contaminated soil above cleanup levels. Groundwater not identified as a media of concern.

• Newport Industrial Park Development – Voluntary cleanup completed and No Further Action issued in 2011 for remediation of dioxin/furan, metals, and petroleum in soil. Groundwater not identified as a media of concern.

Other sites listed above were Leaking Underground Storage Tank sites, 6 of which received No Further Actions in 2011. Only soils were identified as media of concern for these sites.

Ecology files were not reviewed for any of these sites as part of this project. Ecology’s databases only list those contaminated sites that are known to Ecology and does not list those that have yet to be investigated or have not been reported to Ecology. While this review did not suggest that existing groundwater contamination would be a major concern for a new groundwater source, if wellfield investigations move forward as part of this project, additional investigation can be completed to support an evaluation of groundwater contamination risk based on specific test well locations proposed for further study.

Natural Resources
Environmental natural resources in the vicinity of the project include wildlife, fish and wildlife habitat, riparian areas and palustrine areas (wetlands). The Pend Oreille River in vicinity of Newport is listed as Critical Habitat under Endangered Species Act for Slavenlinus confluentus (bull trout), no other Critical ESA Habitat is listed in other areas of the project. Furthermore, WDFW manages Priority Habitat and Species designations which are mapped in the vicinity of much of the project improvements. This includes priority areas for regular waterfowl concentrations on the Pend Oreille River as well as for both Kokanee and Rainbow trout in the Little Spokane River. Much of the upper headwaters of the Little Spokane river is mapped as palustrine (wetlands) aquatic habitat.

3. Basis of Planning

Flow Demand Criteria
The intent of the project is to provide water supply from the Pend Oreille River into the Little Spokane River to offset consumptive beneficial uses associated with potential Little Spokane Water Bank appropriations. Based upon a water demand analysis conducted as part of the Little Spokane Water Banking Feasibility Study (Aspect, 2015), 7,240 acre feet of supply (10 cfs continuous) may be needed to facilitate water banking goals. While final water banking mitigation quantities may be subject to change during subsequent phases of study, this quantity has been used as the basis of planning for this Appraisal Study.

The feasibility of accommodating the interbasin transfer at the quantities proposed may be limited by a number of factors including:

• Available freeboard in natural downstream conveyance channel (available volume between instantaneous stream flow and ordinary high water);

• Water source-based constraints (water quality, physical water availability);
• Legal availability of water from Pend Oreille River; and

• Maximum conveyance infrastructure limitations.

• An objective of this study has been to identify how these factors may be addressed through existing information, future data collection and analysis, and infrastructure improvements.

**Infrastructure Criteria**

**Sources of Supply**
Potential sources of water supply for the project include both direct surface water from and groundwater in continuity with the Pend Oreille River. Advantages of surface water supply include relative certainty of water availability and lower pumping costs, while disadvantages may include greater consideration of water quality impacts. In contrast, groundwater supply may provide for greater certainty of high water quality and would likely be easier to permit. Relative uncertainty exists with respect to proven aquifer targets that would need to be evaluated through future study as described in Section 7 of this memorandum. Groundwater supplies would also likely require additional annual operations and maintenance costs due to the higher pumping lift (associated power cost) required to bring water to the surface.

Because the source of supply for this project is intended to mitigate for continuous beneficial uses, reliability criteria is relatively high—meaning that continuous pumping ability should be generally assured with limited interruption. Therefore it is assumed that at least one measure of redundancy (e.g., standby pump) be provided to accommodate repair/maintenance while the system is continually operating.

**Groundwater**
The general planning criteria for a groundwater source location includes identification of high yield alluvial aquifer targets (ideally sand and gravel deposits) in close proximity to the Pend Oreille River. A suitable groundwater source would ideally be located northeast of the basin divide and west of the Washington-Idaho border. A possible configuration for groundwater supply based upon flow and reliability criteria would likely be a wellfield consisting of three (or more) groundwater wells, each sized for roughly 1/2 the proposed project flow of 10 cfs [approximately 4,500 gallons per minute (gpm)] to provide a measure of redundancy and flexibility. It is also possible that a wellfield with more numerous, smaller capacity wells would be needed based on aquifer conditions, and this is accounted for in project contingency costs.

**Surface water**
The planning criteria for a suitable surface water source location includes areas within Washington along the southern bank of the Pend Oreille River. Furthermore, any surface water source must be located on shorefront properties that may ultimately be amenable to such a facility. In order to reduce pipeline conveyance and reduce costs, a surface water pumping station should be located as close to the basin divide as possible.

Because the Pend Oreille River is situated upstream of Chief Joseph Dam, fish passage to a potential point of diversion by anadromous salmonid species is not possible; however the project area is designated critical habitat for ESA-listed bull trout. While infrastructure criteria is not subject to National Marine Fisheries Services (NMFS) requirements for anadromous salmon
species, screening of surface water intake pipe would be required based upon RCW 77.57.010, and would therefore need to be designed to meet the requirements of the Washington Department of Fish and Wildlife (WDFW).

**Pipeline Conveyance**
Pipeline conveyance will be required from the water supply facility (either surface water or groundwater) to the proposed discharge location downstream of the basin divide.

The general criteria and considerations for pipeline alignment include consideration of:

1. Available corridors including preference for existing publicly owned right of ways or easements; and

2. Pipeline / pump station economics.

Generally, the shortest path may yield the most favorable economics; however, existing surface conditions (paved/unpaved) may yield an overriding consideration for a longer route. Furthermore, existing site encumbrances, and legal considerations such as right-of-way or easement use permits provisions are important considerations for selection of a pipeline alignment. Furthermore, limiting crossings of major developed corridors such as state highway routes, railways and surface water courses is important to optimizing economics.

Pipelines would be sized to optimize pipeline diameter and flow velocities. Generally, pipelines would be sized to limit velocities to less than 5 feet per second (fps) to limit head-loss (friction loss) and limit pipe wear.

Available pipeline materials may consist of metal (steel or ductile-iron), or plastic (PVC or HDPE). Because the pipeline would be subjected to relatively high pressures and likely be constructed through primarily urban corridor, the construction would most likely be of ductile iron which is a generally accepted standard for water distribution pipeline.

Depth of cover over pipe facilities may vary, but would likely be 4-feet minimum, which is customary for water supply pipelines in areas potentially subject to freezing. Special considerations related to increasing depth must be made within public rights of way (e.g., City of Newport (City)) in order to avoid the need for future relocation to accommodate City-owned utilities such as municipal water supply or sanitary sewer.

**Discharge Location**
Two major categories of discharge location exist for this project including:

1. Surface water discharge; and

2. Subsurface infiltration (or combination of the two).

Surface water discharge may include discharging into an energy dissipation structure (stilling well) with low energy overflow into the highest reaches of the basin as possible. Because the existing natural conveyance channel of the Little Spokane River may have limited conveyance capacity relative to the planned project flow criteria, considerations related to either improving existing
natural conveyance or bypassing the uppermost reaches with additional pipeline should be considered for project planning. Future study related to characterizing the conveyance capacity of natural systems associated with the Little Spokane River would be needed if this approach is pursued.

Potential impacts related to direct surface water discharge quantities may be mitigated to some extent if subsurface infiltration of a portion or all of the discharge quantity is deemed feasible through further study.

**System Operation Criteria**

Several system operations schemes may be employed for this project including:

1. Constant rate pumping flow regime; or
2. Variable rate pumping/adaptive management.

Under a constant flow regime, water would be pumped from the Pend Oreille River at a constant flow rate of 10 cfs. Because the natural hydrology of the system may fluctuate on a seasonal or annual basis, there may be a need for flow buffering, storage and/or infiltration in order to accommodate continuous inflow. This may potentially be accommodated in existing series of wetlands in the uppermost headwaters of the Little Spokane.

Alternatively, flow supplied to the system may be variable based on interuptibility associated with WDFW flow recommendations for the Pend Oreille River and/or to provide variable flow to maintain Little Spokane River flow targets to potentially be established at various control points within the system.

4. Concept Alternatives

**Development of Concept Alternatives**

Several concept alternatives have been evaluated for purposes of evaluating feasibility, estimating costs and identification of applicable permits. Concept alternatives for this project are composed of a combination of:

1. Source of supply options; and
2. Conveyance and discharge options.

Concept alternative locations are shown on Figure 7.

**Source of Supply Options**

**Surface Water Source**

Potential sites for a surface water pump station on the Pend Oreille River within reasonable proximity to the basin divide, and within the Washington State are relatively limited. The most economical and favorable locations for surface water pumping station exist across state boundaries (in State of Idaho) and therefore were excluded from consideration. Relatively few shoreline parcels exist within reasonably close proximity to the basin divide, within Washington State; however, a shoreline parcel owned by City of Newport for their wastewater treatment facility
appears to be the most feasible location. This has been included in this appraisal analysis following discussions with the City.

For the purposes of project planning/costing, a conceptualized surface water pump station at this location was considered consisting of a single 30-foot deep wet well (sump) with submerged stainless cylindrical end of pipe intake screen extruding into the Pend Oreille River. To provide redundancy and operational flexibility, it was assumed that pumping from the wet well would be accommodated with three vertical turbine pumps each capable of providing approximately 5-cfs (2,250 gpm) at 136-feet total dynamic head (TDH). Typical operation would consist of cycling through any combination of up to two of the three pumps, alternating in sequence.

The pump station would be equipped with automated motor controls including SCADA/telemetry. Additional standard pump station appurtenances include isolation valves, check valves, flow meter, pressure switches, pressure transmitters, surge anticipation equipment, and access/maintenance provisions would be included. Depending on final system operational scheme, the pumps may be equipped with variable frequency drives to provide for matching flows in response to demands expressed by available stream flow in the Little Spokane.

Due to seasonally adverse weather (hot/cold) it is assumed that pumps/motors, electrical control equipment and other sensitive components will be housed within an insulated building structure with heating, ventilation and cooling systems.

**Groundwater Source**

Geologic mapping and limited well log information indicate that bedrock (granite) may be present in the immediate vicinity of City of Newport Wastewater Treatment Facility (Figure 2). However, it is known that existing production wells are utilized by City of Newport, which are located further to the south and east, as shown on Figure 2. While identification of an exact well site is outside the scope of this study, it is assumed that high yield alluvial aquifer targets consisting of sands and gravels in continuity with the Pend Oreille River may be found. For the purposes of this study, it is assumed that these are south of the City of Newport’s treatment facility along a similar pipeline alignment(s) considered for surface water pump station options. Therefore, potential advantages related to pipeline economics may exist with the groundwater source option relative to surface water source option.

A groundwater source alternative for this project would include similar improvements to the surface water pump station with the exception that wet-well/sump, surface water intake and screening would be replaced with a series of three groundwater wells. It is anticipated that pumped water level may be approximately 200+ feet below ground surface at available sites. Therefore, additional pump stages including increased horsepower would be required for the groundwater source option.

**Pipeline Conveyance Options**

Many conveyance pipeline alignment routing options may ultimately be feasible for the project, and several specific variations were considered as part of this study including options proposed by City of Newport Staff, as well as alignments that may follow “best case” scenarios such as along BNSF railway corridors. While the identification of preferred alignment is outside the scope of this study, one pipeline alignment explored during field reconnaissance was ultimately selected for
evaluation that is relatively direct, primarily follows sparsely developed right-of-ways and represents generally the most direct route. The potential cost advantages/disadvantages to other alignments were quantified and found to be comparable in cost and within margin of error of estimating at this time. It is believed that further study including more detailed consideration of existing utilities, property ownership and topography would be required in order to better refine potential pipeline conveyance routing.

Discharge Options
Discharge options include either subsurface (infiltration) or surface discharge. Furthermore, surface discharge may occur at the uppermost reaches of the Little Spokane or several miles downstream at a point at which the natural conveyance channel may better accommodate the additional flow.

Infiltration
Infiltration within the Little Spokane drainage has the potential advantages of providing a level of flow buffering in conjunction with water quality treatment. Options for infiltration include 1) surface infiltration, 2) shallow subsurface infiltration (trenches), and 3) shallow subsurface infiltration wells (drywells). Considerations related to planning for infiltration of surface water include 1) injection water quality and potential pre-treatment needs, 2) hydraulic conductivity of receiving soils, and 3) proximity of restrictive layers such as bedrock, fine grain soils and groundwater table. Furthermore, considerations related to the location and timing of return flow into the Little Spokane River is critical to gaging the value of infiltration for this project.

Four mapped data sources were used to evaluate feasibility including topographic mapping (USGS), surficial geology (Figure 2), basin fill mapping (Figure 3), and soils mapping from USDA/NRCS (Figure 4). Also, some limited well log information was located from Department of Ecology’s well log database.

Both the surficial geologic mapping and the basin fill mapping indicate that near the basin divide, there may be 100 to 300 feet of basin fill with little evidence of shallow bedrock at or near the surface. Approximately 3-miles downstream of the upper headwaters of the Little Spokane River, surface water flows appear to be gaining substantially due to the presence of shallow bedrock. This potentially indicates that return flow related to infiltration may discharge to the river no further down than this location. Siting of a potential infiltration facility would need to be done in a way that ensures that return flow would not flow towards the northwest (towards the Pend Oreille River). Further study is required to establish the subsurface flow regime, as recommended later in this memorandum.

Mapped soils within reasonable proximity to the basin divide are predominantly silts and sands with some gravel. There is evidence of some relatively shallow clay layers as well as peat in some areas. Based on this information preliminary estimates of long term infiltration rates may be on the order of 1 inch per hour, provided soils with sands/gravels may be targets and clays/peats may be avoided. This estimated infiltration rate would need to be refined based on further study.

Furthermore, a planning criteria for pre-treatment may include detention of surface water for up to 40 hours to remove as much sediment as possible prior to infiltration (applicable to surface water
source option only). Based on these coarse scale assumptions, an infiltration facility may require 10 to 15-acres (or more) surface area to accommodate along with a pre-treatment wet pond with a capacity of 30 acre-feet (or more). In planning for a potential infiltration facility, it would be prudent to allow space for redundant infiltration galleries in the event of failure of such facility. Therefore, it is estimated that a site on the order of 30 to 40 acres may be required. While no specific site has been identified for an infiltration facility such as this, there are several undeveloped parcels in the upper limits of the Little Spokane that are either in private or corporate ownership that could be potential candidates for infiltration. These sites would need to be explored during subsequent study.

**Surface Water Discharge Option-1 (At Little Spokane River Headwaters)**

One option for surface water discharge is near the uppermost reaches of the little Spokane drainage at a series of wetlands adjacent to the SR 2 Hwy corridor. This alternative could allow for the shortest distances of pipeline improvement and may also provide additional storage related benefit to accommodate a level of flow buffering. Qualitative visual observations (not measured) of natural conveyance during site reconnaissance indicate that flows up to 10 cfs may not be accommodated in the uppermost drainage without modifications to culverts and dredging of existing channels. Therefore, in order to accommodate discharge this high in the basin, it is likely that in-channel conveyance improvements will be necessary to avoid inundation of land beyond the ordinary high water mark.

**Surface Water Discharge Option-2 (Approximately 2-Miles Downstream of Headwaters)**

An alternative to discharging at the immediate headwaters of the Little Spokane River basin would be to convey water further downstream into the Little Spokane River drainage in order to bypass potentially constraining reaches. A cursory overview of the natural conveyance indicates that the Little Spokane River expands dramatically approximately 3-miles downstream of the basin divide. Therefore, discharge Option-2 involves construction of additional 24” diameter conveyance pipeline along existing corridors including SR2, Scotia Road, and a vacated BNSF right of way.

**Evaluation of Concept Alternatives**

For purposes of evaluating feasibility and developing costs, four concept alternatives based on two source water alternatives (a surface water supply or a groundwater supply) and two discharge locations (discharge to a large wetland in the upper headwaters and discharge to the river approximately two miles downstream). The alternatives are shown in Table 1:

<table>
<thead>
<tr>
<th>Table 1. Concept Alternatives</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Discharge Option-A (Headwaters)</td>
</tr>
<tr>
<td>Discharge Option-B (Headwater Bypass)</td>
</tr>
</tbody>
</table>
Hydraulics Analysis
Hydraulic analysis was performed to evaluate pipe size and to calculate pump horsepower. The Hazen-Williams formula was used to estimate friction loss using a roughness coefficient “C” of 120 to represent cement-lined ductile iron pipe. Based upon 24” pipe (nominal) diameter sizing, approximately 22-feet (water) head-loss would occur due to dynamic forces at proposed flow rate of 10 cfs (4,500 gpm). Coupled with an estimated static lift of 110 feet and an additional 4-feet of losses at the pump station, a total dynamic head (tdh) of 136 feet is calculated for the surface water pumping option. To accomplish pumping at this flow rate/pressure, approximately 190 brake horsepower (pump horsepower) is required (assuming pump efficiencies of approximately 80%).

In contrast, it is estimated that pumping head for the groundwater option may be significantly higher than for the surface water option due to well drawdown at proposed pumping rates. Assuming a pumped drawdown of 100 feet below Pend Oreille river static water levels, total dynamic head for groundwater source option may increase to 236 feet. Therefore approximately 330 brake horsepower is required using similar assumptions. This is a significant consideration, as the power costs for the groundwater source may be roughly double those of the surface water source option.

System performance curves related to both surface water and groundwater supply (variable speed operation scenario) options are provide as Figures 8 and 9.

Project Alignments, Property Ownership and Right of Way
While various options exist for pipeline alignments the alignment chosen for evaluation is the shortest and most direct (Figure 7). This alignment generates at or near the City of Newport (City) wastewater treatment facility. The City has expressed a willingness to support the project and may be a proponent of citing a surface water pump station on City property. The pipeline would most likely cross a BNSF railway right of way upon existing City of Newport’s property and therefore a railway crossing permit would be required. At this point, project improvements would enter City of Newport public roadway right of way in northern extent of City Limits. Near the western/central portions of the alignment, the pipeline would ideally transect a series of public and private properties that are currently in use as parkland or otherwise sparsely developed land. A range from 15- to 20-foot wide easements from these landowners would be required, although the acquisition of these easements is not necessary for project success as alternative routes entirely on public right of way are available. The final portion of the alignment may parallel SR2 which is owned and managed by Washington State Department of Transportation.

The proposed discharge location for Alternatives 1A and 2A is at a wetland complex in the upper headwaters of the Little Spokane River. While modification of the wetland complex is not necessary for project success, there may be benefit to modification of the surface water outlet control in order to provide operational flexibility and storage which would require landowner permission/easements as well as consideration of potential biological impacts. Approximately 1-mile southwest of the discharge location for Alternatives 1A/2A the natural conveyances crosses SR2 in a culvert. This culvert is likely undersized for proposed flows and may need to be replaced necessitating coordination and permitting from WSDOT. The balance of natural conveyance downstream of this point is on private property with the exception of crossing Scotia Road which is owned by Pend Oreille County. To the extent that channel improvements are required to ensure
conveyance capacity and/or driveway culvert replacements are necessary, private landowner easements would be required.

In contrast, Alternative 1B and 2B would pipe the alignment with gravity conveyance several miles downstream of the basin divide in order to bypass flow restricting channel segments. At least one mile of this pipeline would parallel SR 2, therefore a significant utility franchise permit from WSDOT could be required. The balance of pipeline for these alternatives may follow either Pend Oreille County-owned public right of way (Scotia Road) or abandoned railway right of way.

A summary of property ownership including ownership type (right of way/parcel), brief description of improvement and magnitude (length) is provided in Tables 2 through 4 below.

### Table 2. Property Ownership, Pump Station and Pipeline Improvements

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Type</th>
<th>Notes</th>
<th>Improvement</th>
<th>Length (ft)</th>
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<td>Wastewater Treatment Plant</td>
<td>Pipeline and Pump Station</td>
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<td>Active Railway</td>
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<td>Pipeline</td>
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<td>Parcel</td>
<td>City Park</td>
<td>Pipeline</td>
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<tr>
<td>City of Newport</td>
<td>Right-of-Way</td>
<td>S. Garden Ave</td>
<td>Pipeline</td>
<td>300</td>
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<tr>
<td>Pend Oreille County</td>
<td>Parcel</td>
<td>Developed Parcel</td>
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<td>City of Newport</td>
<td>Right of Way</td>
<td>Circle Dr. W</td>
<td>Pipeline</td>
<td>400</td>
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<tr>
<td>Private Property</td>
<td>Parcel</td>
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<td>Pipeline</td>
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<td>Parcel</td>
<td>Newport High School</td>
<td>Pipeline</td>
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<tr>
<td>Private Property</td>
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<td>State Route 2</td>
<td>Pipeline</td>
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### Table 3. Property Ownership, Discharge Improvements (Option-1)

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<th>Type</th>
<th>Notes</th>
<th>Improvement</th>
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<td>Private Property</td>
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<td>Improved Natural Conveyance</td>
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<td>State Route 2</td>
<td>Culvert Replacement</td>
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<td>BNSF Railway</td>
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<td>Right-of-Way</td>
<td>Scotia Road Crossing</td>
<td>Culvert Replacement</td>
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<tr>
<td>Private Property</td>
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### Table 4. Property Ownership, Discharge Improvements (Option-2)

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<th>Approximate Length</th>
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<td>State Route 2</td>
<td>Pipeline</td>
<td>5,280</td>
</tr>
<tr>
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<td>Abandoned Railway</td>
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<td>Right-of-Way</td>
<td>Scotia Road Crossing</td>
<td>Pipeline</td>
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<td>Right-of-Way/Parcel</td>
<td>Abandoned Railway</td>
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Environmental Review and Permitting Considerations

Permitting Framework
Permitting of the project may occur at federal, state, county local and private levels. Regulatory permitting framework has been explored for this project and the following permits may applicable to various project alternatives.

Army Corps Section 10
Under Section 10 of the Rivers and Harbors Act of 1889, 33 U.S.C. 403, restrictions on the alternation of navigable waters exist and are regulated at the Federal Level through the Army Corps of Engineers. Infrastructure improvements including construction of a surface water pumping station on the Pend Oreille River which is a navigable water and will be subject to this jurisdiction. The Little Spokane River has been adjudicated as a “non-navigable” waterway by Washington State Court decisions. Additional research is necessary to determine how this determination impacts federal jurisdiction of the Little Spokane River.

Army Corps Section 404
Section 404 of the Clean Water Act places restrictions on discharge of dredged or fill material within the limits of navigable waters. Permitting such activities are regulated by Army Corps of Engineers. Improvements related to work in either the Pend Oreille or Little Spokane River(s) may trigger this permit.

Ecology 401 WQ Certification
Section 401 of the Clean Water Act allows states to place restrictions or conditions on federal permits or licenses that may impact water quality. A 401 certification may be associated with federal permits required for this project.

WSDOT – Utility Franchise Permit
RCW 47.44 and WAC 468-34 of Washington State Law allows the Washington State Department of Transportation to issue permits and franchises to occupy state owned land with utilities such as water conveyance pipelines. Utility runs (within WSDOT right of way) shorter than 300 feet are typically issued permits, while utility runs longer than 300 feet are issued franchises. Either permits or franchise from WSDOT may be required for this project.

Washington State Department of Fish and Wildlife, Hydraulic Project Approval (HPA)
Under Chapter 77.55 RCW of Washington State Law (Hydraulic Code), the Washington State Department of Fish and Wildlife administers Hydraulic Project Approval, which serves as a permit related to most construction work within waters of the State. Any in-water work will require an HPA.

Washington State Department of Natural Resources, Aquatic Use Authorization
Washington State Department of Natural Resources (WDNR) is charged with managing uses on State owned aquatics land (e.g. stream and lake beds) consistent with RCW 79.105. Typically, use of State owned aquatics land requires a lease from the State; however, based on a Washington State Supreme Court case dating back to 1900 (Griffith v. Holman), the Little Spokane riverbed was considered non-navigable, and in addition held in private ownership. Given this, WDNR Aquatic
Use Authorizations may not apply to this waterbody. DNR Aquatic Use Authorization is clearly required however, for improvements related to work within Pend Oreille River.

**ESA Section 7 Concurrence**
Section 7(a)(2) of Endangered Species Act requires consultation with National Marine Fisheries regarding projects that may affect ESA listed species. Due to the presence of bull trout critical habitat on the Pend Oreille River, it is anticipated that improvements related to a surface water improvement in this waterbody would trigger ESA Section 7 concurrence from NOAA Fisheries/NMFS. Work within the Little Spokane River would not be subject to ESA Section 7 concurrence.

**Tribal Reserved Water Rights**
The Kalispel Tribe has unquantified water rights in the Pend Oreille watershed, as reserved by the Winters Doctrine, stemming from a 1908 U.S. Supreme Court decision (Winters v. United States). These rights are expected to be senior to most or all of the other water rights in the watershed, and would have senior priority to any water rights from the Pend Oreille permitted by Ecology to support Little Spokane water bank seeding.

**County Shoreline Substantial Development Permit**
Development within 200 feet of shorelines will trigger consideration of shorelines permitting per Pend Oreille County’s Shoreline Management Plan. Shorelines permitting may include Shoreline Substantial Development Permit, Conditional Use Permit or Possible Exemptions.

**County Floodplain Permit**
Development within 100 feet of floodplains will trigger floodplain permitting through Pend Oreille County. FEMA regulations further dictate activities that may occur inside floodplain and floodway.

**SEPA/NEPA**
State Environmental Policy Act (SEPA), enacted by Washington State Legislature 1971 requires agencies at all levels of government (State or lower) to consider environmental impacts of projects or proposals.

National Environmental Policy Act (NEPA), enacted by US Federal Government in 1970 requires federal government agencies consider environmental impacts of proposals or actions as well as any reasonable alternatives to those action.

**Water Rights Permitting**
A water right(s) for either the surface or groundwater option will need to be obtained to allow beneficial use of a Pend Oreille water source. The Tri-Counties are in discussions to determine the best course of action for submitting both groundwater and surface water applications to Ecology to seek appropriate water right permits. It is anticipated that the applications would be submitted for a range of 10 to 20 cfs, equivalent to allow some flexibility in project design as detailed analysis progresses. Additionally, depending on the funding source, some flow contribution may be required to be dedicated for instream flow purposes.
Although a SWSL exists on other water right permits from the Pend Oreille River, this project would have the greatest opportunity to provide a firm supply for a WRIA 55 water bank if it were not interruptible to any Pend Oreille flow target. Since a SWSL is not the same as an instream flow rule, it is not (and cannot be) applied uniformly without jeopardy under the Administrative Procedures Act. A case specific SWSL for this project that recognizes instream flow benefit in WRIA 55 could increase the reliability of this project. Alternatively, other mitigation could be added in the Pend Oreille that addresses other limiting factors to provide mitigation, potentially eliminating the need for a SWSL.

As part of water right processing, Ecology will need to consider the Bureau of Reclamation’s withdrawal of unappropriated waters of the Columbia River and its tributaries above Priest Rapids Dam, located on the Columbia River approximately 50 miles upstream of Richland (RCW 90.40.030). This withdrawal expired on December 23, 2014, but an extension request was filed with Ecology prior to expiration, and Ecology considers the withdrawal to remain in effect until the extension request is processed.

**National Pollution Discharge Elimination System (NPDES)**
All point source discharges into waters of the United States are controlled through the NPDES system. In Washington State, the Department of Ecology is a delegated state water pollution control agency by US Environmental Protection Agency. The project concept involves a point discharge to the Little Spokane River, which could be subject to NPDES requirements. Construction stormwater is also regulated under the NPDES program and coverage under NPDES construction general permit will be required as part of this project due to more than 1-acre of disturbance.

**Cultural Resources**
Washington State Governors Executive Order 05-05 requires that any Washington State funded project integrate the Department of Archaeology and Historic Preservation (DAHP) into the project planning process. Furthermore, if federally funded, National Historical Preservation Act, Section 106 permitting is required.

**BNSF Railway**
BNSF often accommodates utilities for crossing as well as use of their right of way corridors (for a substantive fee). BNSF issues permits, franchises and licenses for use of their right of way depending on location and use classification.

**Private Landowner Easement**
To the extent project improvements or uses extend beyond the limits of permitted uses within public right of ways or state owned lands, individual easements from private landowners may be necessary. Based on a Washington State Supreme Court case dating back to 1900 (Griffith v. Holman), the Little Spokane riverbed was considered non-navigable, and in addition held in private ownership. Access to conduct work on private property will require permission from landowners. Actual conveyance of any water introduced into the Little Spokane as part of this project, however, does not require easements from property owners based on RCW 90.03.030, which states in part:
Any person may convey any water which he or she may have a right to use along any of the natural streams or lakes of this state, but not so as to raise the water thereof above ordinary highwater mark, without making just compensation to persons injured thereby; but due allowance shall be made for evaporation and seepage, the amount of such seepage to be determined by the department, upon the application of any person interested.

Given this, it does not appear that private ownership of the Little Spokane streambed, should it continue to be the case, is a fatal flaw in evaluating potential instream flow enhancement and mitigation in the river.

City of Newport Right/Pend Oreille County, Right of Way Permits
City of Newport and Pend Oreille County accommodate private and public utilities within their rights-of-way through issuance of utility franchise. These use authorizations come with special restrictions including location, depth of cover and requirements for maintenance.

Local Building, Filling and Grading Permits
Construction of structural improvements and grading within limits of City of Newport will likely trigger local building, filling and grading permits.

Environmental Approvals and Permitting Approach
Construction of project improvements and ongoing project operation represent impacts to natural resources both in the short term and long term. Short term impacts include in-water work such as dredging and filling for pump station and screening improvements in the Pend Oreille River as well as potential in-channel conveyance improvements in the Little Spokane River. Longer term impacts associated with project operation include potential impacts to wetlands and other aquatic habitat such as instream channels associated with the upper headwaters of the Little Spokane.

During construction and operation, mitigation for potential impacts must be considered including mitigation for potential water quality concerns, installation and maintenance of fish screens, re-establishment of aquatic vegetation and fish habitat and consideration of construction windows that are compatible with fisheries windows (if applicable). Furthermore, ongoing maintenance of in-channel conveyance of the upper headwaters may be required to ensure flow regime is maintained at or below ordinary high water, in conjunction with maintaining current ecological function.

All project alternatives will involve a rigorous permitting process due to the multifaceted nature of the project, spanning several major waters of the State and numerous landownerships. It is anticipated that because of potential water quality considerations, Alternatives 1A and 1B would likely represent the highest overall permitting complexity, including all permits previously mentioned including Army Corps, Section 10 (navigable waters) as well as ESA Section 7 concurrence through NOAA fisheries due to the presence of critical habitat for Bull Trout in the project vicinity at the Pend Oreille River.

Alternative 2A and 2B may potentially avoid permitting nexus associated with ESA listed species and Army Corps Section 10 due to the avoidance of in-water work associated with the Pend Oreille River. Alternative 2B is likely the simplest project to permit as this alternative is associated with the least possible impact to existing aquatic natural resources.
5. Project Economics

Opinion of Probable Cost

Project life cycle costs (opinion of probable cost) consisting of initial capital and ongoing operations and maintenance costs were developed for each of the two alternatives (1 and 2) as well as for each subset alternative (A and B).

Assumptions

The following assumptions were used in development of capital cost estimates:

- Mobilization/demobilization 10% construction subtotal;
- 25% contingency;
- 20% design engineering, surveying;
- 5% to 7% allowance for permitting (depending on complexity);
- Rock excavation assumed for 25% of excavations;
- Pipeline construction of ductile iron or steel;
- Washington State Sales Tax of 7.6% (City of Newport);
- 3% owner related management/oversight;
- 10% construction management/oversight;
- 1% allowance for property (easement) acquisition;
- Construction labor subject to Washington State Prevailing Wage; and
- 5% allowance for habitat mitigation projects.

The following assumptions were used in development of ongoing operations, maintenance and replacement costs:

- Annual Operations and Maintenance Cost for Pumps, Mechanical and Electrical Equipment assumed at 5% of capital cost per year.
- Annual Operations and Maintenance Cost for Fixed infrastructure (pipes, structures - all other construction) assumed at 1% of capital cost per year.
- Pumping power costs of $0.043 per kWh are based on Pend Oreille Public Utility District No. 1 Rate Schedule for 3-phase commercial services and are estimated based on continuous pumping.
Capital Cost
Capital cost estimates (direct and indirect costs) for two project alternatives including two variants per project alternative were developed as part of this study.

Alternative 1 consists of surface water pump station with approximately 12,600 linear feet of 24” diameter conveyance pipeline to convey surface water from the Pend Oreille River to the Little Spokane River. Surface water pump station is assumed to be located at or near City of Newport’s waste water treatment facility. Alternative 1A includes discharge at the Little Spokane River headwaters in conjunction with improvement to natural surface conveyance approximately 2-miles downstream. Alternative 1B includes approximately 14,000 linear feet of additional gravity conveyance pipeline to bypass the reaches of natural channel. Opinion of probable cost estimates for alternatives 1A and 1B are $17.7M and $21.5M respectively (2015 dollars). General breakdown of capital cost estimates are provided in Table 5, and detailed breakdown is provided in Attachment C.

Table 5. Preliminary Project Cost Estimate, Alternatives 1A and 1B

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<th>Item</th>
<th>Description</th>
<th>Alternative 1A</th>
<th>Alternative 1B</th>
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<td>$2,288,000</td>
<td>$2,831,000</td>
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<tr>
<td>Washington State Sales Tax</td>
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<td>$869,000</td>
<td>$1,076,000</td>
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<tr>
<td>Direct Cost Total</td>
<td></td>
<td>$12,309,000</td>
<td>$15,231,000</td>
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<tr>
<td>Indirect Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowance for Easement / Property Acquisition</td>
<td>$123,000</td>
<td>$152,000</td>
<td></td>
</tr>
<tr>
<td>Design Engineering, Project Survey</td>
<td>$2,462,000</td>
<td>$3,046,000</td>
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<tr>
<td>Permitting</td>
<td></td>
<td>$1,231,000</td>
<td>$1,066,000</td>
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<tr>
<td>Management / Administration</td>
<td></td>
<td>$369,000</td>
<td>$457,000</td>
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<tr>
<td>Construction Oversight</td>
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<td>$1,231,000</td>
<td>$1,523,000</td>
</tr>
<tr>
<td>Indirect Cost Total</td>
<td></td>
<td>$5,416,000</td>
<td>$6,244,000</td>
</tr>
<tr>
<td>Total Project Capital Costs</td>
<td></td>
<td>$17,725,000</td>
<td>$21,475,000</td>
</tr>
</tbody>
</table>

Alternative 2 consist of groundwater wellfield with approximately 11,200 linear feet of 24” diameter conveyance pipeline to convey groundwater in continuity with surface water from the Pend Oreille River to the Little Spokane River. The groundwater wellfield is assumed to be located at or near City of Newport’s property situated south of the waste water treatment facility. Alternative 2A includes discharge at the upper headwaters in conjunction with improvement to natural surface conveyance approximately 2-miles downstream. Alternative 2B includes
approximately 14,000 linear feet of additional gravity conveyance pipeline to bypass the upper reaches of natural channel. Opinion of probable cost estimates for alternatives 2A and 2B are $15M and $19.8M respectively (2015 dollars). General breakdown of capital cost estimates are provided in Table 6, and detailed breakdown is provided in Attachment C.

Table 6. Preliminary Project Cost Estimate, Alternatives 2A and 2B

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Alternative 2A</th>
<th>Alternative 2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>General</td>
<td>$934,000</td>
<td>$1,146,000</td>
</tr>
<tr>
<td>2.0</td>
<td>Site Preparation / Demo</td>
<td>$100,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>3.0</td>
<td>Groundwater Well Source</td>
<td>$1,562,000</td>
<td>$1,562,000</td>
</tr>
<tr>
<td>4.0</td>
<td>Pipeline</td>
<td>$3,620,000</td>
<td>$7,400,000</td>
</tr>
<tr>
<td>5.0</td>
<td>Little Spokane Channel Improvement</td>
<td>$1,300,000</td>
<td>$0</td>
</tr>
<tr>
<td>6.0</td>
<td>Environmental Mitigation</td>
<td>$375,000</td>
<td>$500,000</td>
</tr>
<tr>
<td></td>
<td>Direct Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Subtotal</td>
<td>$7,891,000</td>
<td>$10,613,000</td>
</tr>
<tr>
<td></td>
<td>Contingency</td>
<td>$1,973,000</td>
<td>$2,653,000</td>
</tr>
<tr>
<td></td>
<td>Washington State Sales Tax</td>
<td>$750,000</td>
<td>$1,008,000</td>
</tr>
<tr>
<td></td>
<td>Direct Cost Total</td>
<td>$10,614,000</td>
<td>$14,274,000</td>
</tr>
<tr>
<td></td>
<td>Indirect Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allowance for Easement / Property</td>
<td>$106,000</td>
<td>$143,000</td>
</tr>
<tr>
<td></td>
<td>Acquisition</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Design Engineering, Project Survey</td>
<td>$2,123,000</td>
<td>$2,855,000</td>
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<td>Permitting</td>
<td>$743,000</td>
<td>$714,000</td>
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<td>Management / Administration</td>
<td>$318,000</td>
<td>$428,000</td>
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<tr>
<td></td>
<td>Construction Oversight</td>
<td>$1,061,000</td>
<td>$1,427,000</td>
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<tr>
<td></td>
<td>Indirect Cost Total</td>
<td>$4,351,000</td>
<td>$5,567,000</td>
</tr>
<tr>
<td></td>
<td>Total Project Capital Costs</td>
<td>$14,965,000</td>
<td>$19,841,000</td>
</tr>
</tbody>
</table>

Operations and Maintenance Cost
Operations and Maintenance (O&M) costs consist of annual costs operating equipment, monitoring and periodic maintenance and replacement of deteriorating components throughout the life of the project. A major component of O&M cost are power consumption costs associated with water pumping. Table 7 provides a summary of estimated annual O&M costs for various project alternatives.
Table 7. Preliminary Operations and Maintenance Cost Estimate

<table>
<thead>
<tr>
<th></th>
<th>Mechanical /Electrical Improvements</th>
<th>Fixed Improvements</th>
<th>Electrical Costs</th>
<th>Total Annual O&amp;M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1A</td>
<td>$89,000</td>
<td>$61,000</td>
<td>$70,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Alternative 1B</td>
<td>$89,000</td>
<td>$83,000</td>
<td>$70,000</td>
<td>$242,000</td>
</tr>
<tr>
<td>Alternative 2A</td>
<td>$78,000</td>
<td>$53,000</td>
<td>$120,000</td>
<td>$251,000</td>
</tr>
<tr>
<td>Alternative 2B</td>
<td>$78,000</td>
<td>$79,000</td>
<td>$120,000</td>
<td>$277,000</td>
</tr>
</tbody>
</table>

Water Banking Unit Costs
It is likely that a WRIA 55 water bank will include some form of cost recovery for users relying on mitigation credits from the bank. Demand from the water bank may vary depending on the types of mitigation certificates offered (e.g., indoor use only, indoor and outdoor use), and whether mitigation is based on total use or consumptive use. Cost recovery impacts can be estimated through the following example.

Consider mitigation certificates that are based on offsetting 250 gpd of total water use (0.28 acre-feet/year). This accounts for approximately 0.0039% of the 7,240 acre-feet supplied by the project. At a cost range of $15 to $20 million for the project, a capital cost recovery on the order of $580 to $775 / house would be required. Primary factors that could lead this cost to increase include higher total water use/house, and including cost recovery for operation and maintenance. Primary factors that could lead to decreased costs include mitigation for consumptive use only (which would decrease the per home mitigation requirement) and potential state subsidy for public benefits, such as instream flows.

As criteria are established for water bank management, costs per home can be more accurately estimated. However, the costs on the order of hundreds of dollars (or even a few thousands of dollars) per home are likely affordable given the experience of water banks in other areas.

Cost Considerations/Data Gaps
Capital and O&M costs considered have been developed without the benefit of detailed design and various levels of environmental study/review. Further subsequent feasibility study will be required to refine costs based on evaluation of project elements in greater detail. Factors which may tend to dramatically impact cost include the following:

- **Little Spokane Conveyance Capacity.** The input of 10 cfs into the uppermost reaches of the natural conveyance of Little Spokane River presents a project challenge that must be addressed with further scientific study and engineering evaluation. The project flow must be accommodated below ordinary high water or otherwise within limits agreed to by various impacted landowners. Some assumption has been made as to the limit of natural conveyance that may readily handle project flows, however this limit may need to be refined, which could greatly impact cost.

- **Groundwater Well Source Option.** The siting/configuration of a potential groundwater source may have dramatic impact on cost estimates. To provide a level of conservatism, it was assumed that a groundwater source may be cited in the northern extents of City of Newport; however, locations further south may be feasible which could reduce required...
pipeline lengths and reduce cost. Well construction costs may increase depending on potential well depth required. Furthermore, it is assumed that high yielding aquifer targets may be found with production capacities suitable for a wellfield configuration as described herein. It may be possible that a wellfield with more numerous quantity of smaller wells is required. However, it is anticipated that alternative configurations may be similar in aggregate cost.

- **Power Infrastructure.** Power supply to proposed water supply options has not been explored in detail. Should extensive power extension be required, cost may be impacted. Furthermore, it is assumed that reliability criteria do not dictate the need for emergency backup power supply through installation of permanent standby generator.

- **Existing Utilities.** Piped conveyance improvements with pipeline diameters on the range of 24” pose significant technical challenges with respect to installation in urban/suburban settings. Limited flexibility is available to negotiate and avoid other utilities therefore extensive relocation of existing utilities and/or deep installation of pipeline improvements may be required.

- **Surface Water Pump Station.** It is assumed that the surface water pump station may both 1) be installed on City of Newport property in the vicinity of the Waste Water Treatment Facility and 2) surface water pump station may be configured with a wetwell/piped intake with cylindrical end of pipe fish screen. Should the pump station be located on alternative property sites, estimated costs would likely increase. Furthermore, should the need arise for a platform/pump deck style pump station, costs would likely increase due to the height and distance required.

In summary, estimated capital and annual O&M costs for the various alternatives are provided in Table 8 below.

### Table 8. Preliminary Estimated Project Cost Summary

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Total Cost</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Cost</td>
<td>Annual O&amp;M</td>
</tr>
<tr>
<td>Alternative 1A</td>
<td>$17,725,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Alternative 1B</td>
<td>$21,475,000</td>
<td>$242,000</td>
</tr>
<tr>
<td>Alternative 2A</td>
<td>$14,965,000</td>
<td>$251,000</td>
</tr>
<tr>
<td>Alternative 2B</td>
<td>$19,841,000</td>
<td>$277,000</td>
</tr>
</tbody>
</table>

1 – Unit costs developed by dividing total costs by annual quantity of 7,240 acre-feet.

### 6. Recommendations for Additional Design and Analysis

Additional detailed engineering and environmental analysis is needed to further develop and potentially implement this work, as recommended below. Aspect and the County have worked together to develop an Implementation Plan for continued water bank development. This Implementation Plan has been incorporated into a Watershed Plan Implementation and Flow Achievement Grant application to seek funding for completion of water bank development. The grant application was submitted to Ecology on April 30, 2015 and is pending review. Additional detailed engineering and environmental analysis is needed to further develop and potentially implement use of Pend Oreille source water for bank seeding, as recommended below:
**Little Spokane Headwaters**
This work is intended to provide data and analysis focused on engineering and environmental issues specific to the Little Spokane headwaters. Recommended data gathering and analysis includes:

- Establishment of gaging stations;
- Stream geomorphology/hydrology/flood plain assessment, including road crossings;
- Evaluation of wetland and stream habitat enhancement opportunities;
- Water quality data review, sampling, and analysis;
- Evaluation groundwater/surface water interaction;
- Streamflow flow and temperature measurements/seepage runs;
- Installation and monitoring of near stream piezometers;
- Private/public well water level measurements;
- Isotope comparison of surface water and groundwater to evaluate hydraulic connection;
- Evaluation of surface aquifer recharge (SAR) as a mechanism to enhance stream flow; and
- Limited numerical groundwater/surface water flow modeling if deemed appropriate following further study (would also include portions of the Pend Oreille Watershed).

**Pend Oreille Watershed**
This work is intended to provide data and analysis focused on engineering and environmental issues specific to the Pend Oreille watershed. Recommended data gathering and analysis includes:

- Installation of a test well(s) and associated aquifer testing;
- Water quality data review, sampling, and analysis, to include development of a Quality Assurance Project Plan (QAPP);
- Evaluation groundwater/surface water interaction;
- Monitoring/water quality testing during aquifer testing;
- Review of existing well data;
- Development of a conceptual hydrogeologic model of Pend Oreille River and adjacent aquifer; and
- Limited numerical groundwater/surface water flow modeling if appropriate.

**Pre-Design Evaluations**
These investigations and data analyses are recommended to support an assessment of the viability and if viable, engineering design for development and use of a suitable water source and operational
system to obtain and convey water to the upper headwaters of the Little Spokane River. Recommended evaluations include:

- Update of the existing data review and data gap analysis;
- Evaluation of land access options (contact with property owners, physical limitations, right-of-way issues);
- Coordination with City of Newport and other entities as required;
- Evaluation of reclaimed water options;
- Evaluation of potential water quality impacts;
- Evaluation of potential impacts on future water allocations from the Pend Oreille River;
- Preparation of a final assessment of preferred alternative (groundwater or surface water source);
- Establishment of a conveyance approach; and
- Development of additional mitigation options (wetland enhancement, instream flow augmentation, SAR).

**Preliminary Engineering Design**

Recommendations for preliminary design support the assessment of the project’s viability. If determined viable, future detailed engineering design for the development of a suitable Pend Oreille water source and associated operational system will be performed. Recommended preliminary design tasks include:

- Conveyance system, road crossing modifications and associated field work (surveying);
- Stream channel modifications;
- Wetland/habitat enhancement;
- Wellfield (or pump station) design; and
- Detailed cost estimates.

If preliminary design continues to support the viability of the Pend Oreille source for WRIA 55, additional detailed design and implementation approaches should be developed as part of completing preliminary design work.

**Attachments**

Figure 1 – Little Spokane and Pend Oreille Drainage Divide
Figure 2 – Surficial Geology
Figure 3 – Depth of Basin Fill
Figure 4 – Soils Mapping
Figure 5 – WDFW Recommended Flow vs. Gage Data (2002-2012) Pend Oreille River at Newport
Figure 6 – Frequency Below Base / Recommended Flows – Dartford and Newport
Figure 7 – Conceptual Improvements Plan
Figure 8 – System Performance Curves, Surface Water Alternatives
Figure 9 – System Performance Curves, Groundwater Alternatives

Attachment A – Photos from Site Reconnaissance
Attachment B – Well Logs
Attachment C – Detailed Cost Estimates

Limitations
Work for this project was performed for the Spokane County Utilities (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting’s original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.
FIGURES
Unconsolidated Sediments
- Quaternary alluvium, dune sand, loess, and artificial fill
- Quaternary alluvial fans, beach deposits, undifferentiated sedimentary deposits, lacustrine deposits, landslides, peat, terraced deposits, and talus
- Pleistocene continental glacial, glaciolacustrine, and outburst flood deposits, Fraser-age

Intrusive Igneous Rocks
- Oligocene-Paleocene intrusive igneous rocks

Metamorphic Rocks (Amphibolite Faces and Higher)
- Precambrian metamorphic rocks

Other Features
- Deformed rocks in tectonic zones

Water

Geology Data Source: Washington Department of Natural Resources

Surficial Geology
Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington
**Soils (SSURGO)**

- **19** Blueslide silt loam
- **20** Bonner silt loam, 0 to 10 percent slopes
- **21** Bonner gravelly silt loam, 0 to 10 percent slopes
- **22** Borosaprists, ponded
- **43** Dufort silt loam, 0 to 15 percent slopes
- **44** Dufort very sandy loam, 0 to 40 percent slopes
- **51** Hoodoo silt loam
- **60** Kankou sandy loam, 0 to 15 percent slopes
- **61** Kankou sandy loam, 15 to 40 percent slopes
- **62** Kegel loam
- **77** Mobute-Rock outcrop complex, 0 to 40 percent slopes
- **78** Mobute-Rock outcrop complex, 40 to 65 percent slopes
- **79** Moscow silt loam, 0 to 25 percent slopes
- **80** Moscow silt loam, 25 to 40 percent slopes
- **81** Moscow silt loam, 40 to 65 percent slopes
- **83** Moscow-Rock outcrop complex, 40 to 65 percent slopes
- **97** Orwig sandy loam, 0 to 20 percent slopes
- **98** Orwig sandy loam, 20 to 65 percent slopes
- **99** Pits
- **109** Palisad very fine sandy loam
- **123** Rock outcrop-Usk complex, 30 to 65 percent slopes
- **125** Sachem loamy fine sand, 5 to 15 percent slopes
- **129** Scotia fine sandy loam, 7 to 15 percent slopes
- **130** Scotia fine sandy loam, 15 to 25 percent slopes
- **134** Skarih-Rock outcrop complex, 0 to 40 percent slopes
- **145** Typic Xerorthents, 30 to 65 percent slopes
- **146** Uncas muck
- **148** Usk loam, 0 to 20 percent slopes
- **149** Usk loam, 20 to 40 percent slopes
- **151** Usk sandy loam, 0 to 40 percent slopes
- **152** Usk-Rock outcrop complex, 0 to 40 percent slopes
- **163** Water

WDFW Recommended Flow vs. Gage Data

Pend Oreille River at Newport (2002-2012)

Average Daily Mean Discharge, 2002-2012 for Pend Oreille River at Newport (12-3955.00)
Minimum Daily Mean Discharge, 2002-2012 for Pend Oreille River at Newport (12-3955.00)
WDFW Recommended Flow Based on Surface Water Source Limitation (SWSC) for Pend Oreille River at Newport (12-3955.00)

Flow in Cubic Feet Per Second (cfs)

Day of Year

Pend Oreille River at Newport (USGS Station 12-3955.00)
Frequency Below Base/Recommended Flows - Dartford and Newport

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

- Minimum instream flow range Little Spokane at Dartford = 115 to 250 cfs
- WDFW recommendation (SWSL) for Pend Oreille at Newport = 7,700 cfs

Note: Graph shows percentage of days in which a 7-day moving average of mean daily flow did not meet base flow/curtailment flow, 1993-2013
Figure 8 - System Performance Curves, Surface Water Alternatives
Project No. 140129, Pend Oreille Appraisal Study

- System Curve
- Pump Curve - American Marsh 12WC (3-stg), Single Pump
- Pump Curve - American Marsh 12WC (3-stg), 2-Pumps
- Pump Curve - American Marsh 12WC (3-stg), Single Pump, 90% Speed
- Pump Curve - American Marsh 12WC (3-stg), 2-Pumps, 90% Speed

Flow (cfs) vs. Head (ft) graph showing system performance curves for different pump configurations.
Figure 9 - System Performance Curves, Groundwater Alternatives

Project No. 140129, Pend Oreille Appraisal Study

![System Performance Curves, Groundwater Alternatives](drafts/figures/figures_8_and_9_-_pump_station_hydraulics.xlsx)

- **System Curve**
- **Pump Curve - American Marsh 12WC (5-stg), Single Pump**
- **Pump Curve - American Marsh 12WC (5-stg), 2-Pumps**
- **Pump Curve - American Marsh 12WC (5-stg), Single Pump, 90% Speed**
- **Pump Curve - American Marsh 12WC (5-stg), 2-Pumps, 90% Speed**

**Axes:**
- X-axis: Flow (cfs)
- Y-axis: Head (ft)
Attachment A

Site Photographs
Photo 1- Wetland near Headwaters of Little Spokane River

Photo 2- View Looking Southwest along SR2 near Little Spokane Headwaters
Photo 3- Little Spokane River, South of US2 near Headwaters

Photo 4- City of Newport Wastewater Treatment Facility
Photo 5- Pend Oreille River at Proposed Surface Water Pump Station (Option)

Photo 6- Pend Oreille River at Proposed Surface Water Pump Station (View Looking Northwest)
Photo 7- Pend Oreille River at Proposed Surface Water Pump Station (View Looking Northwest)

Photo 8- View along Proposed Pipeline Alignment Near City of Newport Fairgrounds / Park
ATTACHMENT B

Ecology Well Logs
WATER WELL REPORT
STATE OF WASHINGTON

1) OWNER: Mr. Bing Niewman
Address: Lazy Acres Trailer Court Box 351

2) LOCATION OF WELL: County: Pend Oreille
- NE 1/4 SE 1/4 Sec. 24, T 31 N, R 45 E, W 2

3) PROPOSED USE: Domestic [ ] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

4) TYPE OF WORK: New well [X] Method: Drilled [ ] Bored [ ]
Deepened [ ] Cable [ ] Driven [ ]
Reconditioned [ ] Rotary [ ] Jetted [ ]

5) DIMENSIONS: Diameter of well . . . 8 inch inches.
Drilled: 64 ft. Depth of completed well: 61 ft.

6) CONSTRUCTION DETAILS:
Casing installed: 8 in. Diam. from plus 2 ft. to 51 ft.

Threaded [ ] Diam. from ft. to ft.
Welded [X] Diam. from ft. to ft.

Perforations: Yes [X] No [ ]
Type of perforator used:
SIZE of perforations:
perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

Screens: Yes [X] No [ ]
Manufacturer's Name: Johnson well screens
Type: Stainless steel
Diam. 8 in.
Slot size: 0.12 from 51 ft. to 61 ft.

7) PUMP: Manufacturer's Name: [ ]
Type: [ ]
H.P. [ ]

8) WATER LEVELS:
Land-surface elevation above mean sea level: 2200 ft.
Static level: 12 ft. below top of well Date: [ ]
Artesian pressure: 1 lbs. per square inch Date: [ ]
Artesian water is controlled by: (Cap, valve, etc.) [ ]

9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [ ]
If yes, by whom? [ ]
Yield: 150 gal./min. with link ft. drawdown after hrs.

Air Test: [ ]

Recovery test: (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level | Time Water Level | Time Water Level |
------------------|------------------|------------------|

Date of test: 6/12/78
Bailer test: gal./min. with ft. drawdown after hrs.
Artesian flow: g.p.m. Date: [ ]
Temperature of water: Was a chemical analysis made? Yes [ ] No [ ]

10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sandy clay w/some gravel &amp; sand</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Very coarse brown sand w/water</td>
<td>19</td>
<td>64</td>
</tr>
</tbody>
</table>

Amount of water at 35 feet: 200 150 Gallons Per Minute

RECEIVED
JUL 12 1978
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE


WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME: Uhrenkott, Well Drilling
(Person, firm, or corporation) [ ] (Type of print)
Address: Route 1, Box 20, Pownal, Idaho 83531 [ ]

[Signed] [ ] (Well Driller)

License No. (0766) [ ] Date: July 31, 1978 [ ]

7/3/78 [ ]

USE ADDITIONAL SHEETS IF NECESSARY)
WATER WELL REPORT

1) OWNER: Name: Bing Bowemen
Address: Lazy Acres Trailer Court Box 351

2) LOCATION OF WELL: County: Pend Oreille
Well sold to city by Boweman

draining and distance from section or subdivision corner

3) PROPOSED USE: Domestic □ Industrial □ Municipal □
Irrigation X TEST WELL □ Other □

4) TYPE OF WORK: Owner's number of well
If more than one ...
New well □ Method: Dug □ Bored □ Drilled □
Deepened □ Cable □ Driven □
Reconditioned □ Rotary □ Jetted □

5) DIMENSIONS: Diameter of well: 8 inches
Drilled: 80 ft. Depth of completed well: 67 ft.

6) CONSTRUCTION DETAILS:
Casing installed: 8 ft. diam. from plus 2 ft. to 56 ft.
Threaded □ Welded □

Perforations: Yes □ No □
Type of perforator used: "...
SIZE of perforations: "...
Number of perforations: "...

Screens: Yes □ No □
Manufacturer's Name: Johnson Well Screen
Type: Stainless Steel □ Model No.
Diam. 8 in. Slot size 0.050 in. from 7.57 ft. to 67 ft.
Diam. 8 in. Slot size 0.050 in. from 7.57 ft. to 67 ft.

Gravel packed: Yes □ No □
Size of gravel:...
Gravel placed from...to...

Surface seal: Yes □ No □ To what depth? 20 ft.
Material used in seal: Cement
Did any strata contain unusable water? Yes □ No □
Type of water:... Depth of strata:...
Method of sealing strata off:...

7) PUMP: Manufacturer's Name...
Type:...
H.P.:

8) WATER LEVELS:
Land-surface elevation above mean sea level...
Static level: 220 ft. below top of well
Date: 6/6/78
Artesian pressure:...
Date:...
Artesian water is controlled by...
(Cap., valve, etc.)

9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes □ No □ If yes, by whom?...
Yield: 200 gal./min. with Unk. ft. drawdown after hrs.

Air test:...

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Date of test: 6/6/78

Boiler test: gal./min. with...ft. drawdown after...hrs.
Artesian flow: g.p.m. Date:...
Temperature of water: Was a chemical analysis made? Yes □ No □

10) WELL LOG:
Top Soil (soft) 0 3
Sandy clay w/some gravel 3 24

Gravel rock and sand (soft) 24 28
Very course sand w/some gravel 28 81

A lot of water at the depth of
41 feet on 200 G.P.M.


WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME: Uhlenkott Well Drilling
(Person, firm, or corporation) Type or print)
Address: Route 1, Box 20, Pema, Idaho 83538

(Signed):

Licence No. 767 Date: July 3, 1978
Newport 7/8
WATER WELL REPORT
STATE OF WASHINGTON

OWNER: City of Newport

LOCATION OF WELL: Penelope

STREET ADDRESS OF WELL (nearest address): N-13 SE 1/4 Sec 24 T 51 N R 75 E W

PROPOSED USE: Municipal

TYPE OF WORK: New well

DIMENSIONS: Diameter of well 8". Depth of completed well 85 ft.

CONSTRUCTION DETAILS:
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.
- Diam from +1 ft to 85 ft.

SCREENS: Yes

Manufacturer's Name

Type: Gravel-packed

Model No.

Diam. Slot size: from ft. to ft.

Diam. Slot size: from ft. to ft.

Gravel packed: Yes

Size of gravel

Gravel placed from ft. to ft.

Screen seal: Yes

Material used in seal

Did any strata contain unusable water: No

Type of water: Depth of strata

PUMP: Manufacturer's Name

Type: H.P.

WATER LEVELS:
- Static level ft. below top of well Date
- Artesian pressure ps per square inch Date
- Artesian water is controlled by Cap, valve, etc.

WELL TESTS:
- Drawdown is amount water level is lowered below static level
- Was a pump test made? Yes No
- If yes, by whom?
- Yield gal./min with ft. drawdown after hours
- " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " 

WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifer and kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL
FROM TO
Sand Gravel Clay 20 40
Sand Clay layers 30 50
Sand Clay 35 50
Clay 50 55
Brown Sand Clay layers 58 85

No Water

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME
Address
(Signed)
(WELL DRILLER)

Registration No. 6P 05519

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.
### WATER WELL REPORT

**STATE OF WASHINGTON**

**Owner:**
- Name: City of Vancouver
- Address: Sec. 5, T. 23 N., R. 45 E.

**Location:**
- County: Clark
- NE 1/4, SE 1/4 Sec. 23 T. 23 N., R. 45 E.

**Type of Work:**
- Abandoned
- New well
- Method: Drilled

**Dimensions:**
- Diameter of well: 8
- Drilled: 30 feet
- Depth of completed well: 30 feet

**Construction Details:**
- Casing Installed: 8
- Diameter: 1 ft. to 70 ft.
- Screen: Yes
- Manufacturer's Name: Johnson
- Type: Elec. Dig.
- Model No.
- Diameter: 6
- Slot size: 4
- Diam: 8
- Slot size: 4

**Gravel packed:**
- Yes
- Size of gravel: To what depth?

**Surface Seal:**
- Yes
- Material used in seal: 1 ft. to 100 ft.

**Wells Logs or Abandonment Procedure Description:**
- Formation: Describe by color, character, size of material and structure, and show thickness of formation and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand, Boulder</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Sand, Brown</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Sand, Graveline</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Sand, Brown, Fine</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Sand, Graveline</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Sand, Brown</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Sand, Brown, Clean</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

**Pump:**
- Manufacturer's Name: H.P.

**Water Levels:**
- Static level: 21 ft. below top of well
- Artesian pressure: 150 psi
- Artisan well water controlled by (Cap, valve, etc.)

**Well Tests:**
- Drawdown shown at water level is lowered below static level
- Was a pump test made? Yes
- Yield: gal./min.
- Time: hrs.
- Water level: ft.

**Well Constructor Certification:**
- I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

**Well Constructor:**
- Name: C.B. Doss
- Address: 1313 Sunset Dr., Clarkston, WA 99403
- License No: 0393

**Additional:**
- Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.
**WATER WELL REPORT**

**STATE OF WASHINGTON**

**OWNER:** Name: CITY OF NEWHALL

Address: 302 WASHINGTON AVE

**LOCATION OF WELL:** County: King

**STREET ADDRESS OF WELL:** NE 35

**PROPOSED USE:** Domestic ☐ Irrigation ☐ DeWater ☐ Municipal ☐

**TYPE OF WORK:** Owner's number of well (if more than one): WELL E

**DIMENSIONS:** Diameter of well: 8" inches

**CONSTRUCTION DETAILS:**
- Casing installed: 8'
- Diam. from top to 70'
- Liner installed: 8'
- Diam. from top to 70'
- Perforations: Yes □ No □
- Size of perforations: m. by in.
- Gravel placed from: n. to.
- Gravel from: n. to.
- Surface seal: Yes □ No □
- Material used in seal: n. to.
- Material used in seal: n. to.
- Did any strata contain unusable water? Yes □ No □
- Type of water: n. to.
- Depth of strata: n. to.

**PUMP:**
- Manufacturer's Name: BRADLEY AND CO.
- Type: TS 3H 200T SCHMIDT TURBINE P 25

**WATER LEVELS:**
- Land-surface elevation above mean sea level: 19'
- Static level: 19'
- Artesian pressure: lbs. per square inch Date: 6-20-90
- Artesian water is controlled by:

**WELL TESTS:**
- Drawdown is amount water level is lowered below static level
- Was a pump test made? Yes □ No □
- If yes, by whom? DO NOT SIGN
- Value: 75 gpm
- Test: 75 gpm
- Date: 6-20-90

**WELL CONSTRUCTOR CERTIFICATION:**
- I, the well constructor, certify that the well was constructed and/or accepted responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

**NAME:**
- (PERSON, FIRM, OR CORPORATION)

**Address:**
- ST. WASHINGTON AVE

**Licenses:**
- 0393

**Contractor's Registration No.:**
- 159 KB

**Date:** 6-22-90

(USE ADDITIONAL SHEETS IF NECESSARY)
**WATER WELL REPORT**

**STATE OF WASHINGTON**

**OWNER:** City of Newport Washington 5200 Washington St.

**LOCATION OF WELL:** County: **Pendleton**  
**STREET ADDRESS OF WELL (or nearest address):** NE 5E % Sec 24 T 31 N, R 45 W, M.

**PROPOSED USE:** Irrigation

**TYPE OF WORK:**
- Owner's number of well (if more than one) __
- Well "F"
- New well Reconditioned
- Drilled
- Depth of completed well 80 ft.

**DIMENSIONS:**
- Diameter of well 8" inches.

**CONSTRUCTION DETAILS:**
- Casing installed: 8" Diameter from 70 ft.
- Welded
- threadless
- Perforations: Yes
- Size of perforations in. by in.
- Gravel packed: Yes
- Size of gravel
- Surface seal: Yes
- Material used in seal: Bentonite
- Did any strata contain unusable water? Yes
- Depth of strata

**PUMP:** Manufacturer's Name:

**WATER LEVELS:**
- Land-surface elevation above mean sea level ft.
- Static level ft. below top of well ft. below mean sea level
- Artesian pressure lbs. per square inch
- Date
- Artesian water is controlled by

**WELL TESTS:**
- Drawdown in aquifer water level is lowered below static level
- Was a pump test made? Yes
- Flow yield: gal./min.
- ft. drawdown after hrs.

**RECOVERY DATA:**
- Time: Water Level
- Time: Water Level
- Date of test

**WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION:**
- Pulled Screen from 80' 70'
- Redrilled 70 to 80
- Brown Sand
- Decomposed Granite 105 120

**CASING PULLED BACK TO 80' AND SCREEN RESET FROM 70-80'**

**WELL CONSTRUCTOR CERTIFICATION:**

I, [Name], well service (type or print)
(PERSON, FIRM, OR CORPORATION)

Address: 523 NW Hayden Ave. Hayden Idaho

License No.

Contractor's Registration No.

Date: 9-20-90

(USE ADDITIONAL SHEETS IF NECESSARY)
WATER WELL REPORT

CITY OF NEWPORT
STATE OF WASHINGTON

OWNER: Name □ Bing Boworman
Address: Lazy Acres Trailer Court Box 351

LOCATION OF WELL: County Pend Oreille NE □ SE □ Sec. 24 T.21 N. R.4E WM

PROPOSED USE: □ Domestic □ Industrial □ Municipal
□ Irrigation □ Test Well □ Other

TYPE OF WORK: Owner's number of well (if more than one).
□ New well □ Method: Dug □ Bored
□ Deepened □ Cable □ Driven
□ Reconditioned □ Rotary □ Jetted

DIMENSIONS:
Diameter of well 8 inches.
Drilled 90 ft. Depth of completed well 67.1 ft.

CONSTRUCTION DETAILS:
Casing installed: □ " Diam. from to lay 2 n. to 56 n.
□ Threaded □ " Diam. from n. to n. ft. to ft.
□ Welded □ " Diam. from n. to n. ft. to ft.

Perforations: Yes □ No □
□ Type of perforator used
□ Size of perforations
□ perforations ft. to ft.
□ perforations ft. to ft.
□ perforations ft. to ft.

Screens: Yes □ No □
□ Manufacturer's Name: Johnson Well Screen
□ Type: Stainless Steel □ Model No.
□ Diam. n. Slot size ft. to ft.
□ Diam. n. Slot size ft. to ft.

Gravel packed: Yes □ No □
□ Size of gravel.
□ Gravel placed from ft. to ft.

Surface seal: Yes □ No □
□ To what depth? 20 ft.
□ Material used in seal: Cement
□ Did any strata contain unusable water? Yes □ No □
□ Type of water? Depth of strata
□ Method of sealing strata off.

PUMP: Manufacturer's Name.
□ Type: H.P.

WATER LEVELS:
□ Land-surface elevation
□ Static level n. below top of well
Date: 6/6/78
Artesian pressure lbs. per square inch Date:
Artesian water is controlled by (Cap, valve, etc.)

WELL TESTS:
□ Drawdown is amount water level is lowered below static level
□ Was a pump test made? Yes □ No □
□ If yes, by whom:
□ Yield: 200 gal./min. with □ ft. drawdown after hrs.
□ Air test
□ Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Date of test 6/6/78
Bailer test gal./min. with □ ft. drawdown after hrs.
Artesian flow g.p.m. Date:
Temperature of water □ Was a chemical analysis made? Yes □ No □

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME: Uhlenkott Well Drilling
(Person, firm, or corporation)
Type or print
Address: Route 1, Box 20, Penn., Idaho 83538

[Signature] f
d
(Well Driller)

License No. 767 Date: July 3, 1978

Newport 7/6
**WATER WELL REPORT**

**STATE OF WASHINGTON**

**OWNER:** City of Newport  
Address: 5200 Washington Ave.

**LOCATION OF WELL:** County: Pend Oreille  
Ne 1/4 Sec. 34, T 31 N, R 45E

**STREET ADDRESS OF WELL:**  
(If nearest address)

**PROPOSED USE:**  
- Domestic ☐  
- Irrigation ☑  
- Industrial ☐  
- Municipal ☐  
- Water Well ☑  
- Other ☐

**TYPE OF WORK:**  
- Owner's number of well (if more than one) ☐  
- New well ☑  
- Deepened ☐  
- Reconditioned ☐

**Method:**  
- Dug ☐  
- Cable Driven ☐  
- Rotary ☑  
- Jetted ☐

**DIMENSIONS:**  
- Diameter of well: 10" inches  
- Drilled: 110 feet.  
- Depth of completed well: 105 ft.

**CONSTRUCTION DETAILS:**  
- Casing installed: 10 ft. Diam. from 10 ft. to 105 ft.
- Welded ☐  
- Lined: ☐  
- Threaded ☐  
- Diam. from 10 ft. to 105 ft.
- Perforations: Yes ☑  
- Size of perforation: in. by in.
- Size of gravel: in.  
- Size of sand: in.
- Surface seal: Yes ☑  
- Cement + Bentonite ☑  
- Depth of strata:  
- Method of sealing strata off:  

**WATER LEVELS:**  
- Land surface elevation above mean sea level: 21 ft.
- Static level: 91 ft. below top of well  
- Date: 1-17-90  
- Artesian water is controlled by:

**WELL TESTS:**  
- Drawdown in amount water level is lowered below static level:  
- Was a pump test made? Yes ☑  
- If yes, by whom?  
- Yield: 123 gal. per min. with 61 ft. drawdown after 5 hrs.

**DATE OF TEST:** 1-23-90  
- Water test: gal. per min. with 61 ft. drawdown after 5 hrs.
- Artesian flow: g.p.m.  
- Date:  
- Temperature of water:  
- Was a chemical analysis made? Yes ☑  

**WELL CONSTRUCTOR CERTIFICATION:**  
I, [Name], have constructed this well and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

**NAME:** [Name]  
(Company, firm, or corporation)  
License No.: [License Number]

**ADDRESS:**  
[Address]

**REGISTRATION:**  
[Registration Number]

**DATE:** 1-22-90

(USE ADDITIONAL SHEETS IF NECESSARY)
WATER WELL REPORT
STATE OF WASHINGTON

(1) OWNER: Name. John R. Posk
Address: General Delivery, Newport, WA 99156

(2) LOCATION OF WELL: County. Pend Oreille
Section: 24
T. 31 N., R. 45E, W. M.

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one).
New well ☑ Method: Dug ☑ Bored ☐
Reconditioned ☐ Drilled ☐

(5) DIMENSIONS:
Drilled: 190 ft. Diameter of well: 6 inches.
Depth of completed well: 165 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 in. Diam. from +1 ft. to 162 ft.
Threaded ☐ Welded ☑ per ft. to ft.
Perforations: Yes ☑ No ☐
Type of perforator used: 

SIZE of perforations: in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☑ No ☐
Manufacturer's Name: Johnson
Type. Stainless steel ☑
Model No.: 
Diam.: Slot size: from 160 ft. to 165 ft.
Gravel packed: Yes ☑ No ☐
Size of gravel: 
Gravel placed from ft. to ft.

Surface seal: Yes ☑ No ☐ To what depth? 40 ft.
Material used in seal: bentonite
Did any strata contain unsuitable water? Yes ☑ No ☐
Type of water: 
Depth of strata: 
Method of sealing strata off: 

(7) PUMP:
Manufacturer's Name: 
Type: H.P.

(8) WATER LEVELS:
Land surface elevation of mean sea level: ft.
Static level: 130 ft. below top of well Date: 9/24/85
Artesian pressure: lbs. per square inch Date: 
Artesian water is controlled by: 

(9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☑ No ☐ If yes, by whom?
Yield: 24-3 gal./min. with ft. drawn down after hrs.

ESTIMATED AERIAL:

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level

Date of test: 
Bailer test: gal./min. with ft. drawn down after hrs.
Artesian flow: E.P.M. Date:
Temperature of water: Was a chemical analysis made? Yes ☑ No ☐

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of strata and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL FROM TO
Sand & brown clay 0 35
Sand & cemented gravel 35 79
Clay, gray hard 79 99
Clay, tan hard 99 126
Sand, tan clay 126 160
Sand & gravel 160 190

NO PVC Liner Installed
6" Drive shoe installed

RECEIVED
OCT 3 1985
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started: 9/19/85 Completed: 9/24/85

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME: PONDEROSA DRILLING & DEVELOPMENT INC.
(Person, firm, or corporation) (Type of print)
Address: E. 6010 Broadway, Spokane, WA 99212

[Signature] W. Scott Barratt (Well Driller)
License No. 0996 Date: 9/24/85, 19.85

(USE ADDITIONAL SHEETS IF NECESSARY)
### WATER WELL REPORT

**State of Washington**  
**Date Printed:** 05-Feb-2007  
**Log No.:** 54906  
**Construction/Decommission:** Original Construction  
**Notice of Intent #:** 252943

**PROPOSED USE:** DOMESTIC

**TYPE OF WORK:** Owners's Well Number: (If more than one well) 1  
**DEEPEÑED Method:** ROTARY

**DIMENSIONS:** Diameter of well: 6 inches  
**Drilled** 220 ft.  
**Depth of completed well** 220 ft.

**CONSTRUCTION DETAILS:**  
<table>
<thead>
<tr>
<th>Liner installed</th>
<th>Casing installed</th>
<th>WELDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASING</td>
<td>6&quot; Dia from</td>
<td>+2 ft. to 215 ft.</td>
</tr>
<tr>
<td>5&quot; Dia from</td>
<td>210 ft. to 215 ft</td>
<td></td>
</tr>
</tbody>
</table>

**Perforations:**  
Type of perforator used: 
- Perforations from ft. to ft.
- Perforations from ft. to ft.
- Perforations from ft. to ft.

**Screens:**  
Yes  
K-Pac Location: 209  
Manufacturer's Name: JOHNSON  
Type: SLOTTED  
Model No: STAINLESS  
Diam. 5 slot size: 14 from 215 ft. to 220 ft.  
Diam. slot size from ft. to ft.

**Gravel/Filter packed:**  
No  
Size of Gravel:  
Material placed from ft. to ft.

**Surface seal:**  
No  
To what depth: ft.  
Seal method: Material used in seal EXISTING

**Did any strata contain unusable water:**  
No

**Type of water:**  
Depth of strata

**Method of sealing strata off**

**PUMP:**  
Manufacture's name:  
Type: H.P. 0

**WATER LEVELS:**  
Land-surface elevation above mean sea level: 0 ft.

**Static level 150 ft. below top of well Date 11/14/2006**

**Artesian Pressure lbs per square inch Date**

**Artesian water controlled by**

**WELL TESTS:**  
Drawdown is amount water level is lowered below static level.  
Was a pump test made? No  
If yes, by whom

**Yield:** gal/min with ft. drawdown after  
<table>
<thead>
<tr>
<th>Time</th>
<th>Water Level</th>
<th>Time</th>
<th>Water Level</th>
<th>Time</th>
<th>Water Level</th>
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</tbody>
</table>

**Drainage data (time taken as zero when pump turned off/water level measured from top well to water level):**

<table>
<thead>
<tr>
<th>Time</th>
<th>Water Level</th>
<th>Time</th>
<th>Water Level</th>
<th>Time</th>
<th>Water Level</th>
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</tr>
</tbody>
</table>

**Date of test:**  
<table>
<thead>
<tr>
<th>Bail test gal/min</th>
<th>ft. drawdown after hrs.</th>
<th>Air test 15 gal/min w/ stem set at 210 ft. for 1 hours</th>
<th>Artesian flow gpm</th>
<th>Date</th>
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**Temperature of water**  
Was a chemical analysis made: No

---

**CURRENT**

Notice of Intent No.: W233950  
Unique Ecology Well I.D. No: APC728  
Water Right Permit Number:

**OWNER:** POSK, JOHN

**OWNER ADD:** P.O. BOX 556  
NEWPORT, WA 99156

**Well Add:** 406 SILVERBIRCH RD.

**City:** Newport, WA 99156  
**County:** Pend Oreille

**Location:** NW 1/4 SE 1/4 Sec 24 T 31 R 45E EW  
**Lat/Long:**  
Lat Deg Lat Min/Sec  
62 Deg 7 Min

**REQUERED**  
Long Deg Long Min/Sec  
31 Deg 45 Min

**Tax Parcel No.:**

---

**CONSTRUCTION OR DECOMMISSION PROCEDURE**

**Formation:** Describe by color, character, size of material and structure. Show thickness of aquifers and the kind and nature of the material in each stratum penetrated. Show at least one entry for each change in formation.

**Material**  
From | To
---|---
| | |
**EXISTING WELL**

**COARSE SAND W/GRANULAR GRAVEL W/WATER**

---

**RECEIVED**

FEB 15 2007

**NOTE:**

**DEPARTMENT OF ECOLOGY**  
**EASTERN REGIONAL OFFICE**

**Work started** 11/07/2006  
**Complete** 11/14/2006

**WELL CONSTRUCTION CERTIFICATION:**

I, [Name], driller, accept responsibility for construction of this well and its compliance with all Washington well construction standards. Materials used and the information reported are true to my best knowledge and belief.

**Driller** [Signature]  
Name: FORREST TENNANT II  
License No.: 2088

**Signature:**

**If trained, Licensed driller is:** [Signature]  
License No.: [Signature]

**Licensed Driller Signature:**

**Drilling Company:**

**NAME:** FOGLE PUMP & SUPPLY, INC.  
**Shop:** AIRWAY HEI

**ADDRESS:** PO BOX 1450  
Airway Heights, WA 99001  
**Phone:** (509) 244-0846  
**Toll Free:** (888) 343-9355  
**E-Mail:** andrea@foglepump.com  
**FAX:** (509) 244-2875  
**WEB Site:** WWW.FOGLEPUMP.COM

**Contractor's Registration No.:** FOGLEPS09SL4  
**Date Log Created:** 12/20/2007

---

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.
Attachment C

Detailed Cost Estimates
<table>
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<tr>
<th>Alternative</th>
<th>Capital Cost</th>
<th>Annual O&amp;M</th>
<th>Capital Cost (per ac-ft)</th>
<th>Annual O&amp;M (per acre-foot)</th>
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## Table C2 - Preliminary Cost Estimate, Surface Water Pumping Alternatives

**Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA**

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<th>Total Cost</th>
<th>QTY</th>
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### Alternative Cost Summary

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### Indirect Cost

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<td>Design Engineering, Project Survey</td>
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<tr>
<td>Permitting</td>
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<tr>
<td>Management / Administration</td>
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**Total Project Capital Costs**

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<td>$17,725,000</td>
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### Table C3 - Preliminary Cost Estimate, Groundwater Pumping Alternative

**Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA**

**Aspect Consulting**

06/30/15

#### Alternative 2A

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#### Direct Cost

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<th>Cost</th>
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<td>Construction Subtotal</td>
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<td>Contingency</td>
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<td>Washington State Sales Tax</td>
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**Direct Cost Total**

$10,614,000

#### Indirect Cost

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<th>Description</th>
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<tbody>
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<td>Allowance for Easement / Property Acquisition</td>
<td>1% $106,000</td>
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<tr>
<td>Design Engineering, Project Survey</td>
<td>20% $2,123,000</td>
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<td>Permitting</td>
<td>7% $743,000</td>
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<tr>
<td>Management / Administration</td>
<td>3% $318,000</td>
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<tr>
<td>Construction Oversight</td>
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**Indirect Cost Total**

$4,351,000

**Total Project Capital Costs**

$14,965,000

---

Aspect Consulting

06/30/15

Table C3

Preliminary Cost Estimate, Groundwater Pumping Alternative

Page 1 of 1
<table>
<thead>
<tr>
<th></th>
<th>Mech / Elec Improvements</th>
<th>Fixed Improvements</th>
<th>Electrical Costs</th>
<th>Total Annual O&amp;M</th>
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<tr>
<td>Alternative 1A</td>
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